ARCHIVES

OF

OTOLOGY

EDITED IN ENGLISH AND GERMAN

BY

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OF NEW YORK

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AND

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ARCHIVES OF OTOLOGY.

DISEASE OF THE EAR OCCURRING DURING THE COURSE OF PAROTITIS.

By D. B. St. JOHN ROOSA, M.D.

THE interest lately shown in the discussion of deafness following mumps, warrants further publication upon this subject, especially if there are new cases to be presented. Inasmuch as I have recently had an opportunity of studying and tracing one of these cases more thoroughly than has ever before been my fortune, and since two of them, published in 1874,[1] have escaped the observation of some of the recent writers upon this subject, I have endeavored to gather together, in the following paper, what knowledge I have been able to get in my private practice from a study of disease of the ear occurring during the course of parotitis. The specialists, both in our country and in Germany, have seen but few of these cases. It is possible that general practitioners have seen more of them, but the facts to substantiate such a supposition have not appeared. It is much to be desired that any unpublished experience of this kind should be made generally accessible. I am emboldened to present in this paper all the cases that I have seen, of which I have notes, even though some of them have been printed before, from reading an article by Dr. Brunner, of Zurich, lately published in these ARCHIVES. Dr. Brunner says[2]: "If Roosa has actually seen as many of the cases of deafness after mumps, as he says in the discussion of Buck's two cases, I am very sorry that he has not

[1] *American Journal of the Medical Sciences*, vol. lxviii, page 389.

[2] Vol. xi, page 102.

given us any more exact communications with regard to them."

Dr. Brunner is mistaken in supposing that I ever claimed to have seen many cases of impairment of hearing during or after parotitis. Any one who is interested in such a small matter as to what I claimed as to my experience, will find by reference to the dicussion that occurred in the American Otological Society, that this remark of Dr. Brunner's is entirely unjustified.[1]

I think the papers by Buck, Brunner, Moos, and Knapp give the idea, that this subject of deafness after mumps has been greatly neglected by the writers on aural medicine and surgery, including myself. But the text books of Toynbee, Hinton, and Roosa, as well as that of Dalby, really give as much information as that contained in some of the recent papers. The reason for the meagreness of statement is to be found in the fact, that none of us saw these cases, as a rule, until they had run their course. It is only during the last two years, that I have seen a case near enough to its beginning to allow of any accurate study of its etiology. Cases of aural disease after mumps came to us, as do so many cases of deafness after cerebro-spinal meningitis, when all acute symptoms had subsided, and we could only learn of them by hearsay. I am very glad to be able to report an entirely new and acute case in this paper, and one which, in my opinion, is valuable as indicating the causation, treatment, and prognosis.

There has been, I think, no such silence on the part of English writers or myself upon the subject, as one reading recent articles would be led to suppose. Toynbee's reference to the subject, in his work published in 1860,[2] is so complete that the recent German writers have added very little if any thing to it. He states that "the peculiar poison which causes the disease generally known by the name of mumps is *very often* the source of complete deafness, which, however usually occurs in one ear only." In this sentence will be found an epitome of most that has been said of late

[1] These ARCHIVES, vol. x, p. 274.

[2] "Diseases of the Ear," London, page 361.

on this subject, except that *very often* should be stricken out. In the first edition of my work on the ear, I mentioned mumps as a cause of disease of the ear, while in later editions, especially in the one of 1878, I gave a fuller notice of the subject. James Hinton,[1] in his most excellent work, a book that is singularly honest and suggestive, uses the following language, which it seems to me, indicates a comprehensive study of the subject, and adds very much to what Toynbee said twenty-two years ago. "Next, or perhaps equal, in frequency to scarlatina, in this respect, stands mumps, which has an effect on the nervous apparatus of the ear which has as yet received no explanation, and affords no clue to the use of remedies; every part of the ear being normal, so far as examination can extend, but the function is almost abolished. '*But some cases* (the italics are mine) *of damage to the ear from mumps present an intermediate character, showing clear signs of a tympanic disorder mixed with the nervous symptoms. The similarity of the nerve affection that follows mumps to that which ensues upon parturition, is very striking; and the resemblance is increased by the fact that quite frequently the latter affection also is accompanied with symptoms of a catarrhal character.*'" Such a paragraph as this, atones to a great degree for the vagueness complained of in the authors who have spoken of disease of the ear occurring after mumps.

It is to be noticed, however, that Toynbee and Hinton both speak of the affection as if it were a common one. It was this statement of Toynbee, that led me to lay no especial stress upon my first cases—for I supposed I was alone among otologists in having seen but few of them—and I published them in an article upon diseases of the internal ear. In the same way, I published a case, in an article upon acoustic neuritis and atrophy of the acoustic nerve, in September, 1881,[2] which I had seen and treated for three weeks. This latter case is one of those presented by Dr. Buck, at the meeting of the American Otological Society, a case which he saw after he had been under the care of

[1] "The Questions of Aural Surgery." Henry J. King & Co., London, 1874.

[2] These ARCHIVES, vol. x, p.

Dr. Ely and myself. I have notes of ten cases of disease of the ear occurring during parotitis, out of a total number of more than 4500 cases of aural disease that I have seen in private practice, and of which I have taken notes.

CASE 1.—*Parotitis. Deafness of one side. Patient first seen three years after the occurrence of the mumps.*

H. A. H., aged twenty-three, student of medicine. Three years ago the patient had a slight attack of the mumps. During it he lost the hearing of the right ear. Hearing distance, R $\frac{\text{mastoid}}{4\ 8}$ and L $\frac{4\ 8}{4\ 8}$. The membrana tympani appears to be normal. There is considerable *tinnitus aurium*. The patient was treated through the Eustachian tube for about two months. The tinnitus was usually diminished for an hour or so after the applications through the catheter.

In this case there was certainly disease of the middle ear. It will be observed that the watch was heard upon the mastoid process, while not upon the meatus. The case was seen in 1866, when I was not aware of the value of the tuning-fork in making a differential diagnosis of disease of the middle ear. Yet, from the results of the treatment, I am confident that there was an affection of the middle ear; as I have said, however, the nerve may have been affected.

CASE 2.—*Disease of labyrinth of one side after parotitis. Patient first seen one year after loss of hearing occurred.*

Miss B., aged twenty-one, June 14, 1871. Patient states that she had the mumps one year ago. After recovery, she observed a buzzing sound like that made by insects. She has not heard from the ear since. At times there is an unpleasant fulness in the ear.

The hearing distance from the right ear is normal. From the left, it is $\frac{0}{4\ 8}$.

The membranæ tympani are normal. The tuning-fork is heard only on the right side.

The patient was seen again in September of the same year. She then stated that she had vertigo occasionally. In other respects the condition was the same.

The evidence is clear that the labyrinth was the chief, if not the only, seat of the aural disease in this case. The foregoing cases are those published in the *American Journal of Medical Sciences, loc. cit.*

CASE 3.—*Disease of labyrinth of both sides after scarlet fever, measles, and mumps. Patient first seen thirty-one years after loss of hearing occurred.*

Henry N. X., aged thirty-four, Sept. 15, 1873. The patient states that when two or three years old he had the measles, scarlet fever, and mumps in one year, and that his hearing has been defective ever since. He never had any discharge from the ears, and he rarely has tinnitus.

H D, R $\frac{0}{48}$ and L $\frac{P}{48}$ (?)

The tuning-fork is heard better on the better side. The right drumhead is somewhat sunken. The left one looks well.

Inflation of the middle ear produces no change in the hearing power.

The meagreness of the history does not enable me to say whether the loss of hearing was observed immediately after the attack of parotitis, or after the measles, or scarlet fever. The absence of ulceration at any time, however, inclines me to believe it to be a true case of loss of hearing as a result of parotitis.

CASE 4.—*Impairment of hearing of left ear, occurring during attack of parotitis. Disease of right ear had occurred previously from scarlet fever. Patient first seen about five months after attack of mumps.*

Mrs. J. S. C., aged about thirty-five, Oct. 1, 1875. The patient states that she had scarlet fever at the age of eighteen. She has suffered from greatly impaired hearing on the right side ever since. Last May she had the "mumps." During the course of the disease, she found that she was deaf in the left ear. She heard well on one day, and the next day she found herself deaf. There was no pain in the ear, and no discharge from it. She has suffered from tennitus aurium since. She hears the watch on the right side (on that of the ear deaf from scarlet fever), $\frac{1\frac{1}{2}}{60}$. L ear when

pressed upon the mastoid, $\frac{m}{40}$. She has naso-pharyngeal catarrh. Both drumheads are of good color, and have good light spots.

The diagnosis made was disease of the middle ear on the right side and disease of the labyrinth on the left. The grounds for the diagnosis of labyrinthine disease are, however, not given, except in the statement that the deafness occurred suddenly, and that inflation caused no improvement in the hearing. Unfortunately, I do not remember the case with enough clearness to give any more detailed account of the reasons for believing that the ear affected by scarlet fever was chiefly so in the middle part, while the other had a lesion of the nerve.

CASE 5.—*Impairment of hearing of one side after mumps. Inspissated cerumen. Hearing improved after its removal. Patient first seen ten years after the parotitis had occurred.*

C. H. T., aged twenty-eight, Oct. 12, 1875. The patient states that he had the mumps ten years ago. After that he observed that the watch was heard better in front of the right ear than of the left. He did not regard the condition of his ear very much until last summer, when he had a sore throat and dyspepsia, when his attention was again called to his ears. He then observed a drumming noise in the left ear, and some impairment of hearing. The hearing distance was found to be R $\frac{40}{40}$, L $\frac{\text{Pressed}}{40}$. The tuning-fork was heard better in the worse ear. The pharynx was granular. The right drumhead was very much sunken, and there were opacities in it. The light spot was of good size. The left membrana tympani was covered by hard wax. When it was removed the drumhead was found to be sunken, and it had no light spot. On removal of the cerumen, the hearing distance arose from $\frac{P}{40}$ to $\frac{6}{48}$, and after inflation to $\frac{14}{48}$.

The history and examintion show that this was a case of disease of the middle ear. It is probable that the hearing power was only slightly impaired, until the attack of inspissated cerumen, which reduced it so much as to call the patient's attention to it. From my data, I believe that the average hearing power of the side affected by the parotitis was $\frac{15}{40}$.

CASE 6.—*Double parotitis followed by absolute deafness. Patient seen thirty-two days after occurrence of deafness.*

Mabel O., aged four and a half, Feb. 26, 1875. The patient had parotitis about thirty-two days ago. She recovered promptly. Five days after began to suffer from impairment of hearing, and in twenty-four hours she became deaf. For two or three days there was some unsteadiness in her walk, also occasional vomiting. The little patient was very weak.

The patient was found to be absolutely deaf. The drumheads were normal in appearance. No improvement resulted from treatment. That this was a case of disease of the labyrinth is indisputable.

CASE 7.—*Sudden deafness of one ear after mumps. Patient seen a year after the disease occurred.*

R. W. H. of Australia, aged twenty-three, May 3, 1880. The patient states, that he became deaf rather suddenly in the left ear, after an attack of mumps about a year ago. He also had a low fever. Just as he was recovering from the mumps he found that he was hard of hearing on the left side. He could hear the ticking of a watch however. He has remained hard of hearing from that time. H D, R $\frac{48}{48}$; L $\frac{0}{48}$. The bone-conduction for tuning-fork C is better than aërial on the left side. Both membranæ tympani are opaque. No improvement to the hearing resulted from inflation.

This is, I think, a clear case of disease of the middle ear after parotitis; that the internal ear may also have been affected, will not be denied. Yet the probabilities are, that the disease was situated exclusively in the middle ear. The tuning-fork test is, I think, very reliable in determining the situation of the lesion, and that certainly positively indicated disease of the middle ear.

CASE 8.—This case has already been published twice: once by Dr. Buck, in the *American Journal of Otology;* and again by myself, in these ARCHIVES. The patient was treated by Dr. Edward T. Ely and myself, for three weeks, before he consulted Dr. Buck. The reader is referred to these ARCHIVES, vol. x, page 217, for a full account of the case.

Parotitis three weeks before. Deafness two weeks since. Dizziness for one week. Dulness of hearing in the right ear also, which soon passed away. Constant tinnitus.

W. D. C., aged forty-one, sent to me by Dr. J. W. S. Gouley, June 25, 1881.

H D, R $\frac{30}{40}$; L $\frac{P}{40}$ (?). The tuning-fork is heard only in the right ear. It is not heard at all by aërial conduction on the left side.

As I said, in discussing this case in the ARCHIVES, although it had become one of the labyrinth on the left side, it may have begun in the middle ear, for on the other side there was a slight affection of the middle ear, which passed away. I see no reason why a slight affection of the middle ear may not have extended and become a serious affection in a part that tolerates only a very slight lesion; certainly the labyrinth is in direct communication by blood-vessels with the tympanic cavity, which, in turn, through the auditory canal and the mastoid process is directly connected with the parotid gland.

CASE 9.—*Parotitis a year before patient was seen by the writer. Hearing was found to be impaired soon after.*

Janet R., aged twelve, sent to me by Dr. J. W. S. Gouley, March 11, 1882. The patient had parotitis on both sides a year ago. She made a slow recovery. Her hearing was found to be impaired soon after, and it has remained so. Her general health is fair.

H D, R $\frac{48}{48}$; L $\frac{2}{48}$. She cannot say in which ear the vibrating tuning-fork is heard, when placed upon the forehead or teeth. In the left or bad ear the bone-conduction is better than the aërial.

The drumheads are slightly sunken and the light spots are small. The hearing is diminished immediately after inflation.

The patient was seen a few times, but as she seemed to be rather worse for treatment of the middle ear, she was dismissed unimproved.

This case seems to me to be a clear one of disease of the middle ear, although I will not undertake to say that there was not also a lesion of the labyrinth. The fact that she

invariably became worse after inflation of the ear inclines me to think so. But the fact that there was still considerable hearing power left in the ear, inclines me to the belief that the affection was primarily in the middle ear.

CASE 10.—*Parotitis on each side. Chill fourth or fifth day after. Great impairment of hearing. Recovery of one side after inflation of the middle ears. Improvement in the other.*

Robert B., aged eight, was brought to me by his mother on April 24, 1882, with the following history: About three weeks before he was attacked with mumps, affecting each side. On the fourth or fifth day after the mumps appeared, he had chilly sensations one evening, probably in consequence of the lowering of the temperature of the room in which he was. The next day he had a high fever; he vomited; and on that day it was observed that he did not hear well. His hearing has not become worse since, perhaps he is slightly better. He was treated by his attending physician by being kept warm, and injections of a warm solution of chlorate of potash were daily made to his throat. He did not improve much, however. On examination it is found that he hears loud conversation four feet behind his back. Watch, R $\frac{L}{4\,8}$; L $\frac{\frac{1}{2}}{4\,8}$.

The tuning-fork is heard much better through the bones than through the air, on each side.

The right membrana tympani is of good color. There is a well-formed light spot, and it is not sunken. In the left membrana the light spot is small.

On inflation of the middle ear by Politzer's method, the hearing distance for the watch becomes $\frac{1}{4\,8}$ on the right side and $\frac{10}{4\,8}$ on the left, while the voice is now heard 30 feet.

The patient remained under observation until June. He was treated by the use of Politzer's method of inflation, by syringing the naso-pharyngeal space with a solution of chlorate of potash; and he took cod-liver oil. He then went abroad with his parents. He was directed to continue the treatment, according to circumstances, during the summer. When he returned in October he could hear general conversation with ease, but on the right side the watch was only heard when laid upon the ear, and on the left side for 8 inches. R $\frac{L}{4\,8}$, L $\frac{8}{4\,8}$. Voice 30′. About a month afterward, while under treatment, after the escape of quite an amount

of dark-colored viscid material from his nostrils, the patient said that sounds were unusually loud. On examination the next day it was found that the hearing distance of the right ear was $\frac{5}{48}$, and the left $\frac{30}{48}$. After inflation the hearing distance of the left ear became normal, while the right remained unchanged. At the present time, the patient has passed through an attack of inflammation of the auditory canal and tympanic cavity from exposure to cold, but his hearing has become normal on the left side, while it remains impaired on the right. Feb. 9. R $\frac{12}{48}$, L $\frac{48}{48}$. Voice on right side with normal ear closed, 20 feet. The patient is still under treatment.

This case of impairment of hearing after mumps is a very plain one. It is undoubtedly a case of disease of the middle ear, and not of the nerve. The tuning-fork and the results of treatment indicate this. Yet he had symptoms that are sometimes associated with an affection of the labyrinth. It is quite possible that such an affection might have occurred in the course of any acute disease, if the patient were exposed to a chilling of the body. I am confident, however, that if all the cases of impaired hearing occurring after mumps were observed by an otologist as early as this one was, that a similar process would sometimes be found. Most of the cases seen by an aurist are only seen some time after their occurrence, when the history is very vague. The chief symptom is said to be sudden deafness. In this case the deafness was sudden. Had not inflation come to its relief, within a few weeks, this might have been called a metastatic case ; and I believe the labyrinth might have been invaded by the extension of the inflammatory process through the fenestræ. I see no reason as yet to change the opinion expressed in my text-book,[1] and in my article, from which I have quoted, that in some cases the occurrence of inflammation of the ear after mumps is by direct extension of the inflammation to the auditory canal, middle ear, and labyrinth. That there may be a form of so-called metastatic inflammation, I do not deny. Whether the channel of communication is through the blood, cannot as yet be determined. To my mind the probabilities lie in that direction.

[1] Text-book, 4th edition, 1878, p. 539.

The theory of a metastatic inflammation in these cases, is usually not based upon a study of the symptoms at the time they occurred, but upon reasoning from analogy; *i. e.*, it is said, because the testes and breasts are sometimes affected by metastatic inflammation, therefore a disease of the ear, occurring after mumps, is also a metastatic affection. Hinton, as is seen by the quotation, thought a catarrhal inflammation of the middle ear one of the causes, in some cases at least, of the impairment of hearing *often* seen after mumps. As I have shown, my last case was certainly of this character.

Every one admits that cases of extension of suppurative inflammation of the parotid gland to the external auditory canal, are not uncommon. Probably this extension may take place through the fissures of Santorini. If a suppuration may extend in this way, why not a catarrhal process? We are not without examples of the extension of an inflammation to the middle ear from the auditory canal and outer layer of the drumhead. Every physician at all accustomed to see much of aural disease, has seen cases where from a draught of cold air, the entrance of cold water or irritating substances, an inflammation has been set up in the middle ear by extension, and where the symptoms in the auditory canal have passed away long before those in the middle ear have been relieved. Dr. Brunner's case, is by no means given with minuteness. It is impossible to learn from his account of it, how long after the attack of deafness he saw the patient. Until we have a more full report, it is impossible to say whether or not there was at any time, an inflammation of the middle ear. Certainly, however, there was not at the time the patient was examined by Dr. Brunner.

Dr. Buck's first case was seen still earlier than my last one. On the third day of the mumps the patient had "a sharp pain in the right ear"; on the day following, she discovered that she had lost the hearing of that side; on the seventh or eighth day Dr. Buck saw her. The hearing power seemed to be nearly gone, but the pharynx gave evidence of having been recently inflamed, and the drumhead was "slightly drawn inward." The right Eustachian tube was also

swelled, at least "it was only with difficulty" that air could be forced through it into the middle ear.

Certainly here is evidence enough, that whatever happened to the labyrinth, some morbid process had occurred in the middle ear. I do not know of any natural explanation of such a case, but to say that the inflammation extended by continuity of tissue. If an analysis of the ten cases I now report be made, I think we are justified in assuming:

1. An acute catarrh of the middle ear may occur during the course of mumps, and be attended by fever and vomiting.

2. This catarrh may extend from the parotid gland, through the auditory canal and outer layer of the drum-head, or through the mastoid process.

3. An affection of the labyrinth may occur simultaneously, or by extension from the middle ear.

4. It is probable that there are cases where the disease is transferred to the labyrinth in the same manner that an inflammation sometimes occurs in the testes and the breasts during the course of mumps, but this cannot be considered as proven, until more detailed experience is furnished of cases observed a few hours after the impairment of hearing occurs.

Contrary to the opinion of Toynbee, Hinton, and Dalby,[1] I cannot regard these cases as among those that often occur, for after nearly twenty years of active practice among aural patients, I have notes of but ten cases of disease of the ear after parotitis. There is certainly no comparison in this with what occurs in this country after scarlatina, measles, or typhoid fever. Some inquiry among general practitioners has always shown that it is rarely observed by them. My cases were chiefly from places remote from New York City. Very few are presented at my clinic in the Manhattan Eye and Ear Hospital. During the last year there is a record of but one having been seen there by any of the surgeons out of some twelve hundred cases. My innocent remark at the American Otological Society, that I had seen enough of these cases to make me anxious if any one got a disease of the ear

[1] In a letter just received from Dalby, he says: "I may say that it is within my experience, in a very large number of cases, that the hearing is completely lost during an attack of mumps in one or both ears."

during mumps, was in some manner so distorted, that Brunner was led to believe that I had seen many of them. Those that I have seen convince me that any hope of retaining the hearing power, must depend upon the prompt use of local antiphlogistic means. If the labyrinth be invaded, however, it is doubtful if the cases be not incurable, even if seen at the instant the hearing becomes affected. But what is imperatively needed to clear up the whole subject is the assistance of the general practitioner. If he will call in the otologist so soon as the hearing becomes impaired during an attack of mumps, we may explain some, at least, of the points, that are now doubtful.

A CASE OF BIN-AURAL OBJECTIVE SOUNDS WITH SYNCHRONOUS MOVEMENTS OF THE MEMBRANA TYMPANI AND THE PALATAL MUSCLES.

By Dr. RICHARD C. BRANDEIS, New York.

Bessie K., aged twelve years, came to me in December, 1882, for the relief of persistent noises in both ears, which had troubled her for more than a year past. The child, though sufficiently developed for her years, was pale and anæmic, and wore a peculiarly harassed look, evidently caused by physical disturbances.

On questioning her I found that the noises complained of had set in without any assignable cause, and had never ceased since they were first noticed. They were so loud that they could be heard by any one near her. As she expressed herself, "it feels as if there were a clock ticking inside my head."

Although at first very sceptical as to the truth of her story, I was soon compelled to believe it, because I was able to hear a loud, ticking noise on both sides, at a distance of more than eighteen inches from the head. The noises were uniform in intensity and frequency, as far as I could determine by a cursory examination.

On careful inspection I found the left membrana tympani slightly opaque and somewhat retracted, but not sufficiently so to attract special attention. On the right side the membrane was atrophic and very flaccid and, as I soon found, moved to and fro synchronously with the audible sounds. This movement was especially noticeable at the inferior posterior quadrant of the membrane, but on careful inspection I found that the other portions also participated in the vibrations.

The hearing of the voice and watch was normal on both sides, and the patient stated that audition had never been noticeably impaired.

When I proceeded to inspect the pharynx, I was surprised to find that the soft palate and uvula moved up and down in spite of the most forcible pressure being applied to the tongue by the spatula,—which was sufficient to place the anterior and posterior pillars of the fauces on the greatest tension. The retractions of the velum palati corresponded in frequency and regularity with the tinnitus, and, as I found, were synchronous with the movements of the right drumhead.

On inspection of the neck it was found that the muscular contractions also extended to the digastric muscles on both sides, as well as to the mylo-hyoid and thyro-hyoid muscles, but careful laryngoscopic examination failed to show any movements of the larynx, either as a whole or in part.

The palatal contractions numbered from 120 to 124 to the minute, and occurred in cycles, as follows: there would be a forcible contraction bringing the velum into contact with the posterior wall of the pharynx, and then eight or ten retractions, less intense, but much shorter; then there was again a forcible contraction, and the short and sharp ones would follow in due succession. This never intermitted, but continued as long as the patient was under examination.

By throwing sufficient light into the nasal cavity and dilating the nostrils, I was able to observe the regular synchronous movements of the palate in the posterior nares, and, by listening carefully, satisfied myself that the noises were as intense when heard near the nose as near the ear.

On examining the right membrana tympani, I found that its movements were synchronous with those of the palate, and corresponded also in violence. There was noticed a violent retraction of the entire drumhead, but especially of the inferior posterior quadrant, corresponding with that portion generally occupied by the cone of light, and this was followed by eight or ten vibrations, less marked and intense.

I demonstrated the case to my colleagues, Drs. R. O. Born and F. E. D'Oench, who agreed with me as to the synchronous contractions of the muscles of the palate, and probably of the tensor tympani. The patient was given dilute hydrobromic acid, ten drops of which were to be taken four times a day. The medicine was taken regularly for a week, and at that time I learned that there had been daily intermissions of the tinnitus, varying from one half to two and one half hours. At this visit no evidences of

any movements of the right drumhead could be detected, but the contractions of the palate were as frequent as before. Owing to the anæmic condition of the patient, I now suspended the use of the hydrobromic acid, and administered iron and arsenic instead. On December 11th I saw the patient for the third time, and, noting a return of the movements of the drumhead and an increase in the intensity of the tinnitus, I brought the patient under Prof. Knapp's notice, calling his especial attention to the vibrations of the membrane. When he examined her he failed to observe the phenomenon on which I laid such stress, and I then also satisfied myself that these vibrations were not uninterrupted. Arsenic and iron continued, and Politzer's inflation and suction by means of my modification of Siegle's speculum applied. These were followed by a temporary amelioration of the symptoms, which, however, only lasted one or two days, and when I again saw the patient on the 15th all the phenomena were present. I now introduced Politzer's manometer, a curved tube, one millemetre in diameter, filled with colored fluid, into the right meatus, which was also filled with water, the two columns of fluid being joined by a rubber tube passed over the proximal portion of the manometer, and preventing any ingress of air. Decided fluctuations in the column of fluid contained in the manometer took place, varying in height from one half to one and one half millemetres. This fluid was never raised above the zero mark, but fell from it a variable distance, as noted above, showing that the movements of the drumhead were not positive, but negative ; in other words, there was no protrusion, but a marked retraction of the membrane, varying in frequency from 120 to 126 times in the minute.

In order to determine whether these movements were dependent upon contractions of the tensor tympani muscle, or whether they were due to the alternate compression and escape of the air contained in the Eustachian tube and the tympanic cavity, I applied a thick layer of collodion to the entire surface of the drumhead. As soon as this became adherent and all the ether had evaporated, the membrana tympani was drawn outward and was quite rigid. All movements of the drumhead were suspended, and the noises were as persistent and intense as before, and were audible at twenty-one to twenty-four inches. This proved conclusively that there was no spasm of the tensor tympani which might explain the synchronous in- and excursions. This immobility obtained for more than a week, when the collodion began to flake off, and

as the drumhead was restored to its normal condition, the tinnitus reappeared as of old.

During all this time there was no appreciable change in the frequency or the nature of the contractions of the palatal muscles, and in consequence thereof, I was unable to afford the poor patient any relief from the noises which so sorely distressed her.

I was very anxious to get a rhinoscopic view of the pharyngeal orifices of the Eustachian tube in order to determine the effects which the continuous muscular contractions might have on the lips of the canal. But owing to the uninterrupted movements of the palate, and to the small size of the naso-pharyngeal cavity, I was unable to make an examination. In order to enlarge the cavity by drawing the soft palate forward, I employed Wales' method, which consists in passing a narrow band through one of the nasal passages into the pharynx, then drawing it out through the mouth and tying both ends over the teeth. Passing the narrow tape into the right nasal canal, I succeeded in drawing the right half of the palate forward and introducing a small rhinal mirror. I soon had a view of the corresponding opening of the Eustachian tube ; but owing to the force employed in drawing the palate forward, I overcame the tendency of the muscular contractions, and thus was foiled in my desire to witness the alternate opening and closure of the mouth of the tube. I observed, however, that as long as the traction on the muscles of the soft palate endured, there was a cessation of the noises in the corresponding side of the head. As soon as the tape was slightly loosened, these began to manifest themselves again ; and when the ribbon was entirely removed, they reappeared with their original intensity. During this experiment the left half of the soft palate continued to contract and relax without any diminution in its intensity.

At the next visit which the patient paid me, I introduced two tapes, one into either nasal canal, and tying both of them so tight that the palate was absolutely unable to move, succeeded in causing the noises to disappear entirely for the time being. This was but sorry comfort ; for as soon as the tapes were loosened and withdrawn, the tinnitus reappeared with greater force and frequency than before.

This abnormal behavior of the soft palate, and of the posterior wall of the pharynx, induced me to make an effort to repeat the

experiments of Gentzen,[1] and Falkson,[2] in order to see whether I could obtain any graphic illustrations of the excursions which these parts made. As both these observers experimented upon patients in whom the orbit had been eviscerated, and the orbital walls removed, so as to expose the nasal surface of the palate plainly to view, I was compelled to modify my experiments, as in my case the parts were intact. I made a small lever of cedar wood, 1.5 *mm.* in thickness, 3 *mm.* in width, and 15 *cm.* in length, and wrapped a bit of tin-foil around one end of the strip of wood so as to increase its weight. To the other end of the lever I fastened a small piece of lead pencil. A small hook was fastened into the middle of the lever, and a piece of elastic steel wire attached to it, which was again fastened to a hook in a forehead band, which was passed around the head of the patient. I now introduced the lever into the right nasal canal, in such a manner that the end which was weighted with the tin-foil rested directly on the soft palate. I was, however, disappointed in my hopes in having the lever move synchronously with the soft palate, owing to the small size of the nasal passage, which prevented the lever from moving freely.

Having failed in this endeavor, I made up my mind to have a depiction of the movements of the palate by introducing the lever into the oral cavity and placing it on the velum palati. Taking care that the steel wire was clear of any of the prominences of the face, I was delighted to find that my pencil moved up and down with a freedom equal to the retractions of the palate. I found, however, that the lever was easily displaced from its position as long as it was in contact with the concave surface of the soft palate. This was remedied by grooving the tin-foil transversely, and then passing the posterior ridge behind the free border of the velum palati. When put in this position, the lever was not liable to displacement, and recorded the movements of the palate with great accuracy. The irritability of the soft palate was such, that it was not possible to keep the lever in position for more than a few seconds at a time. The drawings were made on card paper, which was attached to a Marey's sphygmograph, which was placed before the pencil in such a manner that its movements were lightly traced upon the paper.

After the pencil began to trace, five or six sharp curves were

[1] Beobachtungen am weichen Gaumen nach Entfernung einer Geschwulst in der Augenhöhle. Konigsberg, 1876.

[2] Beitrag zur Functionslehre des weichen Gaumens und des Pharynx. *Virchow's Archiv*, vol. lxxix, 1880.

made in rapid succession, followed by a low curve, and again succeeded by a number of sharp, short tracings. These corresponded with the contractions of the velum palati, and with the noises perceived by the patient and observer.

Although cases of objective noises in the ear have been reported by many observers, among them Lucae,[1] Politzer,[2] Delstanche,[3] Johannes Mueller,[4] Küpper,[5] Poorten,[6] Holmes,[7] and S. M. Burnett,[8] the text-books generally give but a meagre account of this condition. In Burnett's treatise on the ear[9] we find a very able and judicious consideration of objective noises in the ear, with a careful analysis of the literature to the time of publication.

The four authors first named above have given instances in which the noises were due to voluntary efforts on the part of the subjects, and were probably produced by a voluntary contraction of the tensor tympani muscles, as suggested by Lucae.

I have a friend, a physician, subject to chronic rhino-pharyngitis who can produce these sounds at will. In his case, however, I am pretty well convinced that the tinnitus is not due to any clonic spasm of any of the intrinsic muscles of the ear, but is owing to forcible contractions of the masseters combined with a gentle friction sound, produced by the movements of the condyle of the lower maxilla in the glenoid fossa. In this case the sounds are distinctly audible at a distance of several inches from the subject.

Cases in which the noises were of an involuntary nature afford more interesting features than those above mentioned, and the explanations given of the causes thereof have been of various nature. For instance, they have been attributed by Müller and others to contractions of the tensor tympani muscle; Wreden has reported a case in which the

[1] *Archiv für Ohrenheilk.*, Bd. iii, p. 201, 1867.
[2] *Ibidem*, Bd. iv, p. 19, 1868.
[3] "Étude sur le Bourdonnement de l'Oreille," Paris. 1872, p. 47.
[4] "Manual of Physiology," Eng. Edit., London, 1838–42 vol. ii, p. 1262.
[5] *Archiv für Ohrenheilk.*, p. 296, 1873.
[6] Poorten: *Monats. für Ohrenh.*, No. 4. 1878.
[7] *Archiv of Otol.*, vol. viii, p. 145, 1879.
[8] *Ibidem*, vol. viii, p. 357.
[9] Philadelphia, 1877, p. 440, *et seq.*

tinnitus was supposed to be due to clonic spasm of the stapedius muscle. Politzer and Luschka have attributed the noises to a spasm of the palatal muscles, by means of which the anterior wall of the orifice of the Eustachian tube is suddenly drawn away from the posterior wall, and the noise is produced by the sudden and forcible contraction of the muscles. I am convinced that this was the cause of the tinnitus in the case which I have just described, in spite of the movements of the membrana tympani. This latter condition might lead one to suppose that there must have been simultaneous or consecutive contractions of the tensor tympani muscle on the right side at least, but I think that this can be disproved by the fact that the tinnitus remained unaffected in spite of the exhaustion of air in the external meatus, by means of my suction syringe. I applied sufficient force to draw the entire drumhead and chain of bones outward, which would have been sufficient to overcome any tendency to contraction, if only while the instrument was applied. These movements of the membrana tympani were probably due to a vacuum in the Eustachian tube and tympanic cavity, caused by the sudden opening of the faucial extremity of the Eustachian tube and the contraction of the muscles of deglutition, which tended to exhaust the air contained in the cavity of the middle ear.

In Küpper's[1] case which was very similar to mine, the spasm of the palate could be controlled by the application of pressure on the base of the tongue and on the minor occipital nerve near the insertion of the sterno-cleido mastoid muscles. I found, however, that when I applied a tongue-depressor the movements of the palate became more rapid, although the excursions were not so great as before; but the contractions of the glossal muscles were somewhat retarded.

The cause of the muscular contractions in my case is difficult to find, the more so as spasms of the muscles of deglutition are very rarely met with; and in spite of a very careful search I have not been able to find any mention thereof in the more recent treatises on diseases of the nervous system.

[1] *Loc. citat.*

After I had had my patient under observation for some time, and finding that there were some symptoms pointing to a tendency to the appearance of the menses, I supposed that she might have an inclination to chorea. I thereupon placed her upon a course of arsenic and iron. This, however, failed to afford any relief, although her general condition improved considerably. Later, I combined this with application of the induced current, both generally and locally, but without any apparent benefit. The patient has recently passed from under observation, but I have no reason to believe that the condition complained of has been ameliorated.

ANATOMICAL RESEARCHES ON THE DEVIATIONS OF THE NASAL SEPTUM.

STUDY OF THE DIFFICULTIES WHICH THEY OCCASION IN OPERATIONS, AND ESPECIALLY IN THE CATHETERIZATION OF THE EUSTACHIAN TUBE; EXPLANATION OF A NEW METHOD FOR OVERCOMING THEM.*

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(*With five wood-engravings.*)

I HAVE been impressed by the fact that although one may justly be preoccupied by the difficulties of introducing the beak of the catheter into the orifice of the Eustachian tube during catheterization, sufficient account is not taken, in my opinion, of the obstacles which so often interfere with the first act of this operation, that of the passage of the instrument into the nasal fossæ.

It is, however, during this period of catheterization, that the patient is liable to experience the greatest discomfort, because the instrument touches hard parts of bone and cartilage in the nose, contact with which may become extremely painful. What aurist has not seen patients so terrified by the distressing sensations occasioned in the beginning of catheterization that they interrupted the operation and absolutely refused its repetition, thus frequently making all efficacious treatment impossible?

I go so far as to think that the dread inspired in the public by Eustachian catheterization proceeds chiefly from the pain occasioned at the time of the passage of the instrument through the nose. It has, therefore, seemed to me useful

* The practical portion of this work was briefly communicated by the author to the International Congress of London, and published in the transactions of that Congress vol. 3, pp. 432-434. The anatomical researches were made during the winter of 1881-1882. Later articles, such as that of M. Zuckerkandl, not having been at the disposal of the author, could not, therefore, be utilized for this study.

to investigate the causes of this phenomenon more carefully than has been done up to this time, and to find out whether it be possible to avoid the inconveniences to which I have referred.

The following article contains the results of my anatomical and clinical researches on this subject.

My investigations had for their object the solution of the three following problems:

1. What is the seat and the nature of the obstacles which so frequently arrest the catheter during its passage through the nose?

2. What is their rôle in this operation, and in the therapeutics of the nasal fossæ?

3. How can one recognize the existence of these obstacles, and avoid them in a rational and scientific manner?

I.—SEAT AND NATURE OF THE NASAL OBSTACLE IN CASES OF DIFFICULT EUSTACHIAN CATHETERIZATION.

A.—*Clinical investigations.*

Long before undertaking the special researches which form the basis of the present article, I had learned by practice that, in the case in question, the obstacle is seated in the front and lower part of the nasal fossæ. It was, therefore, evidently useless to have recourse to posterior rhinoscopy, which generally only reveals to us the reflection of the back and upper part of the nasal fossæ, foreshortened and from behind.

Facts having proved this to me, I was obliged to use anterior rhinoscopy, the examination of the interior of the nose by the nostrils.

This method demonstrated that *in the numerous cases where the catheter encounters an obstacle in the nasal fossæ, this is not in the turbinated bones, as is often supposed, but in the septum.* A priori, one would be inclined to charge this either to hypertrophy of the lower turbinated bone, which is so common, or to the presence of mucous polypi; but inspection by the method which I shall explain later, shows that the much enlarged mucous membrane of the turbinated bone generally yields enough to a gentle pressure to allow

the passage of the catheter. As for the mucous polypi, they let the beak of the instrument go by, taking their original position again as soon as it is passed.

The obstacle therefore belongs only to the septum; it forms there the protuberances or spurs which I have described in a previous article.[1] I only considered them in that place in regard to their importance in the treatment of chronic coryza by the galvano-cautery, and I merely mentioned there the part they play in the catheterization of the Eustachian tube, giving notice that I should take up the subject in a later publication. The present article is intended to realize the execution of that project.

Having recognized the seat, always identically the same, of these particular deformities of the septum, and the important part they may play in catheterization, of which we shall treat farther on, I was desirous of elucidating the *anatomical pathological-conditions* under which these malformations present themselves. In doing so I was asked to enlarge the field of study, and to consider various other points concerning the nasal septum.

B.—*Anatomical-pathological researches on the deviations of the nasal septum.*

My researches are based, on the one hand, on the dissection of more than one hundred fresh heads; on the other, upon the study of skulls at the Orfila Museum of the Faculty of Medicine, Paris, and especially of the immense anthropological collection at the museum of the Jardin des Plantes. As the cartilaginous framework is more or less completely lacking in dry skulls, I have examined them particularly with regard to the conformation of the vomer and the perpendicular lamella of the ethmoid, while I have studied the cartilaginous septum from life and from fresh heads which I have dissected.

Knowing that the reading of dry columns of figures alarms the most intrepid reader, I refrain from presenting a detailed table of the different categories of my observations, which

[1] B. Loewenberg: Contribution au traitement du coryza chronique simple. In *Union médicale*, 28 Juillet, 1881.

have been made upon hundreds of skulls. I shall confine myself to stating briefly the principal results of these researches.

Superior horizontal deviation of the nasal septum.—It is only in about one case out of seven that I have found a septum absolutely straight in all its parts, consequently in a much smaller proportion than is generally supposed. (See treatises on anatomy.)

In other cases, which constitute, as one may see, the very large majority, one or several deviations exist. According to my investigations, these must be divided into several groups, which I shall call *vertical deviations* and *horizontal deviations*, the latter being divided into *superior and inferior horizontal deviations*.

The superior horizontal deviation pertains to the upper portion of the septum, and particularly to the perpendicular lamella of the ethmoid. Its convexity is oftener in the direction of the right than of the left, in a proportion which I have found to be from about three to five.

Inferior horizontal deviation of the nasal septum.—I call inferior horizontal deviation the lateral deformity of the lower part of the septum. It occurs, as I said in my communication to the London Medical Congress,[1] at the junction of the cartilaginous with the osseous septum; or, to express it more precisely, at the junction of the inferior posterior border of the cartilage of the septum, posteriorly, with the anterior border of the vomer, and, anteriorly, with the ridge that surmounts the line of junction of the palatine apophyses of the superior maxillaries.

It proceeds from the fact that the bony part on the one hand and the cartilaginous part on the other are not in the same vertical plane, but join under a dihedral angle projecting toward one side. When this deviation extends as far as the front extremity of the junction, it forms there the protuberances or spurs which I have described (*loc. cit.*), and which are located in accordance with what I have just said of their origin, in the lower and front part of the nasal

[1] Transactions of the International Medical Congress, London, 1881, vol. iii, p. 432.

fossæ, where this osseous-cartilaginous junction terminates. In cases where these excrescences are unilateral, they exist oftener at the left than at the right, as does the convexity of the lower horizontal deviation, as we shall see later.

I have studied the conformation of the lower deviations, and the protuberances which result from them, from numerous vertical and transverse sections of the septum. They have shown me that these projections could be formed in several different ways (figs. ii, iii, and iv, at the end of this paper.) In the great majority of cases it happens in this way: It is known that the two lamellæ of the vomer form between them a groove, open at the top and in front, which continues along the crest of the maxillaries, often as far even as the front and lower nasal spine. The edges or lips of this groove receive between them the lower edge of the cartilage, which here presents a very marked enlargement of triangular shape (figs. i and ii, 4). Any one examining a certain number of skulls is struck by the fact that the front part of the osseous septum is often inclined on one side in such a way as to encroach upon one of the nasal fossæ. In these cases the lip of the vomer and of the crest of the maxillaries advances toward this side, and makes with the edge of the cartilaginous septum which inserts itself there, the acute angle which constitutes the lower deviation. The angle is therefore formed by a lower osseous plane and an upper cartilaginous plane.

It is the same with the protuberances which it forms at the entrance of the cavity.

Often this projection is not confined to the entrance of the nasal fossæ, but extends all along the septum. In very marked cases the appearance in living subjects is rather singular; when dilating the nostril and illuminating far into the interior of the nose, one sees running along the septum a sort of pad or cushion, placed laterally. As one examines it from the front to the back, it is seen to rise more and more, conformably to the direction followed by the osseous-cartilaginous junction, the projection of which forms it.

Dissection and the study of dried skulls have taught me that the deviation sometimes continues beyond the car-

tilaginous part, and then inclines toward the suture which follows it ; that is to say, toward the junction of the vomer with the perpendicular lamella of the ethmoid.

In certain cases where the vomer itself presents no inclination, one of its lips may, nevertheless, advance toward one side and there form a protuberance with the lower back edge of the cartilage which inserts itself in this place.

Thus, therefore, the lower deviations and their protuberances are formed by the lateral inclination of the bone and cartilage, and both contribute usually, as sections demonstrate, to the formation of the projection. I have, however, met with subjects where one or the other, alone, was accountable for the prominence. This particularity was often due to a marked incurvation of the front and lower part of the cartilage, or to its oblique implantation (C. figs. iii and iv). Here the lower swollen edge is no longer exactly encased in the bony groove, but overruns it on one side, and forms the projection of itself. In other individuals the effect of this asymmetry is that the protuberance is formed on one side by the cartilage, and on the other by the bony substance (fig. iii), just as if the cartilage had slipped laterally upon the bone.

Figures ii, iii, and iv represent some of the most remarkable sections which I have obtained; they show the different ways in which the substratum of these deformities is constituted in different individuals.

Relations of horizontal deviations to each other.—In the majority of cases I have found that the inferior deviation forms the reverse of the superior deviation; that is to say, that the convexity of the one is turned in the opposite direction to that of the other; for example, in the case most common, that where the septum deviates to the right in its upper part, it deviates, on the contrary, toward the left in its lower part. We have already seen that this conformation generally involves the existence of a protuberance on the side of the convexity of the inferior deviation; here, then, is the explanation of the greater frequency of the spurs in the left nostril.

In certain persons the arrangement is still more irregular:

it is like a kind of torsion or undulation of the septum from top to bottom, by means of which the groove of the vomer and the crest of the maxillaries do not participate in the curve of the lower deviation, but deviate in their front part in the same way as the superior deviation; for example, in case of superior deviation to the right, and of inferior deviation to the left, the right lip of the vomer is projected into the right nasal fossa, and forms a protuberance there.

In the minority of cases, the convexities of the two horizontal deviations face the same way. Here the lamella of the ethmoid bulges on one side (superior deviation), and is as if arched over the vomer; the angle it makes with the latter constitutes the inferior deviation. The protuberances, when they exist, are usually found in these cases on the same side as the two convexities. Sometimes, however, they are on the opposite side, on account of a species of twist similiar to that which I have described for the preceding group.

(I will add that I have at times seen something analogous, but working in a horizontal direction and on the same deviation, the direction of which then varies from the front backward; for example, an inferior deviation, the front part of which directed its convexity to the right, the back part to the left.)

Vertical deviation of the nasal septum.—Besides the horizontal deviation which I have described, I have found, either in the living subject or in the cadaver, anomalies of quite a different kind and which do not seem to have been appreciated according to their importance. These are deviations in the vertical direction. They are not, like the preceding, horizontal or slightly ascending projections, but *folds extending from top to bottom along the septum narium* in its front part, consequently pertaining especially to the cartilage of the septum. These folds present a convexity toward one side, a concavity toward the other. When they extend all the way down, they sometimes obstruct the inferior meatus as a protuberance proceeding from an inferior horizontal deviation would do.

In addition to the deviations which I have described,

there are in certain cases more complicated and more irregular deformities, sometimes to such a degree as to defy all description.

If horizontal deviations are manifestly due to malformations, I have, on the contrary, seen a certain number of vertical deviations which proceeded from traumatic causes, such as a fall, or a blow upon the nose dating from early childhood. Perhaps the irregular deviations which I have just mentioned may also be of traumatic origin.

II.—RÔLE OF DEVIATIONS OF THE NASAL SEPTUM IN SURGICAL THERAPEUTICS, AND ESPECIALLY IN THE CATHETERIZATION OF THE EUSTACHIAN TUBE.

In analyzing exactly the importance of the deviations of the septum narium, it seems to me that the injurious influence which they may exercise in regard to the functions of the nasal fossæ has been exaggerated, whereas enough consideration is not given to the impediments they often occasion in the diagnosis and the treatment of affections of these cavities.

In regard to the first point, it is thought that these malformations may considerably impede respiration and phonation. On this subject, I call attention to the necessity of distinguishing between the two groups of deviations which I have established above.

If it be supposed that the horizontal deviations can oppose themselves to the passage of air, so far as to hinder these two physiological actions, it must not be forgotten that the aërial circulation, although diminished in one half the nose (by reason of the convexity of the deflected septum), is therefore all the more free in the other, on account of its enlargement by the concavity of the septum. There is therefore compensation. It is otherwise with vertical deviations; here there can be no question of compensation, for this deformity narrows one of the nasal fossæ from top to bottom, to the degree of closing it almost entirely in certain cases, without the other being widened on that account, at least at the place where the fold begins. Now, it suffices,

I think, that there should be in the whole extent of the nasal canal one single narrowed point which does not allow the air to pass in sufficient quantity under the ordinary respiratory pressure, to make respiration by the nose impossible.

(I do not insist further upon this point, having enlarged upon it in my article on adenoid tumors.)

If the influence of deviations on the physiological function of the nasal fossæ is exaggerated, the other extreme is fallen into, I think, as to their importance for the diagnosis and treatment of affections of these cavities. It is, however, evident, *a priori*,—and a long experience has proved it to me,—that the convexity of the deformity may hide from sight and screen from surgical operation, all or part of the depths of a nasal fossa, while the concavity may harbor tumors which run the risk of passing unnoticed. This is what happens with horizontal and still more with vertical deviations. We will pass summarily in review, in relation to the effect of these deformities, the pathology and therapeutics of the nasal fossæ, and terminate with Eustachian cathethrization considered from this special point of view.

A.—*Simple chronic coryza.*

Like many other specialists, I am of opinion that the principal part in the treatment of chronic coryza belongs to the galvano-cautery. In a former article (*loc. cit.*) I treated this point, and brought forward the difficulties of sparing the septum in cases where deviation exists. I described in the same place cauteries made specially for this purpose according to a new principle, that of the unilateral action. They are indispensable in cases of decided protuberances, to avoid burning the latter, which I consider as *noli me tangere*, because the cicatrization of cartilage wounds is extremely difficult, especially in the case in question, where the perichondrium is necessarily destroyed by the cautery. I will add briefly that I have succeeded in making these instruments much flatter still, and consequently much easier to use, by turning back the sheet of platinum upon the flat side of the cautery.

B.—*The mucous polypi of the nasal fossæ.*

In following the old methods, according to which the mucous polypi of the nose were torn away with pincers without dilating the nostrils or illuminating the nasal fossæ, the turbinated bones have often been fractured—even torn away. I firmly believe that the protuberances of the septum, often visible to the naked eye on raising the end of the nose, must have met with a similar fate. The present methods, which permit us to radically cure this formerly incurable affection, are, as is known, the use of either the cold or galvano-caustic snare, and the subsequent destruction of the pedicles by the galvano-cautery.

One can readily understand that a marked deviation of the septum may seriously interfere with this form of treatment. The vertical deviation must be mentioned here in the first place; sometimes the convex fold which it forms at the opening of a nostril masks it completely. It then becomes very difficult to recognize the existence of the polypi and to reach them with the snare. Here is a curious example of this kind, upon which I operated in 1878. The patient, aged sixty, who had long been affected with mucous polypi of the nose, presented a vertical deviation. The cartilaginous septum had deviated from top to bottom, toward the left. The right nasal fossa, which was very wide, contained an enormous quantity of tumors easily seen and taken hold of, and which I was able to extract with ease by means of the galvano-caustic snare. On the left, after having removed some polypi which came forward as far as the entrance of the nostril, I was met by the convexity of the vertical deviation. Between the projecting fold which it formed from top to bottom, and the outer wall of the nasal fossæ, there was only an opening the size of a pea, quite filled by an end of polypous excrescence. On the other hand, palpation by the pharynx with the finger showed that the whole portion of the nasal fossa back of this contraction was filled with polypous masses. The patient not being able to endure posterior rhinoscopy, and being obliged to leave Paris at once, I could not operate

upon the polypus from behind, but I was obliged to adopt the method of tearing away, which I only use in case of its being impossible to do otherwise.

I took hold of the excrescence with the snare, and gently drew out, through the small opening, an enormous and very soft polypus, having exactly the shape and size of a white worm (larva of Melolontha vulgaris, May-bug) arrived at full maturity. Immediately after, palpation showed that the fossa was empty. Had it not been for want of time, I could have accustomed the patient to rhinoscopy and then I could have destroyed, as I usually do, the point of implantation of this polypus by means of a galvano-cautery, bent and introduced by the pharynx under the control of the mirror; not being able to do so, I could not promise the patient that there might not be a relapse.

In the case of another gentleman whom I still see occasionally, there is horizontal superior deviation convex at the right, and horizontal inferior deviation convex at the left; the two nasal fossæ were filled with mucous polypi. After relieving the left of those which obstructed it, I finally found still another bunch of small polypi, beginning at the posterior extremity of the middle turbinated bone and niched in the concavity of the perpendicular lamella of the ethmoid, which had deviated to the right. It required persistent effort and an energetic but prudent use of the galvano-cautery of lateral action to destroy these tumors and to preserve the septum intact.

C.—*Epistaxis.*

I merely mention the difficulties caused by deviations in cases of obstinate epistaxis, when they hinder the search after the point of bleeding.

D.—*Nasal pharyngeal douche.*

I call attention very particularly to the importance of deviations of the septum in the use of the Weber douche, not only because the injection passes with difficulty into the nasal fossa which is contracted, but *because it passes too easily into the other which is widened.* Poured into the latter, the

liquid reaches the nasal pharynx superabundantly, and thence passes, behind, into the narrowed nasal fossa. The effect of the contraction of the passage is an augmentation of resistance and of lateral pressure upon the nasal and pharyngeal walls, and finally the liquid may invade the Eustachian tube and even the tympanic cavity.

If too strong a pressure be used (a syphon hung too high above the head of the patient, for example), and a liquid too cold, too warm, too concentrated, or not enough so, a violent otitis media may result from this penetration of the liquid into the cavity.

In my opinion, such imprudences as these have prevented distinguished aurists, particularly in America, from making use of this process, which I believe to be excellent, on condition of employing it according to the following directions:

Injection with gentle pressure (I prefer the use of a syringe, the stream of which can be immediately stopped or checked); tepid liquids, consisting of weak solutions; straight position of head of the patient. Necessity of thoroughly teaching the method and having the person in charge of making the injections practise it before me. In cases of considerable deviations, inject only by the narrowed side.

E.—*Catheterization of the Eustachian tube.*

At the beginning of this article I dwelt upon the importance of a free nasal passage for Eustachian catheterization. We have also seen that one must not be satisfied, in this matter, to speak, as many classical works do, in a general way, of "deviations of the septum"; but examining the question more closely, as we have above,we must distinguish between the different groups of these anomalies. We will now apply the results of my investigations to this special point.

We must first eliminate the horizontal deviations, which I call the *superior*. Not bearing at all upon the inferior nasal meatus, they could not impede catheterization, which has this canal for its field of operation.

On the other hand, I think I have found in inferior devia-

tions, and especially in the protuberances or spurs so often formed by the anterior extremities of these deformities, the principal cause of the diseases of the nasal passage and of the difficulties which are so common in operating through it. Examination of the museum skulls has proved to me that the inferior deviation directs its convexity oftener to the left than to the right, and that consequently the protuberances exist oftener at the left. This particularity seems to explain a fact known, but insufficiently explained up to the present time: *the greater difficulty of the catheterization of the left ear.*

I am in the habit of accompanying the notes which I take of all my patients with elementary drawings in cases which present an anomaly of conformation or any injury worthy of notice. I represent in this way perforations of the drum, exostoses of the auditory meatus, obliquity of the uvula, hypertrophy of the tonsils, deformities of the nasal fossæ, etc., etc. Now, in the majority of my drawings of the septum narium, I find the protuberance on the left. Since 1877, for instance, I have drawn twenty-eight cases where it occurred on that side, eleven where it existed on the right, and fourteen where both sides were affected. And yet I have only drawn cases of nasal obstacles developed to such a degree that they seriously hindered catheterization, and of which I wished to keep a memorandum for future use.

We will now inquire how these protuberances, which so often present the greatest obstacles to catheterization, impede the progress of the catheter. As I have often proved by means of the combined method, which I shall explain later, as soon as the beak of the catheter approaches the entrance of the nasal fossa it strikes against the protuberance which faces it, and which obstructs the width of the inferior meatus where the operation is to be performed (*vide* fig. ii, where 2 represents a slightly developed protuberance). It is then that the Schneiderian membrane, tightly squeezed between two hard substances, viz.: the catheter and the osseous-cartilaginous substratum of the spur, suffers a strong pressure, very painful on account of its abundance of sensitive nerves. (What occurs

here might be compared—*mutatis mutandis*—to what happens when the tibia is struck; the pain results in the same way from the compression of a thin skin between the contusing body and the underlying tissue in contact with the bone.) Thence the fact which I mentioned above, and which is known to all aurists, that many patients at the beginning of catheterization withdraw the head, and refuse the continuance or repetition of the operation. If one persist in advancing the catheter, the protuberance causes the point of the instrument to deviate; it then strikes against the lower turbinated bone, or else passes into the middle meatus. In both cases it is manifestly impossible to complete the operation, unless by an energetic downward pressure, very painful for the patient, the instrument be forcibly drawn back into the inferior meatus and force a passage while maintaining it. In certain cases of vertical deviation the fold of the cartilage continues all the way down, and may obstruct the inferior meatus as a protuberance would do.

Even Politzer's mode of procedure may become difficult on account of the protuberances occasioned by one or the other of these deviations, for their compression by the end of the balloon causes pain to certain patients. It is useful, in such a case, to employ the modification which I proposed long ago, and which, indeed, has been generally adopted: it consists in adding to the end of the balloon a little soft rubber tube, which prevents any disagreeable pressure.

I will add that the projections may make the simple examination with the nasal speculum disagreeable to the patient, on account of the tip of the instrument striking against these highly sensitive spurs.

III.—NEW METHOD FOR AVOIDING NASAL OBSTACLES IN THE CATHETERIZATION OF THE EUSTACHIAN TUBE.

Instead of the probing, so painful to the patient, to which one is forced to resort in the frequent cases where protuberances exist, is it possible to imagine a truly scientific method to facilitate catheterization under these circumstances?

I begin by rejecting any sanguineous operation, such as the ablation of the deviated portion of the septum. In such an act of surgery, the shot would go far beyond the mark, especially taking into consideration what I said previously in regard to the difficult healing of wounds of the cartilage.

The point, therefore, is to get round the obstacle and not to remove it *manû armatâ*. This can be managed in many cases by a process which is known, *catheterization by the opposite nostril*. But cases where protuberances exist on both sides of the septum are not rare, as I have already explained, and then passage is hindered in both nasal fossæ, especially for catheters with a beak long enough to penetrate into the tube of the opposite side. And it is often very difficult by this method to make the instrument penetrate far enough forward into this canal and in a good enough direction to allow the air to penetrate sufficiently, much less liquid substances or bougies! For some years I have used a process which may be said to allow the catheter in all cases to pass through *the narrowed nasal fossa*, sparing meanwhile the sensitiveness of the patient. This method suggested itself to me from the habit of exploring the nasal fossæ of all my patients: it is *catheterization guided by* SIMULTANEOUS anterior rhinoscopy, which process I will now explain. Great importance is justly attributed to the exploration of the buccal and naso-pharyngeal spaces, in the study of diseases of the ear. I have insisted upon this point since 1865, and my efforts have perhaps contributed, with those of such men as v. Troeltsch and Voltolini, to calling attention to this subject.

The point now is to take another step in advance, and to join to the indispensable auxiliaries of the aurist the attentive study of the nasal fossæ, which is no less important in his specialty than is that of the pharynx. The importance of this study is obvious: the interior mucous lining of the nose is continuous with that of the entrance of the tube; the permeability of the nasal cavities influences the access of air to this canal, and finally catheterization and the system of Politzer have the interior of these cavities for their

operating ground. In considering, therefore, the importance of the conformation of the nasal fossæ for these operations and of the condition of their mucous membrane for that of the middle ear, I lay down as a principle *the necessity of exploring the nasal fossæ of every person requiring our attention for an affection of the ear*, unless the disease be manifestly confined to the external ear or to the auditory meatus (eczema, foreign bodies, furuncles, etc.). I do not go so far as to require, in every case, the practice of posterior rhinoscopy, which often necessitates a series of preparatory visits before succeeding completely. On the other hand, anterior rhinoscopy is performed with great ease and always succeeds the first time.

On dilating the entrance of the nasal fossæ by means of the speculum, and projecting (natural or artificial) light into these cavities by the aid of the concave reflector, the eye penetrates to a great depth into the interior of the nose. The first glance shows the conformation of the septum and of the inferior and middle turbinated bones as well as the condition of the mucous membrane and its secretion. We know that in certain cases of abnormal size of the nasal fossæ (ozæna) the eye may pierce as far even as the posterior wall of the naso-pharynx, and on causing the patient to make the motion of deglutition the phenomenon of the pharyngeal contraction may be observed.

In exploring the interior of the nose the glance of the observer includes particularly the anterior and inferior regions of the nasal fossæ, precisely the part where are located the protuberances which form the special obstacle to catheterization in regard to the passage of the instrument through the nose. This same glance shows the operator whether the conformation be normal or the reverse, and, consequently, whether the catheter will pass easily or with difficulty. In the case where anomaly exists, he recognizes at once the nature and configuration of the obstacle. Besides, and on this point I would lay special stress, this observation shows him at once how he can remedy these inconveniences by *my method: catheterization combined with anterior rhinoscopy*.

The surgeon would certainly be blamed who performed

an operation by sense of touch and without the aid of sight upon a part accessible to his gaze—the "oculis subjecta fidelibus" of Horace. As incredible a thing happens, however, daily, even in the most difficult cases of Eustachian catheterization! No one thinks of performing this operation while inspecting, at the same time, the nasal fossæ, which are rendered accessible to the sight by the speculum and lighted by the reflector. This process, the idea of which ought to come, it would seem, to the mind of every aurist, has not, to my knowledge, been indicated up to the present time. I have had occasion to explain it before numerous confrères, both at the last meeting of the International Congress of London (1881), and in Paris, and, to my great surprise, I have met no one who had put it in practice.

Method of Operating.—When catheterization is to be performed upon a patient, and inspection has made evident the regular conformation of the nasal septum, I take off the speculum and the reflector, and proceed according to the usual methods. If, on the contrary, there be a protuberance on the side to be operated upon, I leave the speculum in its place, and also keep on the reflector to light the operating ground. It is plain at once that in proceeding according to the usual method, that is to say, in introducing the catheter the point downward, the beak of the instrument would inevitably graze the protuberance which bars the inferior meatus to a greater or less extent in different cases (see fig. i; the drawing represents a protuberance slightly developed). But one discovers at the same time farther beyond, an interstice (fig. i, 3) having the protuberance on the inside, the inferior turbinated bone above and behind, and the floor of the nasal fossæ below. It is by this path which presents itself to view, already marked out, that the catheter is to be surely and easily directed. To do this, the instrument should first be turned around its longitudinal axis, so as to place the beak outward and to present it in face of this interstice. In advancing it will soon be possible (as soon as the protuberance is passed) to make it resume its normal position, that is, the vertical direction, for, as we have seen, the horizontal inferior

deviation rises as it progresses toward the interior, and soon lifts itself above the inferior meatus.

One then performs what is called "le tour de maître" (the master-stroke), to borrow this term from urethral-vesical surgery. But it is going a great deal too far to recommend making as complete a movement as is done in the catheterization of the urethra, that is to say, turning the instrument through an arc of 180° around its longitudinal axis. According to my experience, a rotation of from 45° to 60° generally suffices to accomplish the object, which is merely to avoid the protuberance. (Fig. i represents a small protuberance. It would suffice in such a case to turn about 45°; where the spurs are more developed in width and height, an increased rotation is necessary.) Guided by my method one need no longer perform "le tour de maître" in an empirical and exaggerated way, but it becomes a rational process exactly proportioned to the exigencies of each case, and where the eye of the operator enables him to avoid all painful contact. In certain cases where the protuberance closes the whole width of the meatus, and where the inferior turbinated bone is very large, I have sometimes been able to manage in *another way:* As there is often in this case a little free space left below the prominence, the catheter must be made flat by turning the beak in or out, and it can thus be slipped forward. Inspection during catheterization teaches something more still: it becomes obvious at once that the opening which is before one (fig. i, 4) could not, as a rule, give passage to ordinary catheters without their causing severe pain to the patient on account of their size, their curve, and the length of the beak. I use, therefore, especially for the latter process, where it is necessary to pass below the spur, delicate catheters having a very short beak. These instruments are all the more indispensable, because in spite of every precaution the prominences sometimes press upon the longitudinal axis of the catheter, causing a deviation toward the exterior. The beak of the instrument, having passed beyond the nasal fossæ, then finds itself too near the Eustachian tube. When, therefore, under these circumstances the ordinary catheters having a

long beak are used, the point, as soon as it is turned so as to place it in the entrance of the tube, strikes against the lateral wall of the pharynx and rotation becomes impossible or, at least, very painful. On the other hand, in using a catheter with a short beak, its point only describes, in turning, an arc of a circle of small radius, and can therefore make the necessary movement of rotation without being interrupted by contact with the pharyngeal wall.

In these cases I like to use catheters of a particular kind: they are thin instruments, having a beak of only seven millimetres and a half in length, which makes *an exact right angle* with the stem. This shape not only facilitates the passage through the nose, but also the rotation of the beak in the pharynx. I had this pattern made by Luer about fifteen years ago for a person in whose case the nasal passage was extremely narrowed, probably by protuberances—I say "probably," for I had not, at that already distant period, recognized the anomaly in question.

New nasal speculum.

There are at present several kinds of nasal specula, all more or less useful for the examination of the nasal fossæ. I used at first, in my process of catheterization, the pattern which I described (*loc. cit.*), and which is nothing more than the usual speculum, only with much thinner branches than are usually made. But all these instruments, for the method of operation which I have just explained, present the following inconvenience: when once the beak of the catheter has passed through the entrance of the nasal fossa which is narrowed by the protuberance, the further presence of the speculum becomes not only useless, inspection being no longer necessary, but even troublesome, for it interferes with the free advance of the catheter, and its fixation at the time when inspiration is required. If it be taken off at this moment, it is necessary to turn the screw of the instrument with one hand while the other secures the catheter. The speculum being no longer held in place, receives, in unscrewing it, concussions against the catheter, which are painful to the patient. I have been led, on that account, after many ex-

periments upon the cadaver (by means of a thin sheet of lead, which is easily shaped as one likes), to a special speculum, different from the old instruments and from the new model of Creswell Baber. My speculum (fig. v, where it is drawn a little too long) is a metallic tube shaped like a truncated cone, at the large end of which a sort of handle or palette is implanted almost perpendicularly to the axis of the cone. A rather wide slit extends the length of the speculum on the side opposite that which holds the palette. The instrument having thin slides is much lighter than ordinary specula, and its contact with the catheter would not displace the latter in so painful a manner to the patient as the ordinary heavy and cumbersome instruments do.

After having introduced this speculum into the entrance of the nasal fossa, the palette being above, it is held there by slightly pressing the latter with the thumb of the left hand, the fingers of which are placed against the back of the nose. The slit is in this way directed downward and horizontally so as to leave the passage free for the introduction of the catheter. When the catheter has passed the narrowed part, the speculum is taken off by turning the slit upward ; it then drops off of itself, the slit making room for the stem of the catheter.

By using the combination of means just explained, I have been able to conduct catheterization successfully and without causing suffering to the patient, under circumstances where the deviation of the septum made the operation impossible or, at any rate, extremely painful by other methods. I have even succeeded where experienced hands had failed, and where, I hasten to add, I should not, certainly, have been more fortunate without the aid of my method.

In regard to the sensation experienced by the patient, the difference between the ordinary processes and mine was such in many cases that the use of the latter was loudly demanded by all who had once tested its advantages. But even in using it, it is often necessary to proceed with much delicacy and circumspection in order to guide the catheter through the two or three dangers which obstruct its way. I say " three " dangers, for the situation is again aggravated

in some cases by an elevation of the floor of the nasal fossæ, which then brings the number of obstacles up to three, counting the inferior turbinated bone and the protuberance.

Explanation of Figures.

I drew fig. i from life, and figs. ii, iii, and iv from sections made upon three different cadavers, selected from the large num-

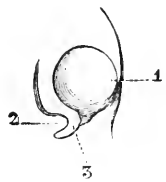


Fig. i.

Fig. i.—1 Inferior turbinated bone. 2 Protuberance of the septum. 3 Free interstice.

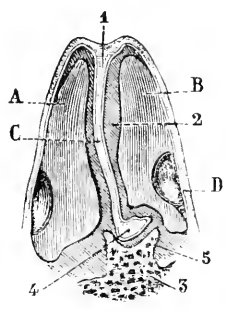


Fig. ii.

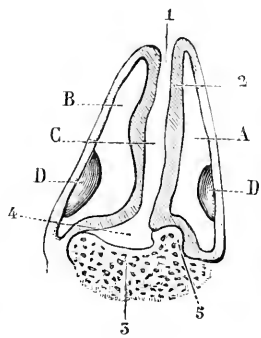


Fig. iii.

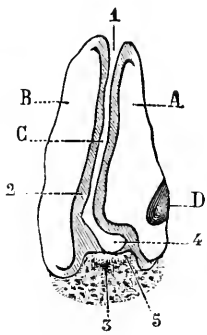


Fig. iv.

Figs. ii, iii, and iv.—Sections of the cartilaginous part of the nose. A, B, Nasal fossæ. C. Septum. D. Inferior turbinated bone. 1 Cartilage of the septum. 2 Mucous membrane. 3 Bone. 4 Cartilaginous protuberance. 5 Osseous protuberance.

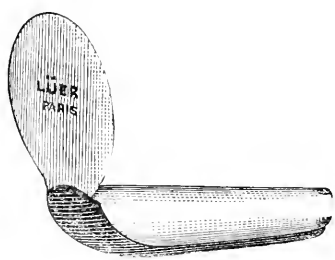


Fig. v.

ber which I have dissected for this purpose. The section was in an almost perpendicular direction from top to botom, on a slightly inclined plane, that is to say, making with the forehead an acute angle open at the top. As it has only concerned the cartilaginous part of the nose, the horizontal superior deviation, which bears particularly upon the perpendicular lamella of the ethmoid, is not shown in my drawings ; the only traces of it are found in fig. ii, where it has partially attained the cartilage of the septum also.

Fig. v was drawn by M. Badoureau, engraver. The instrument is represented a little too long in its horizontal dimensions.

THREE SERIOUS CASES OF MASTOID DISEASE, WITH REMARKS.

By H. KNAPP.

NO department of aural surgery is more important than the inflammation of the tympano-mastoid cavities, when it extends into the cranium. The aural questions are then at once converted into vital questions, which the specialist has to solve with all the grave responsibility that is so frequently inherent to the duties of the general practitioner. Despite the decided progress in our knowledge and management of such cases during the last decades, there are still many points either unexplained or insufficiently appreciated, if we aim at accuracy of diagnosis and seek for unambiguous indications of treatment. The great practical question: "what are the conditions under which the mastoid process should be opened"? can to-day be answered with more precision that it could have been ten and twenty years ago, yet the most experienced aurist will not fail to welcome further clinical and pathological contributions either as confirmations or extensions of his views on this important subject. In illustration of this proposition, I beg to select three cases from my recent practice, accompanying them with a few remarks which they forcibly suggest.

CASE I.—*Acute purulent otitis from sea-bathing; perforation of the occipital bone; drainage of the cranial cavity for three months; death by cerebellar abscess; autopsy.*

Mr. John D. Strickland, of Brooklyn, a healthy man of about thirty-nine years, consulted me for the first time on Aug. 15, 1882.

He was very fond of sea-bathing. During the hot summer of 1882 he went into the ocean every day, swam long against the breakers, lying by preference on his right side. On Aug. 6th he went swimming at 7 A.M. and felt no immediate pain or discomfort anywhere, but at 2 P.M. of the same day he experienced earache, headache, and impairment of hearing. Though these symptoms continued with varying intensity, he went bathing twice again before he consulted me. I found his right *Mt* red and dull, bulging in its upper part, the folds and handle of the left slightly red; relief normal; *h* R $\frac{1}{8}$ on application to ear only; L *h* $\frac{1}{24}$ (ear), $\frac{1}{8}$ (temple), o (mastoid); *V* R $\frac{5}{60}$, L $\frac{20}{60}$. Tuning-fork from forehead best in R, better when ears were closed. Politzer positive; R with a dry snap, after which *h* $\frac{1}{\infty}$ (ear and temple), *V* $\frac{20}{60}$, as in L ear, but mastoid remains *h* o. Moderate congestion and swelling of the pharyngeal mucous membrane. Ordered two leeches behind each ear, and rest. Bathing forbidden. On Aug. 23d he came again, materially improved. R *Mt* still red, L almost normal. Aug. 28th. Had been less careful. R *Mt* red all over, and bulging except at handle, in front of which two hemorrhagic spots. Pain extending over the adjacent parts of the head, especially toward the forehead and occiput. I made a paracentesis, 4 *mm* in length, in the anterior lower part of the drumhead. Blood escaped, but no pus. Politzer positive with perforation whistle, but no evacuation of mucus or fluid, though Valsalva's experiment gave a gurgling sound before the operation. The operation was made in the forenoon; at 9 P.M. a profuse purulent discharge set in, and the pain disappeared. I gave him quinine internally, 0.25 to 0.50 a day, boracic-acid solution to cleanse the ear with, and impalpable boracic-acid powder and absorbent cotton to be put in the ear after the cleansing. During the whole month of September there was more or less discharge from the ear, pain in ear and head varying, more pronounced when discharge was scant or ceased, and absent when the ear ran freely again, which was favored by warm water and vapor ear baths. The pain in the right occipital region never left him entirely, and was mostly accompanied by right-sided frontal headaches. The mastoid region was free from any abnormity, so often and carefully as it was examined. There was no fever, no mental disturbance, no cerebral symptoms except the headache. Patient went to his business off and on, though against my orders.

On the 4th of Oct., after an absence of two weeks, he presented

himself to me again, complaining of more pain in his left occipital region, which, on examination, I found swollen and distinctly fluctuating, though but little tender to the touch, and not red at all. The mastoid was normal, the fluctuation and greatest swelling were 6 *cm* behind the ear, and 2 *cm* above the level of the auditory meatus. I told the patient that between the skull and the scalp there was pus which must be liberated. He consented, and as he was very timid and nervous, I took him to the Ophthalmic and Aural Institute, where, under ether, I made an incision of 3 *cm* in length through the fluctuating part of the scalp down to the bone, and evacuated a considerable quantity of creamy, inoffensive pus. The bone felt denuded to the extent of 2.5 *cm* in diameter, but was smooth, with a depression in the centre of the incision. I put a small perforated silver tube in the wound, covering it with absorbent cotton. The patient was not to be induced to stay in the hospital, but drove home greatly relieved. For the next week, he came to the office with his wife almost every day. There was a free discharge of creamy pus from the wound. The wound was dressed twice a day, the canula cleansed and re-inserted. Patient had lost all pain, and felt very well. The *Mt* was plainly visible in its details ; it was red, and had a small, round, clean perforation in its antero-inferior part. $V \frac{20}{60}$ and the case looked as if it advanced toward a speedy recovery. This was, however, a sad disappointment. After a week, he complained again of his pain over the right eye, which continued more or less intense during his whole illness. A considerable quantity of creamy pus, which never smelled offensive, was discharged through the silver tube every day. With a probe, it could be distinctly ascertained that the pus came from the interior of the skull through a canal in the occipital bone about 4 *mm* in diameter, with rough, ragged edges. At the bottom of the canal, the probe pushed against a resistant fibrous membrane, evidently the dura mater. The outer surface of the temporal bone, as far as denuded, felt perfectly smooth, not indicating caries. The patient's pulse was 76, his temperature not increased. His appetite was good ; his sleep, however, frequently disturbed by the frontal headache.

On the 19th of October, there was a decided aggravation in his symptoms. The frontal headache was very severe, prevented him from sleep ; he felt oppressed, sick at his stomach, was very pale, and fainted for five minutes. He had chills, and cold and hot perspirations. When he came to me on the 20th of Oct., I found

his pulse 104 ; temperature 38° C.; his general condition better ; free discharge from the drainage tube. At the lower part of the occiput, 5 *cm* below and 1.5 *cm* behind the opening, there was a considerable swelling of the skin, pressure on which indicated deep fluctuation, and forced a moderate quantity of pus out through the opening above. I incised the soft parts down to the bone, but liberated no pus, and inserted a drainage tube into this incision also.

Oct. 21st.—Felt better ; no chills ; free discharge from upper opening, none from lower ; swelling, the same ; pulse, 96 ; temperature, 38.8°.

Oct. 23d.—More swelling in lower part ; incisions deeper and longer ; no pus.

Oct. 24th.—No pus yet ; swelling less ; pulse 84 ; feels tolerably well.

Oct. 26th.—Had headache yesterday. After poulticing, copious discharge of pus from the lower opening.

The discharge for the next ten days was interrupted from the lower, constant and free from the upper, opening. The bone at the lower incision felt smooth, not depressed in any place.

Nov. 6th.—Had a good deal of headache and vomiting yesterday. The discharge was scant. Poulticing for three hours was followed by abundant discharge and complete relief from headache.

For the next nine days, scantiness of discharge, headache, nausea and vomiting alternated with free discharge and general comfort. Opthalmoscopic examination, which, in combination with functional examination, had been frequently made during the preceding months, now, for the first time, revealed a moderate swelling at the inferior border of the right optic disc, and some retinal hyperæmia ; the same condition, less marked, was noticed in the left eye. Then, for two weeks, he felt comparatively well ; had not had a headache for eight days ; the lower opening had closed and the swelling disappeared ; the discharge from the upper was free and steady. I took care to keep the bony canal open ; whenever granulations formed I scraped them off with a sharp spoon, especially from the bony walls of the canal.

On November 29th, a fluctuating swelling had formed 2.5 *cm* up and back from the originalo pening. On incision a considerable quantity of creamy pus escaped, and the probe passed also in this place into the cranial cavity by a narrow, ragged, fistulous canal

in the bone. A drainage tube—a perforated silver canula—was inserted. The discharge from this perforation ceased in a few days, and the opening closed in two weeks.

The original fistula continued to discharge regularly ; the patient felt tolerably well ; his complexion, which was naturally pale, had at times a yellowish hue. The symptom of which he complained most was pain in the right side of his forehead ; the occiput was also painful at times, the parietal region rarely, the mastoid never. The mastoid region and its vicinity were, during the whole course of the disease, free from any abnormity ; the auditory canal was likewise free, the drumhead perforated, but not bulging ; very little, and, most of the time, no discharge ; no granulation tissue in tympanic cavity. As the patient could never be persuaded to leave his home, I gave his family physician, Dr. W. F. Schwalm, of Brooklyn, at the beginning of his disease, a full statement of his condition, telling the patient that rest in bed was most conducive to his recovery, and that whenever he felt worse it would be better not to come to New York, but to call me or another aurist to his bedside, should his physician find it advisable. He always assured me that the air did him good, and he felt a desire to take a drive every now and then.

At the beginning of January, 1883, however, his disease took a decided turn for the worse. He was obliged to keep his bed ; had severe headache, nausea, vomiting ; was slightly delirious at times ; had twitchings in his limbs ; his neck was stiff, and his head drawn back and to the right side. The purulent discharge from the opening continued, but was bloody at times. January 9th I was called to see him in consultation with Dr. Schwalm, and found him still in the condition just described. On exploring the wound with a probe, and scraping the osseous canal with a sharp spoon, a moderate quantity of very dark blood oozed out for about five minutes. His pulse was 84, his temperature 99° (Fahrenheit). There was a moderate degree of congestion of the retina, and some œdematous swelling of the optic disc and its surroundings, more marked in the right than in the left eye.

On January 10th the pain extended over the whole head, the deliria and convulsive twitchings were more pronounced ; toward morning he became comatose, and died at 10 A.M., January 11th.

January 12th I made a **post-morten examination**, assisted by Drs. Schwalm and D'Oench. Seven *cm* behind and about

3 *cm* above the level of the auditory meatus, there was a perforation in the cranium, from 3 to 4 *mm* in diameter. The bone in its vicinity was hyperæmic, but not carious. 2.5 *cm* in and up there was another small place where the skull was hyperæmic and slightly depressed at the centre, but the probe did not penetrate. This was the spot where the upper perforation had been, but had closed again. The remainder of the skull was normal; in particular I may mention that the skin, periosteum, and outer bony surface of the mastoid process and its vicinity, far beyond the mastoid foramen, were perfectly normal. The meninges and sinuses of the brain exhibited no alteration. The inner surface of the cranium showed the same hyperæmic condition as described above, at the places where the two perforations were situated. The original perforation, which had remained open, was located about 1.5 *cm* above the greatest convexity of the right transverse sulcus, about 3 *cm* in and upward from the lateral angle of the occipital bone. The point of the perforation was situated either in the lambdoid suture, or near it. The hyperæmic point, where the last perforation had taken place, was about in the centre of the right superior fossa of the occipital bone.

The right half of the tentorium cerebelli was markedly raised over the level of the left half, but showed no other abnormity.

On detaching the dura mater from the occipital and petrous bones, it was found unbroken. Only at the place of the first perforation it was red, thickened, soft, and uneven, yet not (macroscopically) perforated. The lateral sinus was intact, containing dark blood, but no coagula, and its walls were smooth.

At the outer surface of the lateral sinus a thick streak of pus led along the transverse sulcus to a larger collection of pus at the lowest part of the sigmoid fossa. Here the inner table of the bone had completely disappeared in a round area of about 2 *cm* in diameter. It was the free inner open side of an abscess cavity in the interior of the mastoid process. This cavity had bony and ragged walls, and a probe penetrated without resistance from it into the tympanum and auditory canal.

The petrosal sinuses, as well as the posterior and anterior sides of the petrous bones and the tegmen tympani, showed no alteration.

On incising the tentorium cerebelli an abscess the size of an English walnut was found in the middle and outer part of the little brain. It was filled with thick, somewhat greenish, not offensive, pus; had no distinct walls to separate it from the adjacent, not softened cerebellar substance.

The tissue and ventricles of the brain and medulla oblongata exhibited no lesions discoverable with the naked eye.

I removed the petrous bone and the left hemisphere of the cerebellum, but only one fact was found of interest for our present purpose, namely: the mastoid cavity communicated with the tympanic by a very small opening, an unusually narrow orifice of the mastoid antrum.

REMARKS.

The most important feature of this remarkable case was the entire absence of external symptoms during the whole course of a severe suppurative inflammation in the interior of the mastoid process. Commonly the mastoid region is tender to the touch, or on percussion; its integument is swollen and red, at least in a certain degree.

The next unusual feature was the misleading character of the pain. In acute and chronic mastoiditis interna the pain commonly starts from the mastoid region, radiates over the whole corresponding half of the head, and is most intense in the parietal region. In our case the mastoid region was never painful at all, the parietal not much, the occipital moderately, the frontal most severely and most persistently. This led me into the belief that the inflammation had extended from the midde ear through the tegmen tympani to the meninges of the adjacent middle and anterior lobes of the brain.

Then suddenly, in the sixth week of the disease, an abscess made its appearance three or four centimetres behind and two centimetres above the mastoid process, and probing

demonstrated that the pus came from the cranial cavity, through an opening in the occipital bone or in the lambdoid suture. This was followed by an abscess from gravitation at the lower part of the occiput, and later by another abscess farther back and upward on the cranial bone, likewise through a perforation of the skull. My opinion then was that a communication between the middle ear and the cranial cavity had formed, and that the pus was deposited between the dura mater and the bone : in the front part, causing the frontal pain ; in the back part, causing the occipital pain, as well as the perforations of the bone. As the case was of recent date, and the evacuation of pus was followed by complete though only temporary relief of the symptoms, I thought that extensive caries interna did not exist, and that the patient would soon get well if the outlet of the pus was kept free. I had no doubt that the escaping pus was furnished by the cavities of the tympanum and mastoid, and crept along the transverse sulcus between bone and dura mater, and expressed my views in this respect to Dr. W. J. Morton, to whom I had an opportunity of showing the case at my office.

The supposition of a cerebellar abscess could not be entertained with any degree of probability before the last two weeks of the patient's illness.

The most noteworthy features of the whole case are, it seems to me, the perforations in the temporal bone so far away from the original seat of the inflammation, and the effectual drainage of an intracranial suppuration for three months. The autopsy showed that in this case, as in most others, the chief focus of the formation of pus was the mastoid cavity, and I shall, in future, be more inclined to open this cavity, even when no external signs of mastoid suppuration are present. In this way a life may be saved every now and then. If the operation proves the diagnosis to be incorrect, it rarely does harm, and may even do good by its "revulsive effect." Among others, SCHWARTZE, whose merit in this department is so deservedly praised, draws the indications for opening the mastoid wider than I have hitherto done. My hesitation as to the more frequent perform-

ance of this operation was based on two facts: (1) We see so many cases with severe otitis media, even when pronounced cerebral symptoms are present, get well; the natural fatal termination is rare, almost exceptional, while, on the other hand, the statistics of the operation show a considerable death-rate—about 11 % in Schwartze's series. (2) I have assisted in a number of trepanations of the mastoid, and have performed some myself, where the diagnosis was erroneous, the extension of the disease taking place not through the mastoid, but through other well-known channels. Even if such cases afterward do not terminate fatally, the fact of having undertaken an important operation on an erroneous supposition, is humiliating and depressing.

Among the variety of symptoms in acute and chronic otitis media, the one which has guided me more than any other, is *persistent headache* radiating from the ear over the corresponding half of the head. If this was present, and the mastoid showed any symptoms of active participation in the inflammation, I thought trephining indicated. The case under consideration, and a few others that have been published,[1] make, however, the operation justifiable even when there are no external symptoms of mastoid suppuration present, provided that sinus thrombosis can be excluded.

In recommending an extension of the indications for trephining as above stated, I am satisfied that we shall occasionally be disappointed, even if mastoid symptoms are pronounced, and beg to report briefly a case in support of my opinion.

CASE 2.—*Chronic mastoiditis interna; sclerosis; trephining; no pus; death from meningitis or abscess.*

Mrs. Rob. Libas, æt. forty-five, of New York, under the care of Dr. Schwedler of this city, consulted me with the doctor Dec. 6, '79. She had never had otorrhœa; six months previously, for the first time, pain behind the right ear; autophony. In September and October intense headache, almost constant, most on vertex and occiput.

Status præsens.—Pain on pressure behind ear; vertigo; loss of appetite; pale complexion; hearing almost normal; $h \frac{12}{24}$, $v \frac{20}{20}$.

[1] See the case of Dr. F. T. Brown in this number.

Tuning-fork from forehead on both sides. *Mtt* somewhat sunken ; handles retracted. Right mastoid from its tip to 1.5 *cm* above its base slightly swollen from thickening of subcutaneous layer ; skin somewhat red and wrinkled. My diagnosis was that an acute catarrhal otitis had induced a chronic mastoiditis interna, with extension of the irritation to the adjacent intracranial structures. I recommended rest, local depletion ; counter-irritation and derivatives to bowels and skin.

On Jan. 28, '82, I saw the patient again with Dr. Schwedler. The treatment had been carefully carried out, and the patient had had all the benefits rest could give her, yet she had never since been free from right-sided headache. The mastoid was tender on pressure and somewhat puffy. No discharge ; hearing normal. The pain in the head was such, and had lasted so long, that we thought trephining should no longer be delayed. As the patient gladly consented, I opened the mastoid with a drill on Jan. 29th. Periosteum and bone proved healthy. The drill entered 9 *mm* before the cavity was reached. There was free capillary bleeding from the bone, but no escape of pus. No general reaction followed the operation ; the wound suppurated ; the bone was bare but smooth. The patient felt better for a month, then the headache returned, and she died in June, 1880, from meningitis or abscess.

It is a pity that the autopsy in this case could not be obtained. Sclerosis of the mastoid terminating fatally is not common, and there is a number of cases on record in which the trephining of the mastoid under similar conditions brought entire and permanent relief, as, for instance, in the case which I published in the tenth volume of these ARCHIVES, p. 365, etc.

Another case, with imperative indications for trephining, and a perfect success of the operation, may conclude this communication.

CASE 3.—*Acute purulent tympano-mastoiditis ; severe headache ; optic neuritis ; opening of mastoid ; recovery ; restoration of normal hearing.*

Mr. Sam. Rosenthal, æt. twenty-five, of this city, called me to his residence on May 25, 1882. Three weeks previously, after an

exposure, he had had severe earache and headache on his right side, followed in a few days by profuse discharge from the ear. The pain abated for several days, then it returned, and lately the discharge had become scant, and the headache more intense. I found perforative otitis media purulenta; the mastoid, which on both sides was unusually developed, somewhat swollen and painful; the hearing greatly reduced, bone-conduction preserved distinct though not very marked neuro-retinitis in the right eye, and some congestion and œdema of the retina also in the left. The headache was very severe; the patient was feverish, had no appetite, could not sleep, and was greatly depressed. I told him to come to the Ophthalmic and Aural Institute, and if in a few days there was no decided improvement, the bone behind his ear would require an operation. He came at once, had leeches applied before and behind his ear, stayed in bed, took an aperient, and perspired freely. The symptoms abating in no way, I made, May 30th, with a strong knife, a deep incision, 3 *cm* in length, from the tip of the mastoid process to its basis, 1 *cm* behind the insertion of the auricle. The lower part of the bone felt hard and smooth, the middle and upper rough and soft, so that the knife, used with considerable force, cut through the bone 1 *cm* in length. I enlarged the incision by inserting the sharp end of the ivory handle of the scalpel into it, and broke the bony edges off by pressure from within outward. Having thus obtained an opening of 1 *cm* long and 6 *mm* broad, I introduced a sharp spoon, explored the interior of the mastoid process, and discovered a large abscess cavity, the walls of which were rough and, at the medial side, defective. I evacuated the contents with the spoon as far as feasible, and then syringed the cavity with a concentrated warm solution of boracic acid. After this I inserted a perforated silver tube, covered it with absorbent cotton, and held it in position by a flannel roller. The wound was syringed and dressed in this way twice a day. On the second day the water injected into the mastoid escaped from the ear-canal. The syringing had to be done gently, as the patient felt dizzy when the water was injected into the mastoid, but not when injected into the ear. There was a good deal of granulation tissue in the mastoid cavity, which was repeatedly scraped out with a sharp spoon. The partition walls had all been broken down by the suppuration, and the rough walls could be felt on all sides except the inner, where the spoon pressed against soft tissue, the dura mater. The suppuration gradually diminished, the headache disappeared, the neuro-retinitis improved, and the

patient was discharged from the hospital twenty-five days after the operation. He came to me twice a week; when I syringed the cavity and kept it and the opening clear from granulations. The cavity gradually diminished in size. At the beginning of October there was no discharge from the wound any more. I left the canula off; the wound soon closed with a depressed scar, and the patient has had no trouble since. On Oct. 31st the *Mt* was found restored, the handle of the malleus red, the light spot almost normal; $h \frac{2}{24}$, $v \frac{20}{0}$. The patient made a business journey through the country for six weeks, which caused no discomfort, and he has remained well up to date, February, 1883.

In this case the pus had no doubt penetrated from the mastoid into the cranial cavity as in the first case, which is clearly demonstrated by the severe cerebral symptoms, the neuro-retinitis, and the defects in the inner table of the mastoid found on probing during and after the operation. The outer table, which was soft at the time of the operation, would surely have given way soon, and the pus would have found an external outlet, as is noticed so frequently. Yet the operative treatment was decidedly indicated, as it furnished an *early, direct, and free* avenue for the removal of the morbid contents of the mastoid cavity, either spontaneously or by instruments. In our first case this avenue of exit was established by nature, but it proved insufficient by being too late and too far away from the original focus of suppuration. Only the entire absence of any abnormity in the mastoid region deterred me from an operation which might possibly have saved the patient's life. The happy termination of the third case, and the post-mortem conditions of the first, furnish as good an illustration as can be obtained of the importance of opening the mastoid early and sufficiently in purulent mastoiditis interna which extends into the cranium; and even if nature has established an opening, this opening may require operative enlargement, or another may be necessary at another place if the course of the disease continues unfavorable. To the reader acquainted with the modern otological literature, I need not say that this rule, so forcibly suggested by the above cases, has been emphatically advanced by Schwartze and others as the result of similar observations.

A CASE OF ABSCESS OF THE MASTOID, WITH ENTIRE ABSENCE OF TENDERNESS, HEAT, OR SWELLING OVER THE SUPPURATING PART, WITH A CONSTANT DISTANT PAIN NEAR THE OCCIPITAL PROTUBERANCE. TREPHINING; RECOVERY; OCCURRENCE OF ERYSIPELAS DURING CONVALESCENCE.

By F. TILDEN BROWN, M.D., New York.

John McOnerney, age forty-eight, came to Doctor Roosa's clinic at the Manhattan Eye and Ear Hospital on September 14, 1882. Examination by Drs. Edward T. Ely and F. T. Brown showed a muco-purulent discharge from the right ear, partial loss of the membrana tympani, diminished calibre of the auditory canal, no swelling or redness behind the auricle, *no tenderness on pressure or percussion over the mastoid*, inability to hear a watch on contact, tuning-fork heard but by aerial conduction. The sole cause of his coming to the hospital, was great pain at a point along the right superior curved line, two centimetres from the occipital protuberance; occasionally radiating along the right border of the parietal suture over the frontal bone to its interior angular process; thence above and below the orbit.

Previous history.—No direct injury, but had a fall on back of head one month before. Had never had syphilis; was perfectly temperate, and had always been well until the fourth of last June, when he experienced gradually increasing pain in the right ear. Morphine gave temporary relief. Five days after, a discharge appeared. The pain continuing, a blister was applied behind the ear, and on June 16th, he was able to go to work, but returned in a few hours with still greater pain. For the three weeks following, morphine (hypodermically) was given twice daily; this failing, chloroform inhalation was resorted to. Late in July, Wilde's incision was made

at the New York Eye and Ear Infirmary, but the pain became, almost at once, more intense. A few days later a bone-operation was proposed, but the patient's family objecting, he came with a letter from his physician to the Manhattan Eye and Ear Hospital. Here careful watching for two days and nights verified his story of pain, sleeplessness, and loss of appetite, but no abnormal temperature was detected.

The result of a consultation was to defer operation until thorough anti-neuralgic treatment had been tried. Quinine, alcohol, and galvanism were ordered. Five days later the patient was no better, and perforation of the mastoid was determined upon despite the absence of satisfactory local symptons. It was performed by myself under the advice of Dr. Ely. The periosteum was healthy, and on its section the bone presented a similar appearance. Brainerd's drill sunk one and a half centimetres, entered a cavity, when about four grammes of pus came away. A warm solution of boracic acid, thrown into the *meatus auditorius*, found exit through the wound, bringing pus. The dressing was antiseptic and directed to favor free drainage and prevent occlusion. Pain was at once and permanently removed. Two weeks later the patient went home, but returned daily for dressing. The discharge now amounted to three grammes in twenty-four hours, and a watch could be heard on contact. On the evening of November fourth pain was felt about the auricle, followed by a chill with subsequent fever ; the pain prompted a vigorous application of camphorated oil. Toward morning the patient vomited. I was sent for the following night when I found him with a pulse of 90 ; temperature, 103° ; tongue coated ; bowels constipated ; pupils normal in response to light. Probe passed readily, but the discharge was slight. The tissues about the wound and over the parotid region were œdematous and but slightly sensitive ; this pallor suggested serous rather the hæmostatic injection, and might have been either the erysipelatous cause, or the blistering effect, of camphorated oil applied to relieve deeper pain. The diagnosis of erysipelas was made on the fourth day ; this disease, still indifferently marked, had extended to the left malar bone ; pulse was 98 ; temperature, $103\frac{3}{5}°$; delirious through the night ; sight was indistinct ; had convergent squint ; pupils responded feebly to light ; had moderately rhythmic vibrations of the right forearm. I was again led to doubt the absence of meningitis, and called Doctor Roosa in consultation, who, on examination, found

slight cerebral impairment and homonymous double vision existing ; the ocular media were clear. Optic discs not seen on account of want of illumination. The mastoid perforation was free, and afforded no evidence of retained pus, although the discharge was greatly diminished. For this reason Doctor Roosa and myself concluded that meningitis due to adjacent suppurative mastoid disease did not exist, and that the diplopia, with other nervous symptoms, was due to a peripheral hyperæmia of the pia mater, by continuity of tissue with the facial erysipelas, resulting in irritation of the sixth nerve at its point of exit.

This belief proved to be correct, for the intensity of the symptoms subsided, and in eight days convalescence began. The discharges from both channels had ceased, and one week later the wound completely closed. This was an agreeable surprise, for in its relationship to disease of the mastoid, I viewed the erysipelas as analogous to epididymitis succeeding a gonorrhœa, and I expected a return of the discharge as the erysipelas subsided.

It seems to me that there are three points of interest in this case :

1. The entire absence of tenderness, heat, or swelling over the suppurating mastoid, while there was a constant pain referred to a point near the occipital protuberance.

2. The difficulty in differentiating the symptons of facial erysipelas from those of meningitis.

3. The direct suggestion made by the case, of the value of active counter-irritation in the treatment of subacute or chronic suppuration of the middle ear.

PEDUNCULATED BONY GROWTH IN EXTERNAL AUDITORY CANAL, THE RESULT OF LONG-CONTINUED SUPPURATION; REMOVAL BY SNARE; MICROSCOPIC EXAMINATION.

By DAVID C. COCKS, M.D., New York.

Mr. S., æt. twenty-eight, clerk, was sent to me by Dr. A. N. Brockway, Nov. 5, '82. Patient states that twelve years ago he had earache; ear lanced by Dr. Packard. Otorrhœa, which followed with short intermissions, continued to date. He has noticed, and could feel with his finger, the growth for which he now seeks advice, for the past seven years, and during that time it has not altered much in size. He has had severe pain in that ear repeatedly, and at the present time is suffering more intensely than usual. Shaking the head during the attacks of pain was followed by a slight discharge of pus. Examination shows the external meatus of the left ear filled by a polypus. A fine probe can, with care, be insinuated between the growth and the canal for ¾″, except backward, where an obstruction is met about ¼″ from the meatus. The growth was covered with a moist mucous membrane. When the probe was withdrawn a drop of fetid pus escaped. The patient being very nervous, ether was administered, and the wire of Blake's snare placed around the growth, and it was then that a suspicion of the growth not being an ordinary polypus was first formed, for the wire loop on being drawn tight did not readily sever the polypus from its base. Steady traction was then made, and the growth suddenly came out, having been severed from its base while the wire still tightly encircled it. The pedicle, broad and short, was situated on the posterior wall of the external canal, about at the junction of the bony and cartilaginous portions. On examining the growth, a facet was

noticed at the inner end, and inspection revealed a small polypus situated in the middle ear (the membrana tympani having been destroyed). This, after the bleeding was controlled, was seized with forceps and removed.

A microscopic examination of the growth by Dr. J. L. Minor, Microscopist to the N. Y. Ear and Eye Infirmary, showed it to be an osseous polypus. The polypi were placed in a bottle and left for two months. At the end of that time the investing mucous membrane had disappeared, and the extent of the bony change was then first seen. The growth was smaller only by the loss of its external membrane. It was white, hard, and gave forth a *click* characteristic of bone when touched by a probe.

DR. MINOR'S REPORT.

The macroscopic appearance of the two bony tumors is well shown in the accompanying cuts (see figs. 1 and 2), which

Fig. 2 *Fig. 1*

represent the real sizes. The larger one is an irregular cylindrical mass, with a convex upper surface of comparative smoothness, an irregular, nodulated under surface, a roundish outer extremity, and a smooth articular concavity on its inner end. Its measurements are: length, 15 *mm.;*

breadth, 10 *mm.;* thickness, 7 *mm.* The smaller tumor is an irregular prismatic mass, on the outer surface of which is a smooth convex articular surface, corresponding to the concavity of the larger bone. Its measurements are: transverse, 6.5 *mm.;* longitudinal, 3.5 *mm.;* vertical, 4.5 *mm.:* weight of larger, 0.8 *;* smaller, 0.1 gramme.

Both tumors are hard and bone-like, and each is covered by a dense periosteum-like membrane, which closely adheres to the smooth surfaces, and is torn and irregularly attached to the rough surfaces.

Microscopic examinations were made from dried and hardened specimens, consequently the structure of the membrane was not seen. The substance of the tumors, however, leaves no doubt of its nature, for the entire mass consisted of perfectly formed bone-tissue, with beautifully marked Haversian systems, as is shown in fig. 3, which

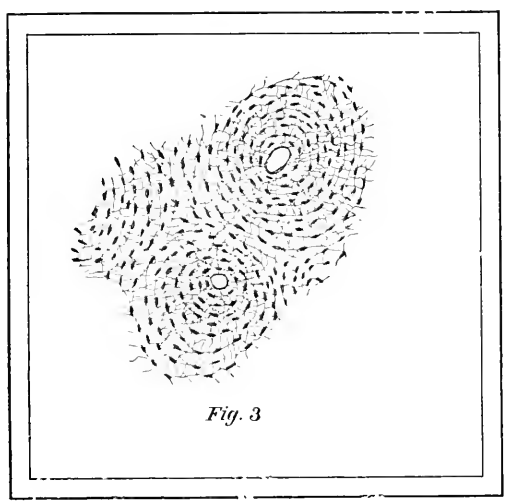


Fig. 3

was drawn from a section ground to extreme thinness. These osteomata undoubtedly arose from masses of granulation tissue, which were associated with the inflammation of the middle ear. Osteoblasts from denuded bone, falling upon granulations, found a nidus for growth and reproduction. This accounts for the ossification; and to

explain the separate bones with articulating surfaces, we may suppose the ossification to have been in two contiguous granulation masses, motion between which was furnished by the movements of the canal, incident upon motion at the temporo-maxillary articulation.

The subsequent history is as follows: The whole canal was syringed twice daily with a saturated solution of boracic acid; and with the exception of a slight erysipelatous attack involving the pinna and surrounding tissues, which lasted four days, the case progressed steadily toward a cure.

The syringing with boracic acid was continued morning and evening. After drying the canal thoroughly, the whole canal was tightly packed with absorbent cotton. The base of the growth dried up, the discharge diminished, a new membrane gradually formed, and by November 27, 1882, all discharge had ceased.

Politzer's method of inflation was practised daily, and on December 1st the hearing power was as follows: L E $\frac{50}{50}$, R E $\frac{60}{50}$.

There is now a membrane which can be made to move backward and forward when air is alternately forced in and out of the canal through a Siegle's speculum, and the hearing on this side is above the standard.

February 10, 1883, L E $\frac{70}{50}$; R E $\frac{60}{50}$.

I have been induced to place this case on record because of the rarity of polypi which have undergone bony metamorphosis.

NOTE.—In the text-book of the "Diseases of the Ear," by Dr. Adam Politzer, translated by Dr. J. P. Cassells, of Glasgow, edition of 1883, published by Henry C. Lea's Son & Co., Philadelphia, reference is made, on p. 639, to this subject. Isolated ossification (Cassells) and calcification of aural polypi are rare, and on p. 618 he speaks of pedunculated exostoses, but his examples are not like the case reported.

THE EXAMINATION OF EARS BY MEANS OF THE TUNING-FORK.

By J. B. EMERSON, M.D., of New York City.

AT the suggestion of Dr. St. John Roosa, I began, more than a year ago, some investigations of tuning-fork tests, as applied to ears with normal hearing. The results which I have obtained seem to me sufficiently interesting to be submitted to the profession.

Over one hundred persons with normal hearing were tested somewhat superficially, and the results were *uniformly similar*. I then made fifty of these cases the subject of very careful testing, and I have tabulated the result with a view to their study. The standard of hearing was a watch, heard at forty inches and over. I found that at least two thirds of those who supposed their hearing was normal failed to come up to this standard. The hearing of some, however, was so acute that they perceived the ticking at fifty, sixty, seventy, and one at eighty inches. No allowance has been made for this excess, but all such cases have been entered in the table as $\frac{40}{40}$.

The fifty cases include persons of a great variety of conditions in life, of both sexes, and they range in age from seven to sixty years. Some of the tests were made in comparative quiet, others amidst the noises of a hospital clinic; I hoped by testing in this way to get an average which might be useful in all circumstances. This is to be taken into account as one of the factors that may explain the absolute differences of duration in the tabular statement. Another

cause for this difference is that my tuning-forks did not vibrate as long after extended use as they did when new; and my A fork finally snapped when subjected to a strain which it had resisted hundreds of times. It is thus seen that the steel in tuning-forks, like that in railroad use, deteriorates from continued vibration. The note, however, remained unchanged to the last. A third factor to explain the absolute difference of duration is the inability of some persons to keep their attention fixed, or to appreciate the more delicate shades of the test. This is especially the case in uncultivated and ignorant persons.

The forks used were: 1st. A fork $32\frac{1}{2}$ *cm.* long, with cylindrical prongs and handle, giving a note more than an octave below the middle C (middle C is $c^1 = 264$ double vibrations according to Helmholtz), and called A (110 double vibrations, H.). 2d. Another fork about 17 *cm.* long, with rectangular prongs and conical handle, giving a note one octave above middle C and called c^2 (according to Helmholtz $c^2 = 528$ vibrations).

In using the forks, I have endeavored to obtain a uniform strength of vibration, striking them on my knee and holding them in corresponding positions for each individual: for aërial conduction about half an inch in front of the concha, and moving continuously to avoid exhaustion and the "deaf spots"; for bone-conduction, the end of the handle of the fork at the junction of the mastoid and squamous portion of temporal bone just behind the ear.

In determining the duration, I struck the fork at an exact five or ten seconds of the watch, and noted the time to the nearest five seconds when the patient ceased to hear the sound; the question being asked, "which is *louder*, through bone or through air?" and answer noted.

While I can only claim approximate results, I think I am justified in believing that all grosser sources of error have been avoided; and for practical purposes the results may be regarded as fairly representing the average.

From a tabulated statement (which for brevity's sake is here omitted) of the fifty cases, the following results were obtained:

In every case the A fork was *louder* when heard through *bone*, and the c^2 fork, when heard through *air*.

The average *duration* in seconds was as follows :

A fork	
Air-conduction	31
Bone-conduction	18
Excess in air-conduction	13
c^2 fork	
Air-conduction	36
Bone-conduction	16
Excess in air-conduction	20
A and c^2 forks	
Air-conduction	34
Bone-conduction	17
Excess in air-conduction	17

A and c^2 are both heard *longer* through aërial than through bone-conduction.

The difference between air- and bone-conduction is less for the A note than for the c^2 note; A being heard about 1.75 times longer through *air* than through *bone*; while c^2 was heard about 2.25 times longer through *air* than through *bone*.

For both A and c^2, the average duration is twice as long through the air as it is through the bone.

Several months since I began to apply the same tests to persons who had disease of the middle ear; and I have also tabulated the results for the following fifty cases.

No.	Disease.	Age.	Hearing Distance.	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
1	Ot. med. cat. subacute Cicatric. *Mt.*	36	R = $\frac{24}{40}$	A.[1] Bone.	10	15		5
				C.[1] Bone.	20	20		
			L = $\frac{2}{40}$	A. Bone.	0	20		20
				C. Bone.	20	15	5	
2	Ot. med. cat. chron. . Cicatric. *Mt.*	26	R = $\frac{15}{40}$	A. Bone.	15	10	5	
				C. Air.	20	10	10	
			L = $\frac{4}{40}$	A. Bone.	5	10		5
				C. Air.	10	15		5
3	Ot. med. cat. chron. .	50	R = $\frac{1}{40}$	A. Bone.	10	15	5	5
				C. Bone.	30	20	10	
			L = $\frac{18}{40}$	A. Bone.	12	15		3
				C. Air.	30	20	10	
4	Ot. med. sup. chron. . Ot. med. cat. chron. .	16	R = $\frac{12}{40}$	A. Bone.	10	10		
				C. Air.	15	10	5	
			L = $\frac{20}{40}$	A. Bone.	15	10	5	
				C. Air.	25	15	10	
5	Ot. med. cat. acute—2 days	24	R = $\frac{18}{40}$	A. Bone.	20	10	10	
				C. Air.	30	15	15	
			L = $\frac{c}{40}$	A. Bone.	20	10	10	
				C. Air.	30	15	15	
6	Ot. med. sup. chron. .	12	R = $\frac{12}{40}$	A. Bone.	10	20		10
				C. Bone.	30	20	10	
			L = $\frac{14}{40}$	A. Bone.	10	15		15
				C. Bone.	30	15	15	
7	Ot. med. cat. chron. .	28	R = $\frac{1}{40}$	A. Bone.	15	15		
				C. Bone.	10	10		
			L = $\frac{3}{40}$	A. Bone.	15	5	10	
				C. Air.	10	25		15
8	Ot. med. cat. acute. .	34	R = $\frac{30}{40}$	A. Bone.	30	15	15	
				C. Air.	15	10	5	
			L = $\frac{18}{40}$	A. Bone.	30	25	8	
				C. Air.	20	10	10	
9	Ot. med. cat. chron. .	35	R = $\frac{5}{40}$	A. Bone.	5	20		15
				C. Bone.	20	25		5
			L = $\frac{8}{40}$	A. Bone.	10	20		10
				C. Bone.	15	20		5

[1] A. means A fork = 110 vibrations. C. means c^2 fork = 528 vibrations.

No.	Disease.	Age.	Hearing Distance.	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
10	Ot. med. sup. chron.	23	R = 0/40	A. Bone.	0	2		2
				C. Bone.	0	5		5
			L = 30/40	A. Bone.	10	10		
				C. Air.	20	10	10	
11	Ot. med. cat. chron.	44	R = 30/40	A. Bone.	15	15		
				C. Air.	20	10	10	
			L = 20/40	A. Bone.	10	15		5
				C. Air.	20	10	10	
12	Ot. med. sup. chron.	50	R = 0/40	A. Bone.	0	5		5
				C. Bone.	5	10		5
			L = P/40	A. Bone.	5	10		5
				C. Bone.	5	10		5
13	Ot. med. sup. chron.	18	R = 20/40	A. Bone.	10	10		
				C. Bone.	25	15	10	
			L = 2/40	A. Bone.	0	10		10
				C. Bone.	10	15		5
14	Ot. med. cat. chron.	38	R = 1/40	A. Bone.	10	30		20
				C. Bone.	10	15		5
			L = 8/40	A. Bone.	10	30		20
				C. Bone.	5	15		10
15	Ot. med. cat. chron.	50	R = C/40	A. Bone.	0	10		10
				C. Bone.	5	10		5
			L = 4/40	A. Bone.	15	15		
				C. Air.	20	25		5
16	Ot. med. cat. chron.	55	R = P/40	A. Bone.	5	15		10
				C. Bone.	5	15		10
			L = 0/40	A. Bone.	5	10		5
				C. Bone.	5	15		10
17	Ot. med. sup. chron.	23	R = 0/40	A. Bone.	0	10		10
				C. Bone.	0	10		10
			L = 24/40	A. Bone.	10	10		
				C. Air (?)	15	10	5	
18	Ot. med. cat. chron.	25	R = 8/40	A. Bone.	5	10		5
				C. Bone.	10	15		5
			L = 6/40	A. Bone.	5	10		5
				C. Bone.	5	5		

No.	Disease.	Age.	Hearing Distance.	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
19	Ot. med. cat. chron. .	20	R = 3/40	A. Bone.	10	15		5
				C. Bone.	15	25		10
			L = 2/40	A. Bone.	5	15		10
				C. Bone.	15	25		10
20	Ot. med. cat. subacute	30	R = 8/40	A. Bone.	15	15		
				C. Bone.	20	15	5	
			L = 1/40	A. Bone.	15	10	5	
				C. Bone.	15	5	10	
21	Ot. med. cat. chron. .	34	R = 16/40	A. Bone.	10	10		
				C. Air.	15	10	5	
			L = C/40	A. Bone.	15	15		
				C. Air.	20	15	5	
22	Ot. med. sup. chron. .	20	R = 12/40	A. Bone.	10	15		5
				C. Bone.	15	15		
			L = 2/40	A. Bone.	0	15		15
				C. Bone.	10	15		5
23	Ot. med. cat. chron. .	47	R = P/40	A. Bone.	10	15		5
				C. Bone.	10	15		5
			L = 2/40	A. Bone.	5	10		5
				C. Air.	10	10		
24	Ot. med. sup. chron. .	16	R = 2/40	A. Bone.	0	10		10
				C. Bone.	10	25		15
			L = 20/40	A. Bone.	15	15		
				C. Air.	20	30		10
25	Ot. med. cat. chron. .	26	R = 3/40	A. Bone.	0	15		15
				C. Bone.	10	15		5
			L = 8/40	A. Bone.	0	10		10
				C. Bone.	5	10		5
26	Ot. med. cat. chron. .	23	R = 4/40	A. Bone.	10	10		
				C. Bone.	20	15	5	
			L = 2/40	A. Bone.	10	5	5	
				C. Air.	20	10	10	
27	Ot. med. cat. chron. .	10	R = 2/40	A. Bone.	15	15		
				C. Air.	20	20		
			L = 12/40	A. Bone.	10	10		
				C. Air.	15	15		

No.	Disease.	Age.	Hearing Distance.	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
28	Ot. med. sup. chron. .	19	R = $\frac{0}{40}$	A. Bone.	0	15		15
				C. Bone.	10	15		5
			L = $\frac{20}{40}$	A. Bone.	5	15		10
				C. Bone.	25	20	5	
29	Ot. med. sup. chron. .	30	R = $\frac{12}{40}$	A. Bone.	5	15		10
				C. Air.	30	20	10	
			L = $\frac{0}{40}$	A. Bone.	0	10		10
				C. Bone.	10	10		
30	Ot. med. sup. chron. .	28	R = $\frac{20}{40}$	A. Bone.	10	30		20
				C. Bone.	10	25		15
			L = $\frac{10}{40}$	A. Bone.	15	30		15
				C. Bone.	15	35		20
31	Ot. med. sup. chron. .	20	R = $\frac{4}{40}$	A. Bone.	10	20		10
				C. Bone.	15	35		20
			L = $\frac{12}{40}$	A. Bone.	15	35		20
				C. Bone.	15	40		25
32	Ot. med. sup. chron. .	16	R = $\frac{C}{40}$	A. Bone.	0	25		25
				C. Bone.	10	15		5
			L = $\frac{0}{40}$	A. Bone.	0	30		30
				C. Bone.	0	20		20
33	Ot. med. cat. chron. .	13	R = $\frac{C}{40}$	A. Bone.	10	20		10
				C. Bone.	15	15		
			L = $\frac{2}{40}$	A. Bone.	10	20		10
				C. Bone.	15	15		
34	Ot. med. cat. chron. .	65	R = n. or 1′	A. Bone.	0	15		15
				C. Air.	20	15	5	
			L = n. at 1′	A. Bone.	0	20		20
				C. Air.	20	15	5	
35	Ot. med. cat. chron. .	35	R = $\frac{12}{40}$	A. Bone.	10	15		5
				C. Air.	15	10	5	
			L = $\frac{14}{40}$	A. Bone.	10	10		
				C. Air.	15	15		
36	Ot. med. cat. chron. .	34	R = $\frac{C}{40}$	A. Bone.	15	20		5
				C. Air.	20	15	5	
			L = $\frac{12}{40}$	A. Bone.	10	20		10
				C. Air.	20	15	5	

No.	Disease.	Age.	Hearing Distance	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
37	Ot. med. sup. chron.	17	R = 10/40	A. Bone.	5	40		35
				C. Bone.	15	45		30
			L = 4/40	A. Bone.	5	35		30
				C. Bone.	15	40		25
38	Ot. med. sup. chron.	37	R = 4/40	A. Bone.	5	20		15
				C. Bone.	15	15		
			L = 0/40	A. Bone.	0	15		15
				C. Bone.	10	15		5
39	Ot. med. sup. chron.	17	R = 6/40	A. Bone.	5	25		20
				C. Bone.	5	15		10
			L = 20/40	A. Bone.	30	30		
				C. Air.	35	25	10	
40	Ot. med. sup. chron.	47	R = 15/40	A. Bone.	15	25		10
				C. Air.	20	20		
			L = 18/40	A. Bone.	10	25		15
				C. Air.	20	20		
41	Ot. med. sup. chron.	16	R = 2/40	A. Bone.	10	25		15
				C. Bone.	15	20		5
			L = 20/40	A. Bone.	25	30		5
				C. Air.	25	20	5	
42	Ot. med. sup. chron.	19	R = 20/40	A. Bone.	15	20		5
				C. Air.	15	10	5	
			L = 0/40	A. Bone.	0	10		10
				C. Bone.	5	10		5
43	Ot. med. cat. chron.	54	R = 1/40	A. Bone.	15	25		10
				C. Air.	15	15		
			L = C/40	A. Bone.	25	20	5	
				C. Air.	25	20	5	
44	Ot. med. sup. chron.	12	R = 12/40	A. Bone.	10	20		10
				C. Bone.	15	25		10
			L = 6/40	A. Bone.	10	25		15
				C. Bone.	20	20		
45	Ot. med. sup. chron.	13	R = 14/40	A. Bone.	15	35		20
				C. Bone.	20	25		5
			L = 8/40	A. Bone.	10	35		25
				C. Bone.	20	25		5

No.	Disease.	Age.	Hearing Distance	Which is louder, Air- or Bone-Conduction?	Duration of Air-Conduction, in seconds.	Duration of Bone-Conduction, in seconds.	Excess of Air- over Bone-Conduction.	Excess of Bone- over Air-Conduction.
46	Ot. med. cat. subacute	49	R = $\frac{P}{40}$	A. Bone.	20	20		
				C. Bone.	20	15	5	
			L = $\frac{P}{40}$	A. Bone.	15	15		
				C. Bone.	20	15	5	
47	Ot. med. cat. chron. .	23	R = $\frac{15}{40}$	A. Bone.	10	30		20
				C. Bone.	15	20		5
	Ot. med. sup. chron. .		L = $\frac{C}{40}$	A. Bone.	5	20		15
				C. Bone.	10	20		10
48	Ot. med. sup. chron. .	9	R = $\frac{P}{40}$	A. Bone.	15	20		5
				C. Bone.	20	20		
	Ot. med. cat. chron. .		L = $\frac{20}{40}$	A. Bone.	25	25		
				C. Air.	30	30		
49	Ot. med. cat. chron. .	23	R = $\frac{15}{40}$	A. Bone.	15	20		5
				C. Air.	20	15	5	
			L = $\frac{20}{40}$	A. Bone.	15	20		5
				C. Air.	20	15	5	
50	Ot. med. sup. chron. .	32	R = $\frac{0}{40}$	A. Bone.	0	2		2
				C. Bone.	0	2		2
			L = $\frac{0}{40}$	A. Bone.	0	5		5
				C. Bone.	0	5		5

In every case the patient asserted that A was much louder through the bone than through the air. In 39 ears the c^2 was heard louder through air; in the remaining 61 ears it was heard louder through the bones. The middle C (c^1 Helmholtz) tuning-fork was used in some of the "39" ears; with it the sound was heard longer through the bone. In 26 of the 39 ears the hearing was $\frac{12}{40}$ and over.

Average duration, in seconds, for 26 ears:

A. Air-conduction	15
Bone- "	17
Excess of bone-conduction	2

Bone-conduction heard 1.13 longer than aërial conduction.

c^2. Air-conduction	21
Bone- "	15
Excess air-conduction	6

Aërial conduction heard 1.4 longer than bone-conduction.

A and c^2. Air-conduction	18
Bone-conduction	16
Excess air-conduction	2

Aërial conduction is heard 1.13 longer than bone-conduction.

In 13 of the 39 ears the hearing was $\frac{4}{40}$ and under.

Average duration, in seconds, for 13 ears :

A. Air-conduction	12
Bone- "	14
Excess bone-conduction	2

Bone-conduction heard 1.16 longer than aërial conduction.

c^2. Air-conduction	18
Bone- "	17
Excess air-conduction	1

Aërial conduction 1.05 longer than bone-conduction.

A and c^2. Air-conduction	15
Bone-conduction	15

Equal.

In 61 ears, in which the c^2 tuning-fork was heard louder through bone, the average duration was :

A. Air conduction	7
Bone- "	18
Excess bone-conduction	11

Bone-conduction heard 2.57 longer than aërial conduction.

c^2. Air-conduction	12
Bone "	18
Excess bone-conduction	6

Bone-conduction 1.5 times longer than aërial conduction.

A and c^2. Air-conduction	10
Bone-conduction	18
Excess bone-conduction	8

Bone-conduction heard 1.8 longer than aërial conduction.

Average duration, in seconds, for the entire 100 *ears* :

A. Air-conduction	10
Bone "	17
Excess bone-conduction	7

Bone-conduction 1.7 longer than aërial conduction.

c^2. Air-conduction	16
Bone "	17
Excess bone-conduction	1

Bone-conduction 1.06 longer than aërial conduction.

A and c^2. Air-conduction	13
Bone-conduction	17
Excess bone-conduction	4

Bone-conduction 1.3 longer than aërial conduction.

From a study of the foregoing table the **following conclusions** seem to be reached :

1st. Relying on the statements of patients in regard to the *loudness* of tuning-forks, as a test in ear troubles, will lead to error unless account is taken of the fork used. As a rule, in normal ears high notes are heard louder through aërial conduction, and low notes louder through bone-conduction. This is true also, to a limited extent, in diseased ears, as verified by the thirty-nine cases cited.

2d. The relative duration of aërial and bone-conduction is a better test. In normal ears, in all cases the tuning-fork is heard *longer* through air than through bone, the proportion being greater for high than low notes ; and for the *middle* C (c^1) it should be heard about twice as long through air as through bone, the average duration in

my cases being for bone seventeen seconds, and for air thirty-four seconds. Any *marked* departure from this indicates disease.

3d. In external- or middle-ear disease this proportion is reduced, and in well-marked cases the average bone-conduction remaining the same or being increased, the aërial conduction will be reduced until it becomes equal to or much less than bone-conduction. In one hundred ears tested, the average duration was for bone seventeen seconds, for air thirteen seconds, or 1.3 longer through bone than air. This reduction obtained also in the thirty-nine cases in which air-conduction was louder than bone-, the average duration in those ears being equal.

4th. When the bone-conduction is longer than aërial conduction, and yet much less than the average duration of bone-conduction for normal ears, it is an indication not only of middle-ear trouble, but that the nervous apparatus is involved. Case 50, in the foregoing table is an illustration of this.

5th. If the proportion between bone and air remain the same, and the hearing power much lowered, it is probably an indication of disease of the internal ear. Air-conduction markedly exceeding bone-conduction the bone-conduction may be entirely lost, and yet air-conduction continue to a limited extent.

The two following cases illustrate this.

Case 1. Mr. ———, forty-five. Chronic alcoholism.

		D. air.	D. bone.
H R = $\frac{8}{40}$	A bone	30	20
	c^2 air	45	25
H L = $\frac{8}{40}$	A bone	30	15
	c^2 air	40	15

Case 2. Mr. ———, twenty-three. Meningitis.

		D. air.	D. bone.
H R = $\frac{3}{40}$	A bone	10	3
	c^2 air	25	5
H L = $\frac{2}{40}$	A bone	10	5
	c^2 air	25	10

Average duration, in seconds :

A and c^2

Air-conduction	27
Bone "	12
Excess air-conduction	13

Aërial conduction is heard 2.25 times longer than bone-conduction.

Before closing I would acknowledge my indebtedness to Drs. Roosa and Pomeroy for the use of their clinics at the Manhattan Eye and Ear Hospital.

TWO CASES OF SYPHILITIC DISEASE OF THE LABYRINTH, WITH REMARKS.*

By DAVID WEBSTER, M.D., New York.

THESE two cases are selected from a number of cases of syphilitic disease of the ear, occurring in the practice of Dr. C. R. Agnew and myself, for presentation to this Society, because the records of them are reasonably complete, and because of the interest that has been manifested in this class of affections during the last few years.

The diagnosis of labyrinth disease was based in both cases upon the total, or almost total, deafness of the affected ear to external sounds, and to the tuning-fork. In the first case there may be room for question as to the diagnosis.

The autophony, the patient's voice "sounding to himself as though he were talking into a barrel," seems to be a symptom of middle-ear disease. But the absence of all abnormal appearances of the membrana tympani, and the inability of the patient to hear the tuning-fork in the deaf ear while he heard it well in the other, as also the suddenness with which the deafness was ushered in, seemed to render the existence of labyrinth disease extremely probable.

In the second case, I think the most sceptical will not question the diagnosis.

The cases are both remarkable, I think, on account of the recovery of hearing, which occurred after months of total deafness. What the specific lesion of the labyrinth was which produced the deafness I am unable to say. It may

* Read before the N. Y. State Medical Society, Feb. 6, 1883.

have been congestion, or it may have been inflammation, or it may have been a periosteal thickening similar to that affecting the orbital walls in the second case. Possibly, some one who has given more thought to this subject than I have may, on reading the cases, be able to arrive at a more positive conclusion as to the nature of the lesion.

In the first case only one ear was affected throughout the course of the disease. This ear either became suddenly deaf, or else its hearing was gradually lost without attracting the attention of the patient, until he accidentally made the discovery. It remained totally deaf, or nearly so, for several months, when, under antisyphilitic treatment, the hearing was gradually recovered, and there has been no relapse up to the present time.

In the second case, one ear became deaf and remained so for several months, when it gradually recovered its hearing, and retained it for nearly a year, when the patient awoke one morning with the same ear again totally deaf. After some months' treatment the hearing was partially recovered, but, soon after, the patient turned up "deaf as a post" in both ears. He is still totally deaf in the ear first affected, and probably will always remain so. The hearing of the other ear was so far recovered under treatment that he hears conversation readily.

In the second case a great deal of vertigo is complained of. In the first case there was none.

Case 1.—May 27, 1874. O. W., aged forty-one, physician, says that he had what some of the most prominent physicians in New York diagnosticated as pulmonary tuberculosis, at the age of twenty-five. The pulmonary disease was a sequel of measles, and was accompanied by copious and frequent hæmoptysis.

After physicians and friends had given him up, he gradually recovered under a very free use of whiskey, and an out-of-door life.

Four months ago, he had an attack of irregularity of heart-action, following extreme exhaustion from extraordinary loss of sleep in attending to his professional duties. The action of the heart was tumultuous, irregular; now rapid, now slow; at times fluttering, and again intermittent. The attack lasted thirty hours and did not recur.

For the last three months he has suffered from intermittent fever, with neuralgia. He has severe headaches every night, coming on at 9 or 10 o'clock, and continuing all night, keeping him awake for hours at a time. These neuralgic pains have frequently been felt in both his ears, and about three weeks ago he discovered, for the first time, that his left ear was totally deaf. He has since experienced a very annoying ringing in the affected ear, and a very little pain.

Hearing power: right, normal; left, click of nails at three inches.

Tuning-fork, on teeth or forehead, heard only in right ear.

Pharynx slimy.

Auditory canals and membranæ tympanorum, normal.

Eustachian tubes easily opened by Valsalva's method.

His voice, which to others seems normal, sounds to himself as though he were talking into a barrel.

As the history seemed to point to malarial poisoning as the cause of his troubles, it was suggested to the patient that he should put himself upon large doses of quinine. This he objected to, however, because the drug had always acted very unpleasantly upon his nervous system. He believed that five grains would set him crazy. He was, therefore, placed upon a mixture containing chinoidin, arsenic, and strychnia. He was advised to drink half a pint of milk four times daily, not to do any night work, and to rest for an hour or two, regularly, at noon.

July 1st.—The patient now recollects that about three months ago he had an ulcer on the back of his neck. From six weeks to two months he has had tibial periostitis, and tender spots on each ulna. The neuralgic pains continue. The hearing of the left ear has slightly improved, the click of nails now being heard at three feet. The patient was now placed upon iodide of potassium, in increasing doses, with cod-liver oil.

July 15th.—No headache; no neuralgic pains. Has slept well for the last eight or ten nights. Some tibial tenderness remains. The left ear hears the watch in contact, and the voice as in ordinary conversation, at ten feet. There is less tinnitus aurium.

July 28th.—Has had ulcers on velum for the last ten days, but they are now nearly well from cauterizing with nitrate of silver. The left ear now hears the watch at a quarter of an inch.

Aug. 25th.—Mucous patches and ulcers on tongue, lips, and buccal mucous membrane. The left ear hears the watch at one and a half inches.

The patient was now advised to place himself under the care of Dr. F. J. Bumstead.

I complete the history of the case by the following extract from a letter from the patient, dated May 8, 1879, about five years after we first saw him :

"I am very happy to inform you that my general health is now first-rate. I can hear a watch tick at arm's length with my left ear, but not quite so clearly as with my right. It does not trouble me, however, in any way whatever, and my left ear is just as good as my right for purposes of auscultation. For ordinary conversation, practically the left ear is as perfectly good as the right, and I can hear ordinary conversation quite as well as before my left ear became deaf. You will doubtless recollect that the last time I saw you I had mucous patches in my mouth and throat in large numbers. Dr. Bumstead at once placed me upon blue mass and iron, which, together with potass. iodide, I continued to take for two years, taking from six to ten grains of blue mass with half that quantity of ferri sulph. daily ; at one time taking this for nearly a year without intermission. I had returns of the mucous patches, ulceration of fauces and soft palate, and had, two or three times, ulceration of the epiglottis, which was very nearly destroyed, the disease proving very obstinate and unyielding. During the last year that I took it, I took not less than six ounces of the blue mass. Since that time I have had no manifestation of the disease whatever, and have taken no medicine. During all the treatment I never became salivated, and no physiological effects whatever were shown. My health is now as perfectly good in every way as ever, and I may say my hearing is perfectly restored. I consider mine as a typically bad case with a typically good result. No doubt exists in my mind that had I neglected treatment, or followed it carelessly, the disease would have caused my death."

Case 2.—B. M., aged 43, druggist, came under observation in January, 1878. He stated that he had contracted syphilis while in the army in 1862. The chancre was followed by an eruption, and some loss of hair, but no sore throat or enlargement of glands. He had nocturnal pains in his left shoulder, disturbing his sleep, for a year, on returning from the war. His left shin was then tender and painful for over a year. An ulcer appeared on his sternum in 1863. There are now eight sores over his sternum, with evidences of necrosis. Six months ago the right eye began to pro-

trude, and there is now very marked exophthalmos. There is no diplopia, and the eye moves freely in every direction. Vision $\frac{20}{20}$ each eye, and no lesion to be seen with the ophthalmoscope. The exophthalmos seems to be the result of orbital periostitis.

The right ear became deaf gradually about four months ago. It now seems to be totally deaf to external sounds, not even hearing the tuning-fork when applied to the forehead or teeth, but hears a constant singing. The hearing of the left ear is normal. There is no visible lesion of the external or middle ear on either side, and the Eustachian tubes are pervious. The patient has much vertigo, feeling at times as though he were walking like a drunken man.

He was placed upon mercurial inunction.

Feb. 19th.—The gums were "touched," and the mercurial ointment was discontinued about a week ago. There is less tinnitus, and the ear is recovering its hearing.

The patient was now placed upon a saturated solution of iodide of potassium, commencing with five drops three times daily, and increasing the dose two drops daily.

March 1st.—The patient says he can hear with his right ear as well as ever, that the ringing has left it, and that he is no longer troubled with vertigo. He is taking seventeen drops of the saturated solution of iodide of potassium after each meal.

Nov. 2d.—The patient has been overworked, and has not slept well for two weeks. He complains of pain in his left elbow and left leg. In both ears the hearing remains normal. The vision of both eyes is normal, and the exophthalmos of the right is no more marked than when first seen. He has been taking iodide of potassium, gr. xx, *ter in die*, all summer. Advised to stop the iodide and resume mercurial inunction.

Feb. 11th, 1879.—The patient awoke a few mornings ago with the right ear again deaf, and the tinnitus as bad as ever. The left arm and leg have not been painful for two months past. The sores on his sternum are gradually healing. The principal trouble now is with the right side of the head. The scalp about the vertex is tender on pressure, and there are shooting pains through the right side of the head. He complains of a dull, heavy feeling, and tires easily. Ordered mercury with iodide of potassium.

Sept. 18th.—The patient now hears the tuning-fork with his right ear, though less than with his left, and he hears click of nails at two inches. The tinnitus is less intense. The drum-membranes

appear normal. The sores on the sternum are nearly healed. The scalp at the vertex is still tender. Walking up stairs fatigues him and causes palpitation. The exophthalmos is no worse, and vision is $\frac{20}{20}$. Ordered blue mass with iron and quinine.

Nov. 26th, 1880.—The patient comes to the office so deaf that he has to be communicated with in writing, and with so much vertigo that he is unable to go about alone. He says that he heard very well with his left ear until he received a blow on the left temple with a car-brake, about two months ago. Some swelling followed, and he soon began to lose the hearing of the left ear. It grew gradually worse until about four days ago, when he became totally deaf and has so remained. He hears a great roaring continually in his left ear. His voice is elevated in pitch. The right ear is absolutely deaf to all tests; the left hears click of nails in contact. The tuning-fork placed against the forehead or teeth is faintly heard in the left ear. He cannot perceive any improvement with audifan or hearing-tube. Right drumhead sunken, reddened at periphery, and light spot small; left in a similar condition. Eustachian tubes open on using Politzer's method. Advised to push mercurial inunction.

Dec. 3d.—Mouth touched. H D R o., L $\frac{1}{\text{nails}}$. Can now understand sentences shouted into left ear. To take iodide of potassium, gr. v, *ter in die*, and increase the dose two grains daily. Is less dizzy; came over from Jersey City alone to-day. The ulcers of his sternum are not yet healed.

Dec. 23d.—Now hears sentences, uttered distinctly, at ten feet. H D R o, L $\frac{\text{cont.}}{60}$. Has taken up to fifty drops, thrice daily, of a saturated solution of iodide of potassium. Yesterday an iodide eruption appeared. He has a catarrhal discharge from his nose, and is still greatly troubled with tinnitus. To stop the iodide, and to snuff up salt and water every morning. After thus cleansing the nares, he is to apply Smith's powder (arg. nit. gr. v., potas. sulph. ʒ ss., bismuth. subnitrat. ʒ i. ℳ.) by means of a powder-blower. To drink milk freely.

April 9th, 1881.—Patient thinks that he hears better than when last seen, but the usual tests show no change in his hearing.

On January 19, 1883, I asked Dr. J. Oscroft Tansley to make a careful examination of this patient's condition, and he gave me the following notes:

"H D Right=nails at five feet; watch, not at all. The left ear was closed with a towel, yet I cannot but think that the nails were heard in the left ear and not in the right.

"H. D. Left=watch at two and a half inches. Tuning-fork heard only in left ear when placed on middle or extreme right of teeth or forehead. Closing the left, it was heard *only* in the left ear. Closing the right, it was heard *only* in the left ear. Closing both, it was heard *only* in the left ear.

"Tuning-fork, left ear, by aërial conduction, forty-five seconds; by bone conduction, fifteen seconds. The right ear cannot be made to hear the tuning-fork either by aërial or by bone-conduction. The patient says he *feels the vibrations*, but does not hear the sound, with that ear.

"Appearances: Left membrana tympani slightly removed from normal appearance. Malleus drawn slightly backward and a little foreshortened. Light spot slightly cut off on base, but of normal brilliancy. Drumhead not thickened at all, but translucent. Right membrana tympani presents same appearances as left. Malleus not so much, *if any*, foreshortened. Light spot, bright and glistening. Base, perhaps, slightly indistinct; otherwise normal.

"Both membranæ act well under Siegle's tympanoscope.

"Diagnosis: Right, labyrinthine or nervous deafness. Left, otitis media catarrhalis, with labyrinthine complications. Patient has occasional vertigo, with inclination to fall laterally, and a feeling of heavy weight in head. During the time of his total deafness in both ears he experienced singing noises, but has had none since."

A CASE OF CLONIC SPASM OF THE LEVATORES PALATI, PRODUCING A RHYTHMICAL CLICKING NOISE.*

By Dr. CORNELIUS WILLIAMS, of St. Paul, Minn.

LATE ASSISTANT SURGEON AT THE NEW YORK OPHTHALMIC AND AURAL INSTITUTE, SURGEON TO THE OUT-DOOR DEPARTMENT MT. SINAI HOSPITAL, ETC., ETC.

Violetta Z., twelve years old ; good frame ; full-blooded brunette ; weighs ninety-one pounds. She has not yet menstruated, nor are there any menstrual molimina.. Her mother is a French-American, in good health. There are seven children, all living, Violetta being the sixth. The father was a German, well educated, and a talented musician. He was drowned some eight years ago, in a fit of insanity. In the mother's family there have been some cases of Pott's disease. The immediate family and near of kin are all healthy, and of more than average intellectual development. They are all of strongly-marked nervous temperament, and the father was extremely so.

When Violetta was ten years old, having occasion to get up during the night, she lost her way in going back to her bed, and reaching her grandmother's room by mistake, she laid her hands upon the aged lady in the dark, and so alarmed her, and was herself so much frightened by the grandmother's shrieks, that she almost went into convulsions. She refused to return to her own bed, but lay in her sister's arms, starting and sobbing, the night through. Next day she was extremely pale and nervous, nor did she recover her wonted spirits for a number of days. This happened in the spring of 1880, and a short time after this the child discovered that a strange clicking sound was produced in her mouth, but suffering no inconvenience from it she mentioned it to no one. In the June following she fell into Lake Elmo (Minn.),

* Shown at a meeting of the Ramsey Co. Med. Soc. in Jan., 1883.

and came near being drowned, and a short time after this she called the attention of her mother to the clicking, which had now become constant. The family medical attendant was consulted, who pronounced it a common affair; the uvula was cut off entirely, and one tonsil was amputated without result as far as concerned the clicking. The patient is in good general health; appetite and digestion good; sleeps well. She is easily fatigued, but is kept up by any excitement. There has been for the last three years diurnal incontinence of urine, the act of micturition recurring about every half hour, but at night it is hardly ever necessary for her to get up more than twice. Dr. S. W. Hand, who was kind enough to examine her, informs me that there is considerable leucorrhœa, and that the urethra is unusually large and patulous. He explored the bladder and found no evidence of stone. The act of micturition is not painful. Drs. Hand, Boardmann, Abbott, and Wheaton examined her heart at my request, and report that there is nothing abnormal about it.

Upon looking into the patient's mouth, it is perceived that the velum palati is rapidly raised and lowered without being made tense in its entirety. At the moment of relaxation of the levatores a sound is produced which is as much as can be like the ticking of a small brass clock, and in a still room it may be heard at a distance of twenty feet. The clicking corresponds to a complete contraction and relaxation of the levatores palati, and by actual count is 120 a minute, with very little variation in frequency at any time. When the mouth is opened widely, the azygos uvulæ is sometimes seen to contract, but such contraction would seem to be physiological. The tone of the clicking is changed by closing the nose and by otherwise altering the usual conditions of the mouth and nose as to the volume of air contained, but that, or any other manipulation, procures the cessation of the noise or its cause. Laryngoscopic examination shows the larynx to be normal, save a slight congestion. Rhinoscopy is not practicable. Otoscopy reveals the membrana tympani of each ear slightly indrawn, the handle and short process of the malleus of the right being abnormally prominent. Light spot gone from both *Mtt.*

By means of the diagnostic tube, I am able to hear the clicking sound in either of the patient's ears—more distinctly in the right. It may very well be likened to the ticking of a watch under a pillow, or the sound of the fœtal heart. If there is any movement of the membrana tympani, I have not been so fortunate as to ob-

serve it. The girl's voice is natural, and she can sing with correctness, uttering the chest notes without difficulty, but is unable to produce head notes at all. In running the scale, a decided tremolo is remarked. The patient, of necessity, breathes through the mouth, and from habit keeps it open during sleep. When there is tonsillitis, to which she is subject, there is considerable druling. At such times she is apt to have glottic spasm. The spasm of the levatores ceases during sleep. At irregular intervals, perhaps fifty or a hundred times through the day, there is an interrupted spasm of the diaphragm, giving rise to a sudden and deep inspiration in two or three motions, as in sobbing, followed by prolonged expiration. At times, it may be for an hour or half a day, she hears in her ears a sound comparable to the rapid revolution of a small fan-wheel. Acuteness of hearing normal.

This affection is in all probability choreic. The history is exquisitely that of chorea. Weir Mitchell lays great stress upon climate and season in the etiology of chorea, his observations showing the disease to be more prevalent in spring and in cold climates. Chorea is infinitely more frequent in girls at about this patient's age than in any other class at any other age. Sir Thomas Watson has found chorea to be much more frequent in brunettes than in fairer persons. Whatever the predisposing, the immediate exciting, cause is oftener fright than any other. It is impossible to say, in any given instance, absolutely, that a child has *not* had rheumatism. According to A. Jacobi the disease is sufficiently common in infants, and it is well known that the proneness to cardiac complications does not depend upon the severity of the joint affection. Fugitive pains in the limbs and slight elevation of temperature may then very well be the only obvious indication of a morbid condition which may be accompanied by the deposition of particles of fibrine more or less minute or numerous upon the valves of the left heart, and hence the possibility of embolism. The levator palati is supplied with motor filaments by the facial through the connection of its trunk with the Vidian by the petrosal nerves; the stapedius is also supplied by a filament from the facial. Choreic spasm of muscles supplied by the facial is common enough, but a choreic affection of the muscles of the soft palate has been heretofore unknown.

The only similar case I have been able to find recorded, is that by E. L. Holmes, these ARCHIVES, vol. viii, p. 144. No mention is made of such a disorder by any of the standard works wherein the subject is treated and which are accessible to me, except in Ziemssen it is stated that: "Spasm of the soft palate is almost entirely unknown; even the behavior of the affected muscles in spasms proceeding from the facial nerve, and in those proceeding from the motor filaments of the trifacial, is unknown." Irregular twitchings of some of the palatine muscles are observed, in advanced cases of locomotor ataxia, etc. Rhythmic choreic contraction of any muscle continued for so long a time would be an extraordinary circumstance. The contractions of the palate muscles in this case continue with about the same frequency at all times during the patient's waking hours, and do not vary more than four to six in the minute. They do not seem to be influenced by exercise, or having the attention drawn to the matter. The levator palati, though a voluntary muscle, is not in all persons under perfect control of the will, therefore any psychic excitement would be less apt to influence its movements.

The clicking noise is probably occasioned by the vacuum produced at the moment the superior surface of the velum leaves the roof of the naso-pharynx to which it has been applied by the spasm. I had an opportunity of watching the behavior of the velum palati during an attack of acute tonsillitis, and found that though the spasm of the levatores continued without abatement the clicking ceased, and the elevation was not so considerable because of the swelling of the parts, which prevented the complete closure of the posterior nares. When I showed this case at the meeting of the Medical Society, it was stated by some of the gentlemen present that a similar condition existed in the case of a demented woman then in St. Joseph's Hospital. Upon examination of this woman, however, I found that the noise in her mouth is produced by closure of the mouth, placing the tip of the tongue against the lower teeth, and approximating tongue and soft palate, a trick which she had acquired, but which failed her when the mouth was opened; of course any one can do the same.

THE NEW YORK INSTITUTION FOR THE IMPROVED INSTRUCTION OF DEAF-MUTES.

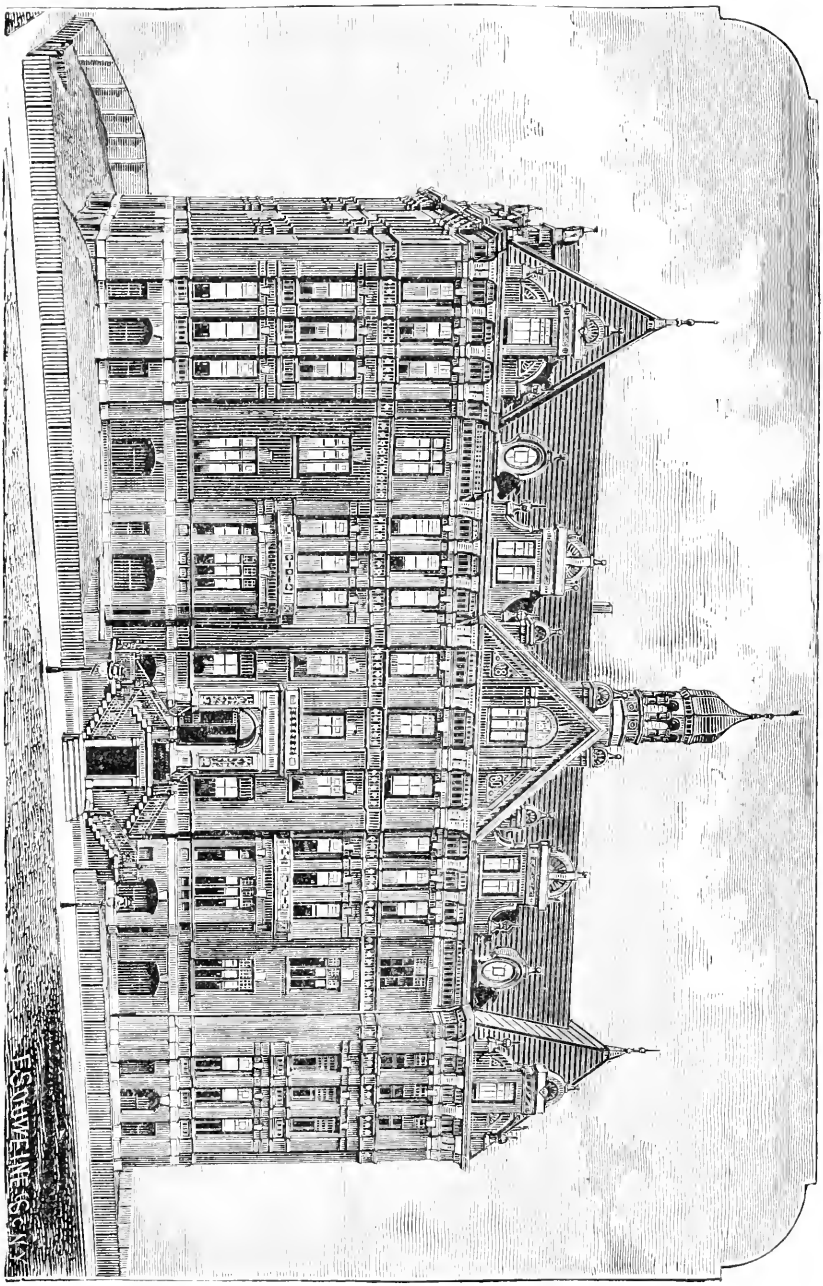
By D. GREENBERGER, Principal.

(With three drawings.)

CONSIDERING that many of our pupils come to us by the advice of those who are engaged in the specialty to which this journal is devoted, it may not be amiss to give, in the following, an account of the workings of this Institution.

The school has been in operation since March 1, 1867. Beginning with a small number of pupils, its sphere of usefulness has gradually extended, and now it is the largest articulation school in the country. Its affairs are managed by a board of trustees, consisting of fifteen members, who are elected by the "Association for the Improved Instruction of Deaf-Mutes." Deaf-mute children, whose parents have been residents of this State for the last three years preceding the application, may be supported at public expense. Pupils from other States are charged for their board and tuition. During the sixteen years of its existence, the Institution has received pupils from almost every State in the Union, and its former graduates are scattered over the land, taking their places in society as useful citizens.

The system of instruction in use at this Institution is what is commonly known as the *oral method.* The pupils learn to speak *orally* and audibly, and to understand what is said to them by observing the movements of the speaker's lips. The language of natural gestures, which every intelligent deaf-mute child invents for himself, and by means of



which he makes himself understood before entering school, forms the medium of communication between the teacher and pupil during the first school year. Afterward all signs and gestures are discarded during the hours of instruction. The questions put by the teacher and the answers given by the pupil are purely and exclusively oral. The manual, or "deaf and dumb" alphabet, is not employed in this Institution.

In explaining, to the readers of this journal, the method of teaching deaf-mutes to speak, it seems hardly necessary to call attention to the fact that the vocal organs of our pupils are commonly in the same normal condition as those of hearing persons. We do not receive children whose loss or want of speech was caused by paralysis of any part of the vocal machinery, nor do we admit those who fail to acquire speech on account of mental imbecility. Our Institution is intended for those only who are of ordinary intelligence and remained mute, or became so, in consequence of congenital or acquired deafness. The name "deaf-mute" is misleading. People who have not given any thought to the matter are apt to believe that the persons to whom that name is applied are afflicted with two distinct infirmities, viz.: deafness and mutism. Hence I have often been told: "You have one advantage, namely, that your pupils cannot disturb you by making a noise." But this is not so. Deaf-mutes can make a noise, and as a rule use their voices a great deal. During an experience extending over a period of more than twenty years, I have never met a deaf-mute who did not use his voice in calling others, or in expressing his feelings, emotions, etc. Of course, the sounds produced are inarticulate. These children do not learn to imitate articulate speech, because they do not hear. But, having the use of their vocal organs, we can teach them to articulate on the following principle: Each of the elements of speech requires its own particular configuration of the mouth and special disposition of the tongue, etc. These various changes of the relative positions of the vocal organs during the formation of speech can be seen by the deaf-mute, and he can learn to imitate them. He can also feel

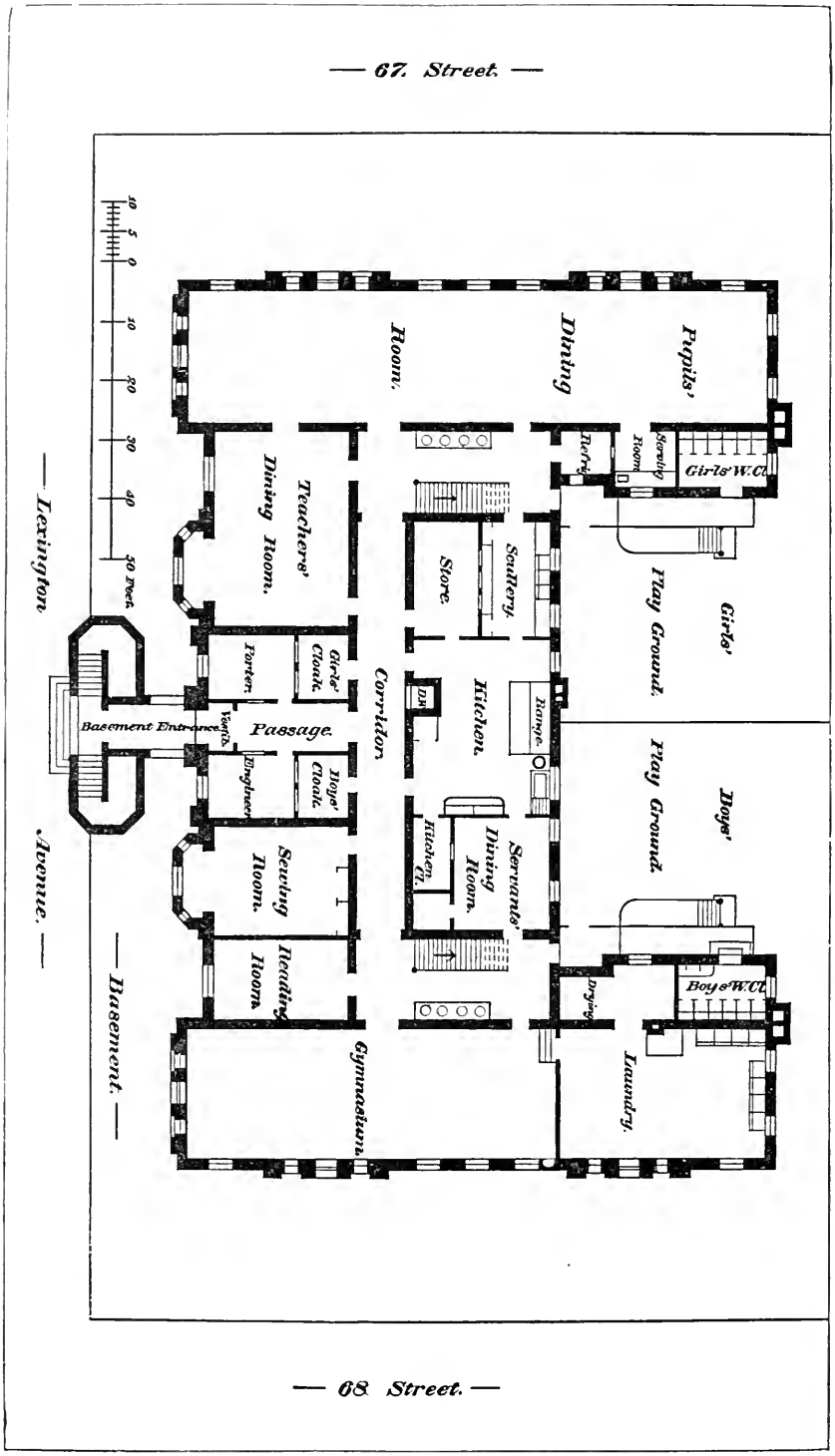
the breath which is emitted from the mouth during speaking, and the vibrations caused in the larynx during the utterance of the vowel sounds and vocalized consonants. The beginning is made with short words of easy pronunciation, as: *bow*, *paw*, *toe*, *papa*, *tie*, *tea*, etc. The mode of procedure is as follows: The pupil stands before the teacher, so as to have a full view of her mouth. She lets him put one of his hands on her throat and hold his other hand before her mouth at a distance of two or three inches, while she slowly and distinctly pronounces the word *paw*, for instance. The child feels, with one hand, the expulsion of breath which is emitted from the teacher's mouth in forming the sound of *p*, and with his other hand, he feels the vibrations caused in her throat by the enunciation of the sound of *aw*. At the same time, he has to watch carefully the motions of her mouth. After the process has been repeated several times, he is required to imitate what he has seen and felt. An intelligent child will succeed in this after a few attempts, though the voice is usually either too high or too low, and has to be regulated accordingly.

The art of lip-reading is acquired incidentally during the instruction in articulation. While watching the movements of the teacher's lips and trying to imitate them, the deaf child learns to distinguish between these various movements. Our pupils read the lips of strangers almost as readily as those of their teachers. They understand what is said to them in a whisper as well as what is spoken in a loud voice, and many who have keen eyesight can read the lips at a distance of sixty or seventy-five feet. To those who can hear, it often seems a matter of great surprise that a deaf person should be able to understand what is said to him by merely observing the movements of the lips. But it must be remembered that whenever there is one sense lacking, some other or others will become more efficient through increased use. Deaf-mutes therefore are very quick to receive impressions through the sense of vision. It is not likely that they see every one of the movements of the tongue, but they see the principal ones and guess the rest. Sometimes it is sufficient for them to read a few

leading words of a sentence and they supply the others. A moustache of ordinary size does not hinder lip-reading, because it partakes of the movements of the lips, but if the latter are entirely hidden by an unusually heavy growth of hair, then labial reading is rendered difficult, and sometimes impossible. Some deaf-mutes learn to read the lips with remarkable facility. A young lady, a former graduate of this Institution, who is totally deaf, goes into society and takes part in a general conversation of a large company, and often strangers do not notice that she cannot hear. During the lessons, the pupils often stand around the teacher, so that some can see the side only of her mouth, yet they understand what she says and follow the lesson.

To teach pupils to speak and read from the lips is not the most difficult part of our task. The instruction in language and the mental development, present far greater difficulties. There are some pupils who acquired a knowledge of language through the ear before they became deaf. But these form a very small minority. The great mass of them have no knowledge whatever of the English language, and can communicate only by means of natural gestures which every deaf-mute child of ordinary intelligence invents for himself to make known his wants to others. The range of this language varies in each individual according to the degree of his intelligence. At best, it is a very inferior mode of conveying thought, and cannot be used as a basis from which we could translate into our language. Besides, the natural order in which these signs are used is different from our conventional arrangement of words in a sentence. For instance, if a deaf-mute beginner were to make the simple statement, "I see a book on the table," he would be very apt to express it thus: "Table book on I see." Thinking in pictures instead of words, he sees in his mind's eye first the table, then the book, and then he thinks of the relation between the two objects and of himself.

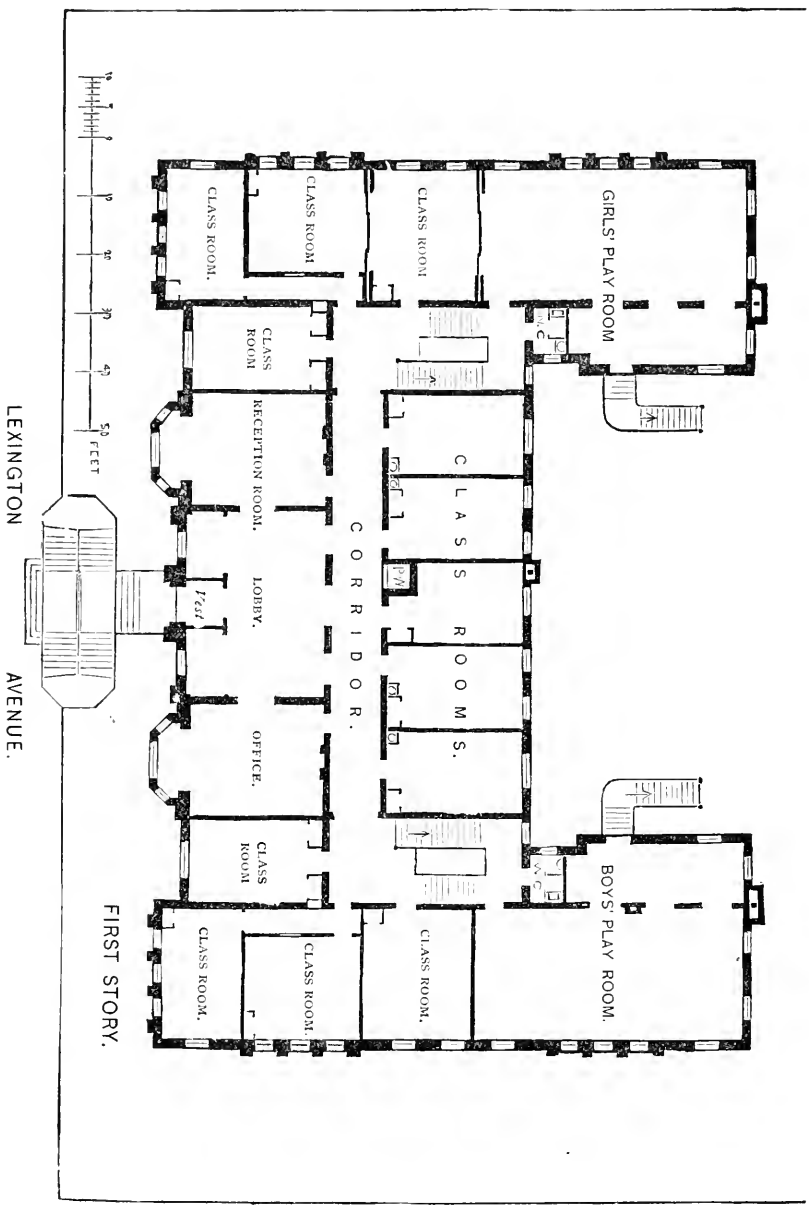
We find that in studying the vernacular of their country, our pupils have all the difficulties that other people encounter in studying a foreign language. Many ingenious and scientific plans have been devised by deaf-mute in-


— 67. Street. —
Pupils' Dining Room.
Girls' Play Ground.
Boys' Play Ground.
Laundry.
Gymnasium.
Reading Room.
Sewing Room.
Teachers' Dining Room.
Corridor
Passage.
Kitchen.
Servants' Dining Room.
Store.
Scullery.
Range.
Kitchen Cl.
Girls' Cloak.
Boys' Cloak.
Porter.
Basement Entrance.
Vestib.
Dispatcher.
Dryers.
Boys' W.C.
Girls' W.C.
Servants' Room.
Refrig.
D.W.
10 5 0 10 20 30 40 50 Feet.
— Lexington Avenue. —
— Basement. —
— 68 Street. —

structors to overcome these difficulties. In this Institution we have tried several of these scientific systems and discarded them. For the last three years we have employed the natural method, by which our pupils learn the English language in the same manner as it is acquired by a hearing infant. We call attention to the objects on hand in the school-room, and teach their names; when a child motions to tell the teacher that he wants a drink of water, he is taught how to ask for it in words; when he comes in from a walk and tries to tell what he has seen, he is taught how to express it in words, etc., etc. I have found that since we have employed this natural method, our pupils make more rapid progress in the use of spoken language than they did formerly, when we followed a scientific system based upon the rules of grammar. Everybody knows that it requires years to study a foreign language from books, whereas the children of immigrants coming to this country and mingling with others in the streets, learn to speak English well in a few months. The reason is, that they learn it in a natural way, which is far superior to the most ingenious artificial system that could be devised. The superiority of the natural method of teaching language over all grammatical and scientific systems has also been clearly demonstrated in the case of deaf-mutes.

In addition to acquiring the use of articulate speech and learning to read from the lips, the pupils are instructed in all those branches which are taught to hearing children in the common schools. Our older scholars are quite proficient in arithmetic, geography, history, grammar, natural history, natural philosophy, drawing, etc. In September, 1881, one of our graduates passed a successful examination for admission into the Columbia College School of Mines, and was duly enrolled as a student. The branches in which he was examined were algebra, geometry, French, and German. He is now in the Sophomore class.

The new and beautiful home which was erected for this Institution at a cost of about $150,000, has been completed and in use since the fall of 1881. It occupies the entire front of the block on the westerly side of Lexington Ave-


67th Street.
LEXINGTON AVENUE.
FIRST STORY.
GIRLS' PLAY ROOM
BOYS' PLAY ROOM.
CLASS ROOMS.
CORRIDOR.
CLASS ROOM.
RECEPTION ROOM.
LOBBY.
OFFICE.
Vest
68th Street.

nue, between 67th and 68th streets. The site and neighborhood are as eligible as any on Manhattan Island. The ground is high and well drained, and Central Park is within a short walking distance. The building itself contains all the appointments that architectural skill, sanitary science, and experience with deaf-mutes could suggest. No expense and no pains have been spared to make this building perfectly well adapted to the wants and requirements of the class of unfortunates it is intended to shelter. The class-rooms are light and airy; the dormitories are roomy and well ventilated; the bath-rooms and lavatories have an ample supply of water; the gymnasium and play-rooms are large and commodious. Proper accommodations for the sick are provided on the top floor of the south wing, and perfectly isolated from the rest of the building, so as to afford the means of quarantining cases of contagious disease in case of necessity. The dining-rooms, the culinary apartments, etc., are fully in keeping with the style and character of the rest of the establishment. The building is lighted by gas and heated by steam. All precautions that human foresight could suggest have been taken against danger by fire.

REVIEWS.

I.

Die Taubstummen und die Taubstummenanstalten nach seinen Untersuchungen in den Instituten des Königreichs Würtemberg und des Grossherzogthums Baden. Von Medicinalrath Dr. Hedinger. Stuttgart: Verlag von Ferdinand Enke, 1882. (The Deaf and Dumb and the Deaf and Dumb Institutions, after his Investigations in the Institutions of the Kingdom of Würtemberg and the Grand Duchy of Baden.)

Reviewed by A. HARTMANN, Berlin.

Translated by D. Greenberger, Principal of the Institution for the Improved Instruction of Deaf-Mutes, New York.

The monograph by Hedinger now before us owes its origin to investigations of pupils of the institutions for deaf-mutes in Würtemberg and Baden. In the first part of the book, which treats of general matters (forty-five pages), we find accounts of the internal arrangements and size of the institutions; then follow short remarks on congenital and acquired deafness, which are based upon individual statistical records. Toynbee's observations are extensively quoted, while more recent and exact investigations are not mentioned. Likewise, in the discussion of the degree of hearing, only deaf-mutes whom Toynbee examined are considered, besides those of the institutions of Würtemberg and Baden. In reference to attempted cures of deaf-mutism, Hedinger lays stress upon the importance of treatment by medical specialists. He does not consider it out of question "that at least in the case of those who are not totally deaf, the power to distinguish vowels, and to appreciate sound in general, may be preserved, if it cannot be improved."

"At any rate the hearing of a large proportion of the cases of acquired deat-mutism that annually enter the institutions, might have been preserved to a greater or less degree." These views

seem to conflict with the statement made in the introduction, that so far no cure of deaf-mutism has been effected.

In reply to this, the reviewer takes the liberty to remark that in our literature there are a number of cases recorded in which such cures proved successful. Based upon this experience it must be reiterated again that it is desirable that deaf-mutes should be subjected to a professional examination and eventually to proper treatment.

In the chapter on the education of deaf-mutes, the resolutions of the Congress of Deaf-Mute Teachers, at Milan, are published, and the advantages of the oral method especially pointed out. But we must not forget that deaf-mutes who have been educated to use written language only, attain to as high a degree of moral and intellectual development as those who have been taught to articulate. Though they are very much hindered in their intercourse with hearing persons, yet they have the advantage that a considerable portion of time which has to be spent in the training of the voice, can be applied to intellectual development. This is of so much more account, as we find that the articulation of many deaf-mutes is imperfect, and the power of reading the lips leaves a great deal to be desired. Conception of ideas and a knowledge of the vernacular are gained by means of spoken as well as written language.[1]

The branches which are taught in schools for deaf-mutes and the question whether it is best to educate them in institutions or at their homes are discussed in special chapters, and the advantages and disadvantages of boarding- and day-schools are carefully weighed. The author seems to consider boarding-school life the

[1] Here I must interrupt the reviewer for a moment to say, with all due respect and regard, that there is no force whatever in his arguments against the oral method. Of late years the system has been so much improved that, under the charge of a competent teacher, deaf-mutes may acquire the power of speech, and the facility to read the lips during the first four or six months of the course. Henceforward their progress in the various branches of study must be far more rapid than in the case of those who are educated by means of writing and dactylology. For it must be remembered that we can speak a sentence in one ninth part of the time that is required to write it, or in one third of the time required to spell it on the fingers by means of the manual alphabet. In regard to the results it must be admitted that the articulation of some deaf-mutes, who have been educated by the oral system, is imperfect, and that their power to read the lips leaves a good deal to be desired. But even an imperfect articulation, proves of incalculable value in the intercourse with hearing and speaking people, few of whom understand the sign language; even the least successful scholars learn to speak intelligibly enough to be readily understood by their parents and friends, who soon become accustomed to their peculiar enunciation; and the number of those who learn to speak and read the lips so well that they can easily communicate with strangers is increasing from year to year.—The Translator.

most appropriate for the first half of the number of years of school time, and day-schools for the other half.

The second part of the monograph consists mostly of tables showing the results of examination of 415 deaf-mutes. Of this number, 181 were cases of congenital, and 234 of acquired, deafness. The first table shows the names, ages, causes of deafness, condition of the drumhead and of the nose and mouth, examination of the hearing, and special remarks. In the second and third tables statistics of congenital and acquired deaf-mutism are given separately. Then follow two combining tables, and table VI is a summary of the whole statistics.

It is to be regretted that the examination into the causes of deafness, which is of paramount importance, is the weakest point of Hedinger's investigations. He seems to have relied entirely upon institution reports. The reviewer inclines to this view, because he thinks that if the author himself had gathered the statistics, or if he had delegated somebody else to do it, we would not find the following among the causes of deafness, viz.: "in consequence of vaccination, convulsions, sleeplessness during the first year, teething, sickness," etc.

The reviewer frequently found during his own examinations, how deficient the records of deaf-mute institutions are in regard to the origin of the loss of hearing, and therefore called attention to the fact that special statistics of deaf-mutes have no value unless the investigations are made by means of exact lists of questions. Hedinger, too, acknowledges this, although he does not act accordingly, for he says that we must be very careful in drawing certain inferences from statistics, and that above all close examination, full lists of questions, and less regard to personal statements are necessary, lest we should fall into the same errors and meet with the same reproaches that other disciplines, especially political economy, justly incur.

Careful readers will receive with reserve the statements about the influence of diseases of the nose and pharynx upon deaf-mutism. Hedinger found affections of the pharynx in 157 and affections of the nose in 112 of all deaf-mutes. In the opinion of the reviewer it does not seem judicious to draw any conclusion from this as to whether these affections are to be considered causes of deaf-mutism. Hedinger's tables themselves show that a large percentage of those who lost their hearing through cerebro-spinal meningitis and diseases of the brain are suffering with affections

of the nose and pharynx, in which case such affections cannot be considered of etiologic moment. Likewise, we know that even among persons of normal hearing the percentage of diseased condition of the nose and pharynx is quite considerable. Therefore, if we find the same condition as frequently among deaf-mutes, we must not infer that these diseases are to be considered causes of deafness. Equally cautious we have to be in utilizing the otoscopic results, because we know that even among persons of normal hearing we very frequently find deviations from the normal.

If the author believes that his investigations are the first otologic examinations of deaf-mutes, we take the liberty to call his attention to the researches of Victor Bremer, de Rossi, Roosa, and Beard.

Apart from the criticisms which we considered our duty to express in reviewing the monograph before us, we feel constrained to express our high esteem for the author on account of the industry and perseverance which were required to undertake such extensive investigations and to complete them.

II.

Lehrbuch der Ohrenheilkunde für practische Aerzte und Studirende. (Text-Book of Otology, for Practitioners and Students.) By Prof. Adam Politzer. In two volumes. Vol. II. With 152 wood-engravings. Stuttgart: Ferdinand Enke, 1882. [1]

Reviewed by A. HARTMANN, Berlin.

The first volume of Politzer's text-book having found general recognition, the appearance of the second was looked forward to with interest. Now that this volume lies before us in imposing proportions after an interval of four years, we are not surprised that the most thorough and careful preparation of this volume has consumed so great a length of time. Politzer's work, now completed, is so excellent in its execution that we do not hesitate to pronounce it the best and most complete hitherto written on otology. The anatomy and physiology of the ear as well as its pathology and treatment have been handled in an

[1] Excellently well translated into English by J. P. Cassels, M.D., of Glasgow. One volume of 800 octavo pages. London: Baillière, Tindall, & Cox. Philadelphia: H. C. Lea's Son & Co., 1882.—ED.

equally thorough manner, and herein the previous meritorious personal labors of the author have been particularly utilized. Special mention should also be made of the numerously interspersed patho-anatomical observations and illustrations which alone secure a high value to the book.

Although most of our readers presumably own a copy of Politzer's text-book, it might not be inappropriate to briefly summarize its contents and to point out some details which suggested themselves to the reviewer on its perusal.

The present volume begins with the description of the adhesive processes in the middle ear. Politzer points out that in these, with far greater frequency than in all other forms of inflammation of the middle ear, symptoms occur which indicate a simultaneous affection of the labyrinth, especially in the insidious form of the disease ending in synostosis of the stapes. In these cases, clinical observation forces us to the assumption "that the disease of the two portions of the ear—the middle ear and the labyrinth—is produced simultaneously by identical trophic disturbances." For the explanation of the continuous noises Politzer refers to the increased pressure in the labyrinth which starts from the drum cavity, in addition to the affection of the expansion of the acoustic nerve. In the adhesive processes Politzer's treatment is confined in the main to the air douche and injections of a solution of sodium bicarbonate. Politzer regrets that it has hitherto been impossible to keep an artificial opening in the drum permanently patulous, and believes that the solution of this problem will signalize a great advance in the therapeutics of affections of the ear. As novel should be mentioned the division of the anterior malleolar ligament which Politzer has repeatedly performed in case the manubrium is much retracted, when only temporary improvement occurs after the air douche. About the results of tenotomy of the tensor tympani Politzer does not express a very favorable opinion. In several patients who came to him some months after tenotomy had been performed upon them, complete deafness had ensued in the operated ear. A mobilization of the plate of the stapes as recommended by Kessel, Politzer thinks to be impossible of execution according to his experiments.

The adhesive processes are followed by acute purulent inflammation of the middle ear, which Politzer—perhaps not quite justly—separates from the acute otitis media, running its course

without perforation of the membrana tympani. Both affections, surely, differ only in degree and in the frequently merely accidental occurrence of perforation. In intractable acute suppurations of the middle ear Politzer recommends as excellent treatment injections of warm water through the catheter into the middle ear when the pains persist even after perforation of the drumhead, also in those stubborn forms in which the perforation is situated on a warty elevation of the membrana tympani, and in painful inflammations of the mastoid process.

Under the head of chronic purulent otitis media, the appearances of the membrana tympani are illustrated by a very large number of excellent wood-cuts; the perforation of Shrapnell's membrane and the vertical sections appear to us especially worthy of mention. The accompanying description of all the conditions which are liable to occur in chronic suppuration of the middle ear is exceedingly complete and instructive. Besides the usual occurrences, we find a long series of hitherto little noticed and rare observations, which render the whole chapter one of particular value. For the removal of inspissated masses from the depth of the auditory canal Politzer employs a rubber tubule, 4 *mm.* in thickness and rounded at the extremity, which is slipped over the point of the syringe and inserted to the depth of 2 *cm.* into the external auditory meatus. For cleansing the recesses of the middle ear Politzer uses a canula of hard rubber instead of German silver. The carious processes in the temporal bone developing in the course of suppurations of the middle ear, otitic meningitis, and cerebral abscess, are likewise illustrated by a large number of personal observations and drawings, and are very minutely discussed. In inflammations of the mastoid process, accompanied by violent pain, Politzer had very good effects from Leiter's cooling apparatus; besides, Politzer places a great value on irrigation of the drum cavity through the tube. He thus cured numerous cases in which others thought operative opening of the mastoid process indicated. The diseases of the mastoid process and its artificial opening are likewise illustrated by a large number of wood-cuts.

In his division of the subject, which differs from the ordinary, the description of suppuration of the middle ear is followed by that of the affections of the external ear, which are succeeded by the new formations, otalgia, and the neuroses of the muscles.

The affections of the labyrinth, of the acoustic nerve, and of its

central portion are preceded by an introduction, in which the difficulties of a satisfactory treatment of this chapter are pointed out, inasmuch as the number of exact post-mortem researches with accurate observations during life is still very small. In the same way the results of our methods of testing the hearing are as yet rather unsatisfactory for the exact diagnosis.

Ménière's disease is discussed very fully. In Voltolini's inflammation of the labyrinth the deafness can be caused either by a simultaneous purulent inflammation of the labyrinth propagated from the skull cavity, or by an affection of the trunk or the root of the acoustic nerve. Although Politzer himself had occasion in one case to make an exact post-mortem, he still believes that this form of inflammation can secure the right of being recognized as an independent form of disease only after repeated post-mortem verifications.

All the diseases affecting the nervous apparatus are treated with care and with equal completeness, as well as the affections of the sound-conducting apparatus ; and here we find also a series of the most interesting observations recorded. Three smaller chapters form the conclusion of the book : the malformations of the organ of hearing, deaf-mutism, and the acoustic instruments for people with impaired hearing.

ARCHIVES OF OTOLOGY.

THE EFFECTS OF NOISE UPON DISEASED AND HEALTHY EARS.

By D. B. ST. JOHN ROOSA, M.D.*

IN the collected works of Doctor of Medicine Thomas Willis, published in Amsterdam, a little more than two hundred years ago, in a chapter upon the sense of hearing, and in a paragraph relating to deafness caused by relaxation of the membrana tympani, there is an account of a somewhat famous woman, who could only hear the voice of her husband when a servant was beating a drum in the same room.[1]

Although this passage is often alluded to, it is seldom quoted. No apology will, I think, be required for a translation of it.

"Although hearing is very little produced by the membrana tympani as compared with the proper organ of the sense, yet it so far depends upon it, that deprivation or diminution of that sense not infrequently proceeds from its injury or impeded action. Indeed, a certain kind of

* Read before the Medical Society of the County of New York, April 23, 1883.

[1] The original reads as follows :

Quanquam auditus à tympano, velut proprio sensionis organo, minime peragitur, tamen iste in tantum ab hoc dependet, ut non raro à tympani actione læsa, aut impedita sensus illius privatio, aut diminutio procedat. Enimvero surditatis species quædam occurrit, in qua licet affecti auditus sensu penitus carere videantur, quam-diu tamen ingens fragor, uti bombardarum, campanarum, aut tympani bellici, prope aures circumstrepit, adstantium colloquia distincte capiunt, et interrogatis apte respondent, cessante vero immani isto strepitu, denuo statim obsurdescunt. Accepi olim à viro fide digno, se mulierem quæ licet surda fuerat, quousque tamen intra conclave tympanum pulsaretur, verba quaevis clarè audiebat ; quare maritus ejus Tympanistam pro fervo domestico conducebat, ut illius ope, colloquia interdum cum uxore sua haberet. Etiam de alio Surdastro mihi narratum est, qui prope companile degens, quoties una plures campanae resonarent, vocem quamvis, facile audire, et non alias potuit. Proculdubio horum ratio erat, quod tympanum in se continuo relaxatum, soni vehementioris impulsu ad debitam tensitatem, quo munere suo aliquatenus de fungi potuerit, cogeretur.

deafness occurs, in which, although the patients seem completely to lack the sense of hearing, yet so long as a great din, such as that of bombardments, or of chimes of bells, or of drums, resounds about their ears, they take in distinctly the conversation of those about them, and answer questions intelligently, but, upon the ceasing of such tremendous uproar, they immediately become deaf again. I once had it from a trustworthy man, that he had been acquainted with a woman, who, although she was deaf, would, nevertheless, distinctly hear whatever was said so long as a drum was beaten within the room, and consequently her husband employed a drummer as a household servant, in order that by his aid he might occasionally hold conversations with his wife. I have also been told of another deaf person, living near a bell-tower, who could easily hear any voice whenever the bells were pealing—but not otherwise. Doubtless the reason of these things is, that the membrana tympani, habitually relaxed when left to itself, was forced by the shock of a sound much more intense than usual to a state of tension sufficient to enable it to perform its function in some degree." [1]

In the two centuries that have followed the narration of Willis's observations, the symptom of hearing better in a noise, has not only been given the name of the author, and is known in our time as *Paracusis Willisiana*, but the facts as stated by the author, have in turn been denied and affirmed, and while many have admitted the truth of the observations, and have conceded that there are some persons with impaired hearing who hear better in a noise, Willis's explanation of the phenomenon has been rejected by them. I doubt, if in this audience of physicians, there would be found any great unanimity of opinion on this subject. The writers on aural medicine who allude to it at all, are by no means agreed upon the facts nor upon their explanation. Wilde [2] admits the credibility of Willis's cases, and argues against the notion of Kramer

[1] *Opera Omnia, Amstelædamia., apud Henricum Wetstenium. Pars physiologica, Cap. xiv, p.* 69.

[2] "Aural Surgery," English edition, p. 289.

that the auditory nerve became so excited by these loud sounds as to be able to do its work better. Wilde explains the phenomenon by reference to the state of the membrana tympani, and says that it is remarkable that it does not occur in cases where that structure has been in whole or in part removed. Later on, I shall show that Wilde was in error in thinking that it could not occur when there was a hole in the drum-head.

Tröltsch[1] says: "These statements (as to hearing better in a noise) are founded, as a rule, upon a want of exact observation, as well as upon self-deception." He then relates one of Willis's cases, and also one reported by an author named *Ficlitz*. The latter was that of a deaf son of a shoemaker, who could only hear conversation in the room, when he stood near his father and the latter pounded sole leather upon a large stone. This same boy, heard well in a mill when it was in action.

I cannot agree with Tröltsch, in his idea that the symptom of hearing better in a noise is not a common one. As I have said, on several occasions, my own experience has proven that it is a very frequent one. During the subsequent part of this paper, I shall have an opportunity of making my statement good. *Rau*,[2] like Kramer, believed that better hearing in a noise depends upon excitement of a torpid acoustic nerve. In somewhat poetic style, he says: "If the auditory nerve be awakened from its slumber by loud talking, the patient will momentarily hear even words spoken in a low tone very well. This sometimes goes to such an extent, that the hearing is temporarily restored, to a considerable degree by a loud and regular sound, for example, during the pealing of bells, drumming, a ride in a rattling wagon, or the like." Burnett,[3] of our own country, is positive that the symptom is a real one, but confines it to the later stages of chronic aural catarrh, "when the condition of the tympanum has become dry or sclerotic, or when the thickening of the mucous membrane has become great in the moist form."

[1] Tröltsch, Lehrbuch, 6 Ausgabe, p. 253, passim.

[2] Lehrbuch, p. 292.

[3] "Treatise on the Ear," p. 386.

Dr. E. E. Holt[1] doubts if, in any case the hearing-power is improved by noise, and he states that, so far as he is aware, no one has "ever made a careful investigation to ascertain whether the claim of such persons was a real one or not."

In the first edition of my book upon the ear, and in all the subsequent editions, I related from my personal experience the case of a mail agent, on one of our railways, who, although very hard of hearing in a quiet place, could hear very well in his car amid the noise of a train. I have had frequent opportunities to study this case, and there is no question as to the facts. No person who did not know of this gentleman's infirmity would ever suspect him of impaired hearing while conversing in the din of a rapidly-going train of railway carriages. But the instant he reached a quiet place, it was with the greatest difficulty that he could hear loud conversation specially addressed to him.

Politzer, in his great treatise, not long since published in German, and very recently translated into English, has no doubts as to the existence of these cases, and confirms what was stated by me years ago, "that the patients can understand speech during such noises much easier, and at a much greater distance, than people with normal hearing."[2] Politzer, however, states that he has observed this symptom "almost exclusively in the incurable forms of affections of the middle ear."

I have known of two cases where this symptom occurred, in patients who regained their hearing perfectly. While the symptom frequently accompanies incurable disease of the middle ear, I believe it is a very frequent symptom in sub-acute cases, when both ears are affected. Of course, it would not be observed in disease of one ear only. I also have two cases under observation in which the drum-heads are entirely, or nearly removed, and yet these patients hear well in a noise. One of these, I published in the fourth edition of my book. While the occurrence of the symptom in sub-acute cases disposes of the notion, that hearing better in a

[1] Transactions of American Otological Society, 1882.

[2] Lehrbuch, p. 233.

noise implies an incurable disease, the fact that it also may exist when the membrana tympani is gone, shows that Willis's explanation of the phenomenon is not exclusively, if at all, correct. I have never yet seen the symptom except in disease of the middle ear. I believe it never occurs except in cases where the nerve is sound. I have looked over my cases with great care as to this point, and I have yet to see a patient who had, as I supposed, disease of the acoustic nerve, and who yet heard better in a noise. If this be true, the theory of an extraordinary excitement of the nervous apparatus, as a cause of the phenomenon, must be rejected. Politzer explains the symptom by a reference to some effect upon the *ossicula auditus*, made by the great din.[1] This is the only theory, incomplete as it is, which fulfils the conditions made by such cases as those just mentioned, where, although the membranæ tympani were gone, the ossicula were intact. How the ossicles are affected is a problem yet to be solved, but when it is solved, it will be possible to invent an instrument to enable those deaf from disease of the middle ear, to hear conversation not only in a noise, but in the quiet of an ordinary room. This latter will, certainly, not be a task beyond the capabilities of a physicist of the 19th century.

The statement, that these cases rest upon inexact observations, will soon be disproven by a ride of a few miles in a railway carriage or in a clattering wagon, with a person deaf from disease of the middle ear, to ordinary conversation in a quiet place. Examinations of boiler-makers, or of those who suffer from affections of the acoustic nerve, will, however, be disappointing, and will lead, as in Dr. Holt's paper, from which I have already quoted, to a doubt in the mind of the observer as to the reality of the symptom. I now quote one of the cases in which the hearing was better in a noise, and which was one of sub-acute catarrh of the middle ears, from which the subject fully recovered under my observation. The writer of his own case is now a practising physician in this city. At the time of the occurrence of the disease he was a boy in school, and I reported his case, except as to the symptom now under discussion, in the *American Jour-*

[1] See also A. H. Buck, *Medical Record*, July 5, 1875.

nal of Medical Sciences and in my text-book. Dr. B. writes to me as follows:

"With regard to the disputed fact of many deaf persons hearing conversation better in noisy places, I wish to give in brief my experience. For several years previous to my sixteenth, I had been much troubled with varying degrees of deafness, due, as I then heard and now understand, to acute catarrh of the middle ear, complicating general pharyngeal catarrh. At school I was at a great disadvantage, suffering at times great embarrassment on account of my limited hearing. Living far up-town, I was in the habit of being driven home or to the doctor's by my mother. When surrounded by the noise of wheels and glass, I invariably had occasion to request a moderation of her voice; and she not infrequently made the remark: "How well you hear in the carriage!" Furthermore, on several occasions, my parents were surprised to find that they could not safely carry on a confidential conversation requiring only sound enough to suffice their own hearing powers, while in a quiet room their talk would have been unintelligible.

"This is only an echo of the experience of many deaf people I have questioned on the subject."

The other case was that of a student of seventeen years of age, and is so similar to the one just given that I simply allude to it. As I have already intimated, the power of hearing better in a noise is a different subject, from that of the effect of certain noisy occupations upon the ear. Patients like my friend, the mail agent, may travel for years in the din of a train, and always find their hearing improved and not decreased, so long as it depends upon disease of the middle ear. Neither do I know of any cases of deafness that have been caused by such occupations. But although there is a class of patients who have been made deaf by noise, often confounded with those whose impairment of hearing has resulted from catarrh, they should be entirely disassociated from them. Boiler-makers, and those who become deaf from an exposure to the continuous shock of loud sounds, suffer a lesion of the acoustic nerve. These patients do not hear better in a noise, but they have a source of

relief in quiet places, and, like ordinary people, they hear better away from the din that is such a comfort to a person deaf from many forms of disease of the middle ear.

I must confess to have assisted in the creation of confusion in our ideas as to hearing better in a noise, and the effects of noise upon the ear. In 1874, in an article upon diseases of the internal ear,[1] and a few months subsequently in my book,[2] I gave the results of my examinations of a certain number of boiler-makers, and I incidentally assumed that they heard better in the noise of their occupations. When the paper by Dr. Holt, to which I have referred, appeared, I found that he denied the correctness of my main conclusions; that is, that the impairment of hearing in boiler-makers is generally a result of a lesion of some part of the labyrinth, and that, besides his doubt that any deaf person, much less boiler-makers, ever heard better in a noise, he was inclined to attribute their impairment of hearing to a disease of the middle ear. I then made a new series of examinations upon boiler-makers, assisted by Dr. J. B. Emerson. As a result of these recent investigations, which were undertaken with the much better means of a differential diagnosis between diseases of the middle and internal ear, now at our command, I find that I cannot agree with Dr. Holt's conclusions, except in one particular, and that is the one just mentioned, *i. e.*, that boiler-makers do not hear better in a noise. This incidental statement made by me, I now find to be entirely incorrect. But that boiler-makers do suffer from a lesion of the internal ear, and not of the middle ear, in so far as they have a peculiar affection from their occupation, I do not think admits of a doubt. The very fact that they do *not* hear better in a noise is an incidental proof that they suffer from a lesion of the labyrinth. Boiler-makers, like men in other occupations, often have impacted cerumen, and occasionally catarrh of the middle ear, but the disease caused by their occupation, "boiler-makers' deafness," in my opinion, is easily shown to be a disease of the labyrinth.

[1] *American Journal of the Medical Sciences*, vol. lxviii, p. 381.

[2] "Diseases of the Ear," fourth edition, p. 509.

Other occupations of a similar nature, that is, occupations amid continuous concussions, undoubtedly cause the same lesion. A recent visit to an establishment where two engineers were employed for the production of electric light, showed me that they had become somewhat hard of hearing, since they had been engaged in an occupation exposing them to the sound of regular concussions from the striking of metallic plates together.

The confusion which I assisted in producing upon the subject, was not, however, as regards the seat or cause of the aural lesion, but as regards the ability of these workmen to hear better in the din in which they labor. It will perhaps be remembered that in the earlier part of this paper, I stated that those who hear better in a noise always suffered from some form of disease of the middle ear. When some years of observation had convinced me of the uniformity of this rule, I was puzzled to account for my cases of so called boiler-makers' deafness, which, in my paper upon this subject, I had assumed were also improved by being in a noise. I had said: "It will be observed that the subjects of it (boiler-makers' deafness) hear very well in the tremendous din of a boiler-shop, while they are quite deaf in an ordinarily quiet place."[1] This remark, I am constrained to say, although in my text-book, is strikingly incorrect. Boiler-makers, as we should naturally believe, are no exception to the rule, that those who have disease of the nerve hear worse in a noise. Boiler-makers hear so badly in their shops that they have a language of signs that is quite elaborate, called a "boiler-maker's language." They hear no better in a noise than do people with sound ears; on the contrary, they hear better in a quiet place.

If, however, a person deaf from disease of the middle ear, who hears better in the noise of a railway train, enters a boiler-shop, that person will hear better than the boiler-makers, or than persons with sound ears.

It is only very recently that I have been able to send a patient suffering from chronic disease of the middle ear, who heard well in a railway carriage, to a boiler-shop. I had predicted, that although boiler-makers with disease of the

[1] "Treatise on the Ear," p. 510.

acoustic nerves, and persons with sound ears, hear very badly in the dreadful din, such a patient would hear well in such a place.

The patient whom I sent, is a lady of about thirty years of age, who has had chronic disease of the middle ears, of the proliferous form, for many years. She cannot hear the watch at all, and conversation only when directed into the ear, and then with difficulty. In the cars she hears very well. She only hears the tuning-fork by bone-conduction. Her account of the experiment is as follows:

"I went with my husband (he has excellent hearing) this afternoon to the boiler-shops of the Dickson Co. (Scranton, Pa.), where the noise is perfectly deafening. I could distinctly hear what my husband said, although he purposely spoke in a low tone, while *he* could not hear a word I said, unless I put my mouth to his ear and screamed. I think, perhaps, cars and boiler-shops are the places for me to live." In a subsequent note she informs me that she could not hear the watch tick, although she hears conversation so easily.

In this case it will be noted that the improvement does not depend upon the loud tone of the speaker.

Boiler-makers speak in graphic language of the effects of the din upon their ears. Said one of them to me: "Those heavy hammers jar every nerve in the body." They do not find much relief from wearing cotton in their ears, except when first entering the shop. An experienced workman, however, told me that all old boiler-makers had learned to equalize the pressure and reduce the shock by opening the mouth frequently. Of course, by this procedure they open the Eustachian tube more freely.

My reasons for contending that the lesion in these cases is situated in the nerve predominantly, are that the aërial conduction was always louder than the bone-conduction, as tested by the tuning-fork "C," and that it was heard longer than by bone-conduction. The only apparent exceptions to this rule were those in which, in addition to the lesion of the acoustic nerve, there was also inspissated cerumen. When the wax was removed however, and the cases were

transposed into their proper place, of diseases of the acoustic nerve produced by concussion, the tuning-fork was heard through the air louder and longer than through the bone. I consider all the other tests that we as yet have, for the differential diagnosis of affections of the middle and internal ear, as so much inferior to this, although of great corroborative value, that I am constrained to consider all observations upon boiler-makers that have not been made in this way, as so defective as to tell nothing of the true seat of the disease. As has been suggested by many writers, there is no doubt that something might be done to avert the consequences of those concussions in producing disease of the acoustic nerve, if workmen could be induced to wear ear protectors, but from some reason or other, they are, as a rule, quite averse to wearing cotton in their ears, or any contrivance for protecting their ears from the effects of a great and constant concussion. Almost all boiler-makers say that they were deafer at first than after they had become accustomed to the occupation; and they all say that they hear better after a period of rest, say from Saturday to Monday.

That excessive sound must necessarily be as harmful to the nerve of hearing, as is excessive light to that of sight, is a natural deduction from our knowledge of the effects of the waves that produce those two senses, and all experience confirms the belief that there may be an accoustic neuritis produced by noise, as well as an optic neuritis caused by exposure to a glare.

The fact that most patients suffering from disease of the middle ear hear better in a noise, especially that of a railway car, I find as a result of a series of examinations extending over many years, and embracing several thousands of cases. Wherever this symptom is not present, I have found that either the disease was primarily or secondarily one of the labyrinth or acoustic nerve.

I have gone with such patients to a train in motion, and I have always found their statements correct. From hearing a voice with difficulty directly in the ear, they have been enabled to hear it twenty feet, that is to say to hear conver-

sation at that distance and with ease. In my experience they do not always hear a watch tick farther, but most of these marked subjects hear a watch a very short distance, if at all, in a quiet place. There is, I think with Politzer, sometimes an improvement in this respect also.

This symptom would often be found in acute disease of both sides did such diseases last long enough to admit of proper tests. To say that the whole explanation is to be found in the fact that the voice is raised when in a noise, is to forget that even in a quiet place, with just such an elevation of the voice, these patients do not hear as well as they do in the noise. Besides, the elevation in the voice is usually only slight, and sometimes it is not at all raised.

I have yet to find a case where a mistake was made in a deliberate statement by a patient, that conversation was heard better in a noise. When the symptom does occur, it is so marked that no mistake can be made. When a patient does not know whether he does or does not hear better in a noise, we may assume that he does not, and when he does not, the case will, I think, always be found to be one in which the nerve is somewhat involved.

The cases upon which my conclusions as to boiler-makers' deafness depend are as follows :

CASE 1.—*Boiler-maker twenty years; disease of acoustic nerve.*

John F., æt. thirty-five. Has been in the business for twenty years. Hearing was good when he began ; began hearing noises in his ears ; then became hard of hearing gradually. Cannot now hear a lecture. Does not hear better in the noise of the shops, but he assists his ears by watching the lips of those speaking to him. Was most deaf after working in a boiler. Did not use cotton, because it made him worse when removed. Hissing tinnitus all the time.

	Duration Air.	Duration Bone-, in seconds.
H R = $\frac{P}{4\,8}$, aërial cond. best	23	11
H L = $\frac{3}{4\,8}$ " " "	20	9

M T Rt, good color ; good light spot, not sunken.

M T Lft, sunken ; 2 light spots, good color.

Says that he has never had catarrh.

CASE 2.—*Boiler-maker thirty years. Disease of acoustic nerve.*

X. Y., forty-six years of age. Has been in the business for thirty years. Hearing was good when he began his work. Now cannot hear well when spoken to. Thinks he hears better in a noise, because people speak louder. No pain at any time, but has noises, and hearing failed gradually. Has used cotton, but does not like it.

H R = $\frac{P}{4\ 8}$, aërial cond. best; watch not heard on mastoid.
H L = $\frac{L}{4\ 8}$ " " " " "

	Aërial cond.	Bone-cond. in seconds.
Rt,	26	12
Lft,	21	8

M T Rt, opaque; no light spot, vascular along handle of the malleus.

M T Lft, opaque; sunken, no light spot.

Pharynx sound.

CASE 3.—*Boiler-maker twenty-four years. Disease of nerve one side, of the middle ear and nerve on the other.*

Forty-seven years of age. Has been in the business twenty-four years. Hearing was good before he began it. Sissing tinnitus. Deafness came on gradually, but was worse when he was "holding on"; no pain. Cotton did no good.

H R = $\frac{O}{4\ 8}$, aërial but no bone-conduction.
H L = $\frac{O}{4\ 8}$ " feels something; bone-cond. distinct.

	D. Aërial cond.	D. Bone-cond.
R,	6	0
L,	0	12

M T R, opaque rim; vascular malleus; no light spot.

M T L, good color; vascular malleus; no light spot.

Pharynx catarrhal; uvula elongated.

CASE 4.—*Boiler-maker twenty-four years. Disease of acoustic nerves.*

Fifty-one years of age. Has been in the business twenty-four years; previous to which his hearing was very sharp, now is very poor. Sissing tinnitus; does not hear any better in the shop or car. Wears cotton at times. No pain in ear. Health good. Voice at 4 feet.

H R = $\frac{0}{48}$, aërial feeble ; no bone-cond.
H L = $\frac{P}{48}$ " " " "

	D. Aërial.	D. Bone.
R,	5	0
L,	6	0

M T R, opaque (wax).
M T L, opaque on periph. ; no light spot.
Pharynx in good condition.

CASE 5.—*Boiler-maker twelve years. Disease of acoustic nerve.*

Æt. twenty-five. Has been in the business twelve years. Hearing is good ; no pain or noises.

	D. Aërial.	D. Bone.
H R = $\frac{6}{48}$, aërial best.	21	7
H L = $\frac{18}{48}$, " "	20	10

M T R, good light spot ; opaque on periph. and above.
M T L, " light spot ; opaque.
Catarrhal pharynx.

CASE 6.—*Assistant in boiler-shop for one and a half years.*

Works ten hours a day. Thinks his hearing is good enough. Hears ordinary conversation with his face away from the speaker about twenty feet.

H D, R ear, aërial conduction louder, air 10, B 5
" L, $\frac{10}{48}$, " " " " 16, B 4
Memb. tymp., R, small light spot, opaque.
" " L, " " " vascular.

Pharynx healthy.

CASE 7.—*Boiler-maker thirteen years. Disease of middle and internal ears.*

Has been in the business thirteen years. Hearing always good. Never protected his ears. Had a pain in left ear once, but no discharge. Whispers heard by others not heard by him. Does not hear better in noise.

	D. Air.	D. Bone.
H R = $\frac{L}{48}$, bone-cond. best.	10	9
H L = $\frac{P}{48}$ " " "	13	7

M T R, good color and light spot.
M T L, sunken, opaque ; small light spot.
Tonsil enlarged. Pharyngitis.

CASE 8.—*Æt. eighteen. Boiler-maker for fifteen months. Disease of acoustic nerve.*

Has been in business fifteen months. Hearing good when he came. Not so good now. Hissing tinnitus. No pain. Does not hear better in noise.

		D. Aërial.	D. Bone.
H R = $\frac{5}{4\,8}$	aërial best	12	9
H L = $\frac{1\,2}{4\,8}$	" "	14	7

M T R, small light spot ; prominent short process.
M T L, no light spot ; " " "
Slight pharyngitis.

CASE 9.—*Thirty years a boiler-maker. Inspissated cerumen ; disease of acoustic nerve.*

Æt. forty-nine. This subject is what is technically called a "holder-on." His duties keep him inside of the boiler holding on to the rivets. The shock of sound is much greater here than in the open air of the shop. Thirty years a boiler-maker. Three and a half years in navy. Ears were good when he went into the present business. Hears better when he gets away from noise. Voice, 6′. Watch, $\frac{0}{4\,8}$, each side.

Tuning-fork :

R. E.				L. E.			
A	C	Louder	8	A	C	Louder	8
B	C	"	3	B	C	"	4

Inspissated cerumen on each side. After removal of large plugs of very hard wax, H D for the voice increased to 18′, and the watch was heard, when pressed on each side, $\frac{P}{4\,8}$. The duration of the aërial conduction was increased, but no change in the intensity with which it was heard.

It is interesting to note in this case, that the aërial conduction was louder and longer, even when the ear was plugged with wax. This shows a more marked lesion of the nerve, than the other cases in which inspissated cerumen was found—for in these latter the bone-conduction was better until the wax was removed, when the aërial conduction was found to be as is usual in those suffering from *boiler-makers' deafness.*

CASE 10.—*Boiler-maker thirty-one years. Disease of acoustic nerve.*

James L., forty-seven. Boiler-maker thirty-one years. First job was a riveter, and in twenty days could not hear well; tinnitus like bees; never had earache; healthy; rheumatism; voice 20′.

R $\frac{8}{48}$, L $\frac{8}{48}$. Aërial conduction better each side.
R, aërial, 12 sec. Bone-, 8 sec.
L " 9 " " 9 "
R M T, Good light spot. Good lobe.
" " " " "

Both opaque on periphery.
Healthy pharynx.

CASE 11.—*Boiler-maker for twenty years. Inspissated cerumen removed from both sides; disease of acoustic nerves.*

Æt. thirty-nine. Has been twenty years in the business. Ears were sound when he began; had an occasional earache as a boy. He can't hear a whisper; does not hear well in a boiler-shop. Watches the mouth and gestures. Hears the voice in a quiet room 40′. Watch, R $\frac{0}{48}$, L $\frac{0}{48}$; R side the aërial conduction is better. On the left *the bone-conduction is better.*

R, Aërial conduction is heard 12 seconds.
Bone- " " 6 "
L, Aërial " " 12 "
Bone- " " 8 "

Pharynx is sound.

Inspissated cerumen is found on each side. After it is removed the watch is heard better on each side; *e. g.*, R $\frac{P}{48}$, L $\frac{P}{48}$. Relative distinctness of bone- and aërial conduction not changed. Duration of the sound about as before.

CASE 12.—*Boiler-maker twenty-five years. Inspissated cerumen; both sides. Disease of acoustic nerves.*

Æt. forty-three. This man has been a boiler-maker twenty-five years. He had good hearing when he began his work. Never had an earache. Hears the voice in a quiet room 30′. Watch $\frac{\text{Laid}}{48}$ on right side, $\frac{\frac{1}{2}}{48}$ on left side. R side, *Bone-conduction much more distinct;* L side, the same.

Duration : R aërial conduction, 5 seconds ; bone, 12 seconds. Left side, aërial, 14 seconds ; bone-, 11 seconds. Inspissated cerumen, each side, removed. After removal of wax watch was heard $\frac{3}{40}$ and $\frac{4}{40}$ on the right and left sides respectively, instead of $\frac{c}{40}$ and $\frac{p}{40}$. *The aërial conduction became better in each ear.* Duration as follows : R, aërial, 18 seconds; bone-, 13 seconds ; L, aërial, 22 seconds ; bone-, 12 seconds.

As is seen, the peripheric trouble (inspissated cerumen) masked the disease of the acoustic nerve in this case, but when the wax was removed, the lesion of a boiler-maker's ear was found to exist.

In case number seven, the bone-conduction was decidedly louder than the aërial, but the tuning-fork was heard much longer through the air than through the bone. The left drum-head was sunken and opaque, and there was considerable throat trouble. From these data, I conclude that there is disease of the *middle* as well as of the internal ear in that case.

From all the observations I have been able to make upon this subject, I think, I am justified in drawing the following conclusions :

1. There is a large class of people suffering in quiet places, from impairment of hearing, who hear very acutely and with comfort amid a great din or noise.

2. The disease causing the impairment of hearing thus relieved is situated in the middle ear. It is usually observed in the chronic, non-suppurative form of disease of the middle ear, but it may also be found in acute or sub-acute catarrh of this part, as well as in a chronic suppurative process with loss of the whole or a part of the membrana tympani.

3. The proximate cause of this phenomenon is not as yet positively known. It is probably to be found in some change in the action of the articulations of the *ossicula auditus*.

4. The hearing-power of persons working in such a din as that of a boiler-shop invariably becomes impaired.

5. The lesion caused by this occupation is one of the labyrinth, or of the trunk of the acoustic nerve.

6. Persons thus affected do not hear better in a noise. Their hearing-power is better in a quiet place, and becomes better after prolonged absence from the exciting cause of their impaired hearing.

7. The cases of inspissated cerumen, catarrh of the middle ear, occurring among boiler-makers, are such as occur among those employed in various occupations and only mask and complicate the fundamental primary trouble, so long known as boiler-makers' deafness.

8. In diseases of the labyrinth or acoustic nerve the tuning-fork "C" is heard louder and longer through the air than through the bones of the head.

For an account of my first examinations of the hearing of Boiler-makers, the reader is referred to my work on the Ear, edition of 1877, and to the *American Journal of Medical Sciences*, 1874.

TABLE SHOWING THE RESULT OF THE EXAMINATION

Length of Time a Boiler-maker.	Hearing Distance.	Aërial Conduction.	Bone-Conduction.
Case 1, 20 years . .	Cannot hear ordinary conversation. R $\frac{\text{Pressed}}{48}$, L $\frac{3}{48}$	Better than bone.	———
" 2, 30 " . .	R $\frac{0}{48}$, L $\frac{\text{Laid}}{48}$	"	———
" 3, 24 " . .	R $\frac{0}{48}$, L $\frac{0}{48}$	"	None on right side.
" 4, 24 " . .	Voice 4 feet. R $\frac{0}{48}$, L $\frac{\text{P}}{48}$	Feeble.	———
" 5, 12 " . .	R $\frac{6}{48}$, L $\frac{18}{48}$	Better than bone.	———
" 6, 1½ " . .	Voice 20 feet. R $\frac{5}{48}$, L $\frac{10}{48}$	"	———
" 7, 13 " . .	R $\frac{\text{Laid}}{48}$, L $\frac{\text{Pressed}}{48}$	———	Better than aërial.
" 8, 15 months .	R $\frac{5}{48}$, L $\frac{12}{48}$	Better than bone.	———
" 9, 30 years . .	Voice 6 feet. R $\frac{0}{48}$, L $\frac{0}{48}$	"	———
" 10, 31 " . .	Voice 20 feet. R $\frac{\text{Laid}}{48}$, L $\frac{8}{48}$	"	———
" 11, 20 " . .	Voice 40 feet. R[1] $\frac{0}{48}$, L $\frac{0}{48}$	Better on right side after removal of wax.	Better on left side.
" 12, 25 " . .	Voice 30 feet. R $\frac{\text{Laid}}{48}$[2], L $\frac{\text{P}}{48}$	Better on each side after removal of wax.	Better *until* wax was removed.

[1] $\frac{\text{Pressed}}{48}$ after removal of wax.

[2] $\frac{3}{48}$ and $\frac{4}{48}$ after removal of wax.

OF TWENTY-FOUR EARS OF TWELVE BOILER-MAKERS.

Duration of Aërial and Bone-Conduction.	Diagnosis.	Remarks.
Aërial : R E, 23 sec., L E, 20 sec., Bone : R E, 11 " " 9 "	Disease of internal ears.	Has hissing tinnitus.
Aërial : R E, 26 " " 21 " Bone : R E, 10 " " 8 "	"	———
Aërial : R E, 6 " " 0 " Bone : R E, 0 " " 12 "	Disease of internal and middle ear.	Pharynx catarrhal ; uvula long ; *mt.* vascular along malleus.
Aërial : R E, 5 " " 6 " Bone : R E, 0 " " 0 "	Disease of internal ears.	———
Aërial : R E, 21 " " 20 " Bone : R E, 7 " " 10 "	"	Thought he heard very well.
Aërial : R E, 10 " " 16 " Bone : R E, 5 " " 4 "	"	"
Aërial : R E, 10 " " 13 " Bone : R E, 9 " " 7 "	Disease of middle and internal ears.	Left *mt.* sunken ; small light spot ; pharyngitis.
Aërial : R E, 12 " " 14 " Bone : R E, 9 " " 7 "	Disease of internal ears.	Slight pharyngitis.
Aërial : R E, 8 " " 8 " Bone : R E, 3 " " 4 "	"	Inspissated cerumen, each side.
Aërial : R E, 12 " " 9 " Bone : R E, 8 " " 9 "	"	———
Aërial : R E, 12 " " 12 " Bone : R E, 6 " " 8 "	"	Inspissated cerumen, each side.
Aërial : R E, 5 " " 14 " Bone : R E, 12 " " 11[1] "	"	———

[1] After removal of wax, aërial became R E, 18 seconds, L E, 22 ; bone remains nearly the same : R, 13 seconds, L, 12.

CALCIUM SULPHIDE IN AURAL DISEASES.

By GORHAM BACON, M.D.,

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THAT calcium sulphide is one of the most valuable drugs we possess in the treatment of aural diseases, especially those attended with suppuration, I think no one will deny who has given the drug a fair trial. Dr Sexton, I believe, was the first to advocate its use in diseases of the ear, in an article published in the January number of *The American Journal of Otology* for 1879. During the past two years I have used the drug in both dispensary and private practice, and have been much pleased with the results obtained. Ringer, in his work on "Therapeutics," says: "The sulphides appear to me to possess the property of preventing and arresting suppuration. Thus, in inflammation threatening to end in suppuration, they reduce the inflammation and avert the formation of pus. After the formation of pus, the influence of this group (sulphides) on the suppurative process is still more conspicuous; then the sulphides hasten maturation considerably, whilst at the same time they diminish and circumscribe the inflammation, promote the passage of pus to the surface, and the evacuation of the abscess." "In boils and carbuncles these remedies yield excellent results. When the skin is not yet broken and the slow-separating core not yet exposed, the sulphides often convert the boil into an abscess, so that, on bursting, pus is freely discharged, and the wound at once heals; or if the centre of the hardened, swollen tissues is not yet dead, the pustule dries up, the inflammation subsides, and a hard knot

is left, which disappears in a few days without the formation of a core and without any discharge. These remedies, meanwhile, improve the general health, removing that debility and malaise so markedly associated with boils and carbuncles." Ringer goes on to say that in children of a strumous diathesis, where the phalangeal bones are affected, the sulphides will benefit considerably, especially in those cases where the shaft is found enlarged, very pale, and the cancellous structure infiltrated with straw-colored firm substance.

In most of the cases of acute otitis media in which I have used the calcium sulphide, suppuration had already commenced, but in several, where the mem. tympani was highly congested and bulging, all the inflammation subsided under the use of this remedy, and I believe that it will prevent the formation of pus in many cases, if given sufficiently early in the course of the disease. Its most decided action seems to be in those cases of otitis media in which the discharge has already commenced, as well as in cases of furuncles in the ext. auditory canal, where it will either arrest the inflammation and cause the boil to dry up, or it will promote suppuration and cut short the disease. Those patients subject to furuncles are generally badly nourished and in poor health, which is an indication for the administration of the drug.

The pain so frequent in these diseases, even when the periosteum is involved, is often relieved at once. In diffuse inflammation of the ext. auditory canal, and in mastoid disease, whether affecting the pneumatic cells or the periosteum and tissues externally, great benefit will be obtained from its use. I would not hesitate, however, to perform paracentesis where severe pain was caused by bulging of the mem. tym.; nor in cases of mastoid disease, where there were symptoms pointing to the presence of pent-up pus, and the patient suffering severe pain, with danger of further complications, would I hesitate to perforate the bone. But the fact, that since I have used calcium sulphide in acute inflammation of both middle and external ears, I have had no serious mastoid complication, and have not been obliged to

resort to the knife, I attribute to the early administration of this remedy.

In acute inflammation of the ear, before the formation of pus, I have been in the habit of prescribing aconite for the relief of pain, besides giving the sulphide. Appropriate treatment should be applied to the naso-pharynx and neighboring parts, and particular attention should be paid to the condition of the teeth.

The dose must be adapted to each individual case. In a child, $\frac{1}{10}$ or $\frac{1}{20}$ gr., or even lower, may be used, while in an adult, from $\frac{1}{10}$ to $\frac{1}{2}$ gr. may be given several times a day or every two hours. In some cases a small dose seems to answer better than a larger one, and *vice versâ*.

As regards local treatment, where there was suppuration, I have had the best results from the use of powders—either boracic acid or iodoform; or else I have used the boracid acid et calendula, as recommended by Dr. Sexton, or boracic acid et hydrastis canad., prepared as follows: equal parts of boracic acid and tr. hydrastis canaden. are thoroughly mixed and evaporated to dryness; then the residue is thoroughly pulverized and mixed again with equal parts of boracic-acid powder.

The following cases are examples of those in which I have found great benefit from the use of calcium sulphide.

Case 1.—A. S., æt. twenty-nine, male, came to the infirmary Mar. 6, 1883. Had a severe pain in the left ear the Saturday preceding; lost the hearing in the right ear in 1863 from typhoid fever; tuning-fork when placed on the vertex heard only in the left ear.

Examination shows: Left *Mt* inflamed in lower portion; macerated in appearance, bulging slightly above. Discharge commenced two days ago, and is slight. He is subject to considerable nasal catarrh, for which he has been using the nasal douche.

Treatment: Calcium sulphide, gr. $\frac{1}{10}$ every three hours; canal insufflated with pulv. acid. boracic. et hydrast. canad. Hearing much affected. Could only hear shouting voice. Watch, $\frac{0}{48}$.

Mar. 9th.—No pain now; hearing the same and appearance of *Mt* unchanged. Calcium sulphide increased to gr. $\frac{1}{4}$.

Mar. 16th.—Hears watch now, $\frac{1}{4}\frac{1}{8}$; no discharge now. Inflation by Politzer's method has been used occasionally.

Case 2.—Patient, male, æt. forty-five, presented himself Feb. 20th, and gave the following history: The right ear has been discharging and painful for six days; left ear for eight days. No perforation to be seen in left *Mt*, which is bulging.

Treatment: Canals dried with absorbent cotton, and boracic acid insufflated. Calcium sulphide, gr. $\frac{1}{10}$, given.

Feb. 23d.—Discharge less in left ear; in right one about the same. Right auditory canal filled with pulv. acid. boracic. et hydrastis canad.

Mar. 2d.—No perforation seen in either mem. tympani; congestion has disappeared in both except at upper segment, around the short process and manubrium.

Case 3.—Patient, female, æt. twenty-eight, anæmic, came to infirmary Feb. 13th. She had measles three weeks ago, and both ears have been discharging ever since. Both canals filled with muco-pus. Pulv. acid. boracic. et hydrastis insufflated, and calcium sulphide given; patient very deaf.

Feb. 23d.—Great pain and noise in right ear; same treatment continued.

Feb. 24th.—No pain, but great noises.

Mar. 9th.—Left *Mt* slightly pinkish, and a very small perforation at upper part; no discharge whatever. Right *Mt* slightly congested; no perforation; no discharge. Hearing distance much improved.

Mar. 13th.—No discharge from either ear; both *Mt* clearing up. Hears loud voice in left ear; right normal.

Case 4.—Patient, female, æt. twenty-two. The history in this case was that four weeks ago the left ear began to ache till the following Thursday, when it broke; it discharged a week and then stopped.

Canal dry, very little discharge. Abscess over the mastoid process with deep-seated fluctuation; considerable swelling and induration of the tissues extending down the neck. Patient very anæmic. No treatment except calcium sulphide, gr. $\frac{1}{10}$, every three hours. She returned the following Friday, and said she was better; to continue same treatment.

Feb. 20th.—Swelling and fluctuation over the mastoid process entirely gone; also the induration in the neck. No discharge from the ear for nearly two weeks; general health and appearance improved.

CASE 5.—Patient, female, æt. nineteen, has chronic pharyngitis. Came to infirmary ten days ago, when I removed inspissated cerumen from her ear. Hearing good, and she had no further trouble till Oct. 21st; both ears then began to pain her, especially the left.

Examination showed: Both auditory canals narrowed and inflamed. The *Mt* could not be seen in either ear, but there were evidences of perforation in the left ear. Calcium sulphide, gr. $\frac{1}{10}$, given.

Oct. 27th.—Both auditory canals free from inflammation and shedding epithelial layer; both *Mt* almost normal in appearance, but slightly congested. Hearing has improved each day; same treatment continued.

CASE 6.—Mrs. H., æt. forty, came to my office Nov. 14th. Has naso-pharyngeal catarrh. She said that three weeks ago the left ear began to feel stuffed up and to itch. Last Friday, commenced to pain her severely, keeping her awake at night. Discharge appeared to-day for the first time.

Examination: Furuncle in left ext. auditory canal, lower portion, which was discharging, and which obscured *Mt.* Canal dried with absorbent cotton and filled with pulv. acid. boracic.; aconite in small doses given for the pain, and pil. cal. sulphid., gr. $\frac{1}{10}$. There were some deafness and autophony Nov. 16th. Pain less yesterday, and last night she slept much better. Acid. boracic. et calendula insufflated, and she was given some of the powder to use herself once every day. Aconite and calcium sulphide continued.

Nov. 20th.—Pain has steadily decreased, and last night there was none. Epithelium desquamating from *Mt* and inner end of ext. auditory canal. Every trace of the furuncle gone. *Mt* very much congested and dull and macerated in appearance. Hearing improved. No autophonous noise to-day. Treatment continued. She continued steadily to improve, and Nov. 24th hearing almost normal.

CASE 7.—J. G., male, æt. four and a half, came to my office April 3d, suffering with severe earache. The child was delicate and had grown very rapidly. Had an earache first two months ago. Since Sunday last the right ear has been very painful. Ear pains him now very severely at times. The auricle stands out abnormally from the head. Canal contains some pus. Considerable tenderness over the mastoid. No fluctuation.

Treatment: Calcium sulphide and aconite in small doses.

April 4th.—The child was feverish during the night up to four o'clock, when he slept. No pain in the ear, however.

April 5th.—The pains, which recurred at times, were less severe and much less frequent. Appetite improved. Tenderness less over the mastoid. Same treatment continued.

April 6th.—Patient had more pain last night at times, which was very severe. Calcium sulphide given every hour.

April 7th.—Patient had but little pain after nine last evening. Has been much better all day. No pain. He continued steadily to improve until April 11th, when discharge ceased entirely, although it had never been profuse. Tenderness over the mastoid almost gone, and the redness and swelling which appeared a few days ago in front of the auricle have disappeared. The child was seen again April 16th, when almost all the inflammation had gone and the child was feeling perfectly well.

CASE 8.—Patient, æt. fifty-nine, Irish, came to infirmary Jan. 9th. He has been suffering since Christmas night with severe earache in left ear. The ear broke that same night, and the discharge, which has been profuse, has continued ever since. He complains of noises in the ear, and he has a dull pain over the mastoid. There is considerable deafness.

Examination showed: Left auditory canal filled with muco-pus; *Mt* infiltrated, fleshy-looking, with a perforation in the lower portion. Calcium sulphide, gr. $\frac{1}{10}$, given, and canal cleared of muco-pus with absorbent cotton, and pulv. acid. boracic. et hydrastis insufflated. Discharge diminished under treatment until Jan. 25th, when the auricle became very much inflamed at the antitragus. The inflammation continued to spread until the auricle was entirely involved and twice its natural size on Jan. 26th. The ext. auditory canal was not involved in the inflammation. The discharge diminished in quantity. *Mt* very much congested. The erysipelatous inflammation extended over the mastoid, over parts in front of the auricle, and gradually over the whole scalp, forehead, and left eye; also over the neck. The pain in the mastoid was not increased, but dull in character.

Jan. 27th.—Patient seized with a chill during the evening; dizzy. Jan. 28th, temperature 104.5°; pulse 124 in the evening; discharge free from the ear; *Mt* less congested. He was given appropriate treatment, including local applications for the erysipelas, but at the same time was ordered to take calcium sulphide, gr.

$\frac{1}{4}$ every three hours. The erysipelas subsided, and the pains in the ear and mastoid almost gone on Jan. 29th ; discharge less but thicker. *Mt* less congested, and perforation seen in lower posterior segment. The sulphide given less often, owing to diarrhœa, undoubtedly caused by this drug. The discharge ceased Feb. 2d, and the noises disappeared about the same time.

Feb. 12th.—Watch, left ear, $\frac{0}{4\,8}$, but loud voice heard. *Mt* very little congested in lower segment ; perforation healed.

Feb. 19th.—Returned, saying he had taken a fresh cold, and he complained of an itching sensation last night in the same ear. *Mt* covered with muco-pus, and a perforation in lower quadrant. Watch, $\frac{c}{4\,8}$ after Politzer inflation. Pulv. acid. boracic. et hydrast. insufflated every day, but the discharge remaining unchanged, I ordered him to resume calcium sulphide ; the discharge commenced immediately to diminish in quantity until Feb. 28th, when it ceased altogether. Politzer inflation used. The *Mt* continued to clear up, and on March 13th, the hearing distance was almost normal. He returned April 13th and said he felt entirely well. Hearing normal.

It is difficult to decide how much of the success in treatment to attribute to the calcium sulphide, as local means, Politzer inflation, etc., are employed as well, but in Case 4, nothing but the calcium sulphide was given—no local treatment whatever ; while in the last case, during the second attack of otitis media purulenta, the discharge did not grow less under local treatment till the calcium sulphide was given. In Case 7 nothing was given but the calcium sulphide and aconite.

CHOLESTEATOMA OF THE MASTOID PROCESS WITH RUPTURE INTO THE EXTERNAL AUDITORY MEATUS AFTER USE OF THE IRISH-ROMAN BATHS.

By Prof. S. MOOS, of Heidelberg.

Translated by Porter Farley, M.D., of Rochester, N. Y.

IN volume viii of this journal I have described four cases of severe disease of the mastoid process, among which there was one case of acute caries of the posterior wall of the external meatus, complicated with cholesteatoma of the mastoid process. Recovery followed, but there was a large defect in the bony parts involved. I am now able to report a similar case in which recovery was perfect.

In the first week of May, 1881, I was summoned to Carlsruhe by Dr. Schuberg to visit one of his patients, who for a long time had been confined to his bed by an exceedingly painful affection of the left external auditory meatus.

At my first visit, May 12th, I learned the following history :

The patient, a merchant thirty-three years old, of strong constitution, had been successfully treated twelve years previously by his physician, Dr. Schuberg, for a suppuration of the left mastoid process. The abscess had then been opened by a proper incision, and the wound healed so well that at present a scar is scarcely perceptible. There was no subsequent discharge, and until his present affection the patient is said to have heard well with that ear. In other respects his general health until recently was good.

Three months ago rheumatic pains appeared in the extremities, and for their relief an Irish-Roman bath had been ordered. On

the day following the bath, the patient was attacked with severe pain in his ear, and with shooting pains through that side of his head. A purulent discharge from the ear was accompanied by a remission of the pains. The rheumatic pains, however, continued. A second Irish-Roman bath was ordered. The pains in the ear reappeared, and continued during the last weeks. At times they were terrible. A swelling of the sub-auricular glands had appeared.

At present the patient appears quite sick, and complains of pain deep in his ear. The ear, however, is not sensitive to pressure, either upon the external passage or on the mastoid process, which last, with the exception of the above-named scar, is in every respect normal. Upon examination, several polypi are seen upon the inner third of the external passage ; nevertheless, by Valsalva's experiment, one can hear a distinct sharp hissing of the air, followed immediately by a somewhat freer discharge of pus mixed with cholesteatomatous masses. The tuning-fork placed on the skull is heard on the diseased side.

The treatment ordered was boracic acid and the air douche. From the 12th to the 15th of May, several large cholesteatomatous masses were discharged, some spontaneously, and some by syringing. Meanwhile the patient remained free from pain.

On May 15th, with Wilde's snare, I removed two polypi from the lower and posterior wall of the external auditory meatus. During the operation, and subsequently, great quantities of cholesteatomatous matter were discharged. There was a kidney-shaped perforation of the drum membrane. The labyrinth wall was gray-red. There was great and permanent improvement in the subjective symptoms. On May 21st, the patient visited me at Heidelberg. There was still a discharge of the same matter. On June 21st he visited me a second time at the Heidelberg clinic. At this time, by good illumination I succeeded in probing a carious opening in the posterior wall of the inner third of the external auditory meatus. It was about the size of a pea, and the probe entered in a slanting direction nearly a centimetre. The treatment with boracic acid was continued. The patient visited me eight times up to the 4th of July. On the 27th of June I assured myself that the caries was healing, and that the repair of the drum membrane was begun. On the 4th of July recovery was complete, and the patient had a very satisfactory degree of hearing. Up to the present time he remains sound.

Genetically, this case may be regarded as follows:

The suppuration of the mastoid cells, which occurred twelve years before, healed just as did my case above referred to, and there intervened between the recovery from the first attack and the onset of the second, a period of perfect health. In this case the symptoms of renewed inflammation may perhaps be attributed to the use of the Irish-Roman baths. But there can be no doubt that the accumulation of concentric epidermis masses in the antrum mastoideum, with their slow growth through a long course of years, was a contributory cause. In view of the pathological anatomy of the case there can be no question that there was atrophy of the bony parts, due to the pressure of these constantly increasing epidermal masses.[1] An acute caries of the anterior wall of the mastoid cells appeared as a reactive symptom, caused by sudden swelling induced by repeated use of the Irish-Roman bath. The severe pain was due partly to this process and partly to the resistance offered by the posterior portion of the mastoid cells, in which sclerosis had probably taken place during the disease twelve years before; so that, though this part presented no objective symptoms, its condition certainly had much to do with the excruciating nature of the pain.

It is possible that the first attack of pain occurring after the first bath, with three days' remission after the appearance of a discharge from the ear, was caused by a simple acute attack of inflammation of the middle ear, and that the second period of pain was due to the perforation of the posterior wall of the external meatus. But judgment upon this point must be reserved, as the condition of the drum membrane during the latency of the disease was not known.

[1] The enormous size to which the masses sometimes attain has been proved by examinations which I have made on the cadaver. Before me Bezold observed a case in the living subject and published it. See *Arch. für Augen- und Ohrenheilk.*, Bd. iii, p. 99, and Bd. v, p. 98.

NECROTIC EXFOLIATION OF THE SUPERIOR (?) BONY SEMICIRCULAR CANAL, PRECEDED BY A WEEK OF DIZZINESS AND VOMITING. RECOVERY WITH LOSS OF SUCH DEGREE OF HEARING AS HAD PREVIOUSLY EXISTED.

By Prof. S. MOOS, of Heidelberg.

Translated by Porter Farley, M.D., Rochester, N. Y.

ON May 14, 1881, I received from Dr. Thornwaldt, of Danzig, the following clinical history, which was brought to me by the patient himself:

"A student, Mr. R., has been repeatedly treated by me for disease of the ear. When I first examined him about two years ago, I found the following condition: There was a copious fetid suppuration from the left ear. There was absence of the anterior half of the drum membrane, and the remaining half consisted, for the greater part, of scar tissue. The handle of the hammer was fixed to the opposite wall of the tympanum. Denuded bone could be felt by the probe in that part of the tympanum upward and forward from the promontory. The air douche by means of the catheter indicated a much contracted Eustachian tube, while upon the right side the air very easily entered the tympanum. Hearing on left side markedly diminished. The tuning-fork held on the skull was heard on the left side. The suppuration ceased after treatment of the middle ear by disinfectants and astringents, but only to return from time to time.

"About four weeks ago, after an absence of a year, R. came to me again for treatment. He was then very sick with chills, high temperature, and severe attacks of dizziness. There was a foul suppuration from the left ear, and severe pains shooting

through the entire left half of the head. After syringing with a solution of boracic acid, and catheterization, there was a speedy improvement of the general condition; the swelling of the external passage diminished, and there then appeared quite a large, hard granulation growing from that place where I had previously found denuded bone. As this granulation appeared to have a broad base, I have tried to destroy it by caustics and the galvano-cautery, but up to this time without any satisfactory result. Soon after beginning my last course of treatment, during the act of syringing, a small rough piece of bone was washed out."

At my examination, May 14th, I learned that the disease had existed since the seventh year, and had followed scarlet fever. The patient was very pale and dejected, but was free from fever, pain, vertigo, and subjective noises. A low-ticking watch, held upon the forehead, was heard upon the diseased side, and the tuning-fork held in like manner was heard only on that side. Hearing distance for speech was only about two metres. The left external auditory meatus was so filled with polypi that it was impossible to determine the condition of the deeper parts of the ear.

The treatment with solution of boracic acid was at first continued. In addition to this, up to May 21st, three applications of the galvano-cautery were made to the polypi without any reaction and without any disturbing symptoms during the intervals between the operations. On the 21st the patient sent for me, as he could not go out on account of severe vertigo and vomiting. On that day and the following one I found the condition in the ear to be the same as before. I visited the patient once or twice a day until the 29th, and every day found a normal condition of the pulse, temperature, and pupils. With the exception of vertigo and vomiting there was no abnormal symptom, such as constipation. There were great apathy and nearly total loss of volition, in a patient naturally ambitious and industrious. I directed abstemious diet and confinement to the bed. At first I endeavored by Charcot's quinine treatment to overcome the symptoms, but without success; so that I then limited the amount administered to the degree of simple saturation. As to the dizziness, the patient, upon repeated questioning, stated that when he looked at an object it appeared to move in an upward direction. On the 29th of May occurred the last attack of dizziness and vomiting. On the 31st the patient appeared again at my clinic. When I examined him with

reference to the advisability of a repetition of the use of the galvano-cautery, I discovered embedded in the granulations a black body which felt rough when touched with the probe, and which I easily removed with the forceps. The fragment was buckle-shaped, nine *mm.* long and about one *mm.* broad. The slight amount of soft tissue upon it proved upon microscopic examination to consist only of pus corpuscles and margarine crystals. This bony fragment was for the most part carious, but in certain parts of its concave surface a distinct groove was visible. Hearing was entirely lost on the left side, and has so remained to this day. But there has been no return of the vertigo or vomiting, and, in consequence of the continued treatment with the galvano-cautery, recovery proceeded so rapidly that as regards caries, necrosis, and the formation of polypi the patient could be regarded to be well at the beginning of August. It is now possible to form a better judgment of the condition of the deeper parts. The greater part of the drum membrane is absent. Its anterior and lower margins still remain, and from the latter a triangular tag of cicatricial tissue projects toward the promontory, with which its extremity is united. The malleus and incus are absent, and I have never been able to satisfy myself of the presence of the stapes, although I still have the patient under observation. The recovery from the disease has been accompanied by a highly gratifying improvement in the mental condition of this naturally talented young man. He at least so expresses himself, and so does his mathematical teacher.

This history, aside from its practical value, is of great physiological interest.

After the disappearance of the vertigo, which was experienced in an early stage of the disease, it reappeared violently, accompanied by vomiting, upon an irritation of the labyrinth. These symptoms disappeared upon the discharge of one of the necrosed semicircular canals, and the patient simultaneously lost such remnant of hearing as had till then been retained. The case also shows that irritation of the nerve terminations in the crests of the ampullæ may cause the same symptoms as an irritation of the cerebellum, the centre of muscular co-ordination, and that upon the paralysis or destruction of the nerves of the ampullæ the vertigo disappears.

Such clinical experiences are more valuable than physiological experiments. In such experiments there is great danger of accidental injury to the brain; but no such complication existed in this case; for pulse, temperature, and all the functions of the brain remained normal. The observations of these experiments, made by Nature herself, are valuable because of their cleanness. The more such observations multiply, the better furnished are we for the support of our views concerning the function of the semicircular canals and their adnexa, and that, too, with material far more reliable than is furnished by artificially instituted experiments.

Moreover, the latest results of experimental physiology are confirmative of the view that the nerves of the vestibule stand in close connexion with the function of muscular co-ordination, notwithstanding the contrary results reached by Baginsky, which we have elsewhere referred to, and have disputed on pathological grounds. Högyes,[1] upon the strength of his experiments, speaks as being certain that the vestibular terminations of the acoustic nerve constitute a special apparatus which, according to the position of the head and body, co-ordinate the movements of the eyes, and probably also control all those muscles which are concerned in maintaining bodily equilibrium.

[1] The true causes of the vertigo which accompanies increase of pressure in the tympanum. Prof. And. Högyes, of Klausenburg. *Arch. für die ges. Physiologie*, Bd. xxvi, p. 558.

PYÆMIC ATTACKS DURING AND AFTER RECOVERY FROM AN ACUTE PURULENT INFLAMMATION OF THE TYMPANUM.

By Prof. MOOS, of Heidelberg.

Translated by Porter Farley, M.D., Rochester, N. Y.

THE following case is the only one in my practice in which pyæmic attacks have occurred during the acute stages of an inflammation of the middle ear, and in this they even continued, although for only a short time, after the closing of the perforation. I publish the case, although I have to offer only opinions as to the connection existing between the symptoms. Perhaps others who have made similar observations may confirm my suppositions:

F. von T., student, came under my treatment May 5, 1881. For many years he has had nasal catarrh and a sensation of obstruction in the right nostril. His present disease of the ear began three weeks ago, following a renewed attack of his catarrh, and beginning with pain in the right ear. For three days he had been deaf in that ear. Since the last night he had experienced violent pulsation in it. The right external meatus was moistened with a little pus. The right drum membrane was flat, thick, and of a grayish red. The handle of the malleus was not visible. The mucous membrane of the right inferior nasal meatus was hypertrophied. The tuning-fork was heard by bone-conduction only on the right side. The watch was heard only on contact. Words could be distinguished at two metres. Under treatment by the nasal and air douches and a four-per-cent. solution of boracic acid,

improvement began in a few days. On the 11th of May the patient went out to walk, and was so imprudent as to sit down in the open air, notwithstanding the prevalence of a strong northeast wind. In hardly more than five minutes he experienced a chill and renewed severe pain in the right ear.

Nevertheless, on the morning of the 12th, I found only a considerable congestion of the vessels near the handle of the malleus. There were no visible signs of exudation in the tympanum, but hearing was almost wholly lost. In spite of the negative result of this examination with reference to exudation in the middle ear, there was by evening of the same day a profuse discharge of pus and a perforation in the anterior inferior quadrant of the drum membrane.

Treatment: Rest in bed; frugal diet; boracic acid.

Until May 16th, there was a profuse, painless discharge. On the 19th, the perforation had closed; there was no discharge and the patient felt well.

May 20th, 5.30 P.M.—Chill; temperature, 40.3°; pulse, 112. Loss of appetite; constipation; restless night; frontal headache.

May 21st, morning.—After severe pulsation in the right ear during the night, there was a renewed discharge through a new perforation in the inferior posterior quadrant. Temperature, 37°; evening 39°.

May 22d, morning.—Temperature, 37°. Local condition and treatment the same as before. At noon a chill. At 1 P.M., temperature 39.1°; at 4 P.M., temperature 40.4°; at 6 P.M., 40.6°. Shortly after followed a chill. At 9 P.M., temperature 38.4°. At midnight, temperature 38.8°. Frontal headache.

From this time I was in daily consultation with Prof. Friedreich. Ordered quinine, 0.3 every three hours.

May 23d, 6 A.M.—Temperature, 36.5°. Quinine was used from this time until May 29th. Rochelle salts to correct constipation. Local treatment as before.

May 26th.—Discharge from ear ceased.

May 27th.—Closure of perforation. At 9.30 A.M., a chill; sweating till 2 P.M. At 4 P.M., another chill. At 6 P.M., sweat. At 8 P.M., another chill. Continual headache.

May 28th and 29th.—The fever has subsided. Sweating continues. General condition comfortable. Hearing nearly normal. There is recovery from the local disease, without any perceptible changes in the drum membrane.

Prof. Friedreich examined the internal organs twice daily during the entire prevalence of the fever, but was unable to detect any abnormal condition other than a slight enlargement of the spleen. The urine contained no albumen.

When attacks of pyæmia occur in the course of a chronic suppuration of the ear, we can judge more correctly of the history of the disease than when they occur in acute cases.

In the first place, we are justified in assuming a diseased condition of the petrous bone, especially a gradually progressive caries which favors the propagation of the disease to one of the sinuses of the brain. It is quite otherwise when, as in this case, these attacks occur during the acute stage of inflammation in a previously healthy ear. If the case is not one of acute caries, associated with purulent inflammation of the tympanum, such as we had no reason to believe this to be; or if the presence and malign influence of micro-organisms in the inflamed parts can be excluded—though such a condition of affairs is possible in a simple non-purulent inflammation (Zaufal)—the following theories of the condition must be considered:

1. Intermittent fever. This diagnosis could not be accepted, in spite of the ascertained enlargement of the spleen. The type of the fever negatived it, and so too, especially, did the fact that the chills came on during the use of the quinine. It is well known that the occurrence of new chills and increase of temperature contra-indicate the presence of intermittent fever.

2. Phlebitis and thrombosis of one of the veins or sinuses near the tympanum. This would scarcely be possible during the course of an acute affection of the middle ear, without the presence of certain abnormities in the structure of the organ which would favor a rapid extension of the inflammation to the neighboring veins. As such may be mentioned:

(*a*) Defect in the bony structure of the floor of the tympanum, which was observed by Toynbee fifty-four times; also immediate contact of the inflamed mucous membrane with the sinus of the jugular vein, and consequent phlebitis and thrombosis of that vessel.

(*b*) Defect in the roof of the tympanum, which would favor the extension of the inflammation to the superior petrosal sinus. Toynbee observed such defects twenty-five times, and they have been observed at different times by Hyrtl, Troeltsch, Retzius, Bürkner,[1] Jaenicke,[2] and Flesch.[3] In case of possible participation of the mastoid cells in the purulent inflammation there are other conditions to be considered :

(*c*) A canal lined with dura mater, extending from the mastoid cells beneath the superior semicircular canal to the posterior surface of the pyramid, and which opens above into the sulcus petrosus, between the porus acusticus int. and the entrance to the aqueductus vestibuli (Retzius, Voltolini).

(*d*) A venous canal which begins in the mastoid cells and ends in the sigmoid sinus at the junction of its descending and horizontal parts. (My own observation. See *Virchow's Arch.*, vol. xxxvi, p. 15.)

(*e*) Finally, we must remember the possible existence of numerous small veins which may extend from the mastoid cells toward, and discharge into, the lateral sinus.

Opposed to the theory of phlebitis and thrombosis of a large vein or sinus, there were in this case no observable metastatic centres of inflammation, such as are generally caused by the breaking down of a large thrombus. As to the repeated failure of Prof. Friedreich to discover any trace of embolism in the lungs, it may be objected that there perhaps existed small infarctions in the lungs, so centrally situated and so covered with normal lung tissue as to make their recognition by physical examination impossible ; but in such a case, there would certainly have been some other symptom present, such, for instance, as dyspnœa.

Upon the theory of a phlebitis and thrombosis of a small sinus, for instance the superior petrosal, the non-discovery

[1] Contribution to normal and pathological anatomy of the ear. *Arch. f. O.*, Bd. xiii, p. 163.

[2] Anomalies of the base of the skull, and thinning and perforation of the lining membrane of the tympanum. Inaug. Diss., Kiel, 1877, pp. 5–14.

[3] The recognition of so-called dehiscence of the lining membrane of the tympanum. *Arch. f O.*, Bd. xiv, p. 15.

of embolisms in the parenchymatous organs is more easily understood. The course of the fever, too, and the variations of temperature contra-indicate an inflammation of a large sinus, such, for instance, as the lateral sinus. When this condition exists, without any other complications in the cranial cavity, the fluctuations in temperature between the chills, especially if they are long separated, are much greater; or if the chills occur with short intervals, the temperature remains continuously very high. For instance, in a case of Schwartze's, with no other brain complications, and in which an autopsy was made, the temperature fell 3.9° C.[1] In a case which was observed in Friedreich's clinic and was published by me, the fall was 4.8°.[2]

Wreden considers these great fluctuations of temperature a very important symptom for the diagnosis of phlebitis and thrombosis of a large brain sinus; and he was the first to call attention to the importance of the course of the temperature in the recognition of this condition.[3]

It appears probable to Friedreich and me that in our case the pyæmic symptoms were due to an inflammation of a small brain sinus, probably the sinus petrosus superior. Whether this disease always runs a favorable course remains doubtful.

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[1] *Arch. f. O.*, Bd. xii, p. 129.

[2] Contributions to the Pathology of the Ear. Second paper. These ARCH., vii, p. 465.

[3] These ARCH., iii, 2, p. 173.

ŒDEMA IN THE TEMPORAL AND ZYGOMATIC REGIONS, AS A SYMPTOM OF PHLEBITIS AND THROMBOSIS OF THE LATERAL SINUS.

By Prof. MOOS, of Heidelberg.

Translated by Porter Farley, M.D., Rochester, N. Y.

IN volume vii, p. 469, etc., of *Arch. Opthal. and Otology*, I have published four cases of phlebitis and thrombosis, of the sinus lateralis, among which the fourth, on account of its clinical history, is particularly noticeable.

Besides continuous diffuse headache and a temperature ranging between 38.6° and 40° (without chills), and was no other symptom present except a swelling, which was described by the patient himself as sausage-shaped, and extended from the temple to the front of the ear on the diseased side, and which he had noticed at his own home. I noted down the appearance in the following words: "In the temporal region above the concha is a diffuse, œdematous, painless, colorless swelling, which extends forward and downward, and is lost in the region of the tragus." At the autopsy, circumscript meningitis and a phlebitis and thrombosis of the sinus lateralis were found. During the epicrisis I made the remark that I regarded the symptom of œdema as very important; but as being pathognomonic only when an accompanying caries of the squamous portion of the temporal bone can be excluded. It is as characteristic of a phlebitis and thrombosis of the sinus lateralis as is œdema of the mastoid region (Griesinger), or as is œdema of the eye-

lids and eyeball, of thrombosis of the sinus cavernosus (Huebner).

Since I published this case I have seen another in which I likewise observed œdema in the temporal region. Although I observed it for scarcely a day, and although the intracranial disease was probably complicated, and although I did not finally obtain the results of an autopsy, I cannot refrain from again speaking more particularly on this subject. Reflection has satisfied me that this symptom is of rare occurrence, and for the reason, as we shall later see, that the anatomical conditions upon which it depends are peculiarities of development of an exceptional nature. For this reason I would again call the attention of the profession to this subject. Perhaps others have made similar observations, and by their publications may throw further light upon the matter. It is only by increase in their number that diagnoses based upon probabilities can gain in certainty.

This second case is as follows:

S. P., a maiden lady, thirty-one years of age, was subject during former years to a discharge from the right ear, but without any considerable discomfort until twelve days ago, when she was attacked by a steadily increasing pain, deep-seated in the right ear, and shooting through that half of the head. At the same time, there appeared upon the surface of the right mastoid process a large and gradually increasing tumor; likewise "a hard œdema of the right temple and the adjoining region of the zygomatic process." (Statement of the physician in charge, Dr. W. of K., Rheinpfalz.) The skin was hot. The temperature had up to this time not been taken. There were great thirst, no appetite, and no chill. The physician in charge had, six days before, made an incision over the mastoid process, and he stated that much pus had been discharged, but there had been no decided collapse of the tumor. The severe pain, however, subsided. Since day before yesterday, there had been loss of consciousness, no vomiting, no change in the pupils, pulse ranging between forty and fifty-six.

Treatment had been by use of ice and cathartics.

I saw the patient for the first time at six o'clock on the evening of January 3d. She was absolutely unconscious. The pu-

pils reacted sluggishly, but alike on both sides. The pulse was occasionally intermittent, fully fifty-six in a minute. There was diffuse œdema of the temple and the zygomatic region, with slight reddening of the skin. In the right incisura intertragica is a dirty foul-smelling secretion. The right external meatus is closed by a large polypus, which is attached to the posterior wall. Upon the middle of the greatly swollen mastoid process is a wound about an inch and a half in length. The skin already has a gangrenous bluish-red appearance.

Although under these circumstances the case seemed hopeless, I nevertheless proposed to the attending physician and the relatives, as a last resort, the free opening of the abscess, which was readily acceded to. I made the operation with the cartilage-knife in the direction of the former wound, and by a long incision penetrated a deep carious opening in the mastoid process. A great quantity of ichorous matter was discharged. The periosteum was everywhere loosened from the bone. I easily and repeatedly passed the nozzle of a rubber syringe into this carious opening, and drove the water from it through the external auditory meatus. After the bleeding stopped the pulse rose to 88, and the patient raised her hand repeatedly to the diseased ear. Half an hour after the operation the pulse was 60. During the following night the condition remained unchanged. At nine o'clock the next morning there was no discharge from the wound ; the pulse was 48, the temperature 40.6°. The right pupil was much the larger. Stupor continued to increase, and two hours later death occurred.

I could not obtain an autopsy.

These symptoms, proceeding from the great nerve centre, suggest the following conditions to be considered in making a diagnosis:

1, Abscess of the brain ; 2, œdema of the brain; 3, meningitis ; 4, phlebitis and thrombosis of the sinus lateralis.

Abscess of the brain. As two days before there were no brain-symptoms, its acute stage being short must have been marked by very violent symptoms, such as convulsions or the appearance of sudden paralysis; but such was not the case. The high temperature, over 40°, although taken only once, argues against this diagnosis.

Œdema of the brain was excluded by the persistent cephalic pulse and by the decided dilatation of the pupil on the affected side during the last hours of life. In view of these symptoms, and notwithstanding the absence of vomiting, I inclined to the diagnosis of meningitis, complicated, as these cases due to otitis so frequently are, by a phlebitis and thrombosis of the sinus lateralis. The absence of chills is explained by the probable fact that the thrombus had not yet broken down.

There was no reason to suspect a caries of the squamous portion of the temporal bone, a condition which I have frequently observed, but as yet only in children under two years of age.

Anatomical Connection between Œdema of the Temporal Region and Phlebitis and Thrombosis of the Lateral Sinus.

When œdema of the temporal region appears coincidently with a thrombosis of the lateral sinus, and when it can be shown that it does not depend upon caries of the temporal bone, the question remains whether it is possible to associate the two conditions upon anatomical grounds. This can be done by a consideration of the parts concerned in reference to their manner of development. In the petro-squamous fissure runs the petro-squamous sulcus, which, according to Luschka,[1] is to be regarded as the original sinus transversus. Kirchner[2] gives a picture of this. Its external opening is sometimes found still in the horizontal part of the squamous portion, behind the posterior articular process; it is the foramen jugulare spurium, which, however, is frequently found near the posterior root of the zygomatic process (Luschka, *l. c.*). This sinus either opens into the sinus lateralis, or it perforates the squamous portion and anastomoses with the deeper temporal vein. According to Kölliker,[3] it originates during the fœtal development of the jugular veins. He writes as follows:

[1] Die Anatomie des menschlichen Körpers, Bd. iii, 2, Tübingen, 1867.

[2] Beitrag zur Anatomie der äusseren Ohrtheile. Habilitationsschrift, Würzburg, 1881.

[3] Kölliker: Entwickelungsgeschichte des Menschen und der höheren Thiere, Leipzig, 1879, p. 928.

"The first branchlets of the jugular veins are within the cranial cavity and flow together on each side into one vessel, which may be regarded as the beginning of the actual jugular, and which later appears as the sinus transversus. This vessel, however, does not leave the cranial cavity through the foramen jugulare, but through a special opening anterior to the ear, which, as Luschka has shown, may even be present in the fully developed skull, and is there found in the temporal bone above the glenoid cavity. Later this opening closes, and the blood of the cranial cavity is discharged through an internal jugular, an offshoot from the lower end of the primitive jugular, near the ductus Cuvieri, so that then the original vein appears as an external jugular."

Zuckerkandl's[1] investigations show that the relations above described are not so very rare even in adults. In 280 skulls he found the sinus petro-squamosus twenty-two times, and the foramen jugulare spurium three times. Moreover, Kieselbach,[2] in the case of a child one and a half years of age, could not demonstrate any connection between this sulcus petro-squamosus and the sulcus sigmoideus.

The appearance of the symptom in question assumes the existence of a petro-squamous sinus, and its communication on the one side with the sinus transversus, and on the other with the deep temporal vein after passing through the temporal bone. According to the anatomical investigations above described, these conditions but seldom exist, and therefore œdema of the temporal region, as a symptom of thrombosis of the lateral sinus, will be of rare occurrence. Though this is an indirect sign, its diagnostic value is as great as is that œdema over the mastoid process which appears after the extension of the thrombosis in the emissarium which runs outward through the fossa sigmoidea. That this symptom, first pointed out by Griesinger,[3] may be actually pathognomonic is proved by an autopsy made

[1] Beitrag zur Anatomie des Schläfenbeines, *M. f. O.*, 1873, No. 9.

[2] Beitrag zur normalen und pathologischen Anatomie des Schläfenbeines mit besonderer Rücksicht auf das kindliche Schläfenbein, *A. f. O.*, Bd. xv, p. 253.

[3] *Arch. f. Heilk.*, Bd. iii, page 137, ff.

by him and by another made by me. Griesinger[1] truly says:

"Against the explanation of that swelling by thrombosis of the emissary vein, it cannot be objected that the emissary vein conducts the blood from the sinus outward, and that externally none of its branchlets are affected by its obstruction. The emissarium communicates between the sinus and the post-auricular veins, and the direction of the flow of blood in it is determined by the direction of greatest pressure."

This entire quotation may be adopted as an answer to a somewhat similar objection in reference to œdema of the temple. I had still before me the task of further examining the specimen of the first-described case, to discover, if possible, whether it possessed any such abnormity of development. In reference to the sinus this was not possible, because the diseased and altered lateral sinus, as well as the greater part of the dura of the affected temporal bone, had been already cut away.

In reference to the sulcus, etc., I can now make the following supplemental communication:

There is in this specimen a so-called sulcus petrosquamosus two *mm.* in length. By the side of this, and perforating the squamous portion of the temporal bone, is an emissarium whose external opening is two or three *mm.* above the root of the zygoma. There is no foramen jugulare spurium. There is, however, near the posterior root of the zygoma, and above the spina supra meatum, a depression, an egg-shaped cavity eight *mm.* long, five *mm.* high, and five *mm.* deep; but it has a blind ending.

In this respect the œdema of the temporal region in our first observation is only incompletely explained. It is possible that it depended upon the fact that the cicatrization upon the mastoid process obliterated a number of veins, and that therefore throughout the region of their anastomoses œdema was easier caused during the thrombosis of the sinus.

Further observations are necessary to determine this question.

[1] *L. c.*, pag. 447, und Gesammtabhandlung im Bd. i, Diagnostische Bemerkungen über Hirnkrankheiten, pag. 458.

ON THE PRODUCTION OF ARTIFICIAL DEAFNESS, AND ITS BEARING ON THE ETIOLOGY AND EVOLUTION OF THE DISEASES OF THE EAR.*

By Dr. CASSELLS, Glasgow.

EARLY in the year 1876, my study of the ear, both in a healthy and in a diseased state, led me to conclude that a certain degree of tympanic tension was necessary, not only for the health of its tissues, but for the maintenance of the sense of hearing, and that disturbances in this tympanic tension produced an immediate defect in the power of hearing articulate speech.

How I came to look at this subject, in this way, is easily told. In the first place, I saw that the apparatus of hearing, in a state of health, was a most perfect barometer; that the ear, more readily than any other organ in the body, made us aware directly of the existence of the atmosphere, and that the effects produced by its weight on the ear were often attributed to other causes.

I shall now quote from my original MS. the exact words in which, in the year 1876, I formulated my theory of the etiology and evolution of ear-diseases: the propositions are as follow:

1st. That a certain degree of tympanic tension is essential to perfect function, *i. e.*, perfect hearing.

2d. That the essential cause of all the affections of the

* Read in the subsection of Otology of the British Medical Association meeting in Cork, in August, 1879. A brief abstract appeared in the *British Medical Journal*, vol. ii, 1879, p. 328.

organ of hearing, is a disturbance of the normal tympanic tension.

3d. That all the pathological phenomena of the diseases of the ear evolve themselves with regular sequency.

I now wish to explain one or two points, in regard to these conclusions, before I go farther.

The first of these is, in regard to the amount of the normal tympanic tension.

For all purposes I think that we may regard its measure as the difference between the air-pressure, at any level upon the outside of the membrana tympani of a healthy ear, *plus* the traction force of the accommodating apparatus of the organ, on the one hand, and, on the other, the opposing air-pressure within the tympanum, *plus* the resistance of the tissues; but the exact difference between the weight of the air-pressure on the inside and that on the outside of the tympanum, could be ascertained with the greatest exactness, experimentally, by those who are better circumstanced than I am, in respect to carrying out such experiments.

In saying that the pathological changes "evolve" themselves from this common cause—disturbed tympanic tension,—I do not mean that "the compound parts of an aggregate have passed from a more to a less diffuse state," which is the meaning generally attached to the term "evolution." What I do mean is, that there is to be seen in the diseases of the ear, an expanding or unfolding or an opening out of these pathologic processes, from a simple to a complex condition.

As all the facts upon which my conclusions are based are familiar to most of us here, I shall only speak of them in a general way.

On examining the healthy ear, what strikes one is the amount of elastic tissue and muscle which enters into the construction of the apparatus of hearing, and that there is also a perfect accommodation-apparatus, by which the ear adjusts itself to changes in the atmospheric pressure, and that there is every provision made in the apparatus of hearing, to avert the consequences that might follow the too sudden rarefaction or condensation of the air, either inside or outside of the tympanum.

That the immunity from all annoyances or injury which the healthy ear enjoys, in these circumstances, is due to the power that it possesses of adjusting itself to the respective air-pressures, cannot, I think, be questioned.

The second formula that I have stated is founded on a sound and sufficiently large clinical experience, and I deem it to be a just inference from the first proposition, although I can see that there exists a gap between them. To fill up this gap gave me some thought, for I saw that it was necessary to prove, that a disturbance in the tympanic tension *could* cause tissue-change in the structures of a healthy ear.

To accomplish this, the following experiments for the production of artificial deafness, were undertaken.

The experiments were performed on the 5th of November, 1876, on a man aged forty-three years, in a room, the temperature of which was 64° F.; air quiet and no apparent currents; clear, dry weather.

Here is the state of the man's ears before being experimented on: His hearing distance, on both sides, to articulate speech, was perfectly normal; a watch, the normal hearing distance of which was six feet, was heard by him on the right, six feet clearly and distinctly, and faintly on the left at four feet.

The right membrana tympani was normal in concavity; cone of light interrupted in the centre, otherwise membrana tympani quite normal in all respects. He is a nasal breather by habit. The left Eustachian tube is slightly catarrhal.

Two methods were now used to disturb the balance of the tympanic tension. One, the *Valsalvian method*, of inflating the tympanum, was employed to increase the density of the air contained in the tympanic cavity. The other, known as *Maissiat's experiment*, was used for the purpose of rarefying the air in that cavity.

I have now to ask your attention to the results of these experiments, only with reference to my second formula.

The Valsalvian experiment gave no positive results to this particular investigation. On observing the membrana tympani during the experiment, only the usual and well-known ap-

pearances were to be seen, but no change of tissue whatever; there was, however, a sensation of stuffiness in the ears, with a slight whizzing, subjective tinnitus; there was no appreciable influence produced on the acuteness of the hearing, judged by the watch and voice, while the experiment lasted.

Maissiat's experiment: This experiment was introduced by Maissiat in 1838, who proved by it, that the air in the tympanic cavity is rarefied. Toynbee, who seems to have adopted this experiment, declared that it *condensed* the air in the tympanic cavity, a statement which has been shown to be incorrect by Politzer, who, using more exact experiments, confirms the opinion of its discoverer.

In order to produce an artificial deafness in the same way as a natural deafness is caused, Maissiat's method of rarefying the air contained in the tympanic cavity was employed in the following manner.

First stage of experiment.—A manometer (similar to the one figured on page 153 of Politzer's "Lehrbuch der Ohrenheilkunde") was hermetically fixed in the outer orifice of the external meatus of the right ear. The act of swallowing was now performed in a deliberate manner several times in succession, water being used to facilitate this process, during the performance of which the nostrils were *open*. While this stage of the experiment was being carried out, no movement took place in the mercurial column of the manometer.

Second stage.—The act of swallowing was now repeated, in the same manner as in the first stage, while the nostrils were held firmly *closed*, and the following phenomena were observed and noted:

At the first act of deglutition, the column of mercury in the instrument descended considerably. On this act being repeated a second time, it still farther descended; during the third repetition of it, the mercury was drawn altogether into the meatus.

Third stage.—The experiment was now repeated without the manometer, but in every other respect the same as in the last stage.

While the act of swallowing was being carried out, its effect on the membrana tympani was observed: the first act of swallowing caused this membrane to vibrate backward and forward several times and then to recede a little, becoming at last visibly more concave. With this, there was aroused, at once, a sensation of dulness in the general hearing. On a repetition of this act, the membrane became still more concave, and now signs of congestion began to appear on its surface, along the anterior aspect of the handle of the malleus. At this stage there were now experienced a general and deeper muffling of all sounds and a slight tinnitus. With the third act of swallowing (*the nostrils meanwhile having been kept rigorously closed throughout the experiment*), the following facts were observed: The membrane was rigidly fixed, the congestion of its tissues was increasing rapidly, and looked as if it would go on doing so, were the conditions of the experiment to continue.

There was, at this stage, a complete muffling of all natural sounds, such as the singing voice, articulate speech, the crackling of the fire in the grate, and the noise of the street traffic; all heard distinctly by the subject of the experiment, at the outset and before being experimented on, were now all perceived, as if the ear were stuffed with cotton-wool, but the tic-tac of the watch was heard ringing out clearly and distinctly and at an increased distance to that at which it was heard at the outset of this experiment. Instead of being heard at six feet, as it was then, it was now heard as a clear metallic clink at a distance of nine to ten feet. The subject of the experiment, who was breathing and speaking during its continuance, without in any way affecting or altering its condition, declared that he thought the reason why he heard the watch so well, was that he heard nothing else distinctly.

The perception of aërial tones of the diapason, ranging from $c^1 = 512$ to $c^2 = 1024$, held close to the ear, was almost completely extinguished; the perception of transmitted tones was slightly diminished.

Fourth stage.—On the patient releasing his nostrils and

swallowing a few times in succession, the membrane soon regained its normal position, and in an hour or so afterward the hyperæmia of its surface had diminished; the dulness of hearing lasted for some time afterward.

Fifth stage.—The orifice of one meatus was hermetically sealed up, and the other left open. Maissiat's proceeding was then performed to the same extent as in the third stage, already described. After performing the act of deglutition three times in succession, all the sensations and appearances that were called forth in the third stage of the experiment, were now experienced and seen on the membrane of the left and open ear, while in the right and closed ear, no such sensations were felt. On the instant, however, that the plug was removed from the meatus of the right and hitherto closed ear, similar sensations to those which had been felt in the left ear all along, now made themselves known at once in the right, showing that the air in the cavity of the tympanum had been exhausted, and that the membrana tympani had been pressed in by the superabundant outside air-pressure; this conclusion was tested in the following way:

A pneumatic speculum was now inserted into the orifice of the right meatus, that canal being hermetically closed by the instrument.

The last stage of the experiment was then repeated in all its details, and the membrana tympani inspected, while these were being carried out. Scarcely any motion was to be seen in the membrane of the closed ear, and none of the subjective symptoms were called forth in it so long as the canal remained closed. On the left ear all the former symptoms were as prominent as ever. Air was now admitted to the canal of the hitherto closed ear, and the behavior of the membrana tympani watched. It was seen to be drawn in suddenly with a bang toward the tympanum, and to remain in that position, its surface being very concave.

All the former sensations and appearances were now felt in the ear and seen in the membrana tympani; so great, indeed, was the congestion of the membrane, that I began to fear that a veritable ear-disease had been created in the sub-

ject of the experiment, who, I may add, was a man of education, and accustomed to weigh fine distinctions, and to compare and to differentiate the sensations of sound and feeling.

I have now finished the narration of these experiments. It would, however, be premature to draw any conclusions from them, owing to their limited range and duration, and, therefore, incompleteness. But I think this incompleteness may be for the present moment legitimately supplemented by a "scientific use of the imagination."

If, therefore, three of the more common symptoms of ear-disease can be produced artificially by an experiment in a few minutes, and in the order in which they appear naturally in disease, then, I ask, is it not a warrantable inference to say that a continuance of the same experiment for a few hours or days would lead to the further development of these symptoms, and to the production of more complex tissue-changes ?

Be that as it may, I have to express the hope that you will not regard my theory in respect to the etiology and evolution of the diseases of the ear, as the production of a "luxuriant fancy and few facts," but that you will see that it is the outcome of a fairly wide experience, and that it is built upon a physiological and clinical foundation.

Nevertheless, if I only succeed in enlisting your interest in the subject of my paper itself, I will be content.

UNSUCCESSFUL ATTEMPT AT RESTORING AN EAR-CANAL, CLOSED BY CAUTERIZATION WITH SULPHURIC ACID.

By H. KNAPP.

The Sister of Charity, St. V., of the Asylum St. Vincent de Paul of this city, while suffering from neuralgic pain in the left ear on Nov. 21, 1881, thought to find relief in the topical application of ether, but by mistake poured concentrated sulphuric acid, directly from a little bottle, into the ear. Immediately afterward she had excessive pain, but was free from it the following day. Extensive ulceration and profuse discharge set in. Her physician kept the ear clean by syringing, and endeavored to keep the canal open by inserting pledgets of lint steeped in medicated vaseline, by laminaria probes, and other contrivances, but the gradual closure could not be prevented.

When she came to me in February, 1882, the meatus auditorius was completely obliterated, and the auricle reduced to about one third of its natural size by the contraction of cicatrices which occupied its whole anterior surface. She heard the tick of the watch on contact with the ear and the adjacent parts; V was $\frac{20}{60}$. She suffered from noises in the ear, and her own voice sounded stronger on that side of the head, a symptom which distressed her greatly. The other ear was healthy.

Thinking that the scar might, perhaps, not extend to the bottom of the ear-canal, and even if it did, the caustic might not have destroyed the drum membrane, or might at least have left the tympanic cavity intact, I held an attempt at the restoration of the canal justifiable. With a long, narrow-bladed (Graefe's cataract) knife I penetrated 2.5 *cm.* into the depth of the canal, and enlarged the wound on both sides until the blade of the knife

struck the bone in the inner portion of the canal. After the arrest of the moderate hemorrhage, I introduced a perforated silver tube, which was removed and re-introduced three times daily, the tube and the wound being, of course, carefully cleansed each time. The tube had a tendency to come out, and as, in a a week, it could not be introduced so deep as at the beginning, I made the incision larger than before. The knife was advanced in the direction of the canal until its point was arrested by hard bone, the promontory. The depth of the wound was fully 3 *cm.*, and its calibre was enlarged by incising the tissue down to the bone on the anterior, inferior, and posterior sides of the canal. Though I had undoubtedly opened the tympanic cavity, nothing but a moderate quantity of blood escaped.

I inserted a longer and broader silver tube, which was changed two or three times a day. The patient experienced little pain, and noticed that both the tinnitus and the autophony had disappeared. Her hearing also was better and "more natural." This comfortable condition, however, was not of long duration. The thick canula, which completely filled the new canal, and was held in position by a pad of absorbent cotton, over which the nun's white head-dress passed, surrounding the scalp as a tight-fitting cap, had likewise a tendency to come out, and when pressed in too firmly by the cap, it would inflame the parts and cause pain. Gradually it had to be replaced by thinner and shorter ones. When the canal showed a decided tendency to narrow again, I inserted a laminaria bougie, which dilated the canal, but caused pain and inflammation, and had to be left off.

The patient considered even a partial restoration of the canal to be of material benefit, for she was free from the annoying reinforcement of her own voice so long as the canula was in. With the greatest persistency she had the new canal syringed out and the canula inserted two or three times daily, but in spite of every endeavor we lost ground, and as I knew of no mode to keep the canal permanently open, I advised her at the end of four months to give up further treatment. The canal closed again ; the tinnitus and autophony returned as before.

From the complete failure of the operation I concluded that the concentrated sulphuric acid which was poured in had reached and cauterized the whole extent of the ear-canal, including the drum-head. The subsequent cicatricial

occlusion must have been total. If this condition prevails, I am inclined to think that a restoration of the canal is next to impossible. I base this opinion on the fact that hitherto all our endeavors to accomplish so simple an object as to keep an artificial perforation of the membrana tympani permanently open have proved fallacious.

REPORT ON THE PROGRESS OF OTOLOGY IN THE SECOND HALF OF THE YEAR 1882.

I. — NORMAL AND PATHOLOGICAL ANATOMY AND HISTOLOGY OF THE EAR.

By Dr. H. STEINBRÜGGE, Heidelberg.

Translated by J. A. Spalding, M.D., Portland, Maine.

1. J. G. Wagenhäuser. Contributions to the anatomy of the temporal bone in children. *Archiv f. Ohr.*, vol. xix, part 2, p. 95.

2. Arthur Böttcher. Cotugno; the aquæductus vestibuli, and later authors on the membranous labyrinth. *Archiv f. Ohr.*, vol. xix, part 2, p. 148.

3. Eugene Fränkel. Further investigations concerning ozæna simplex. *Virchow's Archiv*, vol. xc, 1882.

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1. Wagenhäuser's contributions to the anatomy of the temporal bone in children are divided into two parts, the first of which discusses the fossa subarcuata; the second, "the petrosquamous fissure and the extension of the dura mater as a lining membrane of the tympanum." After summing up the data concerning the fossa subarcuata which have been given by other authors, particularly by v. Tröltsch, the author describes the progressive alterations which take place in this region at different periods of intra-uterine life and in newborn children, and illustrates them with plates.

The cavity which lies beneath the superior semicircular canal undergoes a considerable enlargement during the sixth and seventh months, and expands into a canal which reaches the

external surface of the skull, where it exhibits an orifice 5 *mm.* wide. The fossa does not enlarge at a later date, but on the contrary, in newborn children it again appears somewhat smaller, while its canal-like continuation to the outer surface of the skull is closed over by cartilage. The cavity retains its form up to the third or fifth year of life. The author then studied the topographical relations of the fossa subarcuata in the fœtus and young children from successive sections of the temporal bone made perpendicular to the longitudinal axis of the pyramid in a direction from inward outward. All of the sections of the dura mater which penetrated into the canal showed a larger vein and a smaller artery. Bands of connective tissue with numerous small vessels penetrate into the spongy wide-meshed bony substance almost as far as the semicircular canals, and further outward into the neighborhood of the antrum, without, however, taking any part in the lining membrane of this cavity. These conditions also are illustrated by sketches. Wagenhäuser here reminds us of the possibility lately suggested by Prof. Lucae, that morbid processes might be conducted from the interior of the skull to the labyrinths of children by means of these vascular bands of connective tissue, as well as of the importance of the vessels, which have just been described, in the nourishment and further development of the temporal bone of children.

The fact that the fossa subarcuata undergoes considerable enlargement in various animals, and even embraces a portion of the cerebellum, induced the author to extend his investigations amongst several mammals.

In the second portion of his work, the author mentions the sutures (mastoid-squamous, fiss. tympano-mastoid., petro-tympanica), which originate from the union of the individual portions of the temporal bone, and then describes in detail the fiss. petroso-squamosa, its origin by imposition of the tegmen tympani upon the squamous bone, and further, the process. inf. tegm. tympani which separates the fiss. petro-squamosa from the fiss. Glaseri, and the oblique fiss. tegm. tympani. The relations of the fibres of connective tissue which penetrate these fissures were studied in various sections, which are illustrated in a third plate by sketches from the temporal bone of a child of four years of age. The result shows that in newborn children, all along the entire course of the fiss. petro.-squamosa, a direct continuation can be discovered between the lining membrane of the cranial and

tympanic cavities, which in older children is interrupted by the development of the proc. inf. tegm. tymp. in the anterior portion of the tympanum, and these may extend from the middle of the tympanum to the cavities of the mastoid process. Hence, when the bony union of the fissure advances, the connection between the dura mater and interior lining membrane is limited to the posterior portion of the tympanum and the beginning of the antrum. In describing the extension of inflammatory processes from the tympanum, mention is made of a small vein which is visible in all of the sections just above the fissure. Inasmuch as the vein opens into the transverse sinus, it may lead to phlebitis and thrombosis. The propagation of morbid processes from the tympanum to the dura mater, as well as disturbances of nutrition in the bony tegm. tymp., which in such cases appears surrounded both above and below with diseased periosteum, are likewise emphasized.

In conclusion, the author reminds us of the extension of morbid processes in an inverse direction from the interior of the skull to the tympanum, and cites the case, published by Moos and the reviewer, on the formation of a neo-membrane in hemorrhagic pachymeningitis with these words : "The above-mentioned authors are inclined to oppose the propagation of a morbid condition from the dura mater to the tympanum by this process."

As this quotation might be misconceived by readers to whom the original of our work was unknown, as if this were simply a case of agreement concerning well-known points, we should like to define it more precisely by saying that our discovery of a neo-membrane in the middle ear is *unique*, and offers an entirely new argument in favor of a systematic connection between the cerebral membranes and the lining membrane of the tympanic cavity. In the darkness which still envelops the incipient stages of hemorrhagic pachymeningitis, we have no right to explain the participation of the tympanic mucous membrane in this morbid process as simply due to the *propagation* of an inflammation, just as happens in most suppurative inflammations of the tympanum due to infection. The formation of the neo-membrane was, therefore, purposely designated as one of the "*partial symptoms*" of the pachymeningitis, and it was also urged that the regional distribution of the middle meningeal artery, which sends the petrous branch to the tympanum through the Fallopian canal, must be considered in any explanation of the morbid process.[1]

[1] These ARCHIVES, vol. xi, p. 97.

The reviewer finally expresses the opinion that morbid processes are much less frequently transmitted from the interior of the skull to the tympanum, "and at all events this will be of slighter importance in a practical point of view." We cannot unreservedly assent to the first point, since the examination of the middle ear, as the author himself remarks, is usually neglected in making post-mortem examinations. So far as concerns the "practical point of view," nothing can be objected if the author is simply speaking of the indications for proper treatment. But at the close of our work we emphasized the fact that the objective examination of the ear in such cases might furnish important support for the *diagnosis* of pachymeningitis.

2. Böttcher protests against the various erroneous assertions concerning the relations of the aquæductus vestibuli and its connection with the saculi vestibuli, which have found reception in the text-books and journals. The great number of these errors forbids a detailed reference. But Böttcher is justified in reminding us that it was his investigations which first proved the connection of the aquæduct with both sacs, so that the importance of the same as an endolymphatic space originating from the epithelial labyrinthine vesicle was put beyond the question of doubt. The membranous portion of the aquæduct completely fills the bony canal, and consequently is not, as other authors urge, surrounded by a perilymphatic space. Just as little is there any communication of the perilymph with the dural space which the blind sac-like end of the aquæduct encloses.

3. Fränkel reports his various experiments at inoculation with the nasal secretion of a patient who had suffered for some time with simple ozæna. This girl, æt. seventeen, who had suffered since childhood with double otorrhœa, was treated with cotton tampons, by means of which the author was enabled to collect great quantities of nasal secretion. After the tampons had remained for two hours in the nose the secretion appeared like a clear neutral watery fluid, free from smell, and on microscopic examination showed only a few cellular elements and scattered micro-organisms. If the tampons remained for four hours, the secretion was more turbid, it smelt mouldy, and was slightly alkaline. If they remained from six to eight hours the secretion became dirty-yellow, and alkaline with an odor like the discharge in ozæna, while under the microscope it showed numerous cells and a large number of the lowest types of organisms in active

motion. The cells could be demonstrated partly as lymph-corpuscles and partly as structures like giant-cells, with numerous nuclei, which showed where subdivision had taken place, while other cellular bodies were discovered in a condition of regressive metamorphosis. When the micro-organisms had been tinted by the Koch-Ehrlich method, they could be distinguished as micro- and megalo-cocci, and further as delicate, slightly tinted, and coarser, deeply tinted rods. Transmission of the secretion to the nasal mucous membrane of rabbits (instilled or injected) did not produce any disease corresponding to rhinitis, nor did the introduction of the secretion beneath the eyelids produce any catarrhal conjunctivitis. But injections into the subcutaneous tissues were followed by fatal phlegmon. The author defends his former opinions concerning the fetor in the secretion against Bosworth, Herzog, and Bresgen, and insists once more that the micrococci can only give rise to fetor when they reach a nasal secretion which has undergone a change in its chemical composition by the disappearance of Bowman's glands. It is from this point of view also that the favorable action of the treatment by tampons can be explained. Fränkel, however, recommends that the tampons should be renewed every six hours in difficult cases, lest in them, also, the collected secretion should undergo decomposition. In less severe cases the tampons can be left in the nose overnight. These experiments prove further that the micro-organisms found in the secretion are not pathogenous. The fatal result in experiments with animals was due to septicæmic processes, for only a few bacteria were found in the blood, while in the pus of the animals it could not be proved that the rods had undergone multiplication.

Rhinitis atrophica occupies an exceptional position amongst diseases of the nasal mucous membrane, since it is rarely accompanied by a disease of the ear. But if from any reason an aural affection becomes associated with this type of rhinitis, it behaves in a most obstinate manner toward any and every treatment. Under such circumstances, therefore, the prognosis is rendered very much more unfavorable by the associated disease of the nose.

After describing the pharyngitis sicca which sometimes accompanies ozæna simplex, and usually makes its appearance with atrophy of the glands of the mucous membrane, Böttcher gives us an account of the post-mortem conditions in a man who had died of pernicious anæmia at the age of twenty-five, having suf-

fered since childhood with an offensive discharge from the nostrils. The mucous membrane of the nostrils, both of which were very capacious, was reddened and partially slate-colored ; both of the inferior turbinated bones were atrophic and discolored, whilst offensive masses of secretion were found in the nose. The most important alterations were visible on microscopic examination. The olfactory region showed remarkable changes, for Bowman's glands had for the most part disappeared, and the tissue of the mucous membrane had undergone infiltration with small cells, while both the vessels and nerves were normal and the epithelial layer preserved. The acinous glands in the respiratory tract were normal, but a portion of the mucous membrane in the same district was also infiltrated with small cells. No loss of substance could be detected.

Fränkel is therefore of the opinion that the destruction of Bowman's glands is the chief factor in the origination of the offensive odor ; the function of the acinous glands of the respiratory tract alone does not suffice to protect the nasal secretion from the decomposing action of micro-organisms. The author finally describes the operative methods which have been recommended for the cure of ozæna : amongst others, scraping the nose with the sharp spoon, as practised by Bovel, as well as the total removal of the inferior, with partial resection of the middle, turbinated bone, which has been recommended by Volkmann. Fränkel prefers the milder action of the galvano-cautery to the scraping method. So far as concerns Volkmann's operation, which does not take proper account of the foundation and nature of the disease, since the disagreeable odor persists even after subsequent atrophy of the turbinated bones, further experience is demanded before we can ascribe to this method the effect of a radical cure.

II.—PATHOLOGY AND THERAPEUTICS OF THE EAR.

By A. HARTMANN, Berlin.

Translated by J. A. Spalding, M.D., Portland, Maine.

A.—GENERAL.

1. K. Bürkner, Göttingen. Progress in the treatment of diseases of the ear during the last ten years. *Arch. f. Ohr.*, vol. xix, p. 1.

2. L. JAKOBSON. Report of the aural patients examined and treated at Prof. Lucae's clinic, from April, 1877, to April, 1881 *Ibid.*, p. 28.

3. WAGENHÄUSER. Report of the aural clinic at Würzburg for the years 1880 and 1881. *Ibid.*, p. 55.

4. KIRK DUNCANSON. Report of the ear dispensary. *Edinburgh Med. Jour.*, October, 1882.

5. AGNEW and WEBSTER. Clinical contributions to otology. These ARCHIVES, vol. x, p. 335.

6. R. SCHALLE, Hamburg. On aural and naso-pharyngeal diseases, and some of their methods of treatment. These ARCHIVES, vol. xi, p. 113.

7. VOLTOLINI. On the use of quinia in aural affections. *M. f. O.*, No. 10, 1882.

8. EULENSTEIN, Erlangen. Affections of the ear during the course of ilio-typhoid fever. *Inaugural Dissertation*, 1882.

9. WEIDENBAUM. On the diagnosis of deafness in recruits. *St. Petersburg med. Wochensch.*, No. 32, 1882.

10. VOLTOLINI. On the simulation of deafness. *M. f. O.*, No. 9, 1882.

11. MCBRIDE. The causes of tinnitus aurium. *Med. Times and Gazette*, Aug. 26, Sept. 16, 1882.

12. R. C. BRANDEIS. Two cases of tinnitus aurium, due to disturbances in the current of the cervical blood-vessels. These ARCHIVES, vol. xi, p. 155.

13. WALB, Bonn. Boracic acid as an antiseptic. *Centralbl. f. klin. Med.*, No. 34, 1882.

14. A. LUCAE. On disinfective precautions in the use of the air-douche. *Arch. f. Ohr.*, vol. xix, p. 132.

15. CRESWELL BABER. A waistcoat-pocket aural reflector and set of specula. *The Lancet*, Sept. 2, 1882.

16. GEORGE ABBOT. New aural forceps. *Ibid.*, Aug. 26, 1882.

17. BARATOUX. Audiometers. *Rev. mens. de laryng. d' otol.*, etc., No. 8, 1882.

18. A. BURCKHARDT-MERIAN, Basel. One hundred schematic tables for drawing the observed conditions of the ear. Benno-Schwabe's Verlag, Basel, 1883.

19. MOOS, Heidelberg. Etiology and condition of forty cases of congenital deafness. These ARCHIVES, vol. xi, p. 299.

20. F. KARSCH. Statistics of deaf-mutes in the Palatinate. *Friedreichische Blätter f. ger. Med.*, vols. ix and x, 1882.

21. J. A. CAMPBELL. Helps to hearing. 8vo., pp. 108. Chicago: Duncan Bros., Publishers, 1882.

22. L. TURNBULL. Importance of careful examination of the ears in effecting life insurance. *Virginia Med. Monthly*, Sept., 1882.

23. C. J. KIPP. Deafness accompanying sparkling synchysis of the vitreous. *Trans. Am. Otol. Soc.*, 1882.

24. R. C. BRANDEIS. Exhaustion versus inflation. *Trans. Am. Otol. Soc.*, 1882.

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1. BÜRKNER'S review of the progress in the treatment of diseases of the ear, in the last ten years, is about complete, and, on the whole, embraces all that is essential. But his judgments are not always to be assented to. Thus, in his description of paracentesis of the *Mt*, it would seem as if this operation were something that had been devised in the *last* ten years, while it is plain, even from Frank's old hand-book, that this operation was performed long ago, under about the same indications as to-day. Frank even recommended it in the case of small children, just as is now done by Bürkner. Beyond this, we must emphatically protest against Bürkner's criticism of electro-therapeutics: "On the whole, aural surgeons are generally unanimous in rejecting the therapeutical value of electricity." In opposition to this we might quote what Erb says[1] of Brenner, that "his services cannot be diminished by the defective knowledge and jealous opposition of aurists of even the greatest renown, who would gladly rejoice if they could silence such important facts." Favorable results[2] from the use of electricity have been reported, especially by Hagen, Moos, Politzer, and Urbantschitsch.

2. JAKOBSON'S report of the Berlin University Policlinic extends over a period of three years and a half. Preliminary remarks are made upon the value and defects of all statistical tables. Four thousand and seventy-nine patients with four thousand and seven forms of disease were treated. A few cases are reported in detail, amongst them one (No. 4) of a cancroid of the ear, which was partially removed with the sharp spoon, but reappeared. It ceased, however, to spread after being repeatedly and thoroughly syringed, and then dusted over with *herba sabin. pulv. and alum. ust. pulv.;* ana. Amongst other cases we may notice two in which

[1] "Handbuch der Electrotherapie," 2te Hälfte, p. 620.

[2] See cases from V. Tröltsch's Policlinic, *Arch. f. O.*, vol. xix, part 1, p. 58.

subjective noises were caused by muscular contractions. One of the patients complained of ringing in the ear whenever he nipped his eyelids together, while simultaneous incurvation of the *Mt* could be seen by the naked eye and demonstrated by the manometer. The ringing is to be referred to contraction of the tensor tympani muscle. The second patient heard a brief ringing, like c^4, when he snapped his teeth together. When contracting the masticating muscles (the teeth being closed) he heard a roaring on both sides. The phenomenon was explained as depending upon some associated movement of the intrinsic muscles of the ear.

Lucae's method of testing the hearing with tuning-forks of various pitch, both by aërial and bone-conduction, is next cited, and Dennert's views especially criticised. Jakobson also regards a total and irregular diminution of the perceptivity for various tones of the scale, as diagnostic of disease of the sound-perceiving apparatus.

In case of regular diminution, or if lower tones are heard better than high, or inversely, with symmetrical decrease or increase, as we go up or down the scale, Jakobson thinks that it is impossible to make an accurate diagnosis between diseases of the sound-conducting and sound-perceiving apparatus. He lays less stress upon the comparison of aërial and bone-conduction than upon disproportional diminution of perception for high tones, which, in his opinion, allows us with great probability to diagnosticate nervous deafness. The prognosis in cases of the latter variety is very unfavorable.

The last pages of the report give the result of therapeutical experience, especially in the treatment of suppuration of the middle ear. In a great majority of these cases, especially in those which are acute, Prof. Lucae abstains from syringing and the use of the air-douche through the tubes. He is satisfied with simply cleansing the inner ear through the external meatus. The secretion is held in check by boracic acid, iodoform, and herba sabina with alum. Good results were obtained in cases of caries by the instillation of a one- or two-per-cent. solution of copper sulphocarbolate.

Jakobson reports beneficial results from the internal administration of gelsemium and paullinia. Fifteen to twenty drops of the tincture of the former were given in case of violent neuralgic pains, which were independent of the inflammatory symptoms;

while the latter was used in the form of powder (0.40) in case of headaches during the course of the ear-disease.

3. 307 ear-patients were treated at the Würzburg Policlinic in the years 1880, 1881. Amongst the clinical cases described, we may mention one of double othæmatoma, which, without apparent cause, developed itself at a symmetrical point on both auricles. A female patient complained of a roaring noise which was isochronous with the heart and objectively perceptible. It became much louder after resort to the catheter, and diminished after pressure on the carotid artery. After excluding all other possibilities, WAGENHÄUSER thinks himself justified in locating the original starting point of the noise in the internal carotid artery.

4. KIRK DUNCANSON simply gives statistics of the cases that he has treated.

7. VOLTOLINI, who has had great experience, thinks that it is a misdemeanor (!) to give large doses of quinia in intermittent fevers, on account of the possibility of producing quinine-amaurosis or deafness. He recommends smaller doses for longer periods, and assures us of obtaining better results.

8. The facts upon which EULENSTEIN'S dissertation is founded were collected by Bezold in Ziemssen's clinic at the Munich hospital. After close examination for a year, no typhoid patient had ever shown the characteristic symptoms of catarrhal processes of the tubes, incurvation of the *Mt*, etc. Amongst 1,243 cases of typhoid, there were found 56 cases of diseases of the middle ear, divided as follows: 41 of suppuration, 2 of otitis media with tubal symptoms, and 7 of inflammation without perforation and without incurvation of the *Mt*. Nineteen cases showed sensitiveness over the mastoid process, and in five of these an incision had to be made. The author thinks that the affection of the middle ear is purely local,—though caused by the general affection,—and notices that it began about the twenty-fifth or thirty-fifth day of the fever, appearing, however, in three cases previous to the twentieth day. The prognosis is generally favorable.

The central or nervous form of the aural affection, with negative diagnostic points, is independent of the catarrhal process, and may be a sequence of blood-crasis or paresis of the nerve. Mention is also made of the inflammatory alterations in the labyrinth already demonstrated by Moos, as well as the deafness caused by various anti-pyretics.

9. WEIDENBAUM recognizes total deafness as well by the facial

expression and peculiarity of speech, as by suddenly awakening malingerers from sleep, or speaking to them while they lie in the incipient stages of chloroform narcosis. Deafness in moderate amount is proved by the usual methods of examination.

10. VOLTOLINI describes his method of discovering simulated one-sided deafness. He employs a large trumpet-shaped ear-tube, and puts it into the asserted deaf ear of the patient, while the healthy ear is left open. The simulation is discovered by the patient declaring that he cannot hear at all. In order to conceal, the deception still further, a *hollow* plug or tube of horn or rubber, through which the simulant can hear, may additionally be placed in the healthy ear. A case in which the simulation was thus demonstrated is appended.

11. MCBRIDE refers to the literature on the subject, gives full details of the causes of subjective noises in the ear, and comes to the following conclusions: 1. Hyperæsthesia of the auditory nerve is never the direct, but may be the predisposing, cause. 2. The ear ought to be examined in every case in which the cause of the noises is doubtful. 3. The noises can be caused under the greatest variety of circumstances, but auto-perception of the labyrinthine circulation is a very frequent factor. 4. In certain cases the ophthalmoscope may help us to decide by analogy whether the labyrinth is anæmic or hyperæmic. 5. The treatment, of course, depends upon the cause as deduced from the prevalent symptoms.

13. WALB experimented upon the antiseptic action of boracic acid, and discovered that it, to a certain degree, prevented putrefaction and the formation of mould. The experiments were made with freshly prepared fibrine free from hæmatoxylin. Without the addition of boracic acid, colossal bacteria were present, but there was no formation of mould; with a 0.2-per-cent. solution of the acid added, slight formation of bacteria, but no mould; with a 0.4-per-cent. solution, first the formation of mould, then the putrefaction, after which the mould underwent regressive metamorphosis.

When a 1-per-cent. or a stronger solution was added, the putrefaction was completely checked, while the formation of mould continued. Boracic acid, therefore, influences the formation of bacteria only, but not that of mould. Its use is consequently indicated in otitis externa, depending upon the formation of bacteria (as denoted by the smell of decomposition), while in otomycosis it is of no avail.

14. Lucae connects Zaufal's disinfection capsule for the air-douche directly with the silver catheter. For disinfection he resorts to boiling heat, letting the silver catheter remain all the time in boiling water.

15. Baber describes an ear-mirror and specula that can be carried in the waistcoat-pocket.

16. Abbot's ear-forceps are intended by their easier manipulation to be preferable to those commonly in use.

17. Baratoux describes the audiometers previously employed, and mentions Boudet's as he has modified it. He retains the rheostat and telephone, but omits the microphone. An electric tuning-fork serves to interrupt the current. Baratoux has therefore simply returned to the arrangement which was made by the reviewer so far back as 1878.

18. Burckhardt-Merian sends us a little book containing on each leaf—which can easily be torn out—a picture of the *Mt* with horizontal and perpendicular sections of the organ of hearing, one for each ear. The idea is to use them for drawing the condition of the parts for clinical instruction and consultations, as well as for the aurist's own use in his note-books, They appear to us to be of great practical value.

20. Karsch collected the statistics of 633 deaf-mutes in the Palatinate. Of these 340 were male, 293 female. 469 (75 per cent.) were normal, in a mental point of view ; 110 (17 per cent.) weak-minded, but capable of education, and 54 (8 per cent.) more or less idiotic. Most of the latter were advanced in age. 325 cases (51 per cent.) were supposed to be congenital, 308 acquired. In about two thirds of the latter cases the deafness was referred to diseases of the brain. The epidemic, spinal meningitis, plays the chief rôle in these cases, for it was a widely spread disease in the Palatinate in the years 1864–5, 1871–2, and in 1874–5. 68 deaf-mutes had disturbances of sight, but no accurate examinations were made to discover pigmentation of the retina. A large number of the deaf-mutes were poorly developed, in a bodily point of view, 35 being rhachitic, and 38 scrofulous. In 9 marriages, which resulted in 11 deaf-mute children, the father was deaf in 7, the mother in 2, while in no case were the parents themselves deaf-mutes. There was only one case in which of the grandparents one (the mother of the father) was a deaf-mute, and in this case it was not stated whether her condition was congenital or acquired. Of those deaf-mutes who were still living, 10 with healthy wives

and 2 with deaf-mute wives had begotten 25 children. 22 unmarried and 5 married women with healthy husbands had borne 42 children. Of the 67 children with 5 grandchildren, not one was a deaf-mute, and of the 58 who were still alive there was not one that could be called really unhealthy. Particular attention is paid by the author to the influence of blood-relationship in the parents. In his statistics, also, the marriages of relatives are much more extensively represented than appears in the tables of percentages. Amongst the parents of deaf-mutes were found 63 (11 per cent.) who were as closely related as first or second cousins. These gave birth to children, 69 of whom were born deaf and 26 became deaf, *i. e.*, 14 *per cent. of the entire list of deaf-mutes.* 17 of the deaf-mutes were of low mental development, 5 incapable of being educated, 1 albino, 2 hemeralopic. Twelve of the others were otherwise diseased.

Eserichs' hypothesis that deaf-mutism is more frequent in older formations than younger has not been confirmed in the Palatinate. Nor is there any support in these statistics of Mayr's supposition, that the frequency of deaf-mutism stands in inverse ratio to the mortality in children. The social conditions of the deaf-mutes were very unfavorable, probably from their own extreme lack of development. We have mentioned the chief points of this paper, but are obliged for lack of space to refer our readers to the valuable original.

21. J. A. Campbell. Though mainly intended for the laity, this little book contains in a condensed form some information which the practising otologist will find of value. He will be particularly interested in the description of the mechanical aids to hearing. All the forms of ear-trumpets are described and figured, and the principle of their action explained, as well as the audiphone, dentaphone, audinet, and osteophone. A description of the telephone is added. This is one of the few popular books which has a value and a *raison d' être.* Burnett.

22. Turnbull calls attention to the fact that in this country the attention of insurance companies is not directed to ear-diseases to such an extent as their importance demands. Aside from the deaths which are likely to arise from the propagation of inflammation from the middle ear to the brain, there are those of accident to which the impaired hearing of the individual particularly exposes him. It is estimated that there is in this country one death from this cause alone every day. T. advises that the

following questions be answered by every applicant for life insurance: (1) Are you suffering from any form of disease of the ear? (2) Have you pain, noises, or dizziness, or any discharge from the ear? (3) Are you at all deaf? BURNETT.

23. KIPP has noticed that in a number of cases of sparkling synchysis there was deafness more or less complete in one or both ears. BURNETT.

24. BRANDEIS. After enumerating some of the disadvantages and even dangers of Valsalva's and Politzer's methods of inflating the middle ear, as well as those attending the use of the catheter, B. recommends the employment of Siegle's pneumatic speculum as an exhauster of the air in the meatus in certain cases where other means are not admissible or are attended with unpleasant results. BURNETT.

B.—EXTERNAL AUDITORY MEATUS.

25. W. KIESSELBACH. Attempt to form an external auditory meatus in a case of congenital malformation of both auricles with absence of the external meatus. *Arch. f. O.*, vol xix, p. 127.

26. H. KNAPP. Congenital fibrous closure of the auditory meatus; opening frustrated by hæmatophilia. These ARCHIVES, vol. xi, p. 19.

27. A. DUCAU. On a little-known cause of deafness. *Rev. mens. de laryng. et d' otol.*, No. 12, 1882.

28. A. DUCAU. A prune-stone lodged in the ear for thirty-three years. *Ibid.*, No. 7, 1882.

29. A. POLITZER. Parasitic inflammation of the external auditory meatus. *Wien. med. Wochensch.*, No. 29, 1882.

30. A. H. BUCK. A case of foreign body in the external auditory canal; removal by displacement forward of the auricle and cartilaginous meatus. *New York Med. Record*, Dec. 16, 1882.

31. SAM'L THEOBALD. Complete closure of both external auditory canals following otorrhœa. *Trans. Am. Otol. Soc.*, 1882.

32. C. H. BURNETT. On the growth of aspergillus in the ear, with a case of the rare form of the parasite, the aspergillus glaucus. *Philadelphia Med. Times*, Nov. 4, 1882.

33. C. J. BLAKE. The progressive growth of the dermoid coat of the membrana tympani. *Am. Journal of Otol.*, Oct., 1882.

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25. KIESSELBACH reports the case of a child aged six months, with a malformation of the auricle which, in the mother's opinion,

must have been due to pressure exercised by the umbilical cord. Both auricles were mutilated, the left more noticeably than the right. The tragus on the right side was very indistinct to the touch, while behind it lay a little hollow which appeared to designate the entrance to the external meatus. The operation was attempted upon this (right) side. Kiesselbach's motive in performing the operation was that, according to Bremer, this condition of the parts is probably not a simple rudimentary development, but one acquired in the early part of intra-uterine life by external pressure, so that it was quite possible "in a wholly horizontal position of the embryonal *Mt* that the external portion of the meatus does not undergo total closure." Inasmuch as the bony meatus may become developed in an incorrect direction, owing to the altered conditions of pressure and tension, operative interference at an early age appears justifiable. An incision into the hollow before mentioned led down to the subcutaneous fat. On pressing deeper inward to the periosteum no trace of any external meatus could be discovered. The incision was then extended to the lower edge of the squamous portion, from which a fine sound could be pushed into a narrow crevice. The latter was then enlarged forward and backward, until by examination with the sound, the annulus tymp. appeared to have been laid bare. A flap of skin from the auricle was pushed into the incision and fastened by sutures, one of which struck the trunk of the facial nerve. On the twelfth day after the operation the child was taken away by the mother, who was satisfied with what had been done, "for the child was much more sensitive to noises than before." This attempt to create an auditory canal may therefore be said to have miscarried.

27. Ducau speaks of the frequent cases of contraction of the external meatus from wearing handkerchiefs over the ears, so that the auricles undergo constant compression. While v. Tröltsch believes that there are cases of relaxation of the fibrous filaments which fix the cartilage, Ducau thinks that the trouble lies in a flattening of the auricles against the skull, so that they become unfitted for collecting the waves of sound, whilst the tragus, which acts like a cover placed over the entrance to the meatus, offers further obstacle to the entrance of sound. Since instruments cannot long be borne, Ducau advises that a more permanent enlargement of the meatus be obtained by the introduction of laminaria bougies.

28. Ducau reports the case of a plum-stone, which after remaining in the ear for thirty-three years, without causing any pain or inconvenience, was easily removed by syringing.

29. Politzer briefly depicts the symptoms of otomycosis much in the same way as in his hand-book. The most reliable treatment is the use of rectified alcohol as recommended by Hassenstein. The alcohol is used twice daily, being poured into the ear after the removal of the fungoid masses, and allowed to remain at least fifteen minutes. If the remedy causes violent pain, it should be diluted with distilled water.

30. Buck. The foreign body was a locust bean which had become firmly impacted in the bony portion of the meatus, but did not touch the *Mt.* All efforts to remove it through the meatus having proved futile, the auricle and cartilaginous meatus were moved forward, and a hook introduced at one side between the bean and the canal and there turned at right angles. Very forcible traction finally brought it away. The author is inclined to think that in this case the setting forward of the auricle was of but little advantage in getting at the foreign body, and that the removal was finally effected only because a greater amount of force was used than before. These beans are smooth and very hard, and no impression can be made on their surface unless the instrument be applied at right angles to the surface. Hence the difficulty in securing sufficient purchase for the hook to bring it away readily. A drawing of a hook suitable for such cases is given. Burnett.

31. Theobald. Upon each side of the normal meatus there was a cul-de-sac 2 *cm.* deep on the right side and 1.7 *cm.* on the left. Instead of either canal reaching to the *Mt*, they both terminated in a smooth concave floor which was covered with an integument continuous with that of the meatus. Loud voice was heard in the right ear at 6′, in the left ear at 9′. Tuning-fork heard better in left ear. Burnett.

32. C. H. Burnett. The aspergillus glaucus is the name given by Burnett to the form usually known as A. flavescens. He has seen only three cases of it. In treatment he has abandoned the alcoholic method, and now uses boracic acid, borax, boracic acid with chinoline, or with resercin. Burnett.

33. Blake. A series of experiments extending over a period of five years has shown that the growth of the dermoid layer of the *Mt* takes in general a certain definite direction. Thus,

five small discs of paper placed on the surface three above and two below the malleus handle, all finally reached the periphery upward and forward—never downward or backward. A diagram is given showing the path followed by each disc. BURNETT.

C.—MIDDLE EAR.

34. J. BARATOUX. On perforation of the membrana tympani, etc. *Rev. mens. de laryng.* etc., No. 11, 1882.

35. LUDWIG STACKE. On chronic suppurative processes in the middle ear, and their complications. *Inaugural Dissertation.* Rinteln, 1882.

36. THOMAS BARR. The treatment of certain forms of suppuration of the middle ear. *Glasgow Med. Jour.*, No. 5, 1882.

37. OLIVER MOORE. Acute exacerbation of a chronic suppurative inflammation of the middle ear, etc. These ARCHIVES, vol. xi, page 25.

38. S. MOOS. Œdema in the temporo-zygomatic region as a symptom of phlebitis and thrombosis of the lateral sinus. These ARCHIVES, this number.

39. S. MOOS. Pyæmic accidents in the course of and after the cure of an acute suppurative inflammation of the tympanum. These ARCHIVES, this number.

40. S. MOOS. Cholesteatoma of the mastoid process, with acute perforation into the external meatus after the use of Irish Roman baths. Perfect recovery. These ARCHIVES, this number.

41. EITELBERG. Cases of periostitis and caries of the mastoid process. *Wien. med. Pres.*, No. 46, 1882.

42. S. MOOS. Necrotic exfoliation of a bony semicircular canal (superior ?), preceded for eight days by vertigo and vomiting. Recovery with loss of the previous remnant of hearing. These ARCHIVES, this number.

43. DESPRÈS. Otitis interna. Suppuration of the mastoid cells. Trephining. *Gaz. des hôpitaux*, No. 46, 1882.

44. H. KNAPP. Trephining of the mastoid in a case of otitis catarrhalis chronica, with intact membrana tympani. Opening of the transverse sinus. Recovery by first intention. These ARCHIVES, vol. x, page 365.

45. T. H. GLUCK. A case of trephining of the pyramid of the petrous bone. *V. Langenbeck's Archiv*, vol. xxviii, page 556.

46. WEBER-LIEL. An apparatus for washing out masses of suppurative, thickened, or cholesteatomatous material from inacces-

sible, sinuous, and carious regions of the middle ear, and external auditory meatus. *M. f. O.*, No. 7, 1882.

47. T. M. Pierce. A case of extensive disease of the left temporal bone with cerebral hernia. These Archives, vol. xi, page 313.

48. S. Pollock. An artificial membrana tympani made of elastic collodion. *St. Louis Med. and Surg. Jour.*, Oct., 1882.

49. H. Knapp. On the treatment of aural polypi. *Trans. Am. Otol. Soc.*, 1882.

50. C. S. Merrill. A case of acute middle-ear-inflammation, with death on the fourth day, from extension of the disease to the brain. *Trans. Am. Otol. Soc.*, 1882.

51. O. D. Pomeroy. The use of soft india-rubber drainage-tubes in chronic suppurative inflammation of the tympanum, with narrowing or closure of the meatus externus. *Trans. Am. Otol. Soc.*, 1882. Reprinted in *Am. Jour. of Otol.*, Oct., 1882.

52. R. J. McKay. Aural polypus, facial paralysis, mastoiditis, and chronic meningitis, with recovery from the latter. *Trans. Am. Otol. Soc.*, 1882.

53. A. Mathewson. A case of abscess of the cerebellum following otitis media, months after apparent cure. *Trans. Am. Otol. Soc.*, 1882.

54. C. S. Turnbull. Powdered boracic acid in the treatment of chronic purulent inflammation of the middle ear (otorrhœa). *Trans. Penn. State Med. Soc.*, 1882.

55. T. A. Downes. Chronic otitis media purulenta ; its treatment in the Presbyterian Hospital, Philadelphia. *Am. Jour. of Otol.*, Oct., 1882.

56. C. H. Burnett. Further observations on the usefulness of chinoline-salicylate in otorrhœa. *Am. Jour. of Otol.*, Oct., 1882.

57. D. I. Reynolds. Otitis media purulenta. *Med. Herald*, Nov., 1882.

58. Erastus E. Holt. Boiler-maker's deafness, and hearing in a noise. *Trans. Am. Otol. Soc.*, 1882.

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34. Baratoux gives a general view of the various sorts of perforations of the *Mt*, and the conditions with which they may be mistaken. The cure of perforation is next discussed. Atrophic spots and cicatrices can sometimes be distinguished from one another by the fact that the former are generally triangular, while the

cicatrices are round. Atrophic patches are usually situated in the superior and posterior portion of the *Mt.* Calcareous deposits and inflammatory processes on the opposite side indicate cicatricial formation. A case is communicated in which Baratoux was able to improve the hearing and stop the tinnitus, after repeated application of the galvano-cautery.

35. STACKE'S dissertation contains a very comprehensive symptomatology of suppurative inflammations of the middle ear, and their complications, with abundant literary references. He communicates a case of suppurative otitis media with formation of cholesteatoma, which ended fatally by inciting meningitis and thrombosis of the sinus.

36. BARR pays attention to suppurative processes of the middle ear which resist the usual methods of treatment. He enters very minutely into those anatomical relations of the parts which tend to retain the products of suppuration in the upper portion of the tympanum and in the mastoid process, and consequently make these regions inaccessible to the usual therapeutic treatment as well as to syringing through the auditory meatus. Barr uses for this purpose a particular kind of syringe, which is depicted in the original. After removal of the deposits, Barr employs solutions of silver nitrate and insufflations of boracic acid. Three successful cases after this method are added.

41. EITELBERG communicates a case of caries appearing simultaneously in both mastoid processes, pleads urgently in favor of Wilde's incision, with subsequent removal of the sequestrum through the incision, and supports this by four additional cases. The opening in the mastoid process, when indicated in serious cases, should be done as Schwartze urges, at the spot where spontaneous opening generally takes place. This situation, however, in opposition to Schwartze's theories, he found only twice in fifteen cases at the insertion line of the concha, and once just a trifle above the linea temporalis.

43. DESPRÈS describes a case of acute inflammation of the middle ear, otitis interna as he styles it, with violent pain and raging fever. The treatment in the preliminary stage was confined to syringing warm water into the nose. The case soon grew worse, with high fever, great swelling, and extension of the disease to the cells of the mastoid process. As Valsalva's experiment did not succeed, Desprès concluded that the *Mt* was not perforated. He thinks that the plan of catheterizing in cases of exudation in the

tympanum, as proposed by aurists, is perfectly useless. The mastoid process was trephined, and a large amount of laudable pus evacuated. The inflammatory symptoms underwent rapid retrogression. When the patient was discharged there was but a slight serous secretion from the mastoid incision. Flax-seed poultices were the only external application.

It appears to us that the views expressed by Desprès justify the unfavorable opinion of René de Calmette on the diffusion of otology in France, an opinion for which he was violently attacked by his fellow-countrymen.

45. Gluck attempted on the cadaver to ligate the internal carotid in its canal, and succeeded in fifteen cases in chiselling out the artery in its whole course, without wounding the jugular vein or the transverse sinus. He therefore believes that, in conditions which demand trephining of the mastoid process, we can gain a more radical cure by resection of the pyramid of the temporal bone with the chisel. The author subsequently had an opportunity of proving in a case that such an operation was feasible. A patient with chronic suppuration of the middle ear was suddenly attacked, after previous and repeated hemorrhage from the right ear, with violent headache, sudden fainting, convulsions, and amaurosis, which were followed by a soporous condition, facial paralysis, and paralysis of the right arm. A collection of pus between the dura and pia maters, as a result of the otorrhœa and erosion of the internal carotid, appeared to be the probable condition, and was thus diagnosticated. After chiselling away the posterior wall of the meatus, a portion of the mastoid process and of the temporal bone, the dura mater was extensively exposed, as a bluish, tightly-stretched, fluctuating sac. The dura mater was then opened, whereupon about 60 *grm.* of thick fetid pus which had lain between the dura and the pia escaped. The finger could be pushed up into the cavity as far as the internal occipital protuberance. Death ensued on the following night. At the post-mortem examination the dura mater was found sunken into the slightly concave surface of the brain upon the operated side, while its inner surface, from the longitudinal sinus to the base of the brain, was covered with an adherent layer of pus. The base of the skull was unaltered. There does not seem to have been any accurate examination of the ear, from which, however, the disease had its starting-place.

46. Weber-Liel cleanses the tympanum and its cavities with

v. Tröltsch's atomizing apparatus, to which small curved tubes are to be attached as necessity demands.

48. POLLOCK's patient was first placed in a perfectly horizontal position, and three drops of a solution of tannin in glycerine were instilled, and on top of that three drops of collodion. In a few minutes solidification was effected. It was a strong and solid membrane, and vibrated in Valsalva's experiment.

49. The substance of KNAPP's paper is incorporated in the author's article : "Report of 806 cases of ear-disease occurring in private practice," etc., published in the September number of these ARCHIVES for 1882.

50. MERRILL's patient was a man thirty-two years of age, affected for the first time with acute ear-catarrh. Death took place four days after the appearance of the first ear-symptoms. On examination after death, perforations were found through the roof of the middle ear and underneath the dura, and on it were a few drops of greenish pus. There was evidence of acute meningitis. BURNETT.

51. POMEROY. The closure of the meatus, preventing a ready outlet for the matter in the drum cavity, forms one of the greatest obstacles in treating certain forms of middle-ear disease. This is most commonly found, P. thinks, in children. To obviate this he uses drainage-tubes of rather soft rubber, beginning with the smaller sizes, but the largest which the meatus will admit. To introduce it, it should be stretched longitudinally by drawing it over a probe so as to diminish its transverse diameter. This is then carefully introduced until its end reaches the drum cavity, when the probe is withdrawn, and the tube returns to its normal diameter. The outer end of the tube is cut off close to the concha. The tube can be withdrawn at any time by means of a forceps. Under the lateral pressure exerted by the tube, the swelling of the canal usually gives way and the tube becomes loose. It must then be replaced by a larger one. Through these tubes the middle ear can be easily cleansed and any desired medication carried out. Seven cases in which it was used with benefit are related. BURNETT.

In the discussion which followed the reading of the paper, some members, including the President (Dr. J. O. Green), and Dr. Knapp, expressed a preference for a silver tube in drainage of the middle ear. BURNETT.

52. MCKAY. In addition to his other troubles, the patient had a papillitis of the left eye, and there was considerable congestion of the right disc. BURNETT.

53. MATHEWSON's patient was a child eleven years of age, whose left ear was affected with a necrosis of the mastoid and a purulent discharge. Under treatment these symptoms disappeared, and the child was discharged cured in December, 1880. On the 14th of March, 1881, there appeared suspicious head-symptoms, but on examination, the ear was found about as it was when the patient was discharged. The O. S. showed some fulness of the retinal veins, but nothing else abnormal. After a brief convulsion the child died on the 16th of March. On post-mortem examination, the veins and sinus were found filled with fluid blood; there was injection of the meninges, and adhesions at points over the petrous portion of the temporal bone. Some pus under the dura, over the tegmen tympani, and in the sheath of the 5th pair, and an abscess containing an ounce of fetid pus in the left lobe of the cerebellum. BURNETT.

54. Since TURNBULL has adopted the boracic-acid treatment for purulent inflammation, it has become a pleasure to him to handle such cases, so uniform has been his success in treating this class of diseases which before had been to him only objects of despair. BURNETT.

55. DOWNES. The cases, four in number, were under the charge of Dr. C. H. Burnett. The syringe is used for cleansing when the discharge is abundant, and cotton on a probe when it is scant, and powdered calendulated boracic acid blown in in just sufficient quantity to cover the diseased surface. BURNETT.

56. C. H. BURNETT finds the salicylate of chinoline, concerning which he first wrote in vol. iv, No. 2, of the *American Journal of Otology*, a valuable adjuvant to boracic-acid powder. BURNETT.

57. REYNOLDS believes in constitutional treatment in addition to local. The latter consists principally in the application of Listerine (a compound of boracic acid, eucalyptus oil, thymol, and some other less important substances), after a thorough cleansing of the parts by means of the syringe and the catheter. BURNETT.

58. Among the men employed in the steam-boiler factory at Portland, Me., forty were hard of hearing and examined by Dr. Holt. He found the deafness due to changes of a catarrhal nature in the sound-conducting apparatus, the incessant noises agitating the chain of ossicles and producing more or less anchylosis in their joints. Bone-conduction in these patients was as good as in normal ears. The better hearing in noises, which was

claimed by over 100 of his patients, was subjected to various tests, and proved, according to the author, to be a self-deception, based upon the raising of the voice, which the speakers in a noise did instinctively. The noise never improved the hearing in any of the cases that had been tested. BURNETT.

D.—NERVOUS APPARATUS.

59. BRUNNER. A case of complete unilateral deafness after mumps, etc. These ARCHIVES, vol. xi, p. 102.

60. J. SEITZ. Deafness after mumps. *Corresp. f. Schweiz Aerzte* No. 19, 1882.

61. E. J. MOURÉ. Case of total deafness after mumps. *Rev. mens. de laryng. d' otol.*, etc., No. 10, 1882.

62. Extensive fracture of the base of the skull in an infant. Escape of cerebro-spinal fluid from the ear. *Medical Times*, No. 1684, 1882.

63. WILLIAM JAMES. Sense of dizziness in deaf-mutes. *Amer. Jour. of Otol.*, Oct., 1882.

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60. SEITZ communicates a case of deafness after mumps which is analogous to that of Brunner. The patient was a student aged nineteen, in whom deafness had appeared on the right side thirty-six hours after an attack of mumps, which had ceased on the sixth day. The deafness was accompanied with a loud roaring and rushing sound, a metallic clang with every perception of sound, together with excessive vertigo and difficulty in walking. The objective condition was negative and treatment of no avail.

61. MOURÉ mentions previous observations of deafness after mumps, and adds one more to the list. A girl eight years old was attacked on the fifteenth day of the disease, just when the swelling of the glands had begun to disappear, with total deafness on both sides..

Pain and other symptoms were absent. Roaring in the ears appeared a short time later. The examination of the ear showed nothing abnormal. Treatment was of no avail. Disturbances of the equilibrium were not noticed.

62. A child aged one year and seven months fell from his bed, about two feet high, and fractured the base of his skull. He died on the sixth day from lepto-meningitis. During this time blood, and particularly cerebro-spinal fluid, escaped from the left ear.

The fracture affected the middle of the left parietal bone, from

which it reached to the external meatus, and along its upper walls to the annulus tympanicus. It here divided into two fissures, one of which extended through the internal auditory meatus to the jugular foramen, the other into the region of the foramen ovale. The petrous bone itself was not more closely examined. Leaving aside the rarity of such fractures in the tender age of childhood, the author insists that such injuries of the external auditory meatus should be carefully treated with antiseptics (at first syringing with a five-per-cent. solution of carbolic acid, and later with an iodoform bandage or Lister gauze), on account of the communication which exists, in all such cases, between the external air and the arachnoidal space, especially so soon as the fracture extends as far as the posterior wall of the pyramid.

63. James. Of 519 deaf-mutes subjected to the test, 186 are reported as not being made dizzy by a rapid whirling of the head in any direction ; while of 200 students with normal ears, tested similarly, only one remained exempt. Of those deaf-mutes which are reported as dizzy, 134 were said to be so only in a slight degree, 199 normally so, and a few cases abnormally so. Forty-three were subjected to the test of a galvanic current passed through the head. The current, which caused four normal adults to bend the head and body strongly over, produced the same effect in only six among fifty-eight of the class "not dizzy," while in twenty-three of the class "dizzy," fifteen were affected in a greater or less degree. It was also endeavored to learn how far the deaf-mutes were affected with sea-sickness ; and though the report is not very full, what evidence we have seems to lead to the opinion that they are not so much affected as those with normal ears. Attention is called to another phenomenon which seems to point to the semicircular canals as forming an important factor in the function of orientation. Deaf-mutes, as a rule, when their heads are under water, and the effect of gravitation is lost, experience an indescribable feeling of alarm and bewilderment. This is particularly so when the eyes are closed. The paper is a very suggestive one, and it is hoped others will follow out the lines of experiment so well laid out by the author. Burnett.

E.—NOSE.

64. W. J Walsham. The treatment of deflection of the nasal septum. *The Lancet*, Sept 23, 1882.

65. Arthur Hartmann. Partial resection of the nasal

septum in cases of excessive deflection. *Deutsch. med. Wochenschr.*, No. 51, 1882.

66. J. GRUBER. A case of inflammation of the naso-pharyngeal mucous membrane from the presence of a cherry-stone in the nostril. *M. f. O.*, No. 7, 1882.

67. ARTHUR HARTMANN. Supra-orbital neuralgia produced by empyæma of the accessory cavities of the nose, owing to the hindrance of the escape of the secretion from the middle nasal meatus. *Berl. klin. Worchenschr.*, No. 48, 1882.

68. CRESWELL BABER. Remarks on adenoid vegetations of the naso-pharynx. *Brit. Med. Journ.*, August 5, 1882.

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64. WALSHAM has repeatedly and successfully performed Adams' operation for straightening the nasal septum. If the septum is too resistent, a star-shaped incision can be made through the mucous membrane and cartilage. Walsham then proposes to push a narrow knife beneath the mucous membrane, and to divide the cartilage subcutaneously. In this way he thinks that we can better avoid all loss of substance with perforation of the septum.

65. HARTMANN has operatively removed a portion of the nasal septum in three cases of excessive curvature. He operated in two of the cases in order to facilitate the complete removal of nasal polypi, and in the third on account of epilepsy. In two of the cases the prominence was removed with narrow bone-scissors; in the third an incision made with the scissors, and the prominence removed with a chisel applied in a sagittal direction. The septum was not perforated in any of the cases. The hemorrhage was very abundant in the first two cases, and caused considerable time to be lost in the operation. Chloroform was invariably given, and the operation done under artificial illumination.

66. GRUBER'S interesting case was as follows: A woman, æt. twenty-nine, had suffered for a long time from the symptoms of chronic coryza, with intermittent pain in the head, eyes, and in the left ear. The middle ear showed the symptoms of hypertrophic inflammation, against which the air-douche was useless. The rhinoscopic condition was negative. Catheterism was repeatedly performed during a period of six weeks, without meeting with any obstacle, until one day resistance was felt. The catheter had struck a foreign body in the pharynx, which was discovered to be a cherry-stone covered with secretions

After removal of this foreign body the catarrh and subjective symptoms disappeared.

67. Hack was the first to observe that supra-orbital neuralgia may be a purely reflex symptom of disease of the nasal cavities, and HARTMANN now gives us two cases in which the neuralgia was caused by an affection of the accessory cavities of the nose. In both cases polypoid swelling of the external portions of the middle nasal meatus hindered the discharge of the secretion from the accessory cavities. Cure was obtained by removing the polypi. The diagnosis of an affection of the cavities in question can generally be supported by the favorable action of Politzer's experiment. The characteristic symptom in such cases is the welling up of thick, fluid pus, when the contracted entrance to the middle nasal meatus, between the middle and inferior turbinated bones, is enlarged with a thick sound.

68. BABER is of the opinion that tonsillotomy should be done before removing adenoid growths by an operation ; cauterization of the growths is of no use. At night, the patient ought to wear Guye's contra-respirator.

ABSTRACTS FROM THE OTOLOGICAL PAPERS READ BEFORE THE AMERICAN MEDICAL ASSOCIATION, AT ITS MEETING IN CLEVELAND, O., JUNE 5, 6, AND 7, 1883.

The following abstracts are taken from the report on the section of ophthalmology, otology, and laryngology, of the American Medical Association, published in *The Medical Record*, June 16, 1883.

In the absence of the Chairman, Dr. A. W. Calhoun, of Atlanta, Ga., Dr. J. J. Chisolm, of Baltimore, was elected president *pro tem.*

Dr. LAWRENCE TURNBULL, of Philadelphia, read a paper on *paralysis of the facial nerve in connection with diseases of the ear.* Acute and chronic disease of the middle ear will give rise to paralysis, alteration in taste, touch, smell, gait, and vision; further, to epileptiform convulsions, hemiplegia, and insanity. He cites four cases of facial paralysis due to ear disease, of which the first is of particular interest, as the paralysis resulted from a malignant intra-aural tumor, which originally was a polypus, and ultimately caused death by involving the brain.

Dr. W. J. JARVIS, of New York, *on tonsillotomy without hemorrhage*, distinguishes two kinds of hypertrophied tonsils: (a) the ordinary soft variety, which should be removed with the tonsillotome, by preference, and (b) the hard or scirrhous tonsil, which bleeds readily, and should be removed with the ecraseur. In one such case, before it had come under his care, the scissors and tonsillotome had been used by different surgeons, and each attempt had been followed by alarming hemorrhage. He removed both tonsils with the ecraseur. The operations proved bloodless, caused but slight discomfort, but were tedious, each occupying three hours.

A paper on *the action of nitrate of silver on the mucous membrane*

of the throat, by Dr. C. SEILER, of Philadelphia, who advocated very strong solutions, from 20% to 50%, and the solid stick, gave rise to an extended discussion on the application of that remedy, without bringing out any new points.

Other papers were :

On myringitis. By C. WILLIAMS, of St. Paul, Minn., read by title.

On the tinnitis aurium, and the deafness accompanying Bright's disease. By Dr. LAWRENCE TURNBULL.

On nasal disease, the frequent cause of asthma. By Dr. J. O. ROE, of Rochester.

On the appearance of the diseased mucous membrane of the nose and throat of adult patients.

MISCELLANEOUS NOTES.

The committee of organization for the *Third International Otological Congress*, Dr. Burchhardt-Merian (Basel), president ; A. Hartmann (Berlin), L. Loewenberg and Ménière (Paris), had a meeting in Paris, on March 18th, and concluded to abide by the decision of the Second Congress, to hold the session of the third in Basel, Switzerland, the first week in September, 1883. The committee enlarged their number by the following gentlemen : Dalby and Urban Prichard, of London ; Roosa, of New York, and Blake, of Boston.

A French Otological and Laryngological Society has been founded under the title : *Société Française d' Otologie de Laryngologie*, consisting thus far of 18 members from Paris, 13 from the French provinces, and 9 associated members from other countries. The Society will meet three times a year, viz.: in January and October (ordinary sessions), and in the Easter week (general session). It will publish its transactions. The conditions for membership are :

1. A diploma of M.D.

2. A written application accompanied by a printed essay and a MS. paper on some subject connected with otology or laryngology.

The only disciplinary measures mentioned in the By-Laws are : expulsion if a member fail to pay his annual dues after two official notices.

Communications to be addressed to the Secretary, M. le Dr. Baratoux, 12 rue Condorcet, Paris.

ARCHIVES OF OTOLOGY.

THE HYPHOMYCETES ASPERGILLUS FLAVUS, NIGER, AND FUMIGATUS; EUROTIUM REPENS (AND ASPERGILLUS GLAUCUS), AND THEIR RELATIONS TO OTOMYCOSIS ASPERGILLINA.

By Dr. F. SIEBENMANN, of Brugg, Switzerland.

Translated by J. A. Spalding, M.D., Portland, Me.

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There are so many disputed and obscure points concerning the appearance and conditions of life of aspergillus, that I gladly accepted the suggestion of Dr. Burckhardt-Merian to sift the attainable material upon this question, to examine more closely by cultivation than had hitherto been attempted the botanical side of the question of the origin of these fungi, and finally by experiments to gain more light, if possible, upon their pathogenic significance.

This paper consequently will be divided into two parts:

I. *The botany (morphology and physiology) of aspergillus fumigatus, flavus, niger, and of the eurotium aspergillus.*

This portion of the paper being of but little interest to the practical otologist will be published elsewhere.[1]

II. *An account of mycosis aspergillina in the human ear*, with especial reference to the results experimentally obtained. The introduction will give a brief abstract of the most important articles bearing upon this disease that have been published in home and foreign journals, which in turn will be followed by the report of some new cases.

OTOMYCOSIS ASPERGILLINA.

A. *Historical.*—The first case of the appearance of aspergillus in the human ear was reported in the year 1844.

Dr. Mayer found in the ear of a girl, æt. eight, with "scrofulous" otorrhœa, some cyst-like sacs, the walls of which were fibrous and felt-like, white on the outside, greenish and granular within, and composed of masses of fungus. Microscopic examination (300 ×) of the latter showed long, transparent hyphæ terminating in a club-like swelling, which formed the centre of a round greenish head covered with a layer of small round granules. The latter were not united closely together, but generally grouped two by two.

This description is somewhat defective, but accurate enough for us to affirm with certainty that Mayer's fungus, which was examined by Robin and declared to be *aspergillus nigrescens*, was what we call *asp. fumigatus*.

Pacini (1851) published the second case of aural fungi: A patient, who had returned from the salt-water baths of Leghorn, reported that after bathing the water had often remained in his ears, caused pain and itching, and finally destroyed the hearing completely. Dr. Bargellini, who first examined the patient, found in the meatus a few thick-walled, transparent "vesicles" the size of a millet-seed, accompanied with a serous discharge, which prevented him from inspecting the bottom of the meatus. A fortnight later the meatus was obstructed with white flakes, which, on being removed with the syringe, soon reappeared. Another fortnight later, the meatus was blocked with a black

[1] Bergmann's Verlag, Wiesbaden, 1883.

substance. The *Mt* was covered with a white, fatty mass composed of epidermis cells, granulations, and fungus. In the latter Pacini distinguished upon the hyphæ the little heads [sporangia] (60–100 μ diameter), at first bright, yellowish-red, and later of a dark or black color. The heads consisted of a receptaculum and of conidia, which were round, and with a thick translucent epispore hung off radiatingly eight to fifteen together from the receptaculum (or placenta). When perfectly ripe, the "spores" broke up and fell irregularly upon the receptaculum. Pacini regarded the mycelium as an independent alga. The vacuoles and granular opacities were, in his opinion, the mycelial spores. The case was probably one of asp. niger.

Grove (1857) found a fungus in an ear which had been treated for a "scrofulous discharge" with luke-warm injections of water and instillations of glycerine. The mycosis was at first unilateral, but subsequently appeared in the other ear, and was finally cured by instillations of alum. Grove thought that the fungus corresponded with that described by Mayer, but the conidia were oval, reddish-brown, and formed a compact mass which completely enveloped the end of the broad fructifers (conidiophores). This was evidently a case of asp. flavus.

Kramer (1859) described with great accuracy and comprehension a specimen from the human ear of asp. niger, which he calls sterigmatocystis autacustica.[1] This fungus was found in the meatus of a "rather dirty" person, in the form of a white membrane which rested upon the *Mt*, and whose inner surface was covered with black specks supported by pedicles. The membrane proved to be the mycelium; the black points were correctly regarded as the conidiophores. No one has ever better described than Kramer the structure of the latter. He is also the first to show that the sterigmata of this fungus are ramified, a fact which later fell into oblivion. Kramer reports that the affection in this case underwent repeated relapses during the use of glycerine, but was finally cured by the use of lead acetate (0.10 : 30.00).

[1] This title of sterigmatocystis, for aspergilli with ramifying sterigmata, is even in our days advocated by the botanist Van Tieghem.

Several observations on aural fungi and their cultivation were published between 1860–70. Schwartze (1860) expresses the opinion that his aspergillus does not differ essentially from asp. glaucus.

Wreden (1868) published the first really important work upon this disease, which he calls myringo-mycosis aspergillina. In this paper he gives for the first time a detailed and botanically exact description of asp. flavus. (which he calls flavescens), and asp. niger (which he calls nigricans). He thinks, moreover, that both are to be regarded as varieties of the same species, asp. glaucus (eurot. asp.-gl.), and he believes that he has proved this assertion by cultivation (asp. gl. cultivated on orange-peel developed the variety flavescens; upon lemons, nigricans). The "mass of leptothrix" found in the external layer of an aspergillus pellicle when removed from the ear, was looked upon as the direct offspring of the aspergillus. The dimensions of both fungi are accurately given; asp. fumigatus does not appear to have been observed. The chief causes are: (1) spores from the air; (2) moderately dry soil, upon which a bit of epidermis (even only microscopically visible) has been loosened by inflammation. The fungus, therefore, does not grow in cases of diffuse inflammation, nor could it be inoculated upon *the healthy ear*. It prefers the locality of the *Mt* and the neighboring portions of the bony meatus; if the *Mt* is defective, the disease may attack the tympanum. The symptoms of myringo-mycosis, according to Wreden, are: (1) deafness (occasionally sudden), tinnitus, pulsating noises in the ear, *invariably* a violent, tearing, and piercing pain, which occasionally extends over the head and neck, *increasing to just before the exfoliation of the fungus membrane*, and then suddenly ceasing; (2) and objective: injection of the manubrial vessels, loss of brilliancy in the *Mt*, and the appearance of a powdery white deposit, which rapidly increases to a compact membrane (1–3 *mm.* thick) covered with yellowish-brown and black spots. The structure of the latter is of the stratified order, the innermost layer resting on the *Mt*, and containing many of the spots which, under the micro-

scope, are discovered to be conidiophores and clumps of conidia. The inner third of the meatus *is at the same time inflamed, but the secretion is slight and purely serous.* If carefully diagnosticated, the case may be cured in from one week to three months; if neglected, it may persist for a year. It is not generally possible to discover and to observe the removal of a new membrane sooner than in a week, but in one case, in which the fungus rested in the tympanum, the membrane developed once, and even twice, within a space of twenty-four hours. The asp. nigricans causes more pain than flavescens, but is a rarer variety, 4 to 10 being the proportion.

Wreden *regards these aspergilli as genuine parasites that penetrate the skin.* The prognosis is very favorable if the *Mt* does not undergo perforation, but there is excessive tendency to relapse. Wreden recommends their destruction by subchloride salts, especially by calcium hypochlorate (0.10 : 30.00), alcoholic solutions of tannin (0.60 : 30.00), weak aqueous solutions of lead acetate with glycerine, and, finally, chlorine water. He also observed spontaneous cures, as well as cures after the use of sodium carbonate, oil, or even of fat (!). Fowler's solution, strong solutions of silver, and corrosive sublimate, are to be regarded as parasiticides, and inimical to the growth of fungus. *Alcohol is of no essential effect upon the tissues of the aspergillus.* Wreden found that spores underwent germination after remaining two days in aqueous solutions of iron sesquichloride, copper sulphate, and iodine-glycerine.

Weber-Liel (1868) gave an account of three cases of aspergillus; the variety of which was, however, not mentioned. He expresses the opinion that the growth of this fungus is at first saprophytic; later, parasitic; and that *anomalous secretion of the meatus offers a favorable nidus for the conidia.* The irritation is due to the tension of the layers of epidermis while being penetrated by the fungus.

Böke (1869) saw an asp. (fumigatus ?) after the use of an ear-lotion which contained numerous spores in a state of germinal activity. In 1870 Hassenstein recommended

spiritus vini rect. to be dropped into the ear in cases of otomycosis.

In the same year Voltolini described a case of flavus, with ramifying sterigmata, and thought from his experimental cultivations that penicillium, aspergillus, and sterigmatocystis were merely varieties of one and the same species. Gruber also published at this time the first botanical description of *asp. fumigatus as found in the human ear.* The descriptions are not absolutely accurate, but the identity of the fungus cannot be doubted. Karsten described the specimen as about one half the size of fumigatus, otherwise it was identical with this species. Cultivation showed that asp. flavus appeared to be a variety of penicillium, from the fact of the occurrence of accessory conidiophores in fumigatus or flavus. Steudener describes still another case of asp. with small, smooth, black spores; the basidia were of a smoky gray. He also mentions the demonstration by Politzer of a *Mt* which was penetrated by a fungus; a condition by means of which the latter author hopes to support his theory of the parasitic nature of aural fungi. But Steudener replies that he had seen numerous dry aural preparations in which the *Mt*, previously imperforate, had been destroyed after death by fungi whose nature could not be decided, and consequently that Politzer could not thus prove his theory. These fungi were probably saprophytes; the fungi of which we are here speaking *never* appear as genuine parasites in the vegetable and animal kingdom.

In 1873 Wreden reported seventy-four cases of myringomycosis. He concludes that this affection is an independent parasitic disease of the ear, the specific fungus of which is aspergillus with its numerous varieties. Asp. nigricans appears twice as often as asp. flavescens. In myringo-mycosis the pseudo-membrane occasionally covers the neighboring portion of the meatus, but rarely extends beyond the inner third. Its outer surface turned toward the cavity of the meatus is usually of a lardaceous appearance, while on the inner surface the ripe sporangia shine through as yellowish or black specks which are occasionally arranged in a circular form. Suppurative otitis opposes, serous otitis favors, the

growth of the fungus. "It is impossible for me," says Wreden, "to accept a myringo-mycosis without subjective symptoms of disease." He defends his former opinions, with exception of the fact that he formerly met with the asp. flavus more frequently than with asp. niger. His last conclusion, however, is new: "The ascomycete form (the utricular fruit) of the aspergillus has been found." This consists of round, double-contoured sacculi filled with round spores (see plate I, fig. 3, these ARCHIVES, vol. iv). The conidiophores were septated. Wreden found this fungus, which he calls otomyces purpureus, in an ear near the conidiophores of asp. nigricans.[1]

Bezold (1873) furnished the next contribution to the origin of aural fungi. The two chief causes of its growth are: (*a*) the intrusion of portions of fungus; (*b*) morbid condition of the epithelium. He shows from his list of several cases that the previous presence of oil in the meatus is one of the most important causes. The nature of the disease is at first saprophytic, then parasitic. The assertion, that the fungus membranes are not a pure saprophytic formation, is proved by their firm adhesion to the terrain, the swelling, redness, and exfoliation of the region, the fact that the exfoliated epidermic cells are interspersed with fungus, and the repeated relapses despite careful cleansing. Two years later this same author recommends the local application of acid salicylic, 2.00; aqua dest. and alcohol, *aa* 50.00: but

[1] This description does not coincide with that of De Bary's perithecium, nor with the sclerotium of the asp. niger of Wilhelm and Van Tieghem, for the latter are larger, opaque in the first stage, and without spores, while in the second stage they contain free asci with bean-shaped spores. Besides this the ear does not offer those conditions which we must regard as necessary for the formation of sclerotia. In order to settle this question at once I will anticipate the historical development of our subject by referring to an article of S. M. Burnett (these ARCHIVES, vol. x, p. 319). A man affected with psoriasis of the right meatus. Instillation of tinct. opii one part, sweet oil two parts, glycerine two parts, was soon followed by pain and increased deafness. The meatus contained a substance resembling a blood-clot, which, on examination, showed Wreden's otomyces purpureus without spores or sterigmata. The mycelium and epidermis were also tinted red. I have seen a similar condition of purple-colored epidermis and fungi in a case of asp. fumigatus (see case 10, *postea*). As the above descriptions of otomyces show its identity in structure and dimensions with a mould (which has repeatedly been found in the ear and likewise causes irritation and itching which lead to scratching and bleeding excoriations), it is probable in the above case that the coloring matter was foreign, and originated from the blood corpuscles.

even with this treatment he met with one relapse in two cases. Experiment shows that the salicylic acid used in this way exerts an active influence upon the fungus, and especially upon the conidia. One-per-cent. solution of carbolic acid has no effect, nor has calc. hypochlor. A moderately strong solution of potass. hypermang. is more reliable.

In 1879, C. H. Burnett reported twenty cases of asp. niger, in some of which the fructifying organs of the fungus membrane were absent. His botanical determination is very arbitrary. The affection first shows itself on or near the *Mt*, especially the lower half; also in the tympanum as a yellowish dust-like deposit, which later undergoes transformation into a pseudo-membrane. At a later stage the conidiophores and mycelium can no longer be distinguished. The meatus then appears as if obstructed with a plug which bears great resemblance to a wad of newspaper, and does not unroll or break up in water as is the case with a plug of cerumen. A slight serous discharge accompanies or even generally precedes the mycosis. Aspergillus is not observed in company with suppurative otitis. Subjective symptoms are rarely absent; deafness and pain are well marked when the mycosis has invaded the *Mt*. The causes are: mechanical irritation of the meatus, lack of cleanliness, removal of the ceruminous layer by scratching, syringing with soap and water, bathing, besides transportation from ear to ear by cotton, syringes, and specula. Burnett also thinks that the disease at first saprophytic *may* at a later stage become parasitic. The patients' surroundings were generally good. The membrane should be removed by *delicate* manipulation; syringing of alcohol pure or diluted with water (1 to 1 or 1 to 2). Relapses were occasionally noticed, even after a cure by this medication had lasted for months and years. Instillations of silver nitrate are useless; sodium subsulph. is better (0.18 : 30.00). Eczema of the ears should never be treated with oily substances, for they afford too favorable nourishment for aspergilli. Some fungi appeared in ears which Burnett had treated for perforation, eczema, pruritus, etc., with

caustic or astringent remedies. Case seven is interesting in regard to the rôle which, according to Burnett, cerumen plays in the origin of aspergillus.

A young boy suffered in the summer of 1875 from itching and pulsation in the right ear. The ear was then syringed, but the deafness gradually increased. In October, several months after the irritative symptoms had all disappeared, Burnett removed a plug of cerumen which *enclosed* a tuft of aspergillus. The ear at once became normal in all respects. There was no relapse, although no further treatment was instituted.

Bezold, in 1880, reported forty-eight new cases of otomycosis. He found one case of this disease in every sixty-five aural patients, a very curious fact, when compared with the statistics of Blake and Shaw (1873), of but one case in 1,652 aural patients. In nineteen cases the course was free from symptoms and the discovery of the fungus accidental. Simple syringing sufficed for a permanent cure.[1] It is generally in these benignant cases that we find an old perforation of the *Mt*, through which the process extends to the tympanum. In the remainder of Bezold's cases, the mycosis was complicated with itching, exfoliation of epithelium, moderate deafness, pain, and serous discharge; in four cases acute perforation of the *Mt*, with long-continued pain and protracted recovery. The varieties were asp. niger 11, flavus 8, fumigatus 18. Cultivation proved in his opinion that all were genuine. Bezold also thought that he had discovered perithecia in a dry preparation of asp. niger, but the description is not full, and even its yellow color does not correspond with Van Tieghem's account. The causes are: (1) the introduction of irritating foreign bodies which at the same time furnish a good nidus, *e.g.*, portions of plants, tea, liquors, fat, oil—out of forty-eight patients, thirty-eight had instilled oil into their ears; (2) desiccated tympanic secretion. An interesting discovery was made in one patient, in one of whose ears oil was in-

[1] Wreden knows nothing about otomycosis without symptoms, a singular fact, which may be explained by remembering that he does not recognize the invasion of asp. fumigatus, which is without a doubt often free from symptoms (ten out of eighteen according to Bezold).

stilled for deafness, when an asp. niger subsequently appeared with inflammatory symptoms and perforation of the *Mt;* in the other ear were found the conidia of asp. niger—but they were simply in a condition of rest.

Löwenberg considers that the presence of aspergillus is due: (1) to the eczematous action of rancid oils and fats; (2) to fungoid elements in old aqueous remedial solutions (tannin, zinc sulphate). As prophylactic he suggests: (1) that we should avoid the introduction of oil and fat; (2) use alcoholic solutions, or solutions containing as little water as possible,—these should then be diluted to the proper proportions with *boiling water* just before using them for the ear; (3) the instantaneous *heating* of all instruments which have been used in ears affected with mycosis.

I have now given a brief account of all accessible papers bearing upon the subject of hyphomycetes. It has of course been impossible for me to give proper attention to all of the American papers, which are especially productive in clinical cases. And beyond this, I am obliged to confess that I have made no mention of many other articles upon the same topic, for my aim has been simply to show in broad outlines the process of development of the various opinions that have been advanced from time to time during the last forty years, on the nature and treatment of the affection under discussion.

I will now offer a brief account of several cases which have been observed at the clinique of Prof. Burckhardt-Merian, and which are of much interest, throwing light as they do upon the methods of treatment to which we resort and the etiology of the disease.

Case 1.—Mr. S., æt. thirty, January 20, 1874, has complained for four weeks of itching in his right ear, and used glycerine daily to relieve the unpleasant sensation. The meatus is partially closed with whitish shreds composed of aspergillus and epithelium. Ordered a two-per-cent. solution of carbolic acid in glycerine, twice daily.

January, 31st. The aspergillus has disappeared, but the meatus is still somewhat obstructed. Zinc sulphate, 0.05; glycerine 25.00. Cure.

July 17th.—First relapse. Tinnitus is very much marked, especially in the morning. Abundant masses of aspergillus are removed in the form of membranes. Solution of potass. hypermanganate at night, and the meatus to be cleansed with absolute alcohol.

Dec. 4th. Subjective and objective conditions normal.

1875, *March 23d.—Second relapse.* Clumps of aspergillus lying directly in front of the left *Mt.* Instillation of oil.

April 6th. The ear has apparently been entirely obstructed since the last report. Some whitish crumbs with adherent aspergillus are removed by means of hooked probes. After the meatus is thoroughly cleansed, the *Mt* looks reddened, but the meatus normal.

April 10th. Blackish-gray masses of aspergillus as large as a pea are scraped away from the annulus tympanicus and *Mt* by means of hooks. Insufflation of pulverized salicylic acid.

April 15th. Well-developed clumps of aspergillus. The patient is directed to bathe his ear daily for a quarter of an hour with acid. salicyl., 4.00 ; alcohol absolutum, 100.00, and then to syringe the ear. He is to continue this for three days.

April 24th. The ears appear free from aspergillus, and hearing is normal.

1876, *July* 29th.—*Third relapse.* The left ear feels as if it were stopped up. The patient of his own accord has instilled into the ear an alcoholic solution of salicylic acid in order to relieve the intense pain. Whitish masses removed from the meatus show dead aspergillus elements. The recovery now became complete, although no further treatment was employed. There have been no relapses up to this date.

The notes show that aspergillus made its appearance during the long-continued use of glycerine in the ears. We see a relapse in six months, and two others at intervals of about a year. The attacks are relieved by the use of various medicines : Potass. hypermang., carbolic acid water, zinc sulphate in glycerine (which has the property of favoring the formation of fungus). A four-per-cent. solution of salicylic acid in alcohol produces rapid recovery in the last two relapses. Insufflations of salicylic acid are inefficacious. Oil appears to increase the affection. The attack begins twice in the summer, and once each in the winter and spring.

Case 2.—Mr. W., 1874, March 19th. His hearing on the right side has slowly decreased during the last month, and he has suf-

fered from stretching and itching in the meatus. There have been neither tinnitus nor pain. The cerumen contained some snow-white dotted patches of asp. *fumigatus*, with club-shaped conidiophores. Hearing: R, Politzer 25 *cm.*; L, normal. Treatment: removal with the syringe and instillation of a one-per-cent. solution of carbolic acid in glycerine once daily.

March 27th. A few whitish flakes are still syringed away. Hearing normal. The carbolic-glycerine solution is continued eight days, and produces a definite cure.

Recovery after the use of a one-per-cent. solution of carbolic-glycerine, which, in the opinion of Bezold, has hardly any influence upon the vitality of aural fungi.

Case 3.—Mrs. A., December 18th, 1875; has complained for a year of gradually increasing itching of the left ear, which has caused her to scratch it excessively. Since October, small furuncles, intermittent pain, slight discharge. The meatus was not examined by the physician then in charge, but camomile tea was ordered as an instillation.

The hearing is watch 5 *cm.*; meatus filled with lumps of *asp. niger*. After their removal, H 40 *cm.*, meatus hyperæmic. Insufflation of alum and gum.

Dec. 21st. Left ear again "stopped up," violent pain, increased discharge, meatus obstructed with a thick membranous deposit, consisting simply of aspergillus, which is at once removed. Instillations of ol. amygdal.

Dec. 23d. An hour afterward the hearing had again become obstructed. The patient told us that she had laid some mouldy grapes close to the ear-cotton in a table-drawer. A sac-shaped cast of the meatus is syringed out and found to consist of aspergillus. Daily cleansing with a four-per-cent. alcoholic solution of salicylic acid.

Dec. 29th. H 120 *cm.*: meatus less swollen and dry. A large number of whitish scales, which are lying rather loosely in the meatus are removed. The microscopic examination shows that these are only bits of epidermis. Daily cleansing with the previous alcoholic solution.

1876, *January 5th.* No itching. Another epidermic sac, which looks like silk-paper, is removed.

February 11th. Perfect recovery, with normal conditions.

The local application of alum, gum, and oil does not exert any favorable influence upon the course of the disease. Rapid recovery

after the use of a four-per-cent. alcoholic solution of salicylic acid. The aspergillus may have been introduced within the meatus upon the cotton that had lain near some mouldy grapes.

Case 4.—*Oct.* 28, 1878. Mr. G., has had frequent colds during the last four years. During one attack he took an Irish-Roman bath, and noticed on the following day, in both ears, a roaring, which has persisted ever since. He has also had repeated abscesses in both meatus alternately. His hearing has slowly deteriorated from some unknown cause. During the last month he has had eczema of meatus and pain in the ear, for the relief of which glycerine has been used. H, Politzer, left, 20 *cm.*; right, 1 *cm.* Meatus blocked up with eczema, showing just inside a bit of aspergillus (fumigatus ?). The right meatus is filled with whitish-gray masses of aspergillus. The crusts are softened with a two-per-cent. solution of salicylic oil, and the ear subsequently syringed with a solution of sodium sulphate.

Nov. 5th. Left, H, 60 *cm.*; meatus clean; right, H, 5 *cm.* with fresh aspergillus in the meatus. Ordered for both ears three times daily, for fifteen minutes each, a bath of four-per-cent. alcoholic-salicylic acid, and then to use the syringe. After using for eight days, stop using for same length of time.

Nov. 19th. Left ear, H, 40 *cm.*; right ear, H, 80 *cm.* Both meatus free from aspergillus, slightly congested, and containing shreds of epidermis. The itching persists despite the use of an arsenical solution internally, and tar externally. Still both meatus remain permanently clean.

An eczema of the auricle is treated with instillations of glycerine, whereupon the deepest parts alone of the meatus become affected with aspergillus. Brief applications of salicylated oil, syringing with an aqueous solution of sodium sulph., are inefficacious. Definite cure of the mycosis after the use of a four-per-cent. alcoholic solution of salicylic acid. The eczema is not wholly removed, but remains dry.

Case 5.—*Dec.* 10, 1878. Mr. B. has suffered for three years with slowly diminishing hearing, itching, and exfoliation of scales from both meatus. He had previously been troubled with a watery discharge, but never with pain. He is accustomed to remove the cerumen by scratching.

Hearing: left, Politzer, 200 *cm.*; right, 60 *cm.* The left ear exfoliates scales of epidermis in lamellæ. The right meatus contains cerumen and aspergillus fumigatus (white, like meal). We ordered for the right ear the use, three times daily, of the four-per-

cent. alcoholic-salicylic-acid solution, to be followed up with glycerine. For the left ear, only glycerine at first, and the above alcoholic solution in case the itching continued. Cure.

Eczema of both meatus, which the patient scratches a great deal, and thus removes the cerumen. Aspergillus in one ear only. Cure by salicylic acid in alcohol.

Case 6.—*Sept.* 1, 1879. Mrs. H. The right ear is normal. The left ear, during the last five years, has frequently been filled with cologne water, etc., for the relief of toothache. Incessant tinnitus, like the noise of railroad cars; meatus normal; *Mt* opaque and concave. Treatment: air-tight tampons, previously covered with freshly prepared emollient ointment. Internally, hydrobromic acid, gtt. xv, *ter in die.*

Sept. 8th. The roaring has disappeared, but the meatus is filled with asp. niger. A few bleeding excoriations and minute abscesses are visible. Tampons of salicylic cotton (five per cent.) without the ointment.

Sept. 13th. The aspergillus has apparently disappeared. Four-per-cent. alcoholic-salicylic solution brushed on, and the meatus filled with simple salicylic cotton. The hydrobomic acid abandoned.

Sept. 27th. Aspergillus has disappeared. The tinnitus has reappeared. Hearing, 20 *cm.* For the sake of experiment, permanent closure of the meatus with salicylic cotton covered with emollient ointment.

Oct. 4th. The whole meatus is again filled with aspergillus. Thorough cleansing of the whole interior of the meatus with the alcoholic-salicylic solution. Simple cotton in the orifice.

Oct. 11th. The meatus is losing its epidermis. Embrocations of alcoholic-salicylic acid, and continuation of the obturation with *simple* cotton. Pain has entirely disappeared. Recovery.

After hermetically closing the meatus with plugs of cotton covered with emollient ointment, we see a rapid (eight days) development of luxuriant aspergillus. Despite which, however, no spores could be discovered in the ointment. (In my opinion the fungus in question never thrives upon this substratum.) The ointment increased the eczema, partly by direct contact with the skin of the meatus, partly by rendering the cotton plugs so impervious to air as to prevent the escape of the evaporating moisture in the bottom of the meatus. The latter circumstance also explains the manner in which the ointment favored the development of the fungi.

Case 7.—Mrs. H. has suffered for six years with gradually increasing, intermittent pains in both ears, with but little otorrhœa.

June 20, 1880. Chronic eczema of both meatus. Hebra's ointment to be applied twice daily with dossils of lint.

Dec. 3d. The chronic eczema still persists, and there is much itching. Aspergillus *niger* on both sides. Ordered the alcoholic-salicylic solution, to bathe the ears with twice daily for ten to fifteen minutes.

December 17th. No more itching. After removal of loose masses of aspergillus, the meatus are clean. Cured without a relapse.

The patient returned, May 30, 1882, with otitis ext. desquam. Itching was not noticed, nor was there any trace of aspergillus in the portions of cuticle removed. Uninterrupted cure.

A chronic eczema with slight exudation is increased by the application of an ointment, and aspergillus appears. Cure by the four-per-cent. alcoholic-salicylic-acid solution. The eczema reappears at a later date, but does not give off any exudation, as a result of which the meatus remains free from the fungus.

Case 8.—Mr. W., January 21, 1882. For two weeks, excessive itching in both ears, and a feeling as if water were boiling, in the the left ear particularly. He has used a white salve for three days, in the hopes of improving his condition. Squamous, extremely irritable eczema upon the neck and scrotum. Aspergillus *niger* on both sides. (Conidia, 4–6 *mm.* diameter ; sporangia all broken off ; numerous delicate white pellicles composed of epithelium, fibrinous and structureless masses, detritus, and cocci.) Ordered : alcoholic-salicylic ear-baths. As the patient did not return, we assume a recovery.

Eczema on various parts of the body, excessive itching in both ears, appearance of aspergillus niger.

Case 9.—Mr. H., aged eighteen, April 2, 1882, had suffered since childhood with caries of the temporal bone, which, however, healed a year ago.

In the right ear, although there has been no discharge for years, the meatus is filled with cerumen, upon which we see white tufts of aspergillus *fumigatus*, which have developed without any symptoms (especially without itching). There was no treatment and no relapse. The mass removed from the ear consisted of white bunches of mycelium which had been torn away from their resting-place, and stratified thick clumps of epithelium. The latter is white upon its *lower* surface, (the one formerly turned

toward the skin of the meatus,) is composed of swollen layers of epithelium, and is entirely devoid of mycelium. An occasional hyphomycete can be discovered in the middle layers. The upper surface (formerly turned toward the cavity of the meatus) is half covered with cerumen. The other portion shows with the microscope about thirty grayish-green granules, which upon closer examination are evidently the heads (sporangia) of *asp. fumigatus.* The external layers of the skin are here and there, in company with the overlying fungi, tinted purplish-red.

Upon a scab we find an entirely superficial aspergillus fumigatus, which has grown without any symptoms, and which does not relapse after its mechanical removal.

Case 10.—Miss F., aged twenty-five, chronic suppuration of the middle ear for years.

1882, *April 24th.* Ordered, for reasons concerning which Prof. Burckhardt-Merian will in due season justify himself, zinc sulphate, 0.10; glycerine, 20.00; aqua destillata, 5.00. Thorough syringing every two days with boracic acid in aqueous solution. After examination of the other *perfectly clean* ear, boracic acid is insufflated.

May 5th. Patient writes us that after the last insufflation of the boracic-acid powder, she perceived in her ear an itching and tickling which constantly increased; the hearing also was a great deal worse. She sent at the same time a "croupous" cast of the meatus, with the remark that it had been forced from the ear on that very day, during a violent fit of sneezing and coughing.

May 10th. A similar tube-like tissue was syringed out. Ordered the alcoholic-salicylic bath three times daily for a quarter of an hour. This treatment was followed by a violent attack of erysipelas, which extended from the ear over the head. Perfect recovery.

The two masses which had been forced from the meatus were precisely similar to one another; a thick, grayish-yellow, rumpled flexible tube, about two *cm.* long and one half *cm.* thick, having the appearance and consistence of a croupous membrane. Reaction slightly acid. On the first day there was no odor, but on the second it became somewhat more marked, but never putrid, reminding us of the exhalation from long-haired dogs. The centre of the tube is occupied by a very narrow canal entirely filled with pus, mucus corpuscles, and débris. The canal is open at both ends where it appears enlarged and spout-shape. The outermost

envelope (which could be removed with the greatest facility) presents itself in the form of a brilliant, transparent, smooth, occasionally bluish-black, thin membrane, the inner surface of which is almost entirely covered with a fine chocolate-brown, felt-like lining. The surface of the *granular layer*, which lay in contact with the latter, shows a similar fibrous structure and color. The two envelopes, however, do not show the same stratification, for here and there their individual layers fold complexly around one another, or again separate regularly. The fissures and cavities which thus arise are also provided with a dark, fine, granular layer. The gray membranes consist mostly of large fungus mycelia, free from epidermis; the dark, felt-like membranes of similar hyphæ, together with numerous large dark conidiophores of aspergillus niger. The latter are easily recognized by the naked eye as the fine marginal fringes upon the little shreds under the protecting glass. The fruit-heads (sporangia) consist merely of the vesicles and sterigmata, while the ripe dark conidia lie detached upon them (not in chains); many of them are swollen, while but few are provided with embryonic sheaths. I shook the fluid in which the preparation was contained (muddy water with black sediment) over some wheat-bread, and obtained in thirty-six hours an exceedingly luxuriant pure culture of asp. niger, which became one half *cm.* thick in forty-eight hours. After depositing some of the shreds from the membranes with the conidiophores which grew upon them for twelve hours in alcohol, salicylic-alcohol, naphthaline-alcohol, salicylic-paste, and boracic paste, I washed them and subsequently prepared them, after Koch's method, with gelatine. The boracic-paste preparations flourished abundantly, and some of the salicylic-paste preparations showed a few ripe conidiophores. The shreds which had been treated with alcohol and alcoholic solutions did not grow.

Appearance of asp. niger, in a case of middle-ear suppuration, under the use of boracic acid and zinc-glycerine. Four-per-cent. alcoholic-salicylic solution successfully employed.

In my own practice, I have lately met with the following cases of otomycosis.

Case 1.—Mr. B., æt. forty, a joiner. Aspergillus fumigatus, which ran along without symptoms, six months ago, with exception of a slight otorrhœa of brief duration, lies in the shape of a black powder upon the surface and within a mass of cerumen directly in contact with the *Mt.* After removal of this cerumen,

the meatus and *Mt* appear normal. No treatment and no relapse.

Spontaneous recovery of aspergillus fumigatus, dependent upon occlusion of air by a ceruminous plug.

Case 2.—Mr. O. A., æt. thirteen. April 29, 1882. Suffered since last autumn from double otitis media catarrhalis, with perforation of *Mt.* On the left side, discharge for a few weeks and intermittent pain; at present, deafness and tinnitus only. Right ear: hearing, W=o; large defect of *Mt*; secretion alkaline and offensive. The meatus is otherwise clean. Left ear: W, 2 *cm.;* meatus slightly swollen. A gray, firmly-adherent plug completely fills the meatus in the region of the *Mt.* Ordered ear-baths of three-per-cent. aqueous solution of sodium carbonate.

May 2d. Removed from the left meatus an inodorous plug composed of several layers of epidermis, parallel with one another, and as thin as paper. The superficial layers are covered with sporangia of aspergillus fumigatus, similar ones being found deeper down. Lukewarm water injections.

May 7th. The posterior half of the *Mt* is lost, the anterior superior quadrant downy, as far as the margin of the perforation. Young mycelium and sprouting conidia were removed; no old fungus membranes or conidiophores. Alcoholic-salicylic acid, twice daily, for fifteen minutes.

May 9th. A portion of the shreds, which did not, however, contain any young mycelium, or but a few, if any, conidia, underwent germination (in eight per cent. gelatine) in three days' time. Alcoholic-salicylic ear-baths three times daily.

May 14th. Recovery; hearing decidedly improved; no relapse.

Perforation of the Mt on both sides. Aspergillus thrives only on the side in which the secretion is scanty and free from decomposition. Five days after removal of the aspergillus, a relapse, due to germinating conidia which had been left behind. The daily (twice) *use of the alcoholic-salicylic-acid bath, for a week, does not kill the conidia, but finally brings about a permanent recovery.*

Case 3.—Mrs. H, æt. forty-eight. October 2, 1882. Deafness and subjective noises in the left ear for three weeks. Instillations of oil. Itching at the bottom of the meatus, and eczema on various parts of the face. Aspergillus fumigatus in the inner third of the meatus and on the *Mt.* Salicylic-alcoholic bath, three times daily, for a quarter of an hour.

Oct. 19th No itching; some swelling; subjective noises unaltered. *Insufflation of aspergillus niger, and instillation of oil.*

Nov. 6th The latter, in the normal ear, are unaltered. The tinnitus is present in both ears, but the hearing in both is good.

Eczema of the face; aspergillus fumigatus in the left ear. Cure by the use of alcoholic-salicylic ear-baths. The instillation of oil and insufflation of aspergillus niger does not produce any relapse.

B. **Pathogeny and Pathological Anatomy.**—After numerous experiments at cultivation, I am of the opinion that there are four things necessary for the origin and growth of the various forms of aspergillus vegetation: (1) conidia or spores, (2) a peculiar condition of the terrain, (3) a temperature from 20° to 40° C. [68° to 104° F.], (4) a moderately abundant supply of air.

The *conidia* of the three varieties of aspergillus with which we are now concerned are suspended everywhere about us, and, as a matter of course, not infrequently in the air of our dwelling-houses. In order, therefore, to explain any given attack of otomycosis, we have no need of searching for obscure and hidden causes—such as damp, mouldy dwellings, the instillation into the ear of medicated fluids containing conidia, or of substances more or less inclined to undergo decomposition. More than this, such conditions as these are of no importance whatsoever in an etiological point of view, for the aural aspergilli (aspergillus fumigatus, flavus, and niger) only *flourish* in a *high* temperature, or when bits of vegetation or the medicines supposed to be introduced into the ear contain a *large* percentage of nitrogen[1]; the medicines, moreover, ought to contain carbonic-acid gas, as well as traces of mineral salts and alkalies, which is, however, by no means the case with our usual remedies. Why, then, should fluids be more dangerous in this respect than the common air?

Every normal ear offers the two succeeding necessities: a

[1] For the last year I have left about twenty of the most common solutions used in office-practice, upon my desk, opening them from time to time to admit the air, and, at a later date, examining them microscopically. I have never found aspergillus but once, and then as a scanty mycelium upon a tannin solution. Penicillium is by no means infrequent in boraic-acid solutions.

temperature of 20° to 40° C., and free access of air. But such an ear is unfavorable as a nidus for fungi, in so far as pure unaltered epidermis is, as experiments show, a poor soil for aspergillus, while only when moist, and even then but scantily, does it afford sufficient nourishment for the growth of *fumigatus* alone. *We can, therefore, affirm with certainty that the latter variety of aspergillus alone can flourish in a normal auditory meatus*, but even this only under the rare and even abnormal circumstances that the entire district is moist and continues moist for day after day. (Case No. 9.) Under these circumstances, however, the mycelium does not penetrate the epidermis, even when the latter is moist (an aspergillus-strewn epidermis on Koch's serum jelly is never penetrated; the latter remains free from fungus elements), for here the chemical and mechanical activity of the fungus meets with very energetic resistance. Still, the epidermis undergoes rapid decomposition so soon as it contains for a greater or less length of time the amount of water necessary for the energetic growth of the aspergillus, but decomposing skin is not only a poor soil for the conidia of aspergillus, but it may even interfere prejudiciously with their vitality. This is a fact which coincides with our experience that, despite the probable abundance of conidia in the air within the meatus, otomycosis is a comparatively rare disease.[1]

Inasmuch as simple mucus and the mucous membranes are incapable of affording good nourishment to aspergillus, we must at once reject the idea that this fungus might possibly insinuate itself into the healthy mucous membrane of a tympanum, either from the conidia passing through the Eustachian tube or through a perforation in the *Mt.*

What are the abnormal conditions of the ear which offer a favorable foothold for the growth of aspergillus? The first which experience teaches us to reject is any that is accompanied with suppuration, for pus decomposes rapidly within the ear, its reaction is almost always highly alkaline, and its presence is sooner or later accompanied by the formation of

[1] Bezold, as we have seen, counts one case of fungoid invasion to every sixty-five aural patients.

ammonia and sulphite of ammonium, which are highly inimical to the growth of aspergillus. Experience also teaches us that we find a much more favorable soil in the presence of serum, at least of animal serum, and we shall not go far astray if we conclude from this fact that aspergillus will at least flourish equally well upon the serum of human blood. I regret to say, however, that as yet I have been unable to extend my experimental cultivations upon this base; still, its composition—a mixture of some soda- and magnesia-salts, fatty acids, and especially of albuminates and water—would appear to favor the above-mentioned idea. And if we consider additionally that almost every case of otomycosis is accompanied or preceded by a thin serous discharge, since (1) old perforations of the *Mt*, with degenerated lining membrane of the tympanum and serous secretion, are found in one third to one quarter of all the cases of otomycosis at my command; (2) in all the other cases preliminary symptoms of acute dermatitis of the meatus or *Mt*, and exfoliation of the epidermis, are rarely absent (Burnett, etc., "prodromal symptoms"—such as redness and loss of reflex on the *Mt*), and that eczema of neighboring portions of the skin is frequently observed; (3) and that whenever there is an inclination to eczema of the external ear the fungus invades the moist but never the squamous variety, we shall not err in asserting *that almost without an exception a free layer of serum affords the aspergillus the original, the most favorable, and perhaps, after all, the only possible, soil upon which it can flourish.* The most decisive fact is the one to be discussed hereafter: (4) that the fungus, even when otherwise entirely capable of life, ceases to grow so soon as the disease of the meatus, which produces the exudation, is healed or confined within moderate limits. *The primary cause is consequently an inflammation of the skin or middle ear, but it must not be one which secretes a serum capable of undergoing rapid decomposition.* (The fungus membranes in our cases of otomycosis have always been neutral or shown a slightly acid reaction.) A hundred conidia which are lying about in the secretion, either in a state of rest or germination, will perish, where one will de-

velop any great amount of growth or gain a strong foothold, for the secretion from a layer of serum which is thin, inodorous, and free from bacteria for any considerable number of days is, in the majority of diseases of the external and middle ear, a rarity; moreover, even in such cases, the escape of the discharge is so much interfered with by the swollen condition of the meatus, that at a later date we are still sure to meet with a stagnation and consequent decomposition of the secretion. To this chain of circumstances do we owe the fact that otomycosis aspergillina is not more frequently met with. The rule is, decomposition of the more copious or more purulent secretion in the ear, or desiccation of the slight secretion. In the first case the conidia which have fallen off cannot germinate, or, if germination has already begun, it ceases at once, and the shreds of mycelium are soon washed away in a dying condition. If the secretion, on the contrary, is at this time in a state advancing toward desiccation, the fungus must already have undergone luxuriant development, or even be in the stage of fructification, before it can gain any foothold. Only then will it be capable of keeping up a lively interchange of matter in the substratum or of liquefying the same, and, subsequently, by the product so originated, of irritating the underlying corium to renewed secretion, and thus of ensuring a continuation of its own existence. But if, at the moment in which the secretion is rapidly growing poor in fluid elements, the fungus is still backward in its growth, it ceases to develop so long as the serous soil continues to undergo desiccation. The cure of the excoriations which furnish the secretions can then go on undisturbed; the dry serous layer changes into a scab which rests upon the regenerated epidermis, and carries upon its surface the fungus elements in a stationary condition. Finally, it loosens without giving rise to any symptoms, falls at a later stage from the ear, or has already become enveloped in a layer of cerumen.

The statistics of Wreden and other observers show that *children are rarely affected with otomycosis*. The chief reason for this fact may lie in the circumstance that children are infre-

quently affected with those inflammations of the external meatus which furnish only a slight amount of secretion ; in other words, the otitis externa of children is generally of the diffuse type. Besides this, it is a matter of every-day observation that eczema in children, with equally extensive propagation and similar localization, is much more "fluid" than when observed in adults. For this very reason, then, the soil is in those cases much more unfavorable for the growth of fungi, because a moderate secretion undergoes decomposition sooner than one which is deficient in fluid and less abundant in quantity. This inclination to decomposition is, moreover, extraordinarily furthered by the remarkable narrowness of the juvenile meatus, which becomes much more marked by the swelling of the walls, so that the secretion stagnates in much greater quantity than in the meatus of adults. Beyond this the cerumen in the youthful meatus is generally more fluid, and must consequently exercise a deteriorating influence upon the growth of fungi. Finally, we must not forget that in the early years of life at least, affections in the auditory meatus are not generally noticed by the child or taken care of by its parents.

Every thing that has a tendency to transform a suppurative otorrhœa into a serous, or to diminish the amount of the secretion, or to prevent decomposition, *favors the growth of fungus*. Almost every observer, therefore, of otomycosis reports cases in which, during the treatment of suppurative otitis with astringents and disinfectants, they suddenly saw under their very eyes as it were, the formation of aspergillus in the meatus, or on the *Mt*, and even in the tympanum. The solutions of tannin and zinc, as well as glycerine, appeared to act most mysteriously in these cases, and yet this is little to be wondered at, when we reflect that various albuminates offer an especially favorable nidus for the growth of fungi when they have been experimentally mixed with these very solutions.

It is a well-known fact that acute inflammations of the skin may originate from contact with water and aqueous solutions, oils, and fats, and that when they are present they can often be unfavorably influenced by the same applica-

tions. For the same reasons instillations, cleansing of the healthy ear with soap and water, applications of oils and ointments (Steudener, C. H. Burnett, Mayer, Bezold, etc.), have been known to produce, maintain, and even to increase an acute inflammation of the meatus and *Mt.* Particularly will this be liable to happen if the fats are in a rancid condition. In cases of chronic inflammation, the usual treatment by such remedies as these will be more likely to facilitate the exfoliation of the epidermis and to incite a serous secretion. Almost every one of Bezold's patients with otomycosis had previously resorted to the instillation of oil. Cases, consequently, are by no means rare in which the otomycosis made its appearance as the associated symptom of a general eczema, or at least of an inclination to an "eruption" on various parts of the body, in which case then an attempt was made to relieve, in the above-mentioned manner, the itching in the meatus, or the tinnitus, as well as the decrease of hearing.[1]

Scratching also is one of the irritative causes. The simple introduction of an ear-speculum, left in position for a short time, was followed in one case[2] by an increased inflammation and the sudden diffusion of aspergillus, which previously had lain dormant in the meatus. The same may happen in the cases of operative interference, introduction of vegetable growths, plugs of cotton, etc. Since, as we shall see later, the transformatory products of aspergillus irritate the ear extremely, we should not be at all surprised that the aspergillus can extend its locality.

For the same reason, it is a matter of course that the transportation of the secretion of an ear thus diseased to a healthy ear can again excite in the latter an eczema, which may in turn become the transporter of the germs of aspergillus. Nor, further, should we be surprised, in the case of such a double disease, that the affection on both sides should be complicated *with the* IDENTICAL *fungus,* because the

[1] Out of fifty-three cases of otomycosis observed and accurately described by Wreden, Burnett, etc., forty-two suffered from other diseases of the ear, or the ear had undergone washing with soap and water, cleansing, instillations, or mechanical injuries, etc.

[2] Politzer's "Lehrbuch," p. 696.

conidia of this species, after being transported, obtain rapid possession of the new terrain, so that there is no room left for the germination and growth of other conidia which may possibly be floating in the atmosphere. A certain idiosyncrasy, which we will later mention, may exert some influence upon this condition.

Fresh cerumen not only does not favor, but it really prejudices, the growth of aural fungi. For this reason also the *absence* of cerumen may be said to favor otomycosis, although we cannot tell whether an abnormal condition of this secretion (as in chronic inflammation), or its direct removal (by washing or scratching), is the cause.

The coagulation of albumen, as observed in the serum in the shape of a more or less extensive precipitate after the use of zinc sulph., is also favorable to the appearance of fungus.

Bezold has particularly emphasized the eczematous action of various oils, and especially their *specific and favorable action upon the growth of aural fungi*, and my experiments fully confirm this observer's views. The cause, however, does not lie, as has hitherto been assumed, in the good nourishment which the oil offers to the aspergillus, but rather in the circumstance that the oil restrains the formation of atmospheric mycelium and conidiophores in favor of the more extensive development of the thallus, and that by mechanical occlusion of the air it increases the fermentative action of the aspergillus.

The relative amount of sugar in the serum of the blood does not appear to exert much influence upon the appearance of otomycosis. Burckhardt has frequently seen otitis media in diabetic patients, but never knew it to be accompanied by aspergillus mycosis. Experiments also have convinced me that the aspergillus does not flourish any better upon saccharine albuminous solutions than upon similar concentrated solutions which are free from sugar. A slight amount of sugar appears to favor the early appearance of schizomycetes, and thus to deteriorate the soil for the growth of aspergillus.

Whenever we recall to mind the innumerable cases of

complete recovery, in which *repeated* relapses have occurred after months or years, we cannot help believing that there must be some *individual dispositions*, or, as we may say, *idiosyncrasies*, for otomycosis. In order to explain these facts, we must recur to well-known laws of dermatology: (1) that the reaction which follows any given irritation of the skin may vary a great deal, depending upon the individual, just as the course of the common type of eczema shows various peculiarities in various individuals—one person, for instance, after a given irritation, remains with a perfectly healthy skin, another is regularly affected with an erythema, followed by desquamation, while a third suffers from an eruption of vesicles, etc.; (2) that the secretion of excoriated patches, with reference to the relative amount of pus corpuscles contained in the secretion, is likewise subjected to as many individual variations.

Whoever, then, has the peculiarity of suffering from a purely serous, scanty discharge (with but little tendency to decomposition) after having met with some slight external or internal irritation upon the wall of the meatus, and whose meatus is so formed that this secretion cannot easily undergo stagnation, will naturally and easily be inclined to otomycosis.

Beyond this we recognize *a special disposition for especial* SPECIES of aspergillus in the ear, and particularly for those occurring in animal bodies.

In the seventy detailed cases of otomycosis which were available, we found a large number in which the affection repeated itself after an absence for months and years as certified to by a physician. Yet, in nearly all of them we discovered the striking fact that the aspergillus observed in the relapses was always of the same species as that observed in the original attack.

This discovery coincides with a series of other facts which could easily serve to support the above theory of the individual disposition for particular "species."

Raulin's investigations show that even with slight alterations in the amount of salt in its typical nutrient fluid, the aspergillus niger, which had previously luxuriated upon this

soil, at once disappears and gives way to other fungi. Additionally, it has been shown beyond a doubt, that injections of asp. fumigatus and flavus are fatal to rabbits, while those of asp. niger are innocuous; secondly, that the two former fungi flourish remarkably well, the latter very poorly or not at all, upon the serum of beef and dog's blood; finally, that in the lungs of birds the aspergillus fumigatus alone has been very frequently observed. Indeed, Lichtheim had already remarked that certain species of animals were susceptible alone to certain varieties of mycosis. But in addition to this, the experience which has been gained from the observation of otomycosis in man allows us to draw the further conclusion that the disposition varies also within particular species of animals.

It is also clear that the *height of the temperature* in the human ear cannot be without influence upon the frequency of the appearance of this or that variety of fungus. Thus, for example, the aspergillus fumigatus most frequently found in the ear is by its nature the commonest of the three species of aural fungi; it is, morever, so far as its nourishment is concerned, much more modest in its demands than niger and flavus. But in spite of all this, it is a fact that the temperature offered by the inflamed, or even by the normal, ear (36°—39° C.: 98°—104° F.), corresponds much more perfectly to its necessities than to those of either of the others, for where the temperature is but a little below this height the variety fumigatus is absent. Aspergillus flavus has the least desire for warmth of any of the species, and it is an additional matter of fact that the extensive statistics of Bezold and Wreden show that this variety is very rarely met with in cases of otomycosis aspergillina.

Other hyphomycetes have been discovered in the ear, where they are capable of playing the same parasitic rôle as the aspergilli. But all of those, like these aspergilli, also depend upon higher temperatures in order to appear outside the human body. But when the temperature is only precisely as high as that of the human body, the penicillium and the eurotium cease to grow, absorb no more nourishment, and undergo no further septation. Nor, as we have

already seen, do they appear to favor a region which contains much albumen, but, on the contrary, acid saccharine solutions. Penicillium and the eurotia have also rarely been found in a prolific condition upon the living tissues, although, like the aspergilli, they form membranes and can act as a ferment. But in the latter point of view the interchange of matter, as well as the growth, proceeds very slowly; peculiarities which would similarly fail to favor its continued existence in the ear. Thus, for example, tufts of *glaucus* and *repens* which I planted upon the edge of a large defect in the *Mt*, disappeared without a trace in the course of the next eight days. On the other hand, I thrice found EUROTIUM REPENS upon cerumen which had just been removed from the ear. A year ago I examined a plug of cerumen which Dr. Burckhardt had removed from the meatus after recovery from otorrhœa, and found it covered with fine golden-yellow granules and some black down. The latter consisted of the dead vegetations of eurotium repens, while the former represented the perithecia of the same fungus.

Just a few days ago I met with a similar condition, but in this case the perithecia and conidiophores of eurotium repens were *embedded* in the cerumen. A third preparation consisted of a lump of cerumen with membranes of the same fungus.

In all three cases, the mycosis was confined to the cerumen, which, being a bad conductor of heat, is of a much lower temperature than the surrounding walls of the meatus. In spite of this the opportunities for development did not suit this fungus, as was demonstrated by the formation of the perithecia which had already taken place in cases one and two.

I have never seen the eurotium grow upon fresh cerumen, and the cultivation only succeeded when the latter had been kept from two to four weeks under a moist bell glass.

Statistics of Burnett, Wreden, etc., show that otomycosis is much more frequently observed in the second half of the year. Thus if I reckon as "cases" the relapses which have

been noticed after months of freedom from the disease, I get the following table:

	January to July	July to December
Burnett	5	18
Wreden	3	11
Burckhardt	5	7
	13	36

Nevertheless, this observation does not stand in any connection with remarkable alterations in the amount of conidia in the air. For the aspergilli flourish most abundantly when the temperature is high; and yet the extremely hot summer months of July and August show but five cases, whilst thirty-one were observed in the remainder of the year. It is impossible for me to say whether there are more opportunities for fungus growth (eczema of the ear, etc.) during this period than at any other time of the year. It is possible that this proportion is quite accidental, and that it would vary with a larger number of cases. Still I thought it necessary that this fact should not be left unmentioned.

The favorite situation of the fungus pellicle is the *Mt* and the inner third of the meatus, more rarely the tympanum, and still more rarely the two outer thirds of the meatus. The pellicle sometimes envelops the whole wall of the meatus from the *Mt* to the external orifice.[1] This condition of affairs is not particularly worthy of remark when we consider that the three aural aspergilli demand not only a warm soil in which to grow but warm air also, and that they find both of these favorable circumstances in the vicinity of the *Mt*. Additionally, this region is free from cerumen. The anatomical structure of the *Mt*, especially the delicacy of its epidermic layer, which is easily exfoliated even when an inflammation is of but slight degree, and perhaps the arrangement of its blood-vessels and lymphatics, contribute to the fact that moderate exudations (those with

[1] The swelling and excoriation often extend upon the auricle, but upon the latter we never have found any hyphomycetes.

but slightly fluid and serous discharge, and consequently a favorable terrain for aspergillus) are more easily produced in this structure than in other parts of the ear. Burnett, who has had an opportunity of seeing mycosis in its earliest possible stages, observed that the fungi showed a predilection for the deepest portion of the *Mt*, a phenomenon which must depend upon the drainage-relations of the meatus for the secretion which arises in cases of myringitis.

No post-mortem examinations have yet been made in cases of otomycosis, and pathological anatomy, especially the microscope, has never yet been able to contribute any thing decisive toward an explanation of the question *how and whether the structure of the auditory meatus is influenced by the presence of aspergilli.* Observations on the living, however, show that the fungi usually cling very closely to the nourishing soil, and that the latter after mechanical removal of the fungus *often appears reddened and usually excoriated.* The question of the *relation of the mycelium to the tissues to which it is attached* has been partially answered in one of the preceeding sections of this paper, in which we offered proof that the fungus cannot penetrate the mucous membrane or the epidermis when intact, but that it takes root in the freely effused serum. In all our cultivations of aspergillus upon surfaces of a firm (not porous) or fluid substratum we have never seen (macroscopically or microscopically) the young mycelium penetrate deeply below the surface; in every case the thallus maintained its superficial existence. Such experiments as these would throw much doubt upon the suggestion that under precisely similar circumstances the mycelium might penetrate into or between the extremely resistant cells of the rete-mucosum. The case is quite different when the conidia have become enveloped in the tissues by direct or by vascular inoculation. Leber saw his aspergillus develop into threads in the anterior chamber of the eye, while Koch, Grawitz, etc., saw conidia germinate in various coarse organs which do not contain air. I have seen this same process after enclosing a fresh cultivation in ten-per-cent gelatine. The hardened mass was, after a few days, ex-

amined microscopically, and aspergillus fibres more than one *cm.* in length occasionally discovered. Although they have but little intolerance for the removal of air, yet they underwent germination in all of these cases, because the other conditions for their growth were favorable. So much so, indeed, that the mycelium became the object of so extensive development from endosmotic processes and chemical alteration of the adjacent tissues, that it occasionally entirely separated the structures through which it ran. But in vegetations *upon open surfaces*,—as is the case in the ear,—the conditions are entirely different. The pressure caused by the absorption of nutrition in a mycelial cylinder which is sinking from the surface toward the interior, will, of course, act equally upon all portions of the cell-walls. But inasmuch as the current of the humor flows upward and outward, and can more easily devote itself to the new formation of branches upon the surface where the resistance is slighter, the pressure deeper down will never be so forcible as in the above-cited case, so that as a matter of course the mycelium will never cause any interruptions of continuity.

If mycelial fibres in the living ear become accidentally enveloped by the development of the adjacent cells of the rete, which are so rich in protoplasm, their downward and deeper growth ceases. But, as the case goes on, lying, as these fibres do, between the epidermis cells which have, in the meanwhile, undergone cornification, they are pushed to the surface and finally exfoliated. Such an occurrence as this is by no means infrequent, as the stalk of the mycelium always adheres very closely to the substratum, and it is, moreover, an easy way in which to explain Bezold's discovery in the ear of shreds of *epidermis which have been pierced by fungus*.

The inoculation experiments of the above-named investigators prove that *the vital force* offers great resistance to so strange an intruder, and that *the exclusion of air*, after a few days, puts an end to its existence in the depths of living animal tissues.

The fact that myringomycosis aspergillina can lead to

penetration of the *Mt*, simply proves that the irritation set up by the presence of the mycelial membrane can excite the myringitis to such a height as to destroy by suppuration the entire thickness of the *Mt*. Since Gruber has shown[1] that "at least ninety-five cases out of a hundred of primary acute myringitis are complicated with perforation," we must not be surprised at the frequency with which perforation of the *Mt* is noticed in cases of myringitis aspergillina, but, on the contrary, at its rarity. Bezold, *e. g.*, found only four cases of perforation in forty-eight cases of otomycosis.[2] After examining Politzer's preparations of a perforated *Mt*, overgrown with fungi, Steudener remarks, as above cited, that such developments of fungi in anatomical dry preparations are frequently observed as post-mortem appearances, and prove nothing concerning their existence during life.

The firm attachment of the membrane, as is generally the case upon the bare rete or corium, is also noticeable in all other vegetations which are cultivated upon a firm substratum, and can be easily explained by the fact that the mycelium adjusts itself accurately to every inequality of the terrain, fills up all sinuosities, and embraces any jutting promontories. If, additionally, the exudation upon which the fungus grows is tenacious or crust-like, if the aspergillus (as is particularly the case with the species fumigatus) rests upon a thick flake of epithelium, and if even individual fibres of mycelium are surrounded by epithelium, then we have causes more than sufficient to explain the above phenomenon in harmony with the results of our experiments.

Although it often happens that the otomycosis again makes itself visible in a day or two after careful removal of the fungus, and offers an *obstinate resistance* to treatment, yet this is no proof at all that the fibres have taken root in the living tissues. For this occurrence can be easily explained by the peculiarity which the conidia possess of clinging so firmly to the walls of the vessels which contain the nourishing fluid, that it is a matter of exceedingly great difficulty to syringe them off and wash them away. Thus,

[1] *Monats. f. Ohr.*, 1875, No. 9.

[2] The reports of other authors on this point are either absent or inaccurate.

in case number two (*of my own series*), even after powerful syringing for two or three days, we found very young mycelial membranes, composed for the greater part of germinating conidia and fresh, firm, short mycelium. Amongst these, moreover, even by the most careful examination, it was impossible to discover any older fibres of the same structure and thickness as offered by the thallus (stalk) of the membrane originally syringed from the ear.

We are therefore justified in concluding that: *Aspergillus in the ear rarely clings as a membrane to the epidermis (fumigatus); usually (always in the case of niger and flavus) it rests upon the surface of the exposed rete or corium, without penetrating the latter. On the contrary, mycelium of the deeper layers of the thallus may become surrounded by the cells of the rete Malpighi.*

C. Symptoms and Course.—(*a*) Subjective symptoms are occasionally absent: generally we have deafness, tinnitus, pain, itching, and a discharge. Moos was the first (1871) to report cases of asp. niger without any symptoms. Burnett's similar cases appeared at a later date. Bezold says, that of forty-eight patients affected with otomycosis, nineteen were entirely free from subjective symptoms, and that of these, at least ten were affected with asp. fumigatus. Three of my own cases of fumigatus proceeded without symptoms. We consequently see that of twenty-two cases *of otomycosis from asp. fumigatus, eleven (fifty per cent.) were free from subjective symptoms.* It is also very probable that this percentage may be even still higher. The possible cause of the comparatively innocuous qualities of asp. fumigatus lies in the fact of its greater delicacy of structure, that it forms less luxuriant vegetation, and that these tufts of fungus undergo fermentation in the weakest degree, as was shown by our experiments. Besides this, the species fumigatus generally rests upon clumps of epidermis or on thickened and desiccated secretion, so that in all cases in which this species is observed the nerves of the corium are normally covered and protected.

Deafness and tinnitus are particularly well marked when the fungus grows upon the soil which has been furnished by

the secretion from a myringitis. At such times the patients usually complain that the ear is "stopped up." Hearing is generally so extensively reduced that neither Politzer's acoumeter nor the watch are at all heard. Buzzing, roaring, pulsating noises, howling, whispering, and rustling (No. 3 of my own cases) are generally complained of as being persistently present. The pain is of a tearing nature, usually intermittent, often worse at night, while occasionally it spreads over the entire half of the head.

Itching is very rarely absent. It excites the patient to bore and to scratch, and so contributes essentially to an increase of the inflammatory symptoms.

Most authors mention that the affection is accompanied with a slight, aqueous, serous *discharge.* The diluted nature of the secretion arises from the fact that the fungus abstracts from the serum all of its firmer albuminates, and leaves behind the water and most of the salt (as happens with serum-jelly, gelatine, and the albumen of hens' eggs). But this salt water, with which, as a result of the fermentative properties of the aspergillus, unknown products of division and combustion, to say nothing of resinous matters from the fungus membrane, are mingled, is, of course, not an indifferent fluid. It must possess irritating qualities, and to this circumstance is to be ascribed the extreme difficulty of obtaining spontaneous recovery in a case of otitis suppurativa when complicated with otomycosis aspergillina. For under these conditions we have a vicious circle; the aspergillus increases the inflammation, and this in turn by more abundant production of serum furnishes new and more nourishing pabulum for the continued existence of the aspergillus. In this way the fungus can insure a prolongation of its existence within the auditory meatus.

Otomycosis has no especially characteristic subjective symptoms. Depending upon its locality, we see the symptoms of an otitis externa, a myringitis, or a chronic catarrh of the middle ear predominate.

The *one significant symptom* in a large number of cases of otomycosis is the occasional removal by scratching, etc., of a fungus membrane from the ear, and that until a new

membrane is formed the subjective symptoms abate in severity, and then again increase. This spontaneous loosening of otherwise firmly adhering membranes is observed, after a while, upon all albuminous foundations, and also upon gelatine, especially at the period of the highest development of the aspergillus, *i. e.*, in four or five days after being sown. The cause of this phenomenon lies in the increased fluidity of the nourishment. In the living tissues we have still another cause, in that the fermentation when at its height particularly irritates the nerves and vessels of the corium. It is probable, therefore, that at this time the outermost cells of the rete undergo suppuration and subsequent exfoliation, the secretion becomes as a whole much more active, the fungus membrane grows loose at several points, and at last is easily movable upon its foundation. If it happens then to be washed away by fluids, or scratched out, it first of all leaves upon the wall of the meatus a portion of its mature conidia, an accident which is most likely to happen when we recall the extremely fragile connection at such a time between the conidia and sterigmata.

(*b*) Amongst the objective symptoms, in case the *Mt* is intact, are a slight reddening of the locality which the fungus is about to attack, injection of the manubrial vessels, with absence of the light spot, and a serous secretion generally within twenty-four hours. These symptoms are followed by the appearance of a mealy-white deposit, which rapidly undergoes transformation into a compact membrane, is occasionally exfoliated in from five to eight days, and under favorable circumstances regenerated in two days. If the membrane has not been covered with fluid, if neither oil nor instillations have been previously used, if the secretion is moderate and the nourishment of the aspergillus normal, we can see upon the surface of the membrane which is turned toward the air, a greater or less number of the characteristic conidiophores, which at first are white or gray, then of a darker color. If the growth of the fungus is impeded by lack of sufficient food, the mycelium predominates, and may entirely fill the meatus with a fuzzy plug that bears great resemblance to a mass of cotton-wool.

At other times, the mycelium is so scanty that only traces of the same are to be met with in the shape of threads. In still other cases we simply find a more or less thick, fatty-looking "croupous" membrane. If the exudation is very extensive in amount, the masses, when thrown off rapidly one after another, may become compressed in the narrow space of the meatus into a firm plug (neither unrolling nor breaking up in water), which looks, as Burnett expresses himself, like a "wad of moist newspaper." The walls of their fissure-like or cyst-like cavities are often thickly strewn with conidiophores. I have never discovered any epidermis, epithelial elements, or cholestearine amid such luxuriant vegetation, but, on the contrary, excessively long conidiophores, abundant and large mycelium, swollen and unswollen conidia, and a granular mass which resembled that discovered in the thallus of fungi which had been cultivated upon serum jelly, and consisted evidently of coagulated albumen. Many of the sporangia (*all of them* when the membrane has been syringed away) have already lost most of their conidia, and consist merely of the receptaculum and sterigmata (especially in the case of fumigatus). Close by we find younger, smaller, and brighter conidiophores, in which the connection of their conidia is much firmer, owing to their less mature condition. It is consequently plain that the size (and partly the color) of the various portions of the fungus cannot always decisively prove the species. We must, therefore, frequently rely upon cultivation (ten-per-cent. gelatine solution with an addition of one half per cent. tannin). This is particularly true in the case of the fungus-down which is found in the ear, for it may not be an aspergillus at all, but belong to an entirely different species of hyphomycetes.

The scattered, darker, punctiform spots which are usually observed upon the lower side of the membrane (*the one turned toward the nidus*), have led Wreden to the erroneous conclusion that the conidiophores are usually turned toward the surface of the *Mt.* But these embedded sporangia and free conidia are, as cultivation teaches us, the remnants of old cast-off membranes, only a part of which, as in every

cultivation, undergo germination, while the larger part become enveloped in the thallus of the new membrane, and remain there unaltered. Sclerotia have never yet been found in the ear, for the temperature and locality are unfavorable to their development.

These fungi rarely possess any odor. They occasionally smell like mould, never as if putrid. This appears to verify the assertion that aspergillus cannot grow upon a putrifying secretion. Cultivated aspergillus smells strongly of mould, especially in the stage of fructification.

The duration of the disease depends of course upon various circumstances, and may extend over months, and even to a year. Otomycosis in the middle ear is very obstinate, because the sinuous cavities of this district are almost inaccessible to medication.

Eurotium repens has no subjective symptoms. Objectively it appears as an envelope or covering to ceruminous plugs, either as a fine woolly (mycelium) or greenish (conidiophore) deposit, or as a fine sulphur-yellow layer (perithecia), in which case we find it mingled with broken-down, discolored, gray, or brown conidiophores. Eurotium is also found *embedded* in masses of cerumen. Its conidiophores are then to be discovered as black dots upon the yellowish or brown bits of cerumen as they float about upon the water syringed from the ear. The invariable long-oval form of the conidia is characteristic, and quite different from that of the conidia of aspergillus.

D. **Diagnosis.**—Asp. *flavus* and *niger* can generally be recognized by the naked eye, and very easily with a magnifying glass, while the discovery and examination of asp. *fumigatus* and *eurot. repens* demands the assistance of the microscope. The addition of a small quantity of liquor potassæ with glycerine clears up the epithelial fragments, and shows off the fungus more distinctly.

E. **Therapeutics and Prophylaxis.**—A few cases of spontaneous recovery, without any assignable cause, have been observed. Others have been noticed in which the cerumen covered over or enveloped the aspergillus, and my experiments have really shown that, saying nothing of its capacity

of cutting off the entrance of air, *fresh cerumen is hostile to the growth of aspergillus.* In Burckhardt's sixth case, the mycosis disappeared spontaneously as soon as the cerumen had been removed from the ear, where it was exciting eczema.

Syringing with luke-warm water has frequently cured cases, in which, however, the epidermis was intact, and the fungus lay dead in the meatus (usually asp. fumig.). *Alkalies have rarely proved useful* as instillations and ear-baths, although, if properly concentrated, they cause more alterations in the structure of the fungus (by swelling) than acids and salts, and even in slight quantities, as proved by experiments, they interfere decidedly with the growth of the same. But despite these facts, their unfavorable action upon otomycosis may be explained by the circumstance that they increase the secretion of serum by maceration of the epidermis and rete, and thus yield more abundant nourishment to the fungus in the living ear.

The only exception is, that a weak solution of sodium carb. (or bicarb.) is useful for softening masses of epidermis which have become overgrown with the fungus.

The following remedies are contra-indicated, because they may excite an eczema: the sulphates generally, silver nitrate, strong solutions of carbolic acid, and instillations of oil.

Glycerine, solutions of zinc, alum, aqueous solutions of tannin, favor the growth of fungus by affording suitable nourishment, or at least by making the serum more favorable for their reception.

Wreden's favorite and infallible remedy is freshly-prepared calc. hypochlorosa (0.10 : 30.00), but Bezold was unable to obtain any benefit from its use.

Fresh chlorine-, bromine-, or iodine-water, and strong solutions of potass. hypermang., are extremely efficacious.

Potassium chlorate has no influence upon the conidia.

These aqueous solutions, however, all possess the disadvantage of being unable to remain long enough in contact with fresh sporangia (clusters of conidia; little heads of conidia) to exercise any paramount influence upon them.

(Thus, in the case of ripe, cultivated conidia, thrown upon water, we have to agitate the fluid for a long time, and very carefully, before we can succeed in covering them entirely.) And if the membrane is thick, aqueous solutions can rarely reach the interior, to say nothing of the lowermost layer. Of all the aqueous solutions, I have obtained the best results from lead acetate (0.10 to 0.60 : 30.00) instilled or injected into the ear. *For all that, however, this remedy does not in any way influence the vitality of the fungus.* Here again we see an exemplification of the fact that the action of any remedy, even if well recommended, and justly so, in a case of otomycosis, does not depend upon any direct organic injury to the fungus which the remedy may cause, but upon the alteration to which it gives rise in the soil upon which the fungi flourish. Lead acetate, as we know, simply limits the amount of secretion; it has "drying" qualities. The same can be said of *alcohol and various alcoholic solutions of salicylic acid* (two- to four-per-cent.), in the latter of which we possess, according to our experience, a sovereign remedy against otomycosis.

The favorable action of alcohol, which is confirmed by almost every one who has ever employed it, depends upon the circumstances: (1) that the spirit is very easily diffused as well through dry as moist membranes, and that it also comes into most intimate contact with the sporangia; (2) that it dissolves the resinous portions of the fungus elements, deprives the latter in this manner of their protecting envelope, imbibes the water, and renders the protoplasm incapable of life,—if salicylic acid is dissolved in the alcohol the former penetrates all parts of the fungus, especially the organs of fructification; (3) and this is the most important of all, that *the very qualities which have made alcohol so useful an adjuvant in the treatment of chronic inflammation of the external and middle ear, render it invaluable in the treatment of otomycosis.*

The action of alcohol is, consequently, a double one: *it kills the fungi and diminishes the amount of secretion.* The former action, however, is much less powerful than the latter, for experiments teach us that this process may cost

at least ten hours, while after the use of alcohol for two to three hours at the most, in divided intervals of a quarter of an hour each, the fungus cannot find any nourishment in the ear; it must fall from its position and subsequently be driven from the ear. As we also know from Bezold's experiments, that the mycelium, chiefly, is less accessible to the action of salicylic-alcohol than the conidia, and that those fibres which have by chance penetrated into the skin must of course offer still greater resistance; so, therefore, I regard this fact as one of the most decisive supports for the opinion which I have gradually reached while preparing this paper: *that the aspergillus in the ear finds its* FAVORABLE *nidus only in certain anomalous secretions, and in its existence is bound closely down to these; but that, even when acting parasitically, it does not penetrate to any depth into the tissues.*

Solutions of corrosive sublimate in alcohol (1 : 1000), and naphthalin in alcohol (1 : 20), do not exert any greater specific energy than spir. vin. rectif.

The permanent destruction of the *eurot. repens* can be obtained by simply removing the old cerumen upon which it vegetates. Treatment of this fungus alone is quite unnecessary, as its presence does no harm of any sort.

The prophylaxis against otomycosis may thus be summed up, and the most important advice of all is this:

Do not allow the walls of the meatus to be deprived of their cover of cerumen.

Prevent any loss of epidermis, and consequent exposure of the rete to the open air for any length of time.

Avoid all unnecessary application of fats to the ear, as well as aqueous instillations or injections.

Be very careful in the use of zinc sulphate, glycerine, tannin (and possibly of gelatine).

Treat all secretory processes of the external and middle ear in the dryest possible manner, bearing in mind, of course, the alcoholic treatment of suitable cases of this nature, as suggested by Weber.

Endeavor to prevent all mechanical injuries in cases of

eczema of the external ear, and resort eventually to the exhibition of arsenic, iron, cod-liver oil, etc.

Be careful to cleanse all instruments which have been used for the removal or examination of any fungus membranes that have made their appearance in the ear, or which may have become contaminated by the secretion which favors the growth of aspergillus, etc.

On the contrary, I do not lay much stress upon Löwenberg's advice to heat the instruments, to add only water that has been boiled to the saturated or alcoholic solutions at the last moment before using. For, in my opinion, the danger of an infection by mycelium or conidia from long-standing aqueous solutions is not any greater than that of an invasion from the conidia which are almost always present in the air, cotton, etc., and, in point of fact, in almost every aural secretion.

F. **Prognosis.**—This is, of course, somewhat unfavorable for the *original disease* when complicated with mycosis, for it is then extremely obstinate toward the customary remedies, (Bezold emphasizes the *tardy* recovery of perforations of the *Mt* when complicated with mycosis,) while a spontaneous cure is very rare and slow of accomplishment.

Salicylic acid in alcohol (four per cent.) is an absolutely reliable remedy for the mycosis itself. But after this affection is removed, the original disease—even if rendered less severe, as in the form of dry eczema, pruritus, etc.—may continue, and in its exacerbations give rise to relapses of mycosis. Moreover, even when completely cured, the ear may offer some locality of less resistance to disease than before, and so with a new outbreak of eczema become affected once more with proliferation of the various species of aspergillus.

REPRODUCTION OF THE MEMBRANÆ TYMPANI BY SKIN-GRAFTING.*

By C. W. TANGEMAN,

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Joseph M., æt. twenty-eight, farmer by occupation, consulted me at my office for deafness and a purulent discharge from the middle ear, that had existed since he was eight years old, as one of the sequelæ of measles. Patient stated that he could not hear an ordinary conversation at all; he had consulted a number of physicians, but the most that had been done for him, was to amputate the uvula and prescribe ear-drops, and M. was discharged with the caution never to attempt to have the discharge checked; as being an excretion from the brain, the result would be fatal if interfered with. Is it not strange that such advice can be given by physicians at the present time, in spite of the advancement of modern otology? The patient's hearing had been reduced to $\frac{5}{48}$ on the right side, and $\frac{7}{48}$ on the left side; he had the appearance of an idiot, and seemed utterly indifferent to every thing that occurred around him. I cleaned the ears by means of the probe and cotton, and examined the membranæ tympani with the mirror and speculum. The membranes had central perforations, but so large that only a narrow rim remained; the lining of the tympanic cavity was very much thickened, and but very little air could be forced through the Eustachian tubes.

After the ears were inflated and thoroughly cleansed, the tympanic cavity and auditory canal were packed full of "Morson's" impalpable boracic acid. This plan of treatment was repeated as often as the boracic acid dissolved, and in the course of one month

*Compare a paper by Dr. Ely on skin-grafting in chronic suppuration of the middle ear. These ARCHIVES, vol. ix, p. 342, 1880.—Ed.

the discharge ceased ; hearing had improved somewhat—$\frac{7}{4}\frac{}{8}$ on the right side, and $\frac{9}{4}\frac{}{8}$ on the left side,—and treatment was discontinued.

Two years later patient again consulted me for deafness (the discharge had not reappeared), asking that the perforations of the drum membranes be closed in some manner, if possible. He was so persistent in his desire that I concluded to try transplantation, since the openings were so large and the trouble of so long standing that an attempt at reproduction of the destroyed tissue by means of caustics and irritants, would have been a waste of time.

It has long been a well-known fact to physiologists and surgeons, that portions of integumentary structure, when completely detached and transplanted to other parts of the body, retain their vitality and grow on the surface to which they have been fastened. In connection with plastic surgery the most brilliant results have been achieved by the application of this principle. The membrana tympani is more rapidly reproduced than any other structure or membrane of the body, when in a certain condition. At one time it was thought that a point of great importance therapeutically could be gained, in chronic otitis media, if a permanent opening could be kept in the drum-head : while even the basis of the principle was wrong, surgeons failed to establish a permanent opening. But in the above case the perforations were caused by a chronic inflammation which left the edges of openings rounded and thickened.

The loss of hearing was attributed by the patient to the absence of the drum membranes, and he was willing to undergo any operation that promised improvement. He could test for himself the size of the perforations by Valsalva's method of inflating the ears, the air passing through as readily as though there was no impediment. The prognosis concerning the power of hearing was grave enough, but good results could be promised more readily than to guarantee a restoration of the membranes. The first step in treatment was to treat the middle ear. This was done by inflating the ear and saturating a pledget of cotton with Pagenstecher's ointment and putting it into the auditory canal. This soon reduced the thickened condition of the mucous membrane of the middle ear and also improved the acuteness of hearing. I now denuded the edges of the perforation by means of a long, narrow-bladed knife, while the ear was illuminated with the concave mirror. A piece of skin

a little larger than the opening was taken from the arm of the patient, and placed with its raw surface toward the denuded edges of the drum-head, and retained in position by the use of a little collodion. In the course of three days the whole mass separated and came away, leaving the perforations larger, if any thing, than they were prior to the operation. Not being satisfied with the result, I made another attempt; but instead of using one large piece of skin, the graft was cut into small bits and placed in position as before; the auditory canal was plugged with a pledget of cotton saturated with yellow oxide of mercury ointment placed there for the purpose of exciting inflammatory action, which was necessary for union between the grafts and the membrane. Twenty-four hours after the operation the cotton was removed and the drum-head inspected. Only little change could be noticed, but the grafts had all been retained in position, and the general appearance was good; cotton was replaced. Twenty-four hours later, a narrow bridge of tissue was thrown across the opening, dividing it in two parts—the lower and posterior one closing completely in seventy-two hours after the operation. The upper opening remained for some time, but gradually getting smaller, until the patient found it quite difficult to force air through the small opening. The other ear progressed equally well, but patient could not remain any longer for treatment, and passed from my observation, with drum membranes and hearing practically perfect. H., both ears, $\frac{48}{48}$.

While there were two very small perforations remaining, I do not hesitate to state, that in a very short time they will entirely close.

The whole appearance of the patient had changed; he looked bright and cheerful, and could hear as well as anybody.

CLINICAL NOTES ON EAR-DISEASE: ŒDEMA OF THE DRUM MEMBRANE SIMULATING POLYPUS; DEAFNESS IMPROVED BY ELECTRICITY AND PHOSPHORUS.*

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IT is my purpose in this paper to call attention to two somewhat uncommon forms of ear-affection, which may, I trust, prove of some interest to the members of this Society. The first of these is one of œdema of the drum membrane simulating polypus.

I have no doubt that many cases, similar to that about to be described, have been observed; but from a perusal of otological literature, it seems to me that too little reference is made to the possibility of mistaking an œdematous tympanic membrane for a polypus. It is true that such a mistake should not be made by an expert, and yet, I believe, it would be an error in diagnosis not at all inexcusable in a practitioner who was not in the habit of examining cases of ear-disease every day. I have now seen several cases in which it was by no means easy to arrive at a definite conclusion after one examination only; but as most of the patients were examined at the dispensary, I have no record sufficiently accurate to bring before you. Of one case, however, which occurred in my private practice, I have full notes bearing upon the point in question.

*Read before the Medico-Chirurgical Society of Edinburgh.

The patient was an elderly gentleman, deaf in both ears. On the left side the drum membrane was normal, and an affection of the auditory nerve was diagnosed after examination with the tuning-fork. In this ear he heard my watch when in contact with the auricle, instead of at the normal distance of thirty inches. The right ear was almost absolutely deaf, and there was a history of suppuration and discharge from it. On examination with the speculum and reflected light, little pus was found. A light spot was, however, seen, which rose and fell synchronously with the pulse—showing that in all probability a perforation of the membrane existed. In the position usually occupied by the drum-head was seen what to the unaided eye was indistinguishable from a polypus, filling up the entire caliber of the meatus. The polypoid mass presented a very distinct convexity toward the meatus, and had the well-known polished œdematous look of a mucous growth. A probe was then gently introduced along the wall of the meatus, and its point passed well beyond the most prominent part of the convexity before it encountered a slight resistance. Now the difficulty was to decide, whether the resistance was due to the close contact of a polypus with the sides of the canal, or to the fact that the supposed growth was in reality an œdematous drum membrane.

Of course, a little more pressure exercised with the probe would have decided the question, but would also have been an unjustifiable proceeding; for, slight as was the force used, it was sufficient to produce vertigo and a transient feeling of faintness.

An examination of the ear then, extended to the utmost limits compatible with due caution, proved nothing definite, but left the diagnosis between polypus and œdematous swelling of the drum membrane uncertain.

The fact that very slight pressure on the tumor produced such marked symptoms of giddiness and faintness, showed an intimate connection between the polypoid mass and the stapes—for the symptoms described could, I think, only be attributed to the propagation of the pressure from the probe to the contents of the labyrinth through the stirrup bone.

Having arrived at this conclusion, three alternatives presented themselves. The mass might be (1) an œdematous drum membrane, the result of chronic suppuration of the

middle ear; (2) a polypus attached to the stapes; or (3) a mucous growth, the inner surface of which was in contact with that ossicle. In view of the somewhat greater probability of the first-named condition, treatment by means of syringing with boric lotion and the insufflation of boracic acid in impalpable powder, several times daily was recommended.

In about a month after the first consultation the patient was again seen. The hearing power had much improved, and a comparatively normal membrane, in which the *manubrium mallei* could be distinctly traced, replaced the anomalous growth. A small perforation existed which, though invisible, could be detected with the auscultating tube.

Now, in a case like the one first described, it is extremely unpleasant to contemplate the possible effects of attempted removal of the œdematous tympanic membrane, and I think the record of the case shows that the diagnosis could not, in the beginning, be made with certainty.

The differentiation of œdema of the drum membrane from polypus is, then, a matter of some importance, and one deserving of more attention than has so far been bestowed upon it by authors of otological works.

The next case which I wish to introduce to your notice is one of marked deafness, in which a very considerable amount of improvement was effected by the use of electricity,—at first alone and afterward in combination with the internal administration of phosphorus.

At present the general attitude of aurists toward electricity as a therapeutic agent is one of scepticism, although, of course, there are some distinguished exceptions.

Thus Moos has recorded a case of nervous deafness cured by the use of the constant current, but Roosa has criticised the result on the grounds that the patient was distinctly hysterical, and that she was probably under the influence of quinine when the hearing was at its worst. The deafness of cinchonism, we know, is almost universally recovered from. Moos has, however, recorded another case, that of a young man deaf after cerebro-spinal meningitis, in whom

galvanism produced marked improvement (Erb. Electrotherapie, 628). Weber-Liel, too, reports good results from his intra-tubal method of applying electricity; but then his mode of using the remedy seems to require the use of those means of opening the Eustachian tube which so often give satisfactory results without the addition of the electric current.

Dr. Woakes applies one electrode to the veil of the palate or within the Eustachian canal, and thus causes contraction of those muscles which open the tube. Here, again, it may be objected, that only another plan of ventilating the tympanum is substituted for Politzer's inflation. The excellent results obtained by Duchenne (De l' électrisation localisée, 826–852) in some cases of deafness have always been too little regarded by otologists, for if they be accurate,—and we have no reason to doubt the accuracy of the great French physician,—the electrical treatment of ear-disease has been much underrated by recent writers.

Now, in the case which I am about to describe, the only treatment used was the passage of an induced current from ear to ear, the sponges being pressed upon either tragus, and, after the effects of electricity had been clearly demonstrated, the internal administration of phosphorus.

The patient, E. W., aged forty-three, a nurse, consulted me first some years ago. At that time I noticed that electricity produced a marked improvement, but as treatment directed to the naso-pharynx was also used, and a daily record not kept, I was unable to draw any absolutely convincing deductions. The case, however, is shortly referred to in a paper on "Nervous Deafness" which appeared in the *Lancet* of 1881.

In February of this year the patient again came to Edinburgh, and an opportunity was afforded of a careful re-investigation. She has been deaf, to her knowledge, for years, but in 1878 or '79 had very severe neuralgic pains, and thinks that from that time the hearing was worse. The deafness is made worse by sore throat, to which the patient is rather subject. She has had tinnitus of the sea-shell variety, but not constant or troublesome. There is no vertigo. Menstruation once intermitted for a time, but is now regular.

When the patient is excited, she feels a lump in her throat, and the pharynx was not easily excited by tickling with a brush. I may here state that these two were the only facts pointing in any way toward hysteria. In phonation the uvula is drawn toward the right. The hearing distance for a watch normally heard at about thirty inches is :

Left ear : Contact with the auricle.

Right ear : Just off the tragus.

The tuning-fork placed on the brow is best heard in the left or worse ear.

The drum membranes are very slightly concave, but otherwise normal. The Eustachian tubes are pervious, and Valsalva's inflation renders the hearing worse. An induced current just strong enough to produce pricking was used for a few minutes at each sitting, one sponge being applied over each tragus, with the following result :

After the first sitting a slight improvement was noticed.

After the second, on the 11th of February, the hearing distance was :

Left : Just off the ear.

Right : One half inch.

On the 12th of February the hearing power was, before the application of electricity, the same as above, but afterward rose to : Left, $\frac{1}{2}$ inch ; right, $\frac{7}{8}$ inch.

On the 13th it rose to : Left, $\frac{3}{4}$ inch ; right, 1 inch.

On the 15th it rose to : Left, 1 inch ; right, $1\frac{1}{8}$ inches.

Electric treatment was now intermitted, and on the 23d of February the patient began to take $\frac{1}{30}$ gr. of phosphorus twice a day.

On the 6th of March hearing distance was : Left, 1 inch ; right, $1\frac{1}{4}$ inches.

On the 11th of March hearing distance was : Left, 1 inch ; right, $2\frac{1}{4}$ inches.

This was my last examination of the case, and I made one final trial with electricity. It produced an increase of $\frac{1}{4}$ of an inch in the left ear, but did not affect the right. The patient then left Edinburgh. Being desirous of obtaining some other data besides that furnished by the watch test, I requested E. W. to let me have a few observations of her own as to the amount of improvement in hearing effected. These comprised the facts that she heard a dining-room clock tick which was before inaudible, that she

could hear the same clock strike at a greater distance, and that she heard a railway-whistle not heard before. She also stated that she was wakened by the fall of a wine-glass in the room above the one in which she slept.

Now the principle factor of deafness in this case was undoubtedly the presence of proliferous inflammation in the tympanum, and as far as the want of hearing was due to this cause, it was probably irremediable.

Another element, however, contributed to diminish further the hearing power already greatly impaired by organic disease, and in removing this secondary factor of deafness electricity and phosphorus did good service. The course of events in this case was, I believe, as follows: The patient's hearing was so far impaired by the organic disease that she was in a condition to feel acutely any slight addition to her deafness. Neurasthenia of the auditory nerve then occurred, probably as a result of an atonic condition of the nervous system generally, and hence the increased deafness, which was remedied by the use of electricity and phosphorus—the one a local, the other a general, nerve tonic. This subject of neurasthenic deafness I have already considered at some length in the paper before referred to, and I will not trouble you with a recapitulation of the facts there stated.

One aspect of the case in question requires to be somewhat more fully discussed. In stating that there was, under the influence of emotion, the subjective feeling of a lump in the throat, and that the pharynx did not readily resent tickling with a camel's-hair brush, I stated all that could be said in favor of any hysterical element. Now there seems to be at present very great confusion as to the meaning of the latter term. Some authorities seem inclined to place every symptom, from malingering—provided always it occurs in the female—up to marked neurasthenia, in the same category. I cannot but think that we should recognize the possibility of a neurasthenia as distinct from hysteria altogether. In the case I have described, for instance, the patient was a sensible and intelligent woman, showing no

inclination to crave sympathy. Moreover, she at once stated that she heard the tuning-fork through the skull-test in the worse ear,—a fact which, from the point of view of most aurists, would at once exclude the idea of hysterical deafness.

Most persons are at times, even when apparently quite healthy, subject to a feeling of languor and lassitude. This condition is due, I take it, to deficient activity of the nervous system, and when it is continuous, may be described as neurasthenia. Now, if the normal channel through which impressions are conducted to a nerve of special sense be already imperfect, the corresponding sense will naturally suffer most, and the therapeutic indication is to apply electricity locally and nerve tonics to remedy the general condition. As a final argument against the hysterical theory, I may state that I have also observed improvement in hearing follow the use of electricity in the manner described in the male, although I have no extended notes of such cases.

This neurasthenic element should be looked for in patients already deaf from organic disease, but in whom increased deafness occurs under circumstances which can have no influence in changing the pathological condition already existing in the ear, *e. g.*, emotion, fatigue, dyspepsia.

THE ETIOLOGY AND SYMPTOMATOLOGY OF AUTOPHONY.

By G. BRUNNER, M.D., Zurich.

Translated by H. Knapp.

IT may, perhaps, not need a special excuse if, from the opportunity afforded by some personal observations, I endeavor to throw some light on a subject of great physiological and clinical interest which, nevertheless, has been rather neglected in literature.[1]

I mean the phenomenon of autophony, *i. e.*, the pathological resonance of one's own voice, as well as of the sounds caused by one's own respiration and circulation. The question is whether autophony is produced only by insufficient closure of the tube or by the opposite condition, the obstruction of the Eustachian canal. It is a fact that very distressing trumpet-like, full-sounding resonance of the voice and respiration occurs when the tube remains patent, as is demonstrated by the experiments and clinical observations of Poorten, Flemming, and others. Closure of the tube, although not a firm one, is necessary for normal hearing. Hensen also, in his physiology of hearing, has adopted this proposition, and says, "that ordinarily no noise penetrates through the tube into the ear—*i. e.*, if a sounding body is approached to the orifice of the tube through the mouth, it is perceived the

[1] Only the text-books of Urbantschitsch and Hartmann contain a short paragraph on autophony, but we look in vain for a discussion on this subject in the treatises of Politzer and Van Troeltsch, who do not devote a special chapter to diseases of the tube.

more indistinctly the deeper it is introduced; as soon, however, as the tube is opened a change takes place, and autophony occurs, *i. e.*, the person's own voice is perceived sounding strong in the interior of the ear." Does the same phenomenon occur when the tube is closed? On this point authors differ. Urbantschitsch says in his text-book (page 232) that in stricture or closure of the tube patients frequently complain of a sensation of fulness in the ear, and of a strong resonance of their own voice, at times so much increased that they only dare to speak in an undertone. He likewise mentions (page 313) autophony as among the symptoms of acute otitis media, without, however, expressing his opinion on the causal connection between closure of the tube and autophony. According to Gruber, on the other hand (page 576 of his text-book), stenosis and obliteration of the tube are in themselves not sufficient to produce morbid subjective symptoms in the organ of hearing.

How can these differences be made to agree? The conditions unfortunately often are not so evident, as in the case of Poorten, where, in consequence of a diphtheritic scar, the faucial portion of the tube was gaping, and I can confirm the observation of Urbantschitsch that autophony occurs not very rarely in the course of acute or subacute inflammation of the middle ear—that is, where we can expect the closure of the tube to be rather stronger than weaker; and I may add that in some such cases, on Valsalva's or Politzer's experiment, even on catheterization, the air entered the ear with difficulty or not at all.

In spite of this we should think twice over before we designate obstruction of the tube as the cause of autophony, for though in certain cases this seems probable, many more weighty arguments are against it. The fact that autophony is by no means a constant companion of closure of the tube ought to make us hesitate, and give us a hint that other causes must produce it. If obstruction of the tube alone occasioned resonance of one's own voice—an assertion which to my knowledge has not been made with such generality by any person—autophony would be met with

much more frequently; it is too distressing a phenomenon to be disregarded by any patient. I have compiled the recorded fatal cases of obliteration and closure of the tube, but among the few which had been observed during life, I have found as symptoms only high degrees of hardness of hearing, no autophony. This is illustrated by a case of Gruber,[1] and an observation of Oscar Wolf,[2] where a bullet of a gun located in the tube had closed it completely.

Physiology, unfortunately, offers no reliable assistance in settling the question under consideration. We know that in ordinary circumstances the tube is lightly closed, and opens more readily toward the fauces than in the opposite direction. We know, further, that one's own voice does not enter the ear through the tube, but in the ordinary way, through the external canal; but whether the Eustachian tube forms an outlet for the sound-waves entering through the membrana tympani, and what influence its obstruction may have on the resonance in the ear, the text-books on physiology give us no information, if the complete silence of authors does not warrant the conclusion that physiologists do not at all attach such a significance to the tube.

We have, therefore, to rely exclusively on clinical experience, which, I think, doubtlessly demonstrates that closure of the tube in itself does not suffice to produce autophony. What are the other causes that may produce it? The investigations of Moos, Hartmann, and others have demonstrated that the tube in its faucial portion, immediately behind its pharyngeal orifice, is closed in a valve-like manner, the soft membranous wall pressing against the cartilaginous. Now we can easily imagine that the inflammatory swelling in acute catarrh of the middle ear renders the soft lateral wall less adapted to bring about the valve-like closure, whether the inflammatory process has relaxed it, or the inflammatory œdema has made it less pliable. When one's own voice has once penetrated into the interior

[1] Page 575 of his text-book.

[2] These ARCHIVES, vol. ii, No. 2, page 58.

third of the tube, it may, perhaps, resound in the ear even if the canal is closed in its further course. Autophony would in this case occur, not in consequence but in spite of the closure of the tube.

I will now relate some clinical histories which illustrate the foregoing remarks, but I may first give the results of an observation made upon myself not referring to autophony but to the easier performance of Valsalva's experiment in faucial and tubal catarrh.

For ten years I have been suffering somewhat from chronic catarrh of the middle ear, and both my tubes, especially the left, are no longer so pervious for positive and negative pressures on Valsalva's experiment as before, not even immediately after the nasal douche, whereas air and liquid can without difficulty be forced into the ear through the catheter.

On Valsalva's experiment, I feel a certain tension in my left ear, as though the air would break through, but it is not the sensation, well known to me formerly, of a full rush of the air into the tympanic cavity, with extensive motion of the whole drum-head, and frequently I have also the well-known feeling of pressure in the ear, especially during the cold season. In the winter of 1881 I contracted a mild angina with slight transient pain in the ear without disturbance of hearing, and on the second day of the affection, which, by care and frequent gargling, terminated in four days, I observed that each Valsalva's experiment inflated the left drum more easily and completely than had been the case for many years. This condition lasted thirty-six hours. I have made the same observation in others; I remember, for instance, a patient with chronic nasal and secondary middle-ear and tubal catarrh who always considered it a bad symptom, when, on blowing the nose, the air rushed easily and noisily into the ear. He always then knew that something was wrong with his ear.

This temporarily increased facility of Valsalva's experiment at the beginning of pharyngeal and tubal catarrhs has no doubt been observed also by others, but has, to my knowledge, never been described. Is it the increased and, at

the beginning, more liquid secretion which relaxes the tubal valve, (just as immediately after the use of the nasal douche with alkaline solutions the Valsalvian experiment succeeds more easily and with a sounding noise,) or is the catarrhal relaxation of the mucous membrane the cause of the easy performance of Valsalva's experiment?

First Observation.

Mr. F., æt. thirty-four, consulted me September 26, 1875, on account of autophony, which had greatly distressed him for a year. His own voice sounds in his right ear very unpleasantly, rough, and hollow, and the rough resonance which he notices only on uttering the consonants *m* and *n*, disturbs him excessively in speaking. He can avoid it for some moments by a forcible inspiration through the nose with closed mouth, and in doing so he distinctly feels that something in his right ear moves like a valve. For a few moments his voice sounds natural; very soon, however, he feels that something in his ear moves outward, and the old condition is re-established.

To speak without impediment, he is obliged constantly to inspire through the nose and afterward carefully to expire through the mouth, for when he expires with the mouth closed, the distressing symptom reappears.

In the recumbent position, and on inclining his head forward and toward the diseased side, the unpleasant phenomenon disappears; on raising his head, it returns.

Mr. F. experienced the symptom for the first time twenty years ago, but then only several times during the whole year, and a single forcible inspiration through the nose sufficed to keep it off for a long time; only during the last year it has become so permanent that intermissions of one or two days, at the highest, are rare exceptions.

The hearing distance in the diseased right ear was $\frac{150}{400}$ centimetres for the watch; in the left, $\frac{200}{400}$ centimetres. In accordance with this, the patient had no difficulty in hearing ordinary conversation, or in perceiving any external tones and noises.

As long as the resonance of the voice lasted, a tuning-fork (c^1) was heard from all points of the skull only in the right (diseased) ear. When the resonance of the voice disappeared after nasal inspiration, there was no longer any pathological reinforcement of bone-conduction.

The resonance of the voice could also be noticed in the right ear if, while the patient was speaking, I put the auscultation tube alternately from one ear to the other.

The consonants *m* and *n* had a peculiar metallic or hissing secondary sound, and at the same time a snapping noise like the tubal sound was heard during the act of swallowing. Nothing of the kind could be perceived when the other consonants or the vowels were uttered. The patient said quite correctly that he would be all right if he could eliminate the *m* and *n* from the language. The respiratory noise, also, appeared intensified and resonant in the right (diseased) ear, but quite normal in the left. Rhinoscopy discovered the orifice of the tube and its surroundings normal.

In the same way, the air-douche and the probing of the tube with catgut bougies demonstrated that the tube was not stenosed. A bougie of 1 *mm.* in thickness could, without notable resistance, be introduced into the tympanum. As long as the bougie remained in the tube the resonance of the voice was absent, and remained so for some time afterward, which made the patient quite happy; how long I cannot say, as I have not seen him since. I intimated to him, however, that the improvement would be only temporary.

The inspection of the drum-heads furnished help in explaining the autophony. A slight diffuse opacity and foreshortening of the parts situated above the manubrium were present on the left side, as well as on the right. Curvature and cone of light fairly normal. No movement of the drum-head was noticeable on examination whilst the patient was making the forced nasal inspirations, nor later, when he had the sensation of something in the ear moving outward. The pneumatic speculum moved the drum-head and the manubrium on the right side and the left, though not very extensively. The aspiration showed no immediate nor any subsequent influence on the resonance of the voice. Neither atrophic patches of the tympanic membrane nor traces of exudation in the drum cavity were present.

Remarks.—There seems to be no doubt that, in the foregoing rather marked case, we had to deal with deficient closure of the tubal valves. This is proved, above all, by the constant, although transient, effect of forced inspiration with the mouth closed, during which, by the momentary rarefaction of air, the relaxed walls of the

tube were brought in contact, from which, after a short time, they returned either spontaneously or by the opening effect of the expiratory current into the gaping condition which evidently was their position of equilibrium.

If obstruction of the tube were the cause of autophony, the effects of expiration and inspiration would give opposite results—if the expiratory current alone (without closure of the nose) would at all suffice to open the tube.

The occurrence of the resonance of the voice with the nasal consonants *m* and *n*, which also have been called resonants, is easily explicable. They are formed, as is well known, by an exclusion of the mouth by the velum palati during the expiratory current, whereby the air is forced to escape through the nose, producing co-vibrations in the naso-pharyngeal space and the nasal cavity. It is evident that in this way the voice enters the insufficiently closed tube, under more favorable conditions than is the case with the other consonants.

This symptom seems to be constant—at least I have observed it in the other cases, though not so pronounced. The favorable effect of a marked inclination of the head forward is equally constant. It disappears at once when the head is raised beyond a certain point. The cause of this is probably a greater congestion. I shall return to this point later. The continuation of the improvement after the catgut bougie had been removed, was probably the result of the irritation and swelling of the mucous membrane produced by the bougie. This swelling usually lasts a certain time, and may be considered sufficient to cause the closure of a very slightly gaping canal.

The sonorous, trumpet-like sound of the voice is, I think, the result of a change in the conditions of resonance. The ear is accustomed to receive sound-waves which impinge upon the drum-head and chain of ossicles from without, and for this kind of transmission resonance is evidently as much as possible eliminated (by the great deadening power of the drum-head and the smallness of the vibrating ossicles which are nowhere in immediate osseous contact with the walls of the tympanic cavity). The conditions

are entirely different if the sound-waves enter the drum through the tube, in which case the column of air in the middle ear and the walls enclosing it are easily excited into co-vibrations.

We must bear in mind that the autophony developed very gradually in the course of twenty years, and showed its first traces in the fourteenth year of age. At that time a mere inspiration through the nose was sufficient to keep it off for a long time. The changes in the tube must therefore have been very slowly progressing, and very gradually developed in intensity. It must be left undecided of what kind these changes were, whether we had to deal with atrophic or with sclerosing processes in the walls of the tube, or whether, perhaps, a congenital anatomical predisposition was present. This much is sure, that there was no scar drawing the walls of the tube apart, for the pharynx, and the orifice of the tube showed nothing marked.

The disease in this, as in almost all cases, was one-sided.

Second Observation.

Autophony in chronic naso-pharyngeal catarrh.

Susan G., æt. twenty-four, unmarried, complains of hearing, during speech and singing, a disturbing resonance in her left ear for more than a year. It seemed as though her voice, instead of escaping through the mouth, went into the left ear. During eating also she had the sensation as though a door was constantly opening and closing in the left ear. Six months previously the autophony had been almost unbearable; not only every tone in speaking but every inspiration sounded in the ear, and during drinking she had often been under the impression as if the liquid went into the ear instead of going downward. If then she pressed strongly on the neck below the angle of the lower jaw, the sensation for a moment was less annoying.

Tinnitus aurium was formerly present, off and on—now no longer. She has been subject to colds for many years, and the nose sensitive to every current of air. Rhinoscopy shows nothing abnormal at the mouth of the tube, *h* R $\frac{105}{500}$ centimetres, L $\frac{35}{500}$ centimetres. Both drum-heads are somewhat opaque, especially the right. In repeating the alphabet, autophony was particularly noticed with the letters *m*, *n*, *i*, *u*. On Valsalva's experiment both

drum-heads moved readily, positively as well as negatively. On the left side, the posterior superior part chiefly bulges ; the end of the malleus seems somewhat fixed.

On catheterization and auscultation, the initial short puff, which in the normal condition introduces the characteristic inflation-noise (*bruit de pluie*), resulting probably from the separation of the opposed walls of the tube, is wanting. The air enters at once in a full stream without a marked beginning ; on the other (right) side, however, the initial puff is distinct. When suction is produced by means of the air-bag and catheter, the air is distinctly heard to escape from the tympanic cavity, whereas, on the right side, this does not occur even during the act of swallowing.

I diagnosticated insufficient closure of the lower end of the tube, probably in consequence of chronic naso-pharyngeal catarrh. Having had good results from injections of sulphate of zinc through the catheter, I began treatment with their use, and ordered at the same time the nasal douche and gargling. The first injection ($\frac{1}{4}$ %) removed the symptom at once, and the patient was quite happy at being able to speak again without experiencing the unpleasant concussions in the ear. After the improvement had lasted thirty-six hours, the patient returned on the third day, still considerably improved, the resonance of the voice being only insignificant. In conformity with this, I found that the initial puff was well pronounced on inflation, and I was obliged to employ a certain pressure to open the tube without having the patient swallow. I again injected the solution of zinc ; after the third sitting, the patient did not return for the reason that, as I learned, the difficulty was removed and she has been well up to date (fifteen months).

There seems to be no doubt that we had to deal in this case with an insufficient closure of the pharyngeal part of the tube. Nothing supports the supposition that the tube was closed also in its upper portion.

Less explicit is the following observation, in which autophony appeared in the course of an acute inflammation of the middle ear.

Third Observation.

Autophony in the course of an acute otitis media.

Mr. K., school-master, about forty years of age, using snuff a great deal, considerably hard of hearing from chronic middle-ear

catarrh for many years, especially on the left side, contracted in winter a very severe purulent rhinitis, with subsequent purulent inflammation of the right middle ear, and tenderness by pressure on the mastoid process. In the third week, when the acute symptoms had disappeared, the opening in the drum-head, after repeated paracenteses, had closed, and the purulent secretion formerly copious, had ceased, yet considerable inflammatory swelling in the middle ear was still present, and the hearing bad. Distressing autophony set in, which, though transient, had occurred several times in former years.

The autophony was very obstinate, and disappeared very slowly, the free intervals gradually becoming longer in the horizontal position in bed, and also for hours during the day it was absent. Bending the head forward or to the side made it disappear for a short time. Negative Valsalva's experiment and strong nasal inspiration acted in the same manner, though in a less degree; whereas positive Valsalva and strong expiration caused resonance of the voice. Inflation, with weak—either positive or negative—pressure of the bag, produces a strongly consonant, blowing noise, but without the opening puff. The resonance of the voice was particularly strong at *m* and *n*, and the patient, on sounding the consonants, experienced "a rough clatter in the ear —*i. e.*, a metallic clang, with vibrations of the drum-head." He placed the clang at the end of the once-marked or at the end of the twice-marked octave. His own respiration appeared in the ear like a blowing sound which, like the resonance of the voice, could also objectively be perceived. Treatment was directed to cure the tympanic and naso-pharyngeal catarrh: nasal douche, injection of sulphate of zinc ($\frac{1}{4}$ to $\frac{1}{2}$ %) through the catheter, which, I may add, by causing burning in the ear, demonstrated the absence of swelling of the tube. The patient recovered his former hearing, and the autophony disappeared completely.

Fourth Observation.

The following case, observed as early as twelve years ago, seems to be particularly instructive concerning the occurrence of autophony during obstruction of the tube.

A woman of forty-five years of age, who had been long subject to colds, contracted an acute inflammation of the right middle ear, with sensibility on pressure on the mastoid process, tinnitus, sen-

sation of obstruction, and considerable impairment of hearing. Autophony appeared on the diseased side in the second week.

I saw her at the end of the second week. *h* R = o, L = $\frac{1}{400}$ *cm*. The upper portion of the right drum-head was slightly reddened, somewhat dull and retracted, without perforation, and without symptoms of accumulation of liquid in the drum. The very intense and distressing autophony which was noticed, not only in speaking, but during respiration and with each movement of the lower jaw, was also objectively discernible through the otoscope. On the right side the patient's voice sounded unusually strong, with a rough clang, as through a long tin pipe, falling into falsetto during loud speaking ; the respiratory noise was loud and wheezing. On the left side none of these symptoms. The tuning-fork (c^1), placed on the middle of the vertex, showed no distinct otoscopic difference between the right ear and the left.

The patient had noticed that the autophony became weaker or disappeared as long as the diseased ear was held tightly closed with the finger, or when the external canal was filled with warm water.

Inflation had no influence on the autophony. The strongly consonant auscultatory noise made the impression as though it were very distant in the pharynx or at the beginning of the tube. Though inspection of the drum-head failed to discover the presence of liquid in the drum cavity, I made a paracentesis of the drum membrane on the strength of Gruber's statements. This operation did not change the autophony. At the beginning no air passed through the opening; but as soon as repeated strong inflations forced the air audibly through the opening in the drum-head, the subjective and objective autophony had suddenly disappeared. No trace of secretion had been evacuated through the perforation. The air hissed during blowing of the nose with great readiness through the perforation. The improvement lasted until the next morning, though the patient could not force air through the opening longer than the previous evening. Two days later, when I saw the patient again, the perforation was closed without any reaction, but the autophony had reappeared in its full strength. The air-douche through the catheter had no effect. Injection of a solution of zinc removed the resonance of the voice at once, but it reappeared the next morning. Two days later inflation of air and a solution of zinc proved inefficient. I introduced a catgut bougie about 1 *mm* thick through the catheter. It was held tight in the middle of the tube, and could not be pushed

farther; but now the autophony had disappeared, yet returned when I withdrew the bougie, to disappear again when I reintroduced it. I now passed a bougie of about $\frac{3}{4}$ *mm.* in thickness, which, likewise, was held tight at the above-mentioned place, yet finally entered the tympanic cavity, whereupon the autophony ceased (also for the otoscope). I left the bougie in position for ten minutes. The patient felt quite easy in the ear; the constant tinnitus had somewhat subsided; it returned, however, before the bougie was withdrawn. The autophony, on the other hand, had disappeared, yet the patient said, on leaving, that she had the impression as though the resonance of her voice would soon reappear. It did so. The further course may be briefly related as follows: The difficulty proved to be very obstinate, the autophony and impairment of hearing diminishing very gradually, the former disappearing not before three months and a half, when also the acuteness of hearing was improved. The disease, on the whole, was an obstinate tubal and tympanic catarrh, for which the following treatment was ordered: At the beginning, repeated local abstractions of blood; then the nasal douche, gargling, injections through the catheter of a $\frac{1}{3}$ to $\frac{1}{2}$ % solutions of sulphate of zinc. I will mention that, three months after the onset of the disease, Valsalva's experiment did not succeed, and the air did not pass through the catheter in a full stream, but interruptedly, with a sharp, short crepitation, after having overcome a considerable resistance. The solution of zinc, injected into the tube, caused only very slight burning in the ear, demonstrating that the tube was still stenosed.

From the results of the air-douche, Valsalva's experiment, the later exploration, etc., we are compelled to assume a stricture or an occlusion of the tube in its middle portion, and consequently to concede the occurrence of most pronounced autophony in obstruction of the tube. Formerly I, however, endeavored to explain the case by an abnormal resonance produced by occlusion of the tube.

If, at present, I am of opinion that obstruction of the tube in itself does not suffice to produce autophony, I principally support my belief by reasons of clinical experience, and therefore do not hesitate to assume in the case under consideration an insufficient closure of the faucial portion of the tube, together with a catarrhal stenosis of its mid-

dle and superior portions. I am quite aware that I am standing here on disputed ground, and that we are still insufficiently acquainted with the pathological conditions under which resonance in the ear occurs. It is quite possible that autophony is brought about under different circumstances: so much, however, seems to be certain, that it ought to be far more frequent if mere obstruction of the tube were sufficient to produce it; it is surely absent in many pronounced cases of tubal obstruction.

Fifth Observation.

Mr. S. T., æt. sixty-two years, merchant, for the last three months so much reduced and nervous, by dyspepsia and care, that he had to keep his room; complains of late of left-sided autophony, which almost drives him to despair.

In former years he travelled for a snuff-manufacturing house, and used snuff to a very great extent.

Years ago he had an attack of autophony, which, however, disappeared after a single application of the nasal douche and Politzer's experiment. Now it has been present again for three weeks in the left ear, off and on, and also in the right ear, though in a less degree. It set in suddenly, beginning regularly with crepitation in the ear, "with the sensation as if in the interior something gave way and air entered where it ought not to be." At the same time the patient has a strange sensation of the presence of a foreign body, and hears every respiration like a rushing stream of water; each pulse-beat is heard dull in the ear, as is his own voice, especially at uttering *m* and *n*. He distinguishes two or three degrees of intensity of his autophony, each beginning with a peculiar noise. The first degree begins with the above-mentioned crepitation (like firing by platoons), the second begins with a distinct snap in the ear, and the third by a loud explosion (almost like a cannon), after which the autophony is almost unbearable. The patient in this condition sought relief by lying down in bed on his back, or in a sitting posture, leaning his head and chest considerably forward. In this way he could control the resonance, but only so long as he kept up these positions; for by raising his head beyond a certain sharply defined limit, the autophony recurred. At the beginning and the end of the affection, a moderate inclination was sufficient;

at the height of the disease, however, when the autophony was most intense and obstinate, he had to lean very deeply forward in order to obtain the desired effect. At those times, the horizontal decubitus was not always efficient, yet on the whole, he was least annoyed at night when he lay in bed, and the phenomenon did not reappear until some time after rising in the morning. After his meals he commonly felt better; before breakfast, worse.

The examination of the drum-head, with the exception of a diffuse opacity, showed nothing remarkable; no injection, no abnormal concavity, no distinction between right and left; $h = \frac{10}{500}$ *cm.* on both sides. He thought his hearing was good—as good as before autophony set in; $I'' \frac{15}{60}''$; no pain. The Valsalvian experiment did not succeed, of which I convinced myself by simultaneous auscultation and inspection of the drum-head. Ordinary inflation through the catheter produced no improvement. During inflation I heard a distant noise without the characteristic dilatation puff. Only when I injected, during the act of swallowing, a few drops of liquid ($\frac{1}{4}\%$ solution of sulphate of zinc), the crackling noise sounded nearer, and the autophony disappeared for twenty-four hours thereafter. The injected liquid causing intense burning in the ear and redness of the drum membrane—both, however, disappearing quickly,—the sensitive and timid patient refused the further employment of the catheter, as well as any heroic treatment.

I had, therefore, to confine myself to the nasal-douche, insufflation of $\frac{1}{4}\%$ of nitrate of silver with starch powder into the nose, and the application of Politzer's experiment, both in the positive and negative methods. The positive method was not always successful; the negative method (in which the bag acts by suction during swallowing), as well as the positive, if successfully applied, had only a temporary effect. The negative method yielded, on the whole, more satisfactory results than the positive. Inflation of the powder into the nose or the naso-pharnygeal cavity afforded, almost always, relief from or removal of the autophony, and mostly for a longer time than Politzer's experiment. After four weeks the autophony gradually subsided and finally disappeared.

Remarks on the foregoing case.—The conditions of the tube may give rise to some doubt. On the one hand, the failure of Valsalva's and Politzer's experiments, the effect

of the air-douche as detailed above; on the other hand, the occurrence of autophony with crepitation or a snap, and the constant sensation as if something in the ear was giving way, are difficult to reconcile. The most plausible supposition seems to me that the faucial portion of the canal, which forms a vertical fissure, has a tendency to dilate and gape; but that the upper narrower portions were stenosed, as a usual condition in middle-ear catarrh. I consider the latter condition, as I have stated above, to be irrelevant, and refer the autophony to the altered configuration of the lower portion; while the latter, in the normal state, is closed, and when opened spontaneously closes again.

I consider in our case the equilibrium as very unstable,—perhaps reversed,—and find it very remarkable that the lower degrees of autophony begin with a crepitation, the higher with a distinct snap, evidently produced by a sudden, very energetic separation of the walls of the tube.

Chronic catarrhs may, in some cases, be the cause of autophony, in consequence of atrophic processes, wasting of the parts, or alteration of their elasticity, or of the tonus of the muscles. All agents that produce congestion of the mucous membrane or increased secretion—the nasal douche, insufflation of *arg. nitr. cum amylo* into the nose—temporarily removed or diminished the autophony. The favorable effect of eating, the unfavorable effect of fasting, as well as the influence of the position of the head, regularly manifesting themselves in my cases, are of great interest. It may not be easy to explain these facts. Probably the greater filling of the blood-vessels had a decided influence, for the patient stated that the autophony disappeared or diminished if he felt his head congested.

It seems contradictory that the autophony did not only disappear by forcible nasal inspiration and the negative methods of Valsalva's and Politzer's experiments, but also, though less regularly, by the positive method. We can imagine that an external impulse is sufficient temporarily to close the pathologically open tube, or to open it when it is closed. We refer to Hartmann's[1] experiments, according

[1] Mittheilung über die Function der Tuba Eust. *Arch. f. Anat. und Phys.*, 1877, p. 546.

to which increase of pressure in the naso-pharyngeal cavity crowds the membranous wall of the tube against the cartilaginous roof.

From so few observations, to which, however, I might add some others, I would not make positive deductions; our material and our knowledge are still too incomplete. A few comprehensive remarks may, in conclusion, be permitted. Apart from the cases in which autophony was produced by cicatricial contraction in the pharynx, it seems chiefly to accompany acute and chronic naso-pharyngeal and tympanic catarrhs, especially in persons suffering from habitual naso-pharyngeal catarrh. Among the five patients two were accustomed to take a great deal of snuff. In three autophony had begun insidiously. Several years previously it showed itself, usually only on one side; only in the last observation traces were noticed on both sides. Its cause, I consider to have been a patulousness of the tube, in consequence of insufficiency of the valve-like closure of the pharyngeal orifice; or an alteration of equilibrium in the parts, with a tendancy to rupture of the closure; possibly also a spasm of the dilatator muscles. In the further course of the canal there may be an obstruction to which I, however, am not inclined to ascribe an essential causal significance.

Although in all cases the annoying, frequently unbearable, resonance of the patient's own voice, respiration, and pulse constitute the principal complaint, it is evident that the other symptoms vary somewhat, according to the cause and degree of the patulousness.

In my observations (of catarrhal deafness) the autophony never lasted the whole day uninterruptedly; it disappeared during rest in bed, and could also be dispelled for a shorter or longer time by certain manipulations *c. g.*, by inclination of the head, by the negative method of Valsalva's and Politzer's experiments, forcible nasal inspiration with the mouth closed, that is to say by rarefaction of air in the drum cavity,[1] but also by introduction of irritating liquids

[1] I have mentioned above and sought to explain, that exceptionally also the positive methods of Valsalva's and Politzer's experiments remove the autophony for a short time (see above, fifth observation).

into the tube, and of irritating powders into the nose or the naso-pharyngeal cavity.

The resonance of the voice could generally be also objectively perceived, but not always distinctly (for instance in the fifth case), a fact which I am unable to explain.

Rhinoscopy has thus far not given me any assistance in arriving at an anatomo-pathological diagnosis.

The prognosis does not seem to be unfavorable in the catarrhal cases (see above), but in the fourth observation the autophony lasted fully three months.

THE HISTOLOGICAL CONDITION OF SIX TEMPORAL BONES TAKEN FROM THREE CHILDREN WHO HAD DIED FROM DIPHTHERIA.

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Translated from the German by Charles J. Kipp, M.D.

WE are indebted for these temporal bones and the following note to our esteemed collaborator, Dr. Fraenkel, Prosector in Hamburg. "All of the temporal bones were taken from children either under or just over one year of age, who had died from diphtheria of the pharynx or the upper air-passages. Only in one of the cases was the naso-pharyngal cavity not involved. In each of the children tracheotomy had been performed. Two were girls and one was a boy."

METHOD OF EXAMINATION.

The temporal bones had been preserved in Müller's fluid. After careful macroscopical examination of all the parts, the pyramids were separated from the rest of the bones, and placed in a one-per-cent. solution of osmic acid; subsequently they were decalcified according to the method we have repeatedly described. The drum membranes were studied from transverse and parallel sections. They were, however, allowed to remain in connection with the handle of the malleus and the annulus till these were completely decalcified in solutions of chromic acid, gradually increasing in strength from one sixth per cent. to one per cent. After decalcification they were washed in water and then kept in alcohol for a time. For the purpose of making sections,

the drum membranes, with the handle and the annulus, were imbedded in liver.

First (right) Petrous Bone.

The cartilaginous part of the external canal was wanting in the preparation when received. The membrana tympani was injected radially; the handle of the malleus was not visible. The cavum tympani was filled with muco-purulent exudation, and its lining membrane was thickened. No microscopical examination of the lining membrane could be made, as the labyrinth had not been sawed off with sufficient care.

The microscopical examination of the drum membrane showed that the cutis and the layer of mucous membrane were thickened and infiltrated with small cells; the blood-vessels were everywhere distended, and at many points in their vicinity were extravasations of blood. The membrana propria, with the exception of a cleft between the radial and circular layers, which contained granular cells, did not at all participate in the morbid process. The epithelium of the mucous membrane was preserved in part.[1]

Upon the cutis and mucous membrane of the drum membrane were found thick layers of coagulated exudation; the exudation was also seen on the ossicles, on the tympanic pouches, and the chorda tympani. These exudations could, however, be readily lifted off with the forceps from the structures beneath them.

The niche of the foramen rotundum was filled with coagulated blood. All the parts of the labyrinth were normal, and showed nowhere the hyperæmia found in the left temporal bone. The peri- and endo-lymph were coagulated in the cochlea, but not as completely as in the left ear. A narrow strip of coagulated, lymph-like exudation was found on the inner surface of the sacculi and ampullæ.

[1] Reserving to ourselves further investigation, we may mention here that the mucous membrane lining the handle of the malleus was covered with cylinder epithelium; and also that in all of the temporal bones examined here, the wall of the labyrinth was covered with cylinder epithelium—a condition at variance with that found in adults.

Second (left) Petrous Bone.

The cartilaginous external canal was absent. The layers of epidermis and cutis of the drum membrane were thickened; the handle of the malleus was not visible. The antrum and tympanic cavity were entirely filled with a tenacious mucous mass. This mass was composed of exfoliated ciliated epithelium, pus corpuscles, and pigment. The mucous membrane covering the tegmen tympani showed a hemorrhagic infiltration. The vessels in the mucous membrane lining the ossicles were very full. On the inner surface of the drum membrane was a thick exudation which could be pulled off with forceps. The drum membrane showed the same histological condition as that in the right ear. The membrana propria was entirely intact.

The mucous membrane covering the labyrinth wall was increased in thickness up to 0.5 *mm.*, and was infiltrated with small cells. The blood-vessels were over-full, and the vessels in the bony case of the labyrinth were in the same condition. The endo- and peri-lymph of the vestibule were coagulated to a yellowish gelatinous mass. In the scalæ and in the ductus cochlearis of the cochlea this same change had occurred. The blood-vessels of the cochlea were distended. All the structures of the labyrinth were in all other respects normal.

Third (right) Petrous Bone.

The epidermis of the external canal was swollen and was easily removed. The outer layer of the drum membrane was thickened; the handle of the malleus was not visible. The central part was drawn inward in the shape of a funnel. The antrum, the tympanic cavity, and the tuba were filled with a tenacious mass composed of mucus, pus, and blood corpuscles. The vessels of the thickened mucous membrane of the drum membrane and of the tympanic cavity were remarkably numerous and very full.[1]

[1] The blood corpuscles in these vessels appeared of a square form in consequence of the stagnation. The same condition was found in all the other temporal bones.

Microscopically the drum membrane did not differ from Nos. 1 and 2. The glands of the tuba were normal.

The mucous membrane of the promontory was swelled and infiltrated with blood corpuscles, pus cells, and large granular cells (regressive metamorphosis); in some places it measured 0.5 *mm.* in thickness. The vessels were over-full; the epithelium was preserved. The hollow spaces in the bony surroundings of the labyrinth (pneumatic spaces? spongy tissue of bone?) connected with the tract of mucous membrane had apparently also participated in the pathological process. The vessels in these spaces were likewise much distended, and the tissue lining the spaces was infiltrated with cells and blood corpuscles.[1]

The membrane of *Reissner* in the cochlea was completely collapsed. The lymph in the scalæ of the cochlea and in the ductus cochlearis was coagulated only superficially. The A. auditiva was well filled with coagulated blood, as were likewise the vessels entering the canal of Fallopi.

As the child from whom this specimen was taken was not more than one to two years old, the presence of a small yellow nucleus of bone is especially noteworthy.

Fourth (left) Petrous Bone.

The cutis of the external auditory canal was loosened. There was no pus in the auditory canal. The short process was distinctly visible, while the handle of the malleus was only indistinctly seen. The entire middle ear, including the lumen of the tube and the antrum, was filled with mucus. The mucous membrane of the entire middle ear was of a reddish-yellow color; it was thickened and infiltrated with pus cells, and presented everywhere a close net-work of very full blood-vessels. Extravasations of blood and dark granular pigment were found at different points. In several

[1] A similar condition we found in transverse sections of the handle of the malleus of another petrous bone. In this instance there were seen at its periphery spaces or lacunæ of various sizes, filled with the same substance as was infiltrated in the mucous membrane of the drum membrane and connected with it. In the case under consideration we found the same process in the crura of the stapes.

places a fibrous mass (fibrin ?) was entangled in the mucous membrane.

The mucous membrane covering the promontory was here, as in the bones previously described, much swollen and hyperæmic, while its epithelium was well preserved. Its thickness measured 0.5–1 *mm.* Blood extravasations were found in and upon the mucosa. The lymph in the scalæ of the cochlea was coagulated. The examination of the structure of the labyrinth, the expansions of the nerve, and the trunk of the nerve itself gave negative results. A large nucleus of bone was found on the posterior wall of the vestibule, whence it extended to the base of the cochlea and completely surrounded the acoustic and facial nerves.

Fifth (right) Petrous Bone.

The dermoid covering of the external auditory canal was as easily detached as in the other preparations. There was no pus in the external canal. A small perforation was found in front of the umbo. In no other respect did the drum membrane differ from those already described. The tympanic cavity and antrum were filled with mucus and pus, and the mucous membrane was much swollen everywhere. The contents of the tympanic cavity consisted of pus cells, globules of oil, and rather pale granular cells.

The mucous membrane over the promontory was in this preparation as much swollen as in the others, and was infiltrated with blood corpuscles and numerous round cells of various dimensions; its blood-vessels were much injected. The blood vessels of the cochlea, as well as the vessels entering the bone with the periostal layer of the lining membrane of the tympanic cavity, were likewise very full. The epithelium of the mucous membrane over the promontory was well preserved; it was here also everywhere of a cylindrical form. The surface of the mucous membrane formed elevations and depressions which were lined with cylindrical epithelium; sections of the depressions presented appearances similar to tubular glands. In the niche of the fora men rotundum, in front of its membrane, were found groups of cells similar to pus cells, among which were several larger

ones apparently undergoing fatty metamorphosis, as they were stained black by osmium. Besides these, the niche of the foramen rotundum was filled with a substance closely resembling coagulated perilymph, and pretty numerous adhesions between the membrane of the foramen rotundum and the mucous membrane were still visible.

The endolymph in the sacculus and utriculus was coagulated; the perilymph in the scala tympani was also congealed and filled a part of the stairway.

Sixth (left) Petrous Bone.

The epidermis of the external canal was readily removed in patches, and on its surface was found a mucous exudation consisting of pus cells and very many granular cells. The drum membrane was intact in its continuity. Its epidermoid layer was not as much thickened as in the other specimens. The vessels of the cutis and mucous membrane were everywhere visible and very full of blood. In both layers small and large extravasations of blood were found. The membrana propria was unaffected. On the inner surface of the drum membrane was found a thick membranous exudation, which extended uninterruptedly across the malleoincudal point to the tegmen tympani, into the tuba and over the floor of the cavum tympani; it covered in the same manner the wall of the labyrinth up to the region of the stapes. The entire cavity of the middle ear, from the tuba to the antrum was filled with a mass composed of pus cells, innumerable granular cells, and isolated fat globules. The mucous membrane of the tympanic ostium of the tuba was less hyperæmic than the dermoid and mucous layers of the drum membrane; there were, moreover, no extravasations of blood seen here, and its epithelium was well preserved. The mucous membrane over the promontory did not differ in thickness, vascularity, and condition of epithelium from the preparations previously examined.

The perilymph of the scala tympani was firmly coagulated; that of the scala vestibuli less so.

Accidental Conditions.

In one of the cases a concretion composed of phosphate

of lime was found in the lining membrane of the internal auditory canal.

The condition of the tensor tympani muscle was especially worthy of note. This muscle presented in transverse sections of the part situated within the semicircular canal all the characteristics of tendon, and sections cut nearer to the Eustachian tube contained in the centre only scanty bundles of muscular fibres, near which were seen true fat-cells, stained black by osmium, and groups of other cells which resembled the fat-cells but were not stained. This paucity of muscular fibres, which was observed in the tensor muscles of all the petrous bones examined, is evidently not at all connected with the diphtheria, as the signs of a degeneration of the muscular substance were wanting; but it seems probable that it is due to an incomplete development of the true body of the muscle in the earliest period of life, and that later functional exercise causes an increase of volume, and thereby a predomination of true muscular over the tendinous tissue.

SUMMARY OF THE ALTERATIONS OBSERVED.

External Auditory Canal.

In two of the six preparations examined, the cartilaginous auditory canal was wanting. In the remaining petrous bones the epidermis of the canal was either detached or could be readily pealed off, but in only one case (No. 6[1]) was pus present at the same time.

Since granular cells were found together with the pus cells, this change may have occurred during a later stage, while the exfoliation, as such, may possibly have been connected with an earlier stage.

Drum Membrane with Handle of Malleus.

Perforation of the drum-head was seen but once. In six cases nothing could be seen of the hammer, excepting

[1] The absence of a perforation in the drum-head would seem to indicate an independent participation of the external canal in the morbid process, if the looseness of the epidermis is not regarded simply as the result of maceration.

Case 4, in which the short process was visible. In one case radial injection of the *dermoid layer* was visible to the naked eye. The microscopic examination revealed in all of the cases intense injection, great fulness of the vessels, and extravasations of blood in the vicinity of the vessels, while infiltration with pus cells was seen in only one half of the cases.

The *membrana propria* was intact in all of the cases except the first, in which granular cells were found in a narrow cleft between the radial and circular layers.

The *mucous membrane* of the drum membrane showed in all of the six cases, like the cutis, great fulness of the blood-vessels and many extravasations of blood in their neighborhood; furthermore, infiltration of small cells in part of the cases, and infiltration of pus cells in the majority; the latter was seen in the highest degree in Case 6. In addition, there were considerable deposits of coagulated exudation. Prolongations of the mucous membrane, altered as described, were seen to enter with the blood-vessels into the interior of the handle of the malleus.

Contents of the Tympanic Cavity.

The tympanic cavity contained in the first case mucous and pus; in the second case, tenacious mucus; in the third case, viscous mucus, pus, and blood; in the fourth case, mucus and a fibrous mass which was entangled with the mucous membrane; and in the fifth and sixth cases, mucus, pus, and granular cells (stage of regression).

Lining Membrane of the Promontory.

In all of the cases this membrane was increased in thickness from 0.5 to 1 *mm*.. The epithelium was intact in all the cases. The blood-vessels were here also enormously full, and the extravasations which in the other regions of the organ of hearing could only be seen with the microscope, could here be recognized by the naked eye.

In one half of the cases there was simple infiltration of

the mucous membrane with round cells, in the other half pus cells and round cells were found together, and in two of these cases larger cells undergoing regressive metamorphosis were also present.

Prolongations of the mucous membrane, thus altered even in its deeper layers, were observed to accompany the blood-vessels into the capsule of the labyrinth at many places.

The mucous membrane lining *the antrum* was changed in the same manner as that of other parts of the middle ear. The changes in the lining membrane of *the tube* were less marked.

The labyrinth was found to be normal in every respect, the only change being a coagulation of the lymph, which was observed in most of the cases. In one of the cochlear canals, in which the lymph was not coagulated but had escaped, *Reissner's* membrane was found completely collapsed. The particulars will be given in another article.

There can be no doubt that diphtheria existed in the cases described, as it is stated in the notes kindly sent us by Dr. Fraenkel, that in all except one of the cases the naso-pharyngeal cavity was involved. But whether the described changes in the middle ear occurred simultaneously with and independently of the diphtheritic process in the naso-pharyngeal cavity, or whether the disease extended *per continuitatem* through the Eustachian tubes to the ear, we have not, unfortunately, been able to decide. To enable us to decide this point we should have been in possession of the cartilaginous tubes with their faucial orifices. In the remnants of the cartilaginous tube which were found attached to one of the preparations, and in the mucous membrane of the osseous tube, the morbid changes were even less marked than in the tympanic cavity itself. It must therefore remain undecided whether the diphtheritic virus can, under certain circumstances, pass through the tube without causing marked alterations in it, and find the conditions favorable to its development only in the tympanic cavity.

Although we must decline to express an opinion as to the form of the diphtheritic affection which existed in the naso-pharyngeal cavity of the children, whose death was probably

caused by an extension of the morbid process downward in the air-passages, we may be permitted to state that, in our opinion, the disease of the middle ear either followed one of the milder forms of diphtheria or corresponded to the initial stage of this disease (excepting, perhaps, two cases), since the membranous deposits could be readily removed, were easily broken up, and did not present the appearance of exquisite diphtheritic membranes which, as is well known, present under the microscope a net-work of fibrin in which cells are embedded. That the disease was of a mild form and was already on the wane, was evident in two of the cases in which granular cells were found, which may be regarded as an indication of a regressive metamorphosis of the exudation. Additional proof that the disease was of a mild character, or was at least in four of the cases in the initial stage, is furnished by the facts that the epithelium of the mucous membrane of the tympanic cavity was preserved, and that the blood-vessels of this membrane were hyperæmic in all of the petrous bones which we examined. The intense injection of the blood-vessels in the mucous membrane, causing rupture of their walls and extravasations, which, according to the unanimous statement of authors, is always present at the beginning of the diphtheritic process, disappears in the later stages of the severer, malignant forms of diphtheritis.[1]

We would call special attention to the absence of microorganisms in all the diseased parts. We were at least unable to find such either in the tissues, the blood-vessels, or in the free exudation.

Especially worthy of note seems to us the fact that the hyperæmia and infiltration of the mucous coat of the middle ear could also be demonstrated in the periosteal pro-

[1] According to UHLE and WAGNER this is due to the great infiltration of the mucous membrane with pus corpuscles, or with fibrin and molecules of albumen, by which compression of the blood-vessels, and anæmia, necrosis, and later gangrene of the mucous membrane is produced. Klebs* regards the diphtheritic necrosis as the result of a paralysis of the blood vessels caused by microorganisms, in consequence of which stagnation of the blood, globar stasis, occurs. Compare with regard to this also the 5th case of Wendt, *Archiv f. Heilk.*, Bd. xi, p. 257.

* Transactions of the 2d Congress for Internal Medicine.

longations which, in company with the blood-vessels, enter the walls of the tympanic cavity and the ossicles. The same can be said of the membranous lining of the pneumatic and spongy cavities in the neighborhood of the middle ear. This observation furnishes an explanation of the early participation of the bone tissue, and the rapid destruction of the auditory ossicles, which, as is well known, occurs in some cases of malignant scarlatina, with or without diphtheritis.

ON THE INFLUENCE WHICH THE TREATMENT OF ONE EAR ALONE EXERTS UPON THE OTHER.

By Dr. A. EITELBERG, of Vienna.

Translated by J. A. Spalding, M.D., Portland, Maine.

WHARTON JONES[1] was the first to suggest the possibility that one ear might exercise some sympathetic influence upon the other. More accurate observations, however, in this direction have since been made by Weber-Liel and Urbantschitsch,—the former discovering a diminution in the deafness and subjective perception of noises in the one ear after tenotomy of the tensor tympani muscle of the other,[2] while the latter observed the same phenomena after tenotomy of the stapedius muscle,[3] as well as after division of the posterior fold.[4]

Urbantschitsch has recently returned[5] to the question of the sympathetic influence exerted upon the one ear by the treatment of the other, and mentions additional cases in which, at the moment of passing the bougie through the Eustachian tube of one side, the perception of subjective noises, as well as the deafness on the other side, underwent a distinct alteration. At his request, I have lately examined a large number of persons to discover what effect, if any, the treatment of the one ear exerts upon the hearing

[1] Cited in Frank's "Lehrbuch der Ohrenheilkunde," 1845.

[2] *Monatssch. f. Ohrenhlkde.*, 1874.

[3] *Wiener med. Presse*, 1877.

[4] *Monatssch. f. Ohrenhlkde.*, 1877.

[5] Ueber den Einfluss von Trigeminusreizung auf Sinnesempfindungen, etc., *Pflüger's Archiv f. Physiol.*, Band xxx.

and perception of subjective sounds in the other. Although the citations just quoted show that there can be no doubt of a sympathetic connection between the two ears, yet I felt that the subject deserved a more thorough investigation, especially as regarded its frequency as well as its amount, than it had hitherto received from otologists. I investigated particularly the immediate sympathetic action directly after each treatment of the one ear, as well as its duration, during a prolonged course of treatment, and the final result after all treatment had been abandoned. It is to the results thus obtained that I now beg to call the attention of the profession.

All of the experiments were made under precisely similar external conditions in a room that was but slightly exposed to the noise of a crowded city thoroughfare. The watch with which I tested the hearing was always held in precisely the same direction, *i. e.*, in the axis of the auditory meatus. In order to avoid all possible mistakes from those vacillations in the amount of hearing to which all persons are by nature subjected, the limit of hearing in every person whom I examined was not accurately decided upon at any one visit until after repeated and most careful measurements and tests. The number of patients examined was fifty; but as ten of them gave extremely uncertain and confusing answers, I have rejected them entirely. My results, therefore, are based upon the investigation of only forty cases. Each one of these, however, will be given in separate detail, because in no other way can we obtain so clear a picture of the results of my investigations. Beyond this, I can thus offer to every reader an opportunity to take exceptions if he chooses to the correctness of the conclusions which I have drawn.

Cerumen.

Case 1.—20th Sept., 1882, Leontine L., æt. forty-two. Right ear, cerumen. Before removal of the plug, hearing: R, watch on concha; L, 128 *cm.*[1] After removal of the plug: W., R, 81; L, 138.

[1] My watch is heard at a distance of 600 *cm.* by the normal ear.

Case 2.—21st Sept., 1882, Max. P., æt. twenty-three. L, cerumen. Before removal : L, 38 ; R, 103. After removal : L, 53 ; R, 60.

Case 3.—28th Sept., 1882, Gustav. N., æt. nineteen. L, cerumen. Before removal : L, 8 ; R, 110. After removal : L, 64 ; R, 174. 3d Oct. : L, 53 ; R, 80.

Case 4.—2d Oct., Max. L., æt. thirty. R, cerumen. Before removal : R, on the concha ; L, 26. After removal : R, 102 ; L, 44.

Case 5.—3d Oct., Franz R., æt. nineteen. L, cerumen. R, cicatrix. Before removal : L, on the concha ; R, 46. After removal : L, 14 ; R, 57.

Case 6.—6th Oct., Friedrich B., æt. seventy-seven. R, cerumen. Before removal : R, on the concha ; L, 3. After removal : R, on the concha ; L, 3.

Case 7.—11th Oct., Jacob M., æt. forty-one. R, cerumen. Before removal : R, 14 ; L, 12. After removal : R, 17 ; L, 12.

Case 8.—21st Oct., Jacob P., æt. thirty-eight. L, cerumen. Before removal : L, 36 ; R, 21. After removal : L, 10 ; R, 21. 26th Oct. : L, 112 ; R, 23. 31st Oct. : L, 140 ; R, 95. 2d Nov. : L, 102 ; R, 72.

Case 9.—24th Nov., Johann R., æt. fifty-seven. R, cerumen. Before removal : R, 0 ; L, 1. After removal : R, 0 ; L, 1. 27th Nov. : R, 3 ; L, 5. 4th Dec. : R, 3 ; L, 17. 11th Dec.: R, 6 ; L, 35.

Case 10.—27th Nov., Paul R, æt. twenty-two. R, cerumen. Before removal : R, 18 ; L, 126. After removal : R, 150 ; L, 230.

Case 11.—7th Dec., Friedrich R., æt. fifty-two. L, cerumen. Before removal : L, on the concha ; R, 4. After removal : L, 4 ; R, 2. 9th Dec. : L, 4 ; R, 6.

Case 12.—24th Sept., Wenzel L., æt. twenty-seven. Cerumen in both meatus. Before removal of the L plug : L, 1 ; R, 103. After removal : L, 15 ; R, 103.

Otitis externa circumscripta.

Case 13.—22d Sept., Julius S., æt. sixteen. R, otitis ext. circumscripta. Before treatment (induction current on the affected side) : R, 95 ; L, 170. After the treatment : R, 115 ; L, 170.

Case 14.—26th Sept., Rosalie L., æt. forty-three. L, ot. ext. circ. Before treatment (drainage tube smeared with ung. cinereum) : L, 20 ; R, 50. 28th Sept. : L, 20 ; R, 50. The otitis is healed.

Case 15.—7th Oct., Theresa G., æt. fifty-one. R, ot. ext. circ. Before the treatment (drainage tube with ung. cinereum) : R, 70 ; L, 88. 9th Oct. : R, 50 ; L, 60. The otitis is no better. The drainage tube not well borne.

Case 16.—24th Nov., Johann V., æt. twenty-one. L, ot. ext. circ. Before treatment (induction current on the side affected) : L, 6 ; R, 600.

Aspergillus niger.

Case 17.—27th Sept., Rosa S., æt. twenty-two. L, aspergillus niger. L, 20 ; R, 250. Spiritus vini rectificatus. 30th Sept. : L, 20 ; R, 250.

Myringitis acuta.

Case 18.—10th Nov., Johanna G., æt. nineteen. R, myringitis acuta for three days. R, 24 ; L, 194. 14th Nov. : R, 75 ; L, 260. Myringitis better. 20th Nov. : R, 212 ; L, 300. Myringitis cured. 23d Nov. : R, 323 ; L, 410 ; violent naso-pharyngeal catarrh. 28th Nov. : R, 430 ; L, 400. 1st Dec. : R, 450 ; L, 450 ; after alternately occluding both ears. 7th Dec. : R, 600 ; L, 600.

Exudation in tympanum.

Case 19.—19th Sept., Franz P., æt. twenty-seven. R, exudation in the tympanum. R, 3 ; L, on the concha. After using the catheter on the right side : R, 4 ; L, on the concha.

Tympanitis phlegmonosa acuta.

Case 20.—29th Sept., Martin Z., æt. fifty-six. L, tymp. phlegm. acuta. L, on the concha ; R, 35. After catheterization on the left side : L, 2 ; R, 23. Twenty minutes later : L, 2 ; R, 40.

Case 21.—16th Oct., Karl H., æt. thirty-four. R, tymp. phlegm. acuta, for two days : R, on the concha ; L, 150. After paracentesis of the R *Mt* : R, on the concha as before, but weaker ; L, 250. 18th Oct.: R, 0 (abundant discharge of pus) ; L (tympanitis phlegm. acuta on this side also), 50. After syringing the right ear: R, 0; L, 50. 19th Oct.: R, 0 (much pus) ; L, 22 ; (tymp.

phlegm.). After syringing and using the catheter on the right side : R, 0; L, 22. 20th Oct.: abundant pus in each meatus, and the hearing could no longer be accurately tested.

Tympanitis purulenta.

Case 22.—23d Oct., Joseph E., æt. seventeen. L, rupture of *Mt* by a slight blow on the auricle : L, 20 ; R, 13. Induction current on the affected side. 2d Nov.: L, 8 ; R, 12 ; L, Tympanitis purulenta, syringing, boracic acid. 4th Nov.: L, 8 ; R, 14. The otitis is moderating. 8th Nov.: L, 11 ; R, 18. 16th Nov.: L, 22 ; R, 11. 20th Nov.: L, 41 ; R, 20. 23d Nov.: L, 31 ; R, 17. The otorrhœa has ceased. 27th Nov.: L, 47 ; R, 18 ; cold in the head. 30th Nov.: L, 45 ; R, 35. 4th Dec.: L, 105 ; R, 75 ; mucous membrane paler. 11th Dec.: L, 105 ; R, 112. The perforation has not yet cicatrized.

Case 23.—7th Nov., Hermann H., æt. forty. L, tympanitis purulenta for nine days : L, 1 ; R, 184. After syringing the left meatus : L, 11 ; R, 215. 10th Nov.: L, 5 ; R, 525. Left, pus tinnitus. Lead acetate. 16th Nov.: L, 13 ; R, 600. 23d Nov., L, 43 ; R, 600. L, polypoid granulations ; spiritus vini rectificatus. 30th Nov.: L, 82 ; R, 600. The otitis has ceased, the tinnitus is less ; there is a small perforation in the posterior superior quadrant of the *Mt*. 5th Dec.: L, 150 ; R, 600.

Case 24.—18th Oct., Jacob M., æt. forty-eight. R, tympanitis purulenta since day before yesterday: R, 0 ; L, 60. After syringing the right ear : R 0 ; L, 75. 19th Oct.: R, 0 ; L, 60. A great deal of pus in the right meatus. After syringing the right ear: R, 0 ; L, 70.

Case 25.—24th Oct., Theresa K., æt. twenty. L, tympanitis purulenta for several days past: L, 200 ; R, 250. Lukewarm water for syringing the ear. 26th Oct.: L, 300 ; R, 450. The secretion is less.

Case 26.—16th Sept., Edward S., æt. eighteen. Has had pain in the left ear for over a month, and subsequent to an attack of angina. The upper wall of the external meatus is very prominent (abscess). L, 1 ; R, 85. 18th Sept.: L, 2 ; R, 95. Spontaneous opening of the abscess early this morning. Tympanitis purulenta with perforation. After using the syringe : L, 2 ; R, 117. 21st Sept.: L, 61 ; R, 140. Lead acetate. 26th Sept.: L, 74 ; R, 164. 29th Sept.: L, 142 ; R, 208. Tinnitus in the left ear. 5th Oct.: L, 128 ;

R, 170. Lead deposit, otorrhœa diminished. 12th Oct.: L, 230; R, 230. The otorrhœa has ceased. The ears are tested separately. with the other hermetically closed.

Case 27.—1st Dec., Anna P., æt. twenty-eight. L, tympanitis purulenta chronica. On the right side, a cicatrix after tymp. purulenta: L, 10; R, 140. Lead acetate. 6th Dec.: L, 30; R, 380, The otorrhœa has stopped.

Case 28.—19th Sept., Johann L., æt. thirty-two. L, tympanitis purulenta since he was six years old, at which time he received a blow on the head. L, 11, R, 124. After treatment with boracic acid: L, 9; R, 124. 27th Sept.: L, 20; R, 145. The otitis is very slight, 6th Oct.: L, 42; R, 83; slight otorrhœa. 13th Oct.: L, 11; R, 102. Moderate otorrhœa. 20th Oct.: L, 40; R, 160. Otorrhœa moderate. 26th Oct.: L, 40; R, 64. Otorrhœa diminishing. 14th Nov.: L, 25; R, 95. 22d Nov.: L, 15; R, 188. The otorrhœa has ceased.

Case 29.—19th Sept., Marie S., æt. thirty-seven. Right tympanitis purulenta for about one year, with a perforation; polypoid, granulations. R, 10; L, 64. After syringing: R, 9; L, 97. Lead acetate. 22d Sept.: R, 98; L, 300. After syringing: R, 82; L, 160.

Case 30.—21st Sept., Leni B., æt. thirty. Left, tympanitis purulenta, with a polypus, for three years. L, 3; R, 166. After syringing: L, 9; R, 202. Spiritus vini rectificatus. 30th Sept.: L, 19; R, 600. Otorrhœa well marked.

Case 31.—24th Oct., Franz, P., æt. fifty-three. Right, tympanitis purulenta for ten days. R, 0; L, 10. After syringing: R, on the concha; L, 15. 27th Oct.: R, 0; L, 15. Thick masses of pus. After catheterization of the left tube: R, 0; L, 15. After syringing *right:* R, 0; L, 15.

Case 32.—1st Dec., Katharina, P., æt. forty-four. L, tymp. purulenta with perforation; secretion very trifling. Uninterrupted tinnitus in both ears for two months; worse at morning. R, 44; L, 10. Catheter, right side. 4th Dec.: R, 86; L, 8. Tinnitus unchanged. After catheter (right): R, 70; L, 7. 7th Dec.: R, 70; L, 4. The tinnitus, right, is louder than left. After catheterization: R, 63; L, 9. The tinnitus is not sensibly altered. 9th Dec.: R, 99; L, 11. After catheter (right): R, 70; L, 19. The tinnitus is unaltered.

Otitis media catharrhalis chronica.

Case 33.—6th Oct., Franz K., æt. fourteen, has been deaf in both ears for three months; no tinnitus. L, 40; R, 70. After catheterization on the left side: L, 60; R, 102. 10th Oct.: R, 68; L, 70. After catheterization on the right side: R, 93; L, 82.

Case 34.—16th Sept., Rosa H., æt. thirty-four. L, very violent tinnitus (ringing and drumming), with but few interruptions since last spring; R, faint tinnitus. R, 78; L, 71. After catheter R: L, no tinnitus; five minutes later a booming noise L. "The noise sounds a great deal different from what it used to." 20th Sept.: R, 80; L, 70. The tinnitus has disappeared, but the head seems affected; patient complains of vertigo; fulness in the forehead. After catheter on the right side: R, 125; L, 116. "My head feels giddy." 23d Sept.: R, 134; L, 80. Tinnitus ("humming of bees") slight. After catheter right: hearing R, 165; L, 115. In the beginning an indefinable noise, then a buzzing alternating with ringing. Five minutes later the tinnitus just as before treatment, and head easier. 27th Sept.: R, 161; L, 128. Roaring and vertigo, which are relieved by catheter on the right side. 29th Sept.: R, 235; L, 176. There have been neither tinnitus nor vertigo since the last introduction of the catheter; head easy.

Case 35.—28th Sept., Anton K., æt. twenty-six. The patient has suffered for a year from intermittent tinnitus in the left ear, which is occasionally so loud in the early part of the day that he can hardly carry on conversation with those about him. R, 61; L, 11. After using the catheter on the right side: R, 104; L, 14. Tinnitus not altered. 30th Sept.: R, 43; L, 14. Catheter on right side: R, 60; L, 30. Tinnitus unaltered. 4th Oct.: R, 50; L, 20. The increase in the tinnitus previously noticed every three or four days has ceased. After catheter (right): R, 50; L, 20. No action upon the tinnitus. 7th Oct.: R, 35; L, 20. After catheter (right): R, 58; L, 20. 17th Oct.: R, 50; L, 18. The tinnitus has been much more violent in the last five days. Bougie on the right side. 21st Oct.: R, 50; L, 20. Tinnitus less. After bougie (right): R, 50; L, 19. 27 Oct.: L, 19; R, 27. After bougie (*left*): L, 20; R, 46. Tinnitus unaltered. 2d Nov.: L, 17; R, 41. Tinnitus unaltered. After bougie *left:* L, 17; R, 60.

Case 36.—29th Sept., Paul W., æt. twenty-eight, has been deaf since childhood, with constant tinnitus in both ears, though louder on the left side. R, 300; L, 76. After catheter (*left*): R, —; L, 95. 2d Oct.: R, —; L, 80. After catheter (*right*): R, —; L, 56. Tinnitus about the same. 9th Oct.: R, —; L, 52. After catheter (right): R, —; L, 119. Ten minutes later: L, 95. The right ear has been tightly closed during these previous tests for the left ear. Tinnitus, left, is less. After catheter (right): R, —; L, 130. 14th Oct.: R, —; L, 116. Tinnitus weaker in both ears. After catheter (right): R, —; L, 125. 17th Oct., the tinnitus on both sides is extremely slight.

Case 37.—11th Oct., Rosalie G., æt. thirty-eight, has been annoyed for several months with a continuous tinnitus ("seething"), which grows more violent when she lies down. She also complains of vertigo and headache. L, 102; R, on the concha. After catheter *left:* L, 80; R, on the concha. No action upon the tinnitus. 14th Oct.: L, 97; R, on the concha. The tinnitus is "somewhat more rapid." After catheter left: L, 120; R, 2. Tinnitus unaltered. 16th Oct.: L, 97; R, 3. "Ringing; and I feel as if I were going up." The headache is more noticeable on the left side than the right. After catheter *left:* L, 103; R, 1. 19th Oct.: L, 62; R, 4. Ringing is less marked. After catheter left: L, 94; R, 3. 21st Oct.: L, 106; R, on concha. The tinnitus and pain in the head are more noticeable on the left side to-day than yesterday. After catheter left: L, 85; R, 1. Tinnitus and headache as before. 24th Oct.: L, 76; R, 2. Headache less; tinnitus as before. 2d November: R, on the concha; L, 80. Tinnitus on the *right* side now louder. After catheter *right:* R, 1; L, 75. Tinnitus somewhat louder. 8th Nov.: R, 2; L, 80. After bougie *right:* R, 2; L, —. 22d Nov.: R, 2; L, 110. Tinnitus less.

Case 38.—12th Oct., Fanny H., æt. eighteen, has been deaf for several years, and for three weeks has noticed an increased and intermittent tinnitus ("hammering") in the *left* ear. R, 26; L, 24; after catheter (*right*): R, 13; L, 16, and tinnitus unchanged. 14th Oct.: R, 45; L, 63. The tinnitus in the left ear has almost disappeared, while in the right there is a hissing sound. After catheter (*right*): R, 63; L, 67. 17th Oct.: R, 210; L, 210. No tinnitus in either ear. Catheter right. 24th Oct.: both ears 250. When the patient reappeared for treatment a month later (Nov. 28) hearing on the formerly treated (*right*) side had decreased to

85, while on the originally more extensively affected side (left) it still remained at or about the same as before, 210. The subjective noises had now left this side of the head and wandered over to the right.

Case 39.—13th Oct., Elizabeth B., æt. twenty-six, has been deaf for five years in both ears, and suffered from continual tinnitus ("seething"), *which is louder in the left ear.* The patient was catheterized, though unsuccessfully for a long time. R, 3; L, 3. After bougie (right): R, 3; L, 3. Tinnitus unaltered. 14th Oct.: R, 3; L, 6. After bougie right: R, 3; L, 6. 17th Oct.: R, 3; L, 7 Bougie right. 20th Oct.: R, 3; L, 6. After bougie (right): R, 4; L, 6. 23d Oct.: R, 3; L, 3. After bougie (right): R, 4; L, 4. 31st Oct.: R, 6; L, 6. Tinnitus unchanged; bougie right. 3d Nov.: R, 9; L, 7. Tinnitus diminished. After bougie (right): R, 10; L, 9. 10th Nov.: R, 13; L, 7. After bougie (right): R, 20; L, 11.

Case 40.—6th Nov., Hugo B., æt. twenty. L, cerumen. Loud tinnitus on both sides. Before removal of the plug of cerumen: L, 3; R, 1. After removal: L, 3; R, on the concha. 10th Nov.: L, 7; R, 2. 13th Nov.: L, 12; R, 2. 16th Nov.: L, 8; R, 2. 21st Nov.: R, on concha; L, 5. After bougie (right): R, 2; L, 3. 23d Nov.: R, 1; L, 3. After bougie (right): R, 1; L, 9. 27th Nov.: R, 2; L, 2. After bougie (right): R, 1; L, 1. 28th Nov.: R, 2; L, 12. After bougie (right) ———. 30th Nov.: R, 1; L, 8. After bougie (right): R, 6; L, 11. 4th Dec.: R, 2; L, 21. After bougie (right): R, 2; L, 11. Fifteen minutes later: R, 11; L, 21. 11th Dec.: R, 10; L, 32. After bougie (right): R, 16; L, 40. The tinnitus in both ears is much less than it was at the beginning of the treatment.

The frequent increase and decrease in the hearing of the ear that was not treated in the cases which we have just briefly sketched, may depend partly upon spontaneous subjective variations in the function of the auditory apparatus; but in many of the cases it cannot be regarded as any thing else than the result of the influence exerted by the treatment of the one ear upon the other. When I speak further on of the extreme limits of hearing—the hearing at the beginning and termination of the period of observation—I refer to the amounts which were determined at the first and

last visits, and simply to the ear which was not directly treated.

Amongst the cases treated with the bougie, we have to draw especial attention to case 39, because for a long time the use of the air-bag and catheter was absolutely of no avail, while the introduction of the bougie on *one* side at seven sessions increased the hearing power on that side from 3 *cm.* to 11 *cm.* only, on the other side from 3 *cm.* to 20 *cm.*, and also decidedly diminished the extremely annoying subjective noises *on both sides.* In case 40, in which the bougie was at last exclusively employed, the hearing for the watch on the side that was treated at five sessions with this method increased from on the concha to 16 *cm.*, and *on the side that had not been treated* from 5 *cm.* to 40 *cm.* The subjective noises in this case also were greatly lessened *upon both sides.* In case 15, after two introductions of the bougie, we observed an increase of 19 *cm.* in the hearing of the side that had not been treated, although the procedure had been without effect upon the side that had thus been treated.

If we consider the forty cases as a whole, we can offer the following *résumé:* In seven cases (6, 7, 12, 13, 16, 17, 19) the treatment of the one ear was not followed by any change in the hearing of the other; but of these only one (17) made a second visit, while in all the others we had to be satisfied with the first examination. But, inasmuch as the increase of hearing in the ear that has not been directly treated is only observed after continued treatment of the other ear, or may only be observed at a later date without continued treatment, we feel obliged to exclude these seven cases as belonging to the doubtful list. In those thirty cases which were tested immediately after the treatment, we discovered an improvement in the hearing of the ear that had not been treated, as a *momentary influence of the treatment,* to the following amounts—the increased hearing distance in centimetres is inclosed in parentheses: Case 1 (10), 3 (64), 4 (18), 5 (11), 10 (104), 21 (100), 23 (31), 24 (15), 26 (22), 29 (33), 30 (36), 31 (6), 33 (32), 34 (26), 35 (3). The limits of improvement of hearing extend, therefore, from 3 *cm.* to 104 *cm.*

On the contrary, in six cases we discovered a diminution of hearing on the side not treated, as *a momentary result of the treatment*: in cases 2 (43), 11 (2), 20 (12), 36 (24), 38 (8), 40 (1) *cm.* We have, therefore, the extreme limits of diminution of hearing varying from 1 *cm.* to 43 *cm.*

The momentary influence of the treatment upon the hearing of the ear that was not treated was null in nine cases, viz.: 6, 7, 8, 9, 13, 19, 28, 37, and 39.

We meet with still greater variations in those cases in which the increase of hearing in the ear that has not been treated is only discovered at a later date. Or, again, when such an increase has already been observed after the first treatment, it improves still further during a prolonged course of treatment, or even if the cases are simply kept under observation without any treatment whatsoever. I will here remark that it is chiefly the cases of unilateral purulent inflammation of the tympanum, whether acute or chronic, which offer the most extensive variations in the increase of hearing in the ear that has not been treated (as high as 400 *cm.*). Where both ears are affected in a similar manner the improvement in hearing is generally but very slight, sometimes not more than two *cm.* But even this difference indicates, in many a case, that where the patient could only once hear by bone-conduction, the hearing by aërial conduction is now, for a time at least, restored.

An improvement of the hearing of the ear that had not been treated was observed in the course of the treatment of the opposite ear, or in the course of the observation of the case when the treatment was not carried out for any length of time, in twenty cases out twenty-eight: in case 8 (51 *cm.*), 9 (34), 11 (2), 18 (400), 22 (99), 33 (400), 25 (200), 26 (145), 27 (240), 28 (64), 29 (236), 30 (400), 31 (5), 34 (86), 35 (8), 36 (49), 37 (2), 38 (225), 39 (8), and 40 (37). The extreme limits are therefore 2 *cm.* to 400 *cm.*

The hearing of the ear that was not treated was diminished in the course of the treatment of the other ear in two cases: in case 3 (30 *cm.*) and in case 15 (28 *cm.*).

The subjective perception of sound was entirely removed in the one ear by the treatment of the other, in cases 34 and

38; and it is interesting to note that in the former of these the noises ceased immediately after each session, and that in the course of the continued treatment, with more or less prolonged intervals, they repeatedly altered their characteristics. The subjective noises were decidedly improved in cases 35, 36, 37, 39, and 40.

The result of my investigations may be formulated as follows:

1. The treatment of the one ear causes a distinct improvement in the hearing of the other, in a large proportion of cases; it rarely causes diminution of hearing.

2. The greatest improvement in hearing on the side that had not been treated was noted in cases of unilateral, acute, or chronic suppurative inflammation of the tympanum. It was additionally discovered that the hearing power on the side that was not treated, presuming, of course, that the disease had not already invaded that ear, could be restored to the normal amount before the morbid process upon the affected side had run its course.

3. When both ears are affected, the treatment of either one exclusively often produces an improvement in the other, and this not merely so far as concerns the hearing, but as concerns any subjective noises that may have been present.

4. In most of the cases which were under my observation, the ear that had not been treated did not generally return at once to a normal condition, but only after a moderate lapse of time, while on the contrary,

5. In other cases, the hearing which had at first been restored in the one ear by treatment of the other gradually decreased in the course of observation.

These facts may possibly be explained in the following manner. Urbantschitsch has shown [1] that irritation of the sensitive fibres of the trigeminus of one side can exercise upon all of the sensitive perceptions, not only of the side affected, but of the opposite side also, an influence which makes itself felt in most cases by an increase, and in a few others by a decrease in the acuteness of these perceptions. We are therefore justified in assuming that in the same

[1] *Pflüger's Archiv f. Physiologie*, Band xxx.

way the influence of the treatment of the one ear upon the other is purely a reflex action in which the trigeminus is the most important nerve involved, the irritation exercised upon the one ear being thus conducted to the acoustic centre, and thence to the other ear which has not been subjected to treatment.

The same explanation may suffice for those cases in which the effect of the irritation of one ear upon the other continues to increase for some time later, although the irritation itself is no longer practised, or has been practised but once, for, as the above investigations show, after any given irritation has been practised upon one ear, the acuteness of hearing may increase not only upon the side which has been irritated but also upon the other.

I regret that I was unable in the case of these out-patients to watch for a longer period the sympathetic action upon the ear that was not treated, for it appears to me a subject of great interest to discover how long the same may continue. Meanwhile I hope that the observations which I have here published may excite other observers to make more systematic observations in the same province.

THE INFLUENCE OF HEARING EXERCISES ON THE SENSE OF AUDITION OF THE PRACTISED AND CONSECUTIVELY ON THE OTHER NOT PRACTISED EAR.

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ACCORDING to the observations of Urbantschitsch, waves of sound particularly directed into one ear produce an excitation of the acoustic centres on both sides, which is followed by an increase of the auditory function in the other ear, just in the same manner as monocular vision produces excitation of the optic centres, and consequently an augmentation of the visual power in both eyes. Similar investigations, which I have since made on a larger scale, have yielded the following results.

I will premise that the most suitable persons for submitting to these experiments were those whose hearing distance for my watch (heard normally at 600 *cm.*) varied between 5 *cm.* and 20 *cm.* Persons with a greater range of hearing furnished more conspicuous results, but the examinations were more tiresome and apt to be inaccurate, except when the persons were well drilled by repeated examinations on other subjects.

The acuteness of hearing was ascertained in each case after several identical statements of the person examined, taking care only that the observations were not taken at short intervals, for then the excitation of the sense of hear-

ing invariably caused mistakes as to the normal auditory distance.

I convinced myself of the trustworthiness of the statements while standing behind the person, by approaching the watch to the ear, removing it again, and comparing the statements with the corresponding distance of the watch from the ear. I need not mention that the other precautions necessary to avoid mistakes, by intentional or unintentional deception on the part of the person examined, were carefully observed.

The examination was carried on as follows: The sense of audition on the one side was excited by the noise of a watch for a period of from thirty to forty-five seconds, which was followed by a rest of the same duration, in order to avoid fatigue of the ear. If I excited the ear longer than forty-five seconds, attentive and well-drilled persons would not infrequently state that they heard the tick of the watch much weaker and even not at all for some moments. After an examination of five minutes, rarely after a longer or shorter time, the limit of audition was again obtained, but never before the termination of the last period of rest, because, as will be seen by the examples to be mentioned later, the distance at which any sound is heard, immediately after the period of excitation, differs essentially from that at which it is heard after the period of rest. In like manner the limit of audition was determined at intervals of five minutes after the cessation of the noise from the watch, in order accurately to trace the rise or fall of the perception of hearing on the same, or—which was more important for our purpose—on the opposite side during the intermission of the exercises. By the latter term I understand, in contradistinction to the *period* of exercise, those longer intervals during which the sense of hearing was not stimulated to increased activity by the noise of the watch.

In order to obtain a correct understanding of the experiments I will mention that the period of exercise is meant whenever the parenthesis "intermission of exercise" is omitted, and the determination of time (five minutes, etc.) always indicates after what time and how often the hearing

distance was verified. If the record reads, for example: "fifteen minutes later (intermission of exercise)," the hearing distance was not noted at intervals of five minutes but only once, namely after fifteen minutes. Other additions to the records will explain themselves or will, if necessary, be explained by notes. I will mention that the majority of my experiments were made on persons who had been drilled at other investigations, and whose statements had always been found reliable.

In the first place I shall speak of that group of experiments in which the influence of exercise of the sense of audition of one side was observed both on the same side and on the opposite also. To avoid repetition I shall, however, mention those cases in which on other days the influence on the opposite ear only was examined.

First Experiment.—Jan. 22, 1883. A. Sch., æt. thirty-three. Hard of hearing for several years. Constant tinnitus on both sides. Watch: R 4, L 2. Five minutes later: R 7, L 4. Five minutes later: R 8, L 5. Five minutes later: R 6, L 6. Feb. 1st, watch: R —, L 7. Five minutes later: R —, L 8. Five minutes later (intermission of exercise): R —, L 7. Five minutes later: R —, L 9. Five minutes later (intermission of exercise): R —, L 7.

Second Experiment.—Jan. 26th. H. R., æt. thirty-six. Tinnitus on left only. Watch: R 20, L 1. Five minutes later: R 25, L 1. Five minutes later: R 29, L 1. Jan. 30th: *h* R 23, L 5. Five minutes later: R —, L 5. Five minutes later: R —, L 4. Five minutes later: R —, L 3. Five minutes later (intermission of exercise): R —, L 4. Five minutes later (intermission of exercise), R —, L 5.

Third Experiment.—Feb. 5th. S. Sch., æt. twenty-three. Hardness of hearing and constant tinnitus on both sides, the tinnitus louder on the right: *h* L —, R 6. Five minutes later: L —, R 5. Five minutes later: L —, R 4. Thirteen minutes later (intermission of exercise): L —, R 4. Feb. 6th: *h* R 5, L 7. Tinnitus louder on the left. Five minutes later: R 4, L 5. Five minutes later: R 4, L 6. Five minutes later: R 3, L 6. Five minutes later (intermission of exercise): R 4, L 5. Feb. 13th: L 21, R 7. Tinnitus on the left only. After catheterization on the left: L 15, R 8. Feb. 23d: L 7, R 6. Tinnitus on both sides. After catheterization on left side: L 7, R 5. Tinnitus dis-

appeared on right side: R 5, L 7. Five minutes later: R 7, L 10. Five minutes later (intermission of excercise): R 6, L 13. Five minutes later (intermission of exercise): R 5, L 14.

Fourth Experiment.—Feb. 12th. A. K., æt. twenty-seven. Hard of hearing two months, according to patient's statement. Constant tinnitus on left only: *h* R 9, L 6. Five minutes later: R 10, L 7. Five minutes later: R 11, L 8. Five minutes later (intermission of exercise): R 11, L 7. Five minutes later (intermission of exercise): R 9, L 8. After catheterization on left side: R 9, L 8.

Fifth Experiment.—March 13th. L. M., æt. thirty. R, large perforation; L, scar. No tinnitus; *h* L 24, R 6. Five minutes later: L 23, R 10. Five minutes later: L 20, R 6. Five minutes later (intermission of exercise): L 20, R 3. Five minutes later (intermission of exercise): L 21, R 5.

Sixth Experiment.—Feb. 13th. C. St., æt. twenty-three. For two years, constant tinnitus on the left: *h* R 60, L 5. Five minutes later: R —, L 5. Five minutes later (intermission of exercise): R —, L *ad concham*. March 8th: *h* R 114, L 18. Tinnitus on left only. Five minutes later: R 114, L 19. Five minutes later: R 108, L 19. Five minutes later: R 103, L 18. Five minutes later (intermission of exercise): R 118, L 19.

Seventh Experiment.—March 15th. J. V., æt. fifty-six. Hard of hearing about two years. No tinnitus: *h* L 1, R *ad conch.* (by strong pressure). Five minutes later: L 2, R 1. Five minutes later: L 2, R 1. Five minutes later: L 2, R *ad conch.* Twelve minutes later (intermission of exercise): L *ad conch.*, R *ad conch.* (only by strong pressure).

Eighth Experiment.—Feb. 20th. A. L., æt. eighteen. R, cerumen. After removal of the same: *h* R 40, L 40. Five minutes later: R 65, L 62. Five minutes later: R 65, L 55. Fifteen minutes later (intermission): R 60, L 52.

Ninth Experiment.—Feb. 21st. Carl S., æt. five. Perforation in the posterior superior quadrant (after an injury, Jan. 21st); tympanum dry; R, semilunar calcareous deposit in the posterior half of the *Mt*, and a second one as large as the head of a pin, just in front of and beneath the short process: *h* R 46, L 10. Five minutes later: R 39, L 12. Five minutes later: R 44, L 12. Five minutes later: R 31, L 14. Twenty minutes later (intermission): R 45, L 12. Twenty-five minutes later (intermission): R 45, L 12.

Tenth Experiment.—Feb. 26th. Gottfried K., æt. twenty-nine. R, tympanitis suppurativa with total loss of *Mt;* violent and continual tinnitus in the occiput, especially in the morning : *h* L 15, R on *gently* resting the watch against the auricle. Five minutes later : L 15, R not even when *pressed close* against the auricle. Five minutes later : L 15, R heard when *pressed close* against the auricle. Ten minutes later (intermission) : L 14, R heard when *lightly* pressed against the auricle.

Eleventh Experiment.—Feb. 27th. Cecelia S., æt. twenty. R chronic purulent suppuration of tympanum for thirteen years ; polypi springing from the tympanum : *h* L 34, R 0. Five minutes later : L 43, R 0. Five minutes later : L 45, R 0. Ten minutes later (intermission): L 47, R 0.

Twelfth Experiment.—March 6th. Helen B., æt. thirty-two. Deaf for four months since a miscarriage. Tinnitus of slight degree on both sides : *h* L 8, R 8. Five minutes later : L 10, R 11. Five minutes later : L 13, R 13. Ten minutes later (intermission): L 12, R 11. Ten minutes later (intermission): L 11, R 11. Five minutes later (intermission): L 11, R 9. March 9th : L 20, R 21. Tinnitus no longer noticed on the right side. Five minutes later : L 27, R 20. Five minutes later : L 27, R 21. Five minutes later : L 27, R 24. Twenty minutes later (intermission, during which the patient was tested with the aural thermometer)[1] : L 27, R 24.

Thirteenth Experiment.—March 7th. Herman H., æt. fifty-seven. Thickened milky-white *Mt* on both sides. Loud tinnitus on both sides : *h* R 4, L 4. Five minutes later : R 4, L 4 ; five minutes later : R 4, L 4 ; five minutes later : R 4, L 4 ; five minutes later : R 4, L 4.

These experiments show that the *hearing of the practised ear increased* seven times out of thirteen cases, viz. : in cases 1, 2, 4, 7, 8, 11, and 12 ; that it *diminished* in four cases (3, 5, 6, and 9) ; while in two (10 and 13) the auditory nerve did not react in the least.

The increase amounted to 4 *cm.* [1],[2] 1 [2], 2 [4], 1 [7], 25 [8], 11 [11], and 5 [12]. The decrease amounted to 2 *cm.* [3], 4 [5], 11 [6], and 15 [9].

[1] This instrument for testing the temperature in the external meatus is made by Kappeller, of Vienna, from the suggestions of Dr. Urbantschitsch.

[2] The figure in brackets indicates the number of the experiment.

We notice, first of all, that the positive coefficient of excitation (increase of hearing) is so much the greater, the greater the original perception for the ticking of the watch, and that it is so much the smaller the less the original amount of hearing for the watch. An apparent voucher for this statement can be seen in the twelfth experiment, in which, according to tests repeated three days later, after the hearing had increased from 8 *cm.* to 20 *cm.* (possibly as a result of the daily treatment), we discovered a positive coefficient of excitation of 7 *cm.*, whilst at the first experiment, when the hearing amounted only to 8 *cm.*, the positive coefficient (increase) was just 5 *cm.* We are not, of course, justified in assuming from this single case that the positive coefficient of excitation always stands in similar relations to the original hearing distance, for many other causes which we shall later mention exercise undoubtedly a decisive influence upon the same.

We will now examine more closely two cases (10 and 13) in which the excitation of the auditory nerve by the ticking of the watch did not appear to have any influence upon the hearing distance. In both of these cases we find loud and continuous tinnitus; in one case in the occiput, in the other in both ears. But we must not forget that tinnitus, when exceedingly loud, is very apt to interfere with that greater activity of the sense of hearing at which we are aiming in our experiments by the action of a definite source of sound.

Amongst the four cases in which the hearing was diminished after our experiment, tinnitus was present in one (No. 3), but after this subjective perception of noises had for a time been reduced in intensity by proper treatment, the second examination, seventeen days later, on February 23d, showed a slight increase of hearing in comparison with the previous test. In cases 6 and 9 the tinnitus was noticed on one side only, and that was the one opposite the side experimented upon. Nevertheless, as we shall later see, even unilateral tinnitus can exercise some influence upon the energy of the hearing of the opposite side.

We have next to discuss the question: How soon are we to look for the culmination of the increased or diminished

excitability of the nerves of hearing? This appeared to me to take place at the end of two periods of examination,—that is to say, in about ten minutes. There are, indeed, cases in which the culmination is reached after the first period of examination, while in still other cases, it is not noticed until after several frequently repeated periods of examination. Cases of this sort, however, are rare. The same condition of things is noticed with the decrease and increase of hearing during the intermissions of examination. In a few scattered cases I noticed in the periods of examination and intermission both, that the hearing energy varied more or less within certain fixed limits.

We have already mentioned the fact that the hearing is frequently observed to decrease if tested directly after a phase of excitement. I have repeatedly convinced myself of this fact, and for lack of space only suggested it once or twice in the cases here reported, just as for the same reason I have not given the results of all the tests on every day.

I will now subjoin those experiments in which the action of the excitation of one auditory nerve was tested merely in reference to the other ear.

Fourteenth Experiment.—Jan. 23d. Ottilie Z., æt. forty-six. Tinnitus on both sides for one year: *h* R 43, L 96. Ten minutes later: R —, L 116.

Fifteenth Experiment.—Jan. 24th. Anna G., æt. forty-four. Deaf for several years, and lately has had tinnitus on the left side: R 9, L on the concha. Five minutes later: R —, L on the concha. Five minutes later: R —, L on the concha. Jan. 25th: R 11, L on the concha. Five minutes later: R 11, L on the concha. Five minutes later: R 14, L —. Five minutes later (intermission): R 12, L —. Five minutes later (intermission): R 11, L —.

Sixteenth Experiment.—Feb. 7th. Elizabeth O., æt. thirty-two: R, cicatrix; L, excessive retraction of the *Mt.* Tinnitus L only: L 12, R 6. Five minutes later: L —, R 6. Five minutes later: L —, R 6. Five minutes later: L —, R 8. Five minutes later: L —, R 7. Five minutes later (intermission): L —, R 6. Five minutes later (intermission): L —, R 6. Five minutes later (intermission): L —, R 6.

Seventeenth Experiment.—Feb. 9th. Elizabeth T., æt. sev-

enteen. Deaf for several years; no tinnitus; R, perforation after tympanitis purulenta; mucous membrane of tympanum now dry: L 25, R 6. Five minutes later: L —, R 7. Five minutes later: L —, R 7. Five minutes later: L —, R 7. Five minutes later (intermission): L —, R 7. Ten minutes later (intermission): L—, R 6. After catheterization on the *left* side: L —, R 6. Feb. 24th: L 20, R 26. After catheterization on the *right* side: L 22, R 26.

Eighteenth Experiment.—Feb. 16th. Moritz M., æt. 54. Has had myringitis on the right side for a fortnight. Tinnitus: L 40, R 2. Five minutes later: L —, R 3. Five minutes later: L —, R 5. Five minutes later: L —, R 10. Fifteen minutes later (intermission of examination): L —, R 4.

Careful examination of these eighteen experiments, in which the influence of the excitation of one auditory nerve upon the other was thoroughly tested, shows a positive coefficient of excitation (increase of hearing) in twelve cases, amounting to 4 *cm.* [Case 1]: 9 [2], 2 [4], 4 [5], 1 [7], 22 [8], 4 [9], 5 [12], 20 [14], 2 [16], 1 [17], 8 [18]. In three we find a negative coefficient of excitation, 2 [3], 3 [6], and from on the concha to 0 [10]. In the remaining experiments the hearing distance was not altered. In the three cases with a negative coefficient of excitation the hearing distance was diminished twice upon the same side; once it was unaltered. In the latter case, however (10), the hearing distance decreased 1 *cm.* during the intermission of the examination (ten minutes). Among the seven experiments in which a positive coefficient of excitation was discovered on the same side after excitation of the auditory nerve by the ticking of the watch, we find six, again, amongst those twelve experiments in which the hearing on the opposite side also was increased. A searching investigation of these experiments as here detailed shows that in exciting an ear which is *extremely* deaf, the hearing of the opposite ear with better hearing is perceptibly increased, while, inversely, if we excite the energy of the better ear by such methods as have here been employed, it is very rarely possible for us to discover any increase of hearing on the opposite, deafer ear. Indeed, to be precise, it would appear as if the hearing

of the latter ear were, on the contrary, more frequently decreased. But if the hearing happens to increase during the course of treatment, or under further observation without treatment, the results which we have previously obtained undergo alteration according to the amount of the improvement.

We must here take occasion to emphasize the fact that the influence which the tinnitus may exert upon the excitability of the hearing of the opposite side is slight in comparison with that which it exerts upon the hearing of the same side. It is, however, a fact from which we cannot escape, that the tinnitus does exert some influence in many cases, since the positive coefficient of excitation then remains too slight in comparison with the original hearing distance.

Ten or fifteen minutes sufficed in most of my experiments to obtain the highest degree of hearing for the watch upon the side opposite the one excited. I was also able repeatedly to prove to myself that when the period of excitation was carried beyond this extent of time the perception of sound upon both sides—the originally excited as well as the opposite side—gradually decreased. The maximum of excitability was observed in a few rare cases directly after the first five minutes. In some of my experiments, as here described, the *period* of exercise and *intermission* of exercise have been specified interchangeably, so that the increase of hearing coincides with the *period* of exercise, the decrease of hearing with the *intermission* of exercise; a fact which may prove, in the experiments concerned, that the increase of hearing is to be ascribed to the excitation of the auditory nerve, and not, perhaps, to occasional variations in hearing.

A few of the cases in the *intermission* of exercise exhibited a gradual diminution of hearing in intervals which corresponded closely with those of the increase of hearing in the *periods* of exercise, and when the excitation of the auditory nerve of the one side had been followed by a diminution of hearing upon the opposite side, the increase of hearing in the intermission of the exercise was noticed in precisely the same manner. It often happened

however, that the diminution in the hearing distances on the other ear, which followed the excitation of the auditory nerve on the opposite side, became still more marked in the intermission of exercise. We rarely observed a case in which the increase of hearing that had in any way been gained remained permanent during the intermission of exercise. Both an increase and decrease in the intensity of hearing were occasionally observed in the intermissions of exercise.

The values which we have just given are, on the whole, so slight in comparison with those which we obtained in examining the reaction of the one ear following the treatment of the other,[1] that the question urged itself upon me, whether there was any thing more in this whole subject than simple individual variations in hearing, and whether the values which we had thus carefully obtained were not really to be ascribed to these variations? It was, of course, plain from the beginning that the values in this examination could not possibly be so large as some of those obtained in the investigations previously mentioned. For as that paper shows in complete detail, and to which I will simply refer for confirmation of my assertions, we had then to do with a reflex phenomenon which was produced by a relatively powerful irritation, such as is caused by the various methods of treatment—bougie, catheter, etc. In these experiments, however, we are endeavoring by a relatively slight excitation of the auditory nerve of one side, to arouse increased action in the auditory centres concerned, and in this manner to demonstrate an increased activity in the other auditory nerve thus indirectly excited. In a few of these experiments I have pointed out this relation by tabulation of the results after the treatment, and after the excitation of the auditory nerve by the noise of the watch.

In order to discover the normal variations in hearing, if any, in the space of half an hour, for instance, I went through with several verifying experiments. Inasmuch as these were made partly upon the same persons who had

[1] These ARCHIVES: the preceding paper.

been used in the experiments upon which this paper is based, I have added, in brackets, the number of the corresponding experiment.

First [12] *Verifying Experiment.*—March 7th. Helen B., æt. thirty-two. *h* R 12, L 13. Twenty-five minutes later : R 12, L 13.

Second [16] *Experiment.*—Elizabeth O., æt. thirty-two. R 9, L 15. Half an hour later : R 9, L 15.

Third Experiment.—March 2d. Carl F., æt. thirty-nine. L, exudation in tympanum. L 30, R 180. Half an hour later : L 30, R 180.

Fourth Experiment.—March 2d. Wenzel R., æt. thirty-one. L, phlegmonous tympanitis for eight days. L 9, R normal. Half an hour later : L 9, R normal.

Fifth [17] *Experiment.*—Feb. 26th. Elizabeth T., æt. seventeen. R 25, L 23. Half an hour later : R 26, L 24.

Sixth [5] *Experiment.*—March 15th. Lorenz M., æt. thirty. R 6, L 19. Twenty-five minutes later : R 5, L 17.

Seventh Experiment.—Feb. 28th. Gustav. R., æt. twenty-four. R, purulent tympanitis for eight weeks. R 8, L, 16. Twenty minutes later (during which experiments were made with the aural thermometer) : R 8, L 16.

To these verifying experiments we must add all of those in which all attempts to excite to increased activity the auditory nerve of one side, and consecutively that of the other, resulted negatively. Moreover, we must include in this list all of those cases in which periods of exercise and intermissions of exercise alternated with one another in the same session—*i. e.*, to a period of exercise followed by an intermission, and then again a period of exercise, and so forth,—and in which the hearing distance of the same or the opposite side varied after the period of exercise; while after the intermission it was precisely the same as at the beginning of the session.

In five of these seven verifying experiments we found that the hearing distance within a period of half an hour remained the same. In the verifying experiment No. 5 [17] it varied about 1 *cm.* in both ears, and in the verifying experiment No. 6 [5] it varied R 1 *cm.*, L 2 *cm.* after twenty-

five minutes; in the first case in favor of the hearing distance, and in the second, against it. But we must not fail to see that at the time of the verifying experiment No. 5 [17] the hearing distance amounted to R 25, L 23, while on February 9th, when an attempt was made to increase the hearing distance for the watch on the same side as well as on the other, by exciting the auditory nerve of one side only, the hearing distance on the side opposite the one directly irritated was only 6 *cm.* at the beginning, and later, only reached 7 *cm.* Still we find that variations of 1 *cm.* in the hearing are much more frequent with an originally greater hearing distance than with a small one. And then again, the repeated tests of the hearing distance appeared to prove that the improvement in the hearing was to be referred to the excitation of the auditory nerve, since it continued only during the period of exercise. In the intermission of the exercise the improvement in hearing retrograded. In the verifying examination No. 6 [5] we find a spontaneous reduction of the hearing distance on the verifying day (March 15th), while on the day of the original test (March 13th) we discovered on the side opposite the one excited an increase in the hearing distance for the watch from 6 *cm.* to 10 *cm.* directly after the first period of exercise.

There is no doubt that spontaneous variations in hearing can be observed within the space of half an hour, and it is probable that one or the other of the experiments just cited may be included amongst such instances. But I am of the opinion that this can only be the case within certain well-defined limits. On the contrary, my experiments have shown me that the presence, for a long time (twenty to thirty minutes), of any foreign body in the ear, such as the aural thermometer previously mentioned, does not exercise any influence upon the hearing after its removal. Most of our cases appear to prove that we are right in asserting that the improvement or deterioration in hearing on the same or opposite side is really produced by the excitation of the auditory nerve of one side. The explanation of the fact, as has already been mentioned in the intro-

duction, must be sought for in the excitation of the acoustic centres which is thus accomplished.

Analogous facts are mentioned by E. H. Weber[1]: "Exercise of the muscles which perform the movement necessary for writing with the right hand assists the corresponding muscles of the left hand so far that the latter hand can write fairly well at the same time with the right; the movements, however, of the two hands, although symmetrical (from right to left), are not equal in extent."

In this same category is to be included the observation made by Volkmann,[2] that the refinement by exercise of the sense of locality in the skin of any part of the body produces a refined sense of locality on the corresponding point in the other half of the body.

It is still an open question, however, owing to lack of material, whether continued exercise of the hearing of *one* side can produce in many cases a *permanent* increase in the hearing of the same or opposite sides. Toynbee,[3] nevertheless, reports cases in which the methodical use of a hearing-tube had been of great benefit in improving the hearing of those who were very deaf.

[1] Compare Funke, Hermann's "Handbuch der Physiologie," 1880. Band iii, Theil 2, Pag. 382.

[2] "Bericht der Sächsischen Gesellschaft f. Wissenschaft," 1858.

[3] "Diseases of the Ear," edition 1860, page 412.

FURTHER INVESTIGATIONS ON THE PHYSIOLOGICAL SIGNIFICANCE OF THE TRIGEMINUS AND SYMPATHETIC NERVE FOR THE EAR.

By E. BERTHOLD, Königsberg, Prussia.

Translated by Dr. F. E. D'Oench, New York.

WE thought that in a former paper we had concluded to a certain extent the experimental investigations on the influence of the nerves of the tympanic cavity on the vascularization and secretion of its mucous membrane, but the appearance of two new papers, one of them published by Baratoux in 1881 soon after our own, the other by Kirchner a year later, compels us to renew our investigations, and verify the results by new tests.

Referring to our first paper, we would call attention to two points only, in regard to which we differ from the authors just mentioned.

We had found that injury of the trigeminus, at its trunk as well as its roots, produced an inflammatory reaction in the middle ear, and that irritation of the sympathetic nerve was always followed by a perceptible contraction of the blood-vessels of the ear.

When, however, the trigeminus was irritated, or the sympathetic nerve cut, the results were always negative, as far as the blood-vessels of the ear were concerned. We also found the mucous membrane of the middle ear unaltered, even when the sympathetic nerve had been divided several days previously. These negative results are the subject on

which we differ from the authors mentioned above, though neither has repeated the experiments to the same extent. Baratoux has only investigated the results of dividing the nerves of the ear, and Kirchner has for the present experimented upon the trigeminus only.

Let us first see wherein Kirchner differs from us. He chose the mandibular nerve "for practical reasons, as its ramifications extend into the naso-pharynx, a region frequently of etiological importance for diseases of the middle ear." He justifies the selection of this branch, which has nothing to do directly with the ear, by referring to the peculiarities of the trigeminus, which is known to contain fibres of widely different functions. "From its final ramifications reflex action may be induced in the various kinds of centrifugal nerves." "To this, for instance, we may refer the observation of visible inflammatory changes in the tympanic cavity in dental caries, etc." The endeavor to injure the animals experimented upon (cats) as little as possible seems, however, to have furnished the principal reason for selecting this nerve; the animal was therefore neither chloroformed nor put under the influence of curare, in order to exclude every disturbance of respiration or the heart's action. In our experiments we neither exercised any control over the injuries of the trigeminus at its trunk or its roots, nor over the irritation of the latter in the medulla oblongata, as these injuries extend so deeply. The number of experiments performed by Kirchner is not mentioned. Although we had serious objections to Kirchner's method for theoretical reasons, we thought it necessary to test it.

Our experiments were conducted in conjunction with Prof. Grünhagen in his medico-physical laboratory, and I am greatly indebted to my honored friend for his sacrifice of time and labor.

In exposing the mandibular nerve we adhered in general to Kirchner's directions, but performed the experiments under narcosis, as former ones convinced us of the necessity of keeping the animal absolutely quiet in order to observe under the magnifying glass changes so minute as those of the varying fulness of the delicate blood-vessels of the

mucous membrane of the tympanic cavity. We therefore chloroformed the animals (cats) and injected 0.025 grms. of morph. hydrochlor. into the jugular vein in order to prolong the narcosis. As each experiment lasted from one to two hours, arrangements had been made to prolong the narcosis whenever there were indications of its cessation. This was done by introducing a canula into the trachea and connecting it by means of a rubber tube with a bottle containing some chloroform. The stopper of the bottle had another opening in order to admit a sufficient supply of air. When the nerve had been exposed it was not detached at its peripheric end and fastened in Ludwig's electrode, as Kirchner did, but placed upon Grünhagen's electric forceps. We preferred Grünhagen's instrument to Ludwig's electrode, as the latter could only be used to advantage when the nerve was detached near the lower jaw, and we thought it preferable not to injure the nerve. The bulla ossea was not exposed until we had satisfied ourselves that the nerve had been laid bare sufficiently so that it could be irritated without any trouble ; the submaxillary gland was easily avoided.

In exposing the nerve squint-hooks were used almost exclusively. After the bulla ossea had been opened with a pair of needle-scissors, and the mucous membrane incised and pushed aside so as to admit of an inspection of the interior of the bulla, one of us observed with a magnifying glass the appearance of the mucous membrane and the fulness of the blood-vessels, while the other irritated the nerve.

The result of our investigations performed upon a larger number of cats was always negative. We never saw any change in the fulness of the blood-vessels nor the slightest trace of an increased secretion. In regard to the latter, we read Kirchner's remarks with some surprise. He describes the condition of this mucous membrane literally as follows: "If the exposed portion of the mucous membrane of the tympanic cavity is incised with a pair of scissors, a cavity about half the size of a walnut and covered with a white, shining, moist mucous membrane becomes visible. This condition continues after the exposure of the tympanic cavity and is due to the continual secretion of light, thin

mucus. If, for instance, a portion of the mucous membrane is carefully wiped off with a little cotton, it is again covered in five seconds with a thin film of mucus."

We never saw any thing of this thin coating of mucus in healthy bullæ, nor ever observed any thing else than a shining interior, and would compare its degree of moisture with that of the normal cornea or conjunctiva, of which no one will say that they are always covered with a thin film of mucus. We are even not satisfied that the inner surface of the bulla ossea is covered with a mucous membrane, as microscopic examination failed to show glands of any kind. We will not deny that they may exist here and there at the ostium tubæ tympanicum, as in the human ear, as we did not search for them particularly, but it is certain that there are no glands in the membrane in question. According to our idea, the so-called mucous membrane of the bulla ossea of the cat rather resembles a serous than a mucous membrane and for theoretical reasons we cannot, therefore, understand the continual secretion of mucus, described by Kirchner. Neither could we detect an increased fulness of the blood-vessels after irritating the mandibular nerve. But even if this had taken place, we would not have regarded our results thereby disproved. It sometimes occurred in our experiments that a blood-vessel which had been injured, in exposing the nerve, and had ceased to bleed, began again when the nerve was irritated. What would Kirchner say, if we should therefore ascribe to the third branch of the trigeminus the power of considerably increasing the pressure in the blood-vessels of the neck, by irritating the mandibular nerve? Perhaps he would reply the same as we do to one of his observations—namely, that only then a conclusion can be drawn as to the vaso-motor properties of a sensitive nerve by irritating it, when simultaneous irritation of the other vaso-motor nerves can be excluded, as we have shown in our former paper.

If Kirchner had, however, attempted to irritate the third branch of the trigeminus exclusively, nothing would have been left to him but to divide the spinal cord below the medulla oblongata, thereby "inflicting severe injuries."

For the present, therefore, we must be content with the negative result of irritating the trigeminus.

The second experiment of Kirchner we consider still less conclusive, which verifies our result in regard to the consequences of injuring the trigeminus. As Kirchner disposes of the subject in seven lines, we reproduce them literally: "In some experiments, in which we had exposed the third branch of the trigeminus and torn it out as near as possible to the base of the skull, we could verify the observations of Berthold, who, as stated above, had found inflammatory changes, even to the extent of purulent exudation into the tympanic cavity, after an intracranial division of the trigeminus just before the ganglion of Gasser, as well as after destruction of its roots by dividing one half of the medulla oblongata." Kirchner does not explain how he imagines the physiological connection between the injury of the third branch of the trigeminus and its consequence,—the inflammation of the tympanic cavity. We must therefore guess at an explanation. If he assumes that he has torn out the trigeminus to such an extent as also to injure the fibres extending to the ganglion oticum, it could only be objected that the proof for this assumption must be furnished by a careful autopsy. Or does Kirchner assume that the injury caused by tearing out the peripheric portion of the third branch of the trigeminus extends as far as the ganglion oticum? This assumption seems even more improbable than the former.

As we have no statements in regard to the questionable connection between cause and effect, we would only call attention to the fact that purulent inflammation in the immediate surrounding of the bulla ossea frequently produces the same in the bulla itself, without the third branch of the trigeminus being injured, as we observed in the fourth case, reported below, two days after tearing out the ganglion supremum of the sympathetic nerve.

Turning now to the paper of Baratoux, we need concern ourselves with the assertion only that an inflammatory reaction occurs in the bulla ossea after division of the sympathetic nerve, which we had denied. He says, however, that

these changes do not appear within a few days after the operation, but at the end of a month, or even later. As we killed our rabbits a week or two after tearing out the ganglion supremum of the sympathetic nerve, we were obliged to repeat our experiments and test the statements of Baratoux. On May 29, 1882, we therefore operated three rabbits in succession, and tore out the ganglion supremum of the sympathetic nerve. The myosis of the pupil of the corresponding eye and the well-known dilatation of the blood-vessels of the ear clearly proved that the operation had been successful. One of the rabbits died three days later, but the autopsy failed to reveal a sufficient cause. The mucous membrane of both bullæ was normal, as was expected. The second rabbit was killed July 25, 1882—sixty-seven days after the operation; the mucous membrane of the bullæ was unaltered.

The last of these rabbits was killed with chloroform January 4, 1883. The bullæ, when opened, were entirely empty and free from exudation, though some blood-vessels seemed to contain more blood than usual. The mucous membrane was therefore examined at once under the microscope, but found entirely normal. I would call particular attention to a specimen of mucous membrane taken from the bulla ossea and stained with hæmatoxyline, revealing the presence of well-preserved non-medullary nerve-fibres, which proves that eradication of the ganglion supremum of the sympathetic nerve is not followed by degeneration of all the sympathetic nerve-fibres in the mucous membrane of the bulla ossea. Before opening the bulla we satisfied ourselves by the autopsy that we had torn out the gangl. supr. symp. It is therefore certain that division of the sympathetic nerve or extirpation of the gangl. supr. produces no inflammatory changes in the mucous membrane of the tympanic cavity. It is true that in a (fourth) case we found pus in the bulla of a rabbit which had lived only two days after the operation, but in this case the bulla of the injured side was also filled wih pus, which suppuration in both ears we could ascribe to the severe suppuration of the wound which had exceptionally set in.

We cannot confirm either in their entire extent the statements of Baratoux on the influence of division of the sympathetic nerve upon the blood-vessels of the auricle. Baratoux saw the dilatation of the blood-vessels and the thermic phenomena, in their greatest intensity, in rabbits which had been operated about five years previously by Laborde. In our animals, however, the dilatation of the blood-vessels of the ear perceptibly diminished after a few weeks. We never observed hypertrophy of the auricle in question, as Bidder claims to have seen in young animals after injuring the sympathetic nerve. As regards the physiological importance of the sympathetic nerve, we must therefore maintain our former views that it is a vaso-motor nerve, and, as far as our experiments extend, a vaso-constrictor nerve for the whole ear (external, middle, and inner ear), as the blood-vessels always contracted when the nerve was irritated; the results of division in regard to the vessels of the middle ear are, however, negative.

SECONDARY SYMPTOMS IN THE LABYRINTH AS SEQUELS OF CHRONIC PURULENT INFLAMMATION OF THE MIDDLE EAR.

By S. MOOS and H. STEINBRÜGGE, of Heidelberg.

Translated by H. Knapp.

WE are indebted to Prof. Cramer and his assistant, Dr. Tuczek, in Marburg, for the opportunity of examining two petrous bones (membrana tympani, external ear, and Eustachian tube absent), as well as for the clinical history and the autopsy-record of the case. The specimen had been removed from a cadaver twelve hours after death and preserved in a ½ % solution of chromic acid.

Clinical History.

L. T., æt. fifty-two, painter, admitted to the Marburg Insane Asylum, March 17, 1880; died May 21, 1882. Diagnosis: paralytic dementia.

Father intemperate; among four brothers and sisters three showed hereditary taint, one with hallucinations. One brother made an unsuccessful attempt at suicide, and later died of apoplexy. Our patient had been intemperate in Baccho et Venere. In his youth, visual hallucinations; always irritable and restless. In the winter, 1878-1879, he excited attention by his red complexion, exalted notions, and absent-mindedness. In the summer of 1879 he became more and more inconsiderate, cynical, and thoughtless, and showed symptoms of monomania of grandeur. His gait, unsteady for a long time, was conspicuously uncertain and staggering. He was said to have had at home visual and auditory hallucinations (the clinking of chains, the sound of human footsteps), to have spoken of suicide, to have

drunk a good deal, and to have been subject to great sexual excitement. He was transferred from an insane asylum near Zurich to Marburg, against which he vehemently remonstrated.

Though he did not deny the visual and auditory hallucinations, he did not regard himself ill.

On admission, March 18, 1880, no essential disturbances found.

April 26th.—Marked disturbance of gait.

May 7th.—Falls asleep wherever he walks or rests.

March, 1881.—Burns his nates against a stove. The monomania of grandeur and uncertainty of gait gradually increase. The right half of his body hangs inert. He drags his legs. His right shoulder is lower than the left. During the following months his bodily and mental weakness increases.

Jan., 1882.—Obliged to keep his bed. Gradual loss of weight (16 lbs. by the end of May). Assumes good manners; feels elated.

May 26th.—During dinner falls unconscious; slight convulsions of face and hand on left side. Pupils equal; no conjugate deviation of eyes. Catheterization on account of retention of urine. In the night, May 26th, hæmatemesis. Reflexes preserved. Beginning drowsiness. Painful distortion of face. Convulsions in the distribution of the facial and in the arm. Pinhead pupils. Increase of coma until evening of 28th, with diminution of all reflexes.

May 29th.—Continuous coma. Urine voided in bed. Evening: temp., 39.5° C; pulse, 120; respirations, 36. Coarse bubbling râles without dulness. Death at 11.30 P.M.

Autopsy, *May* 30, 1882, 10 A.M., by Dr. Tuczek.—Pupils of medium size, equal. On opening the skull, half a pint of dark blood escapes. Roof of skull firmly united to dura at the vertex. The inner surface of the dura over the whole convexity is lined with pachymeningitic lamellated pseudo-membranes; between them numerous hemorrhages, and on each side a larger bag filled with blood and clots. After removal of brain the anterior and middle cranial fossæ on both sides found lined with similar continuous membranes. The brain with the pia weighs 1040 grammes. On the right side, the frontal lobes and the lower segments of the central convolutions and the anterior segments of the temporal lobes flattened. In the latter situation, a hæmatoma. The pia on the frontal lobes and the anterior part of the central convolutions thickened and opaque on both sides; most intensely,

so as to form tough pseudo-membranes, on the first frontal convolution. The frontal lobes show a beak-shaped contraction ; the pia can be detached easily and without loss of substance. Circumscribed atrophy of cortex is not found. Cortex thin on the whole. At the base, opacities in the subarachnoid tissue, but not conspicuous in the neighborhood of the nerves. The blood-vessels at the base and their ramifications in the Sylvian fossæ intact. The insular convolutions well developed. Both optic nerves, which are thin and flattened, show gray zones and patches on section. The olfactory nerves well developed ; nothing remarkable in the other cranial nerves.

The pseudo-membranes cannot be traced into the internal auditory canals. The medullary substance of the brain, firm, white ; ventricles not dilated, their ependyma delicate. The posterior half of the eyeballs removed in connection with the optic nerves. Optic discs white, markedly depressed. The spinal pia thickened and opaque on the posterior surface, with an osseous deposit here and there. The posterior nerve-roots without a distinct attenuation or discoloration. Their consistency firm. The gray substance in the posterior columns well marked, extensive in the lumbar and lower dorsal medulla.

Macroscopic Condition of the Right Labyrinth Wall.

The lining mucous membrane of the inner wall of the middle ear is so much thickened, that the promontory presents an almost even surface, the niches being completely filled with the hyperplastic mucous membrane. The capitulum of the stapes barely projects over the swollen mucosa. The crura are destroyed by necrosis, with the exception of a remnant of the posterior crus.

Macroscopic Condition of the Left Labyrinth Wall.

The mucous membrane is likewise thickened, but less so than on the right side ; most markedly in the region of the round window.

Microscopic Condition of the Mucous Membrane on Both Sides.

Right. The epithelial cells are large, in part oval, in part round, with very large nuclei (probably epidermoid metamorphosis). Apart from the cells the mucous membrane shows connective-tissue trabeculæ with dendritic branching, similar

to the dendritic formations which are found in the mucous stratum of the normal drum-head. The blood-vessels are not dilated, and are rather empty.

Left. The epithelium is unchanged; the blood-vessels are widely distended with blood. Some hemorrhages in their vicinity.

From the above it follows that on the right side we had to deal with a chronic purulent inflammation of the middle ear, on the left with a congestion of the mucous membrane.

Microscopic Examination of the Labyrinths.

Both auditory nerves normal. The entrance to the *right* round window very narrow, its membrane partially transformed into connective tissue. The spiral ligament at the beginning of the first turn at the side of the scala tympani notched, the periosteum of all the turns of the cochlea partly thickened, partly notched, especially in the scala vestibuli. At the edge of the periosteum, colloid globules. Ganglionic region, nerves in the zona ossea, Corti's organ, normal. Disseminated colloid globules on the external wall of the semicircular canals. Globular yellow and brown-red pigment in the connective-tissue layer of the ampullæ, and in the lateral epithelium of the cristæ. Unusually numerous, partly round, partly oval conglomerations of otoliths of ordinary shape between the nervous fibres of the ampullæ and utricle.

The same are found also in the labyrinth of the *left* side, which is otherwise quite normal. Besides them, isolated mulberry-shaped clusters of otoliths are found in the same region as on the right side, exhibiting the same aspect as illustrated by Leydig in the labyrinth of the ray.

Remarks.

The alterations described in the right labyrinth—thickening and notching of the cochlear periosteum, the changes of the spiral ligament, the scant formation of colloid substance and pigment—probably have no causal connection with the morbid processes in the cranial cavity. They must rather be regarded as sequels of the morbid condition in

the right middle ear, propagated through the membrane of the round window to the cochlea. The pigment also may have resulted from secondary congestion in the contents of the tympanic cavity, not from hemorrhagic pachymeningitis.

HISTOLOGICAL LABYRINTHINE CHANGES IN A CASE OF ACQUIRED DEAF-MUTISM.

By S. MOOS and H. STEINBRÜGGE.

Translated by H. KNAPP.

(With a wood-cut.)

WE owe to the kindness of Prof. A. Politzer, in Vienna, the opportunity of making the following investigation. He furnished the two petrous bones together with the brain of a twelve-year-old girl who had become deaf in her fourth year. We handed the brain to Prof. F. Schultze for the purpose of detailed examination, which, however, as far as the cerebrum was concerned, proved impracticable, as it had been damaged in the preservation fluid. For the description of the other parts of the brain see later on.

The petrous bones, preserved in diluted chromic acid, were totally decalcified by us, according to the method repeatedly communicated in these ARCHIVES. It may be of interest to premise that the osseous nuclei, which we have found and described so frequently in the petrous bone of the adult, were absent in the specimens under consideration.

Prof. Politzer has sent us the following notes concerning the clinical history of the case: The girl was born Sept. 5, 1869. She lost her hearing in her fourth year, exhibiting symptoms of encephalitis. She retained, however, in a certain measure, the power of perceiving vowel sounds, and possessed good mental faculties. Her last disease began May 14, 1881, with an eclamptic seizure followed by paralysis of the extremities on the right side. Death occurred two weeks later.

AUTOPSY.

Meninges normal. An encephalitic patch, with softening in the adjacent parts, in the left parietal lobe extending to the vicinity of the lateral ventricle. Near the cerebral cortex a cavity, the size of a walnut, covered with granulations on its floor. Ventricles and cerebellum normal. Acoustic striæ well developed. This observation was confirmed by Professor Schultze, who found also the medulla and the nuclei of the acoustic nerves normal.

Examination of the Petrous Bones.

The petrous bones were unusually large, considering the age of the patient, though no essential changes were found in the external and middle ears. The right tensor tympani was very flat, but its fibres normal.

The two auditory nerves were firm (the effect of the chromic acid ?), and, like the two facial nerves, of normal thickness.

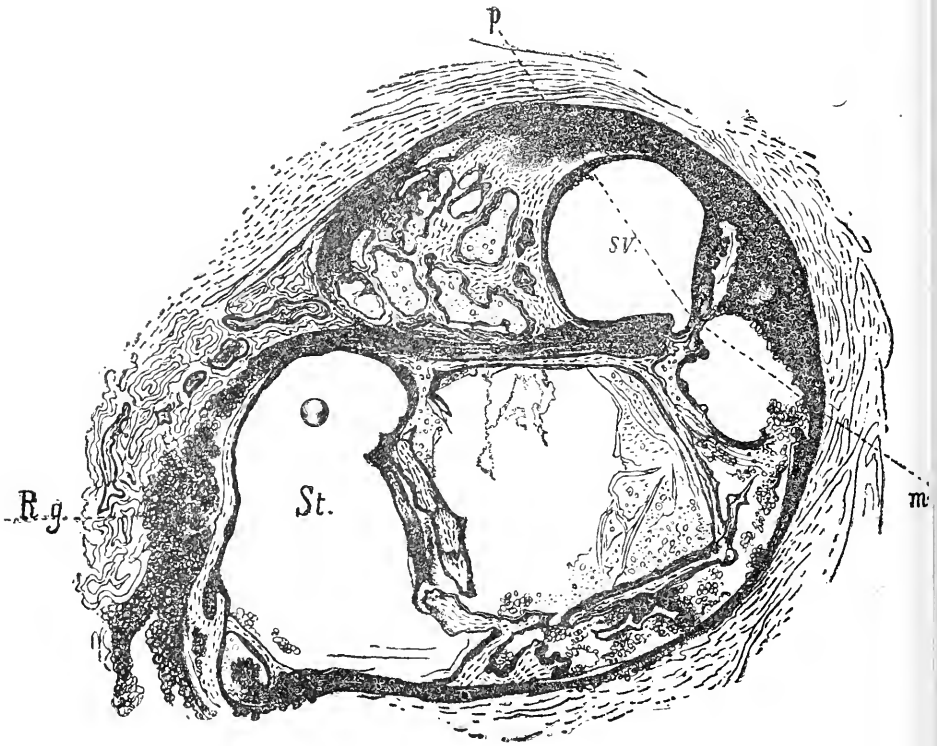
The contents of the vestibule, semicircular canals, and cochlear apparatus were normal on the right side; whereas on the left they showed the following changes:

In the connective-tissue layer of the utricle, semicircular canals, and ampullæ numerous colloid globules and molecular detritus, the latter filling the greater part of the perilymphatic space of the semicircular canals. The calibre of the membranous semicircular canals and the nuclei of the epithelium on their internal surface were well preserved; the outlines of the epithelial cells, however, were indistinct, and the papillæ not discernible. Nerve region normal. Blood-vessels well filled.

Right Cochlea.

The anatomical condition of the round window and its membrane was normal. We found the principal alterations in the first turn, after three or four sections had been cut off with a razor, and the pathological conditions now to be described were most marked at the end of the first cochlear turn.

The changes are represented in the accompanying woodcut (Hartnack $\frac{3}{9}$), which shows a section carried through the right cochlea, perpendicular to the longitudinal axis of the petrous bone. The two leaves of the osseous lamina spiralis are seen in the centre of the drawing. Between them is a clear space devoid of nervous fibres. From both the vestibular and tympanal periosteum of the osseous zona new-formed bone tissue proceeds, which is interrupted



by smaller and larger lacunæ filled with a connective-tissue net-work containing in its meshes round cellular elements. The connective tissue in the scala tympani (*St*) is more distinctly visible than in the scala vestibuli (*sv*). The new-formation of bone, on the other hand, is much farther advanced in the scala vestibuli, more than half the calibre of which is occupied by broad anastomosing osseous

lamellæ, forming smaller and larger irregular cavities which appear less filled with connective-tissue and cellular elements than the cavities in the scala tympani. Thus of the scala vestibuli is left only a small circular space which, under normal conditions, would about correspond to the size of the ductus cochlearis. Its outline is formed by a thin layer of periosteum extending at *p* over the preserved membranous lamina spiralis (*m*). In other sections this portion was even ossified.

The ganglionic region (*Rg*) is preserved, but gives off only a few nerve fibres ending in the osseous lamina.

In several sections of the spiral ligament in the second cochlear turn, a cellular infiltration was found. The scalæ of the second and third turns, whose nerves were well preserved and of normal thickness, as could be seen by an ordinary magnifying glass, showed under the microscope accumulations of molecular detritus. Neither Corti's organ nor the membrana tectoria could be detected in either specimen (not even in the left, which was otherwise normal). According to our experience this occurs in all preparations that have lain too long in chromic acid. To cite an example: we found this condition in the normal petrous bone of a criminal, which had been placed in chromic acid twenty minutes after his execution. We can, therefore, attribute some significance to the absence of these organs in the case under consideration only where the corresponding space was occupied by products of inflammation (see the drawing).

REMARKS.

In the foregoing case we had to deal with an inflammation of the whole labyrinth of the right petrous bone occurring in the fourth year of life. The inflammation had produced in the perilymphatic space of the semicircular canals, ampullæ, and vestibule an exudation which, in the course of time, had undergone in part colloid, in part molecular, degeneration. The sequelæ of this inflammation manifested themselves in the cochlea by proliferations of connective tissue and new-formations of bone

proceeding from the periosteum. This process caused a partial obliteration of the cochlear cavities in the first turn and a fixation of the membranous lamina spiralis. The morbid process stopped at this stage, whereas, in a case observed by Politzer (Compte rendu, second session of the International Otological Congress, Milan, 1880, page 7, etc.), a total ossification of the labyrinth took place. The absence of the nerves, which was total in the first cochlear turn, must likewise be considered a consequence of the inflammation, although the abnormal fixation of the membranous lamina spiralis would in itself have been sufficient to abolish the function of the nerve fibres even if they had been quite healthy.

The integrity of the intrinsic muscles of the ear and of the right acoustic nerve, despite the marked changes in the cochlea, is very remarkable, but in harmony with the results we obtained in the examination of specimens taken from other deaf-mutes.

The pathological condition on the right side does not fully account for the acquired deafness, since, as above mentioned, no changes could be found in the left ear. Our examination, therefore, does not explain the occurrence of total deafness, which possibly was chiefly due to a disease of the cerebral cortex, indicated by the encephalitic symptoms in the fourth year of the patient. A direct demonstration could have been furnished only by an accurate examination of the brain, which unfortunately was rendered impossible by the excessive hardening of the specimen.

NEUROPATHOLOGICAL COMMUNICATIONS.

By S. MOOS.

Translated by H. KNAPP.

I. A Case of Meningitis Acutissima in an Adult. Rapid Recovery, but Permanent Deafness and Staggering Gait.

Thirty-four weeks ago Mr. W., æt. twenty, employé in the post-office, was seized, without assignable cause, in the afternoon at five o'clock, with excruciating pain, vomiting, and loss of consciousness. He does not remember whether he had vertigo. The next morning he was found unconscious in his bed. A physician, who was called in at once, thought that a severe cerebral affection or a mental disease had set in, and telegraphed to the father of the patient. Yet consciousness returned in the course of the forenoon, but without the appearance of any new symptoms. The patient completely lost the hearing in his right ear at noon and in his left in the evening. No further vomiting; the headache soon disappeared. He recovered rapidly, left his bed in a few days, but has been deaf and has had a staggering gait ever since. He has no perception of any kind of sound. Physical examination showed nothing abnormal.

Evidently we had to deal in this case with a meningitis, which was perhaps limited to the posterior cranial fossa. The affection must have propagated itself along the auditory nerves into the labyrinth, producing permanent total deafness and staggering gait.

II. Two Cases of Oscillatory Movement of the Head in Bilateral Affection of the Labyrinth.

In my monograph on the deafness consequent on epidemic cerebro-spinal meninigitis, I said (page 25) that the

staggering observed in children after recovery from that disease, could appropriately be called "duck-gait," and that the head repeated the lateral oscillations of the body, without changing its position toward the body. Up to that time I had never observed a forward and backward movement, nor oscillations or rotations of the head. In the two years which have since elapsed I have had an opportunity to convince myself, by the examination of two patients, that oscillatory movements of the head do occur in children when both labyrinths are simultaneously affected, either independently or in the course of meningitis.

Case 1.—H. H., a girl of five years, of Kaiserslautern, Palatinate, was brought to me by her parents July 20, '81. In May of the same year, during which time meningitis, scarlet-fever, and diphtheria had been prevalent in the place, she fell sick with headache and vomiting, but without loss of consciousness; in fact, her consciousness was undisturbed during the whole disease. Under the application of cold the symptoms abated gradually in a week. On the eighth day the parents noticed for the first time considerable impairment of hearing, which soon increased to total deafness. Then a period of fluctuation of hearing power set in, during which at times she could understand loud voice spoken directly into the ear, at others she could not. Two weeks ago she was unable to hear any thing; to-day, during the consultation, she answers correctly all my questions. She still staggers in walking, and has a tendency to fall sideways. During the reconvalescence the parents noticed, apart from the deafness, nothing abnormal as long as the child lay in bed, but as soon as she was raised, her head oscillated forward and backward or from one side to the other, so that for two days it was necessary to steady her head as often as she ate or drank. The oscillations of the head have not been noticed since.

The objective examination proved completely negative. On the left side she was totally deaf, and has remained so; on the right she correctly repeated loud words, and perceived tuning-forks C and C^1 but not a^1 by bone-conduction.

Treatment: Iodide of potassium and salt baths. August 10th, when I saw her last, she understood loud voice at the distance of one metre.

Case 2.—E. L., a boy of two years, of Ludwigshafen, Palati-

nate, was brought to me by his parents July 23, 1882. At the age of six months he contracted a "severe illness from which he completely recovered only many weeks later." The symptoms were: obstinate vomiting during several weeks, convulsions in arms and legs, periodic strabismus and opisthotonus; further, unconsciousness for several weeks. He can neither speak nor walk, but is able to stand for a short time. One day when he was taken up during the reconvalescence and seated on the floor, "his head began to swing so much as to strike the floor, and we were obliged to hold it steady." The parents did not know whether the oscillations had occurred also (as in the foregoing case) when the child was raised in bed.

III.—Annoying Subjective Sensation of Hearing Produced by a Pair of Eye-Glasses.

Hitzig, Bernhardt, Berger, and Gottstein have advanced the hypothesis that, under certain physiological as well as pathological conditions, voluntary contractions of the mimic muscles of the face may induce simultaneous contractions in the stapedius muscle, accompanied by subjective sensations of sound. In Gottstein's case there was blepharospasm combined with spasm of the stapedius muscle. Each attack of blepharospasm was preceded by a roaring in both ears, disappearing when the blepharospasm ended. Of late Jacobson has published (Report of the Berlin University Policlinik, *A. f. Ohrenh.*, vol. xix, 1, page 42, etc.) two cases in which subjective noises were produced by muscular contractions. One of the patients heard ringing in the ear when he closed his eye. At the same time retractions of the drum-head could be detected by the ear-mirror and the manometer, on which account Jacobson refers the ringing to a contraction of the tensor tympani muscle. In the second case the patient heard during the closure of the jaws a short ringing like C^4. During contraction of the masseter muscles with closed teeth he heard a humming on both sides. Whether this phenomenon was caused by simultaneous contraction of one of the intrinsic muscles of the ear could, according to Jacobson, not be made out with certainty, as objective evidence could not be furnished.

To these observations I can add another:

Mrs. K., sixty years old, consulted me April 10, 1882. At the beginning of September, 1881, immediately after she had put a pair of eye-glasses on, she heard a ringing in her left ear, which disappeared, but returned as often as she put the eye-glasses on again. The application of a Spanish fly-blister to the left mastoid region was followed by numerous abscesses in the left external ear-canal. As long as they were present, no ringing occurred—not even when the eye-glasses were used. After the abscesses had disappeared the ringing in the left ear returned as often as the patient put eye-glasses or spectacles on, and was accompanied by a loud, beating noise. As the patient suffered also from palpitations, I advised her to consult Professor Friedreich, who sent me the following note: "Neither the heart nor any other organ shows objective changes, and I consider the beating of a purely nervous nature. Mrs. K., whom I have known for many years, and who has been under my care several times, suffers from an extraordinary excitability of the vaso-motor nervous apparatus. Quinine in small doses and rest formerly always benefited her very much, and I recommended her the same this time also."

The objective examination of the hearing organ gave on the whole a negative result: Mild pharyngeal catarrh, drum-head unchanged, hearing acuteness 16–20 metres for whispered voice.

I advised the patient not to press the eye-glasses on the nose, but to hold them simply before the eyes. I have not seen her since.

In what way can we account for the ringing in this case? According to the investigations of Lucae healthy people can, by strong innervation of some facial muscles, subjectively produce a deep tone, in consequence of the simultaneous action of the stapedius muscles. In the case under consideration a high tone (ringing) was perceived, which could not have been the perception of the muscle noise of the stapedius, but a subjective sensation of hearing caused by the negative pressure fluctuation of the labyrinthine fluid, occurring when the contraction of the occular muscles during the application of the eye-glasses excites the stapedius muscles to concomitant activity.

IV.—A Case of Mimic Facial Convulsions Complicated with Nystagmus and Vertigo.

In the year 1876 Cyon[1] determined experimentally the

[1] E. Cyon: Les rapports physiologiques entre le nerf acoustique et l' appareil moteur de l' œil.—*Gaz. méd.*, 1876, No. 17; *Vgl. med., Bl.*, 1876, No. 36.

physiological connection between the auditory nerve and the centre of innervation of the muscles of the eye. Cyon considers the ocular movements following upon injury to the semicircular canals as the immediate and direct consequence of such injury. The eyes deviate backward and downward on the same side if the horizontal and the superior vertical canal (in the rabbit) are excited. They deviate forward and somewhat upward if the posterior vertical canal is excited. At the same time the eye of the other side also deviates, but in the opposite direction. The pupil of the eye on the side excited contracts, on the other side it remains wide. At the moment of excitation both eyeballs are tetanized, then they make rapid spasmodic movements in the opposite direction, which rarely last longer than half an hour, and disappear after the division of the auditory nerve of the opposite side.

Excitation of one auditory nerve causes powerful rotations of both eyes. Division of one acoustic nerve produces marked downward deviation of the eye of the same side, and an upward deviation of the other eye. After division of the second acoustic nerve the deviation disappears.

The results obtained by Cyon were supplemented and in part confirmed by the experiments of Högyes.[1] This author, on the strength of his experiments, expresses the opinion that the vestibular terminations of the acoustic nerve are a peculiar terminal apparatus which regulates the movements of the eyes, and probably the movements of all the muscles subservient to the maintenance of equilibrium, according to the position of the head or the body. For our purpose an experiment on a rabbit is particularly interesting, in which the perilymphatic liquid was sucked out with a glass tube and air gently blown through the same tube into the perilymphatic space; whereupon bilateral movements of the eye and, on more forcible blowing, marked nystagmus followed.

Some pathological observations are on record which

[1] On the true cause of vertiginous phenomena by increased pressure in the tympanic cavity. *Pflüger's Archiv*, Bd. xxvi, page 588.

are in harmony with these experiments, or which, in other words, find in them their only rational explanation.

Schwabach[1] observed peculiar oscillatory movements of the eyes in a case of chronic purulent catarrh of the left middle ear with a large defect in the drum-head. These movements were bilateral, horizontal, and directed toward the affected side. They were produced by pressure on the mastoid process immediately behind the auricle, or on the corresponding place in the auricle, only after secondary purulent infiltration had caused marked swelling in the ear and the surrounding parts. They disappeared as soon as the pressure ceased. The ocular movements were accompanied by violent vertiginous movements.

In consideration of Cyon's experiments, Schwabach explains the oscillatory movements of the eyes by an irritation of the semicircular canals in consequence of increase of pressure produced by retention of pus. This communication of Schwabach led E. Pflüger[2] soon after to publish a case of chronic purulent otitis media, with formation of polypi on the upper wall of the external auditory canal quite near the drum-head, in which horizontal oscillatory movements of the eyeballs occurred whenever the polypi were touched.[3]

The symptoms of the following case may also in part be explained by Cyon's experiments.

A forester, sixty-one years of age, consulted me Aug. 18, 1879.

[1] *Deutsche Zeitschr. f. pract. Medicin*, 1878, No. 11; und *med. Centralbl.*, 1878, No. 34.

[2] Nystagmus-like ocular movements in consequence of an aural affection. *Deutsche Zeitschr. f. pract. Medicin*, 1878, No. 35; and *med. Centralblatt*, 1879, No. 22.

[3] For the sake of completeness in regard to the movement of the pupil of the side irritated, as observed by Cyon, I may here briefly report an observation which I made, fifteen years ago, in Friedreich's clinic, and published in the *Archiv von Ohrenheilkunde*, Bd, ii., pag. 197. After the cessation of otorrhœa and the apparent subsidence of a purulent perforative otitis media on the right side, persistent headache, tinnitus, vertigo, vomiting, and contraction of the pupil set in. All these symptoms disappeared when pent-up masses of pus and epithelium had been loosened by two applications of the catheter and then removed by syringing. At that time I considered the vertigo and vomiting symptoms of increased labyrinthine tension from pressure exerted by the inflammatory products on the windows of the labyrinth; whereas, I regarded the contraction of the pupil as due to irritation of the otic ganglion. Cyon's experiments furnish a more plausible explanation of the alteration of the pupil.

He had suffered for ten years from an aural affection, which had made rapid progress owing to frequent exposures in the discharge of his duty. In his right ear he hears a ringing sound constantly, in his left only occasionally. During the last four years he has suffered, in consequence of a violent cold, from a characteristic mimic facial spasm, which occurs only by spells, but which, up to this day, has never left him, and appears twenty or thirty times daily. Each attack is accompanied, as I have repeatedly observed, by countless lateral rotations of both eyeballs, with which, of late, vertiginous seizures, with a tendency to turn from left to right, were associated. The patient considers these vertiginous attacks entirely different from the dizziness which had distressed him during the first years of his ear-affection. The previous dizziness, which lasted a long time, he called permanent; the present, which occurs during the spasmodic attacks, temporary.

On examination I found on both sides injection of the manubrial vessels, both drum-heads partly opaque, partly atrophic, bone-conduction absent for all kinds of sound, auditory acuteness by air-conduction on left almost o, on right $= \frac{15}{1000}$ *cm.* for the watch.

In this case we probably had to deal with a spasm of the stapedius muscle, which accompanied the tic convulsif, and was caused by a labyrinthine irritation from diminished tension. The irritation was transmitted, on the one hand, to the cerebellum; on the other to the centres of innervation of the ocular muscles, causing the occurrence of the facial convulsions, together with vertigo and nystagmus.

V.—A Case of Paralysis (Otitic Reflex Paralysis?) of the Trochlear Muscle in the Course of a Purulent Otitis Media.

(*With a temperature curve.*)

The publication of the following observation seems of interest in supplementing the discussion of the previous case, referring to the relation between the auditory nerves and the centre of innervation of the ocular muscles.

P., æt. fifty, railway employé, enjoyed good health until the middle of February, 1883. In particular the acuteness of both his higher senses left nothing to be desired. At that time, after an exposure, he contracted a coryza, accompanied by violent pain in

the left ear, radiating over the corresponding half of the head, with an evening exacerbation. Loud beating noise in the ear preceded by several days the occurrence of otorrhœa, which has continued profuse up to date. The patient has suffered from almost constant pain, particularly in the left supra-orbital region and the middle of the occiput. Of late he has been feverish; has had, at irregular intervals, chills, constipation, and anorexia, and has lost flesh considerably. In the last ten days he has had double-seeing on the affected side, and constant tinnitus, without dizziness, but with swelling in the middle of the left side of the neck. From March 8th to April 14th he was under the care of Dr. O. Wolf, in Frankfort-on-the-Main, to whose kindness I owe the following notes:

Otitis Media Purulenta, with Propagation of the Inflammation to the Mastoid Cells.

"When the patient came to me I found a muco-purulent secretion in the left auditory canal, the walls of which were somewhat swollen; the left drum-head tumefied and livid, in its lower part a small perforation, through which the air on inflation hissed with difficulty. Mastoid process looks healthy, not painful; $h = o$; loud words heard only when spoken near the ear; bone-conduction on the left side = o, tuning-forks from the vertex intensified on the left. Air-douche and insufflation of boracic-acid powder relieved the pain at once, and raised the hearing acuteness for whispered voice to one metre. On the eighth day of treatment the perforation was closed. As, however, the pain returned and secretion accumulated in the tympanic cavity, an extensive paracentesis of the drum-head was made, and for several days there was copious discharge. The pain subsided, but recurred when, after another week, the opening of the drum-head had closed again. The paracentesis was therefore repeated, but the pain soon returned, and on March 25th the mastoid process swelled. Some days later a bulging of the posterior wall of the ear-canal near the drum-head was noticed. After continued poulticing a copious discharge set in March 28th (probably from the bulging part of the ear-canal), and the patient remained free from pain for a week. On inflation only slight crepitation was heard; the hearing acuteness rose steadily, being on April 5th: $h = 20$ *cm.*, v (whispered voice) = 5 metres. He was able to take a daily walk for several days. April 8th the pain returned with renewed violence, depriving the patient of sleep in spite of large doses of mor-

phia; poulticing also afforded but little relief. The pain extended to the temple and occiput, and the posterior wall of the ear-canal bulged again. Once more a moderate discharge caused relief of pain. As the patient could not have the necessary care at his residence (where, meantime, a child had been born), I sent him on April 14th to his home for a few days, with the recommendation to return should pain occur again. I thought that the frequently recurring pain was caused by accumulation of secretion in the mastoid, an opening of which, either from the external ear-canal or behind the ear, might become necessary. Three days after his departure he wrote me that during the first days he felt very well, but that now the pain had returned with renewed intensity. Since then I have heard nothing of the patient."

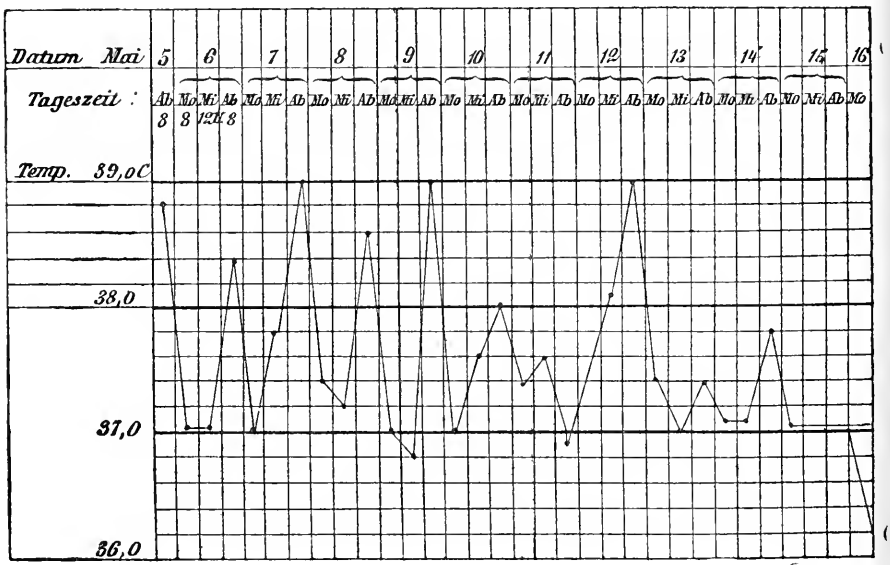
Condition on May 4th.—The patient looks very ill and anæmic, is depressed and fretful. Pulse 84, weak; temperature 38.2°. Complains of diplopia on left side; violent pain in the left frontal and occipital regions; tinnitus aurium. It is difficult for him to turn his head on account of an excessively hard swelling which from the level of the angle of the lower jaw reaches 5-6 centimetres downward along the anterior edge of the left sterno-mastoid muscle. It is as thick as the little finger and covered by skin of normal appearance; $h = \frac{1}{\infty}$, $V = \frac{1/4}{60}$. Bone-conduction for tuning-forks and loud-ticking watches preserved on the affected side.

The external ear-canal filled with pus; its bony portion narrowed to a small slit, yet a small speculum can be introduced. The lower portion of the drum-head perforated, its posterior upper quadrant bulging; mastoid process painful and tender to the touch, the skin over it unchanged.

As to the diagnosis, the disease evidently was a chronic purulent otitis media with perforation of the drum-head and implication of the mastoid process, probably in its anterior portion. At the same time, the repeated chills, the marked emaciation, the diplopia, etc., made me think of an intracranial complication—*i.e.*, a circumscribed basilar meningitis, perhaps phlebitis or thrombosis of a cerebral sinus, or, considering the above-mentioned swelling in the neck, phlebitis and thrombosis of the jugular vein. I therefore framed a grave prognosis and insisted upon an ophthalmoscopic examination, trusting in this way to arrive at a sure

diagnosis. The examination of the eyes made by Prof. Becker on the same day gave the following result:

"Emmetropia. S. normal on both sides. Ophthalmoscopic condition normal. The double images are homonymous, increasing in vertical deviation in the lower, in lateral deviation in the left, part of the field of fixation. Paresis of the left trochlear muscle. A direct connection between this affection and a disease of the ear or brain is not demonstrated; its possibility, in spite of the negative ophthalmoscopic condition, cannot, of course, be denied."



TEMPERATURE CHART.[1]

The local treatment, until the recovery of the patient, was as follows: Every day the ear was inflated and syringed several times, after which the ear was filled with warm water, the patient being on his side, and the inflation repeated. By means of a Leiter's coil cold was applied alternately to the mastoid process and to the swelling in the neck, until the pain and swelling disap-

[1] Explanations: Tageszeit, time of day; *Ab*, evening; *Mo*, morning; *Mi*, noon.

peared. Chloral and the narcotics were not borne and were, therefore, soon discontinued.

Further Course. May 4th.—Chilly feelings and flushes of heat in the night, May 4th-5th ; excessive excitement after two grammes of chloral.

May 5th.—In the morning : passage after bitter water ; locally the same condition. For the first time, some appetite. Pulse 84. Evening temperature 38.8°. Passed a good night.

May 6th.—In the morning : temperature 37° ; status idem. In the evening : temperature 38.4°. Night bad. Great deal of pain in head and nape of neck.

May 7th.—Morning : temp. 37° ; pulse 84, weak ; 4 P.M. : temp. 39° ; evening : temp. 38° ; 12.30 P.M. : sudden fainting turn, with staring eyes, lasting some minutes. The hard swelling in the neck, about at its middle, very painful and tender to the touch. Passed a tolerably good night.

May 8th.—Morning : evacuation after bitter water ; feels well ; appetite moderate ; pulse 84, weak ; temp. 37.2°. Locally, status idem ; profuse discharge. Evening temp. 38.8° ; night sleepless. Little pain, much discharge.

May 9th.—Hardness and swelling in neck diminishing ; pain likewise. Pulse 86. Otherwise, status idem. Noon, 36.4.° 4 P.M., temp. 39°. Slit-shaped contraction of auditory canal lessening. 9 P.M., temp. 38°. Hardness in neck further diminished, but some swollen glands at anterior edge of the sterno-mastoid muscles. Patient complains of distress on left side in swallowing. The examination of the neck, however, shows nothing remarkable. Night, May 9–10, bad. Intense headaches.

May 10th.—Morning : temp. 37°. Evening : temp. 38°; pulse 84. A passage after bitter water. Symptoms same as yesterday. Night of 10th to 11th restless.

May 11th.—Morning : temp. 37.4° ; pulse 84. Less difficulty in swallowing. The first spontaneous stool for weeks. Otherwise, status idem. Noon, temp. 37.6° ; 4 P.M., 38° ; 8 P.M., 37°. Night sleepless.

May 13th.—Morning : discharge has stopped. Bulging of drum-head has disappeared. Perforation still present, but even inflation liberates no pus. Calibre of ear-canal wider. Temp. 37.2° ; pulse 84, strong. Spontaneous stool. Night best during whole sickness.

May 14th.—Morning : perforation cicatrized. Night of 14th to 15th good.

May 15th.—Morning: free from pain. Less diplopia. Temperature permanently normal; pulse 84. Some tinnitus. Sleep, stool, and appetite, normal. Drum-head lacklustre. Tube pervious. Condition of eyes according to Prof. Becker: "Field of single vision much larger. Homonymous diplopia. The image belonging to the left eye lower in the lower left half of the field of fixation." Patient discharged with $v = \frac{10}{20}$, $h = 10$ *cm.* The patient informed me by letter of May 30th that the diplopia had almost totally disappeared; and on June 16th that the noises in the ear had almost entirely disappeared, hearing good, and eyes likewise very good.

Everybody will recognize the difficulty of appreciating the symptoms which in this case complicated the inflammation of the middle ear. I have mentioned above the different possibilities as to diagnosis. Basilar meningitis or propagation of the inflammation to the cavernous sinus would afford a ready explanation of the disturbances in the function of the first branch of the fifth pair and of the paralysis of the fourth. The temperature curve is also in accordance with phlebitis and thrombosis without disintegration of the thrombus. If, in consideration of the normal ophthalmoscopic condition, the presence of a phlebitis and thrombosis of a larger cerebral sinus, especially the cavernous, be unconditionally rejected, nothing remains but to suppose, in harmony with Cyon's investigations, that the retention of pus in the middle ear produced an irritation of the labyrinth which did not extend to the cerebellum—vertigo was absent as long as diplopia was present—but rather to the centre of innervation of the trochlear nerve of the affected side. This irritation caused in the corresponding muscle a reflex paralysis which, with the purulent inflammation and the retention of pus, gradually disappeared.[1]

VI—.A Peculiar Perversity of Tuning of Corti's Organ.

An architect, æt. thirty-two, of excellent musical education, contracted, fifteen months ago, a violent cold, which left behind subjective sensations of hearing and a peculiar disturbance of

[1] The elaborate and interesting paper of Urbantschitsch: "The influence of irritation of the trigeminus on sensory perceptions, in particular on the sense of sight," (*Pflüger's Archiv*, Bd. xxx,) unfortunately reached me only during the correction of the proof of this paper and could therefore not be used.

musical perception on the right side, arising under certain external influences. The sound of a dinner-bell, for instance, or continuous whistling, causes a ringing of high pitch in his right ear. Besides, in singing and whistling he hears the high tones a third of a tone deeper. A low-ticking watch is heard on both sides equally well and normally—*i. e.*, 2 metres. The tuning-forks of medium pitch heard equally well by bone-conduction on both sides; by air-conduction, all somewhat weaker on the right. Etiologically, nothing can be ascertained except the cold. Physical examination shows nothing abnormal.

The patient must have had an unequal degree of tension in the zona pectinata: the region tuned for the deeper tones (near the cupola of the cochlea) was somewhat too tightly stretched; the region tuned for the higher tones (near the round window) was too much relaxed.

The subjective hearing, in consequence of the effect of certain objective tones, may, as I have stated in a previous case, be considered a true neuralgia of the corresponding nervous fibres.

VII.—Acquired Deaf-Mutism after Mumps.

Since I published—induced by the deliberations of the American Otological Society on deafness after mumps,—a case of bilateral labyrinth affection with staggering gait and permanent abolition of hearing after mumps (these ARCHIVES, German edition, Bd. xi, page 51; American edition, vol. xi, page 13), other cases have been published, viz.: one by H. Brunner (these ARCHIVES, vol. xi, page 102), of one-sided deafness after mumps; one case by Calmettes[1]; one by E. G. Moure (*ibid.*, page 301, ff.); and one by J. Seitz.[2]

The case of Calmettes was that of a six-year-old healthy girl, who, during an epidemic of mumps, contracted a mild attack of the affection without pain,

[1] Sur une conséquence peu connue des oreillons. *France méd.*, 22 juillet, 1882, et *Revue mensuelle de laryngologie, d' otologie, et de rhinologie*, 1882, pag. 301.

[2] Deafness after mumps, *Correspondenzbl. f. Schweiz. Aerzte*, No. 19, 1882.

[Compare further a case of one-sided deafness after mumps, by H. Knapp, these ARCHIVES, vol. xi, page 232, and one of bilateral deafness from mumps, by the same author, these ARCHIVES, vol. xi, page 385, and an elaborate paper, "Diseases of the ear occurring during the course of parotitis," by D. B. St. John Roosa, these ARCHIVES, vol. xii, page 1-13.—ED.]

otorrhœa, or noises, but lost her hearing on both sides, so that, eight months later, she was able to hear only loud voice ("l' enfant entendait encore la voix criée"). In the case of Moure, an eight-year-old girl, on the fifteenth day of an attack of mumps, when the swelling began to subside, without pain or other symptoms, lost her hearing completely on both sides in one day. Subjective noises occurred only later, and were still present at the date of examination (one month after the occurrence of the deafness). Examination negative; treatment of no avail. The case of Seitz was that of a student, æt. 19, whose parotitis was almost well on the sixth day, when, in thirty-six hours, deafness occurred on the right side. It was accompanied by intense humming and roaring; and metallic tinkling added to all sensations of sound; further, by vertigo and disturbance in walking. Examination negative; treatment without avail. Seitz supposes a serous exudation to have been present in the labyrinth.

In the following case, which I shall briefly describe, the total bilateral deafness occurred in a girl of four years on the fourth day of double parotitis, which was rapidly disappearing. No other symptom appeared, and the disease ran its whole course without fever. The child, who lost the whole wealth of her vocabulary in a short time, is now in an institution for the deaf and dumb.

In the cases of Calmettes and Moure, and the one just related, neither vertigo nor disturbances of equilibrium were present. The seat of the anatomical disturbance can have been only in the cochlea.

Of what kind this disturbance was cannot be known with certainty until more numerous post-mortem examinations of the labyrinth have been made, as the one by Toynbee thus far stands alone.

REVIEW.

The Diagnosis and Treatment of Diseases of the Ear. By OWEN D. POMEROY, M.D., etc. With 100 illustrations. New York: Bermingham & Co., 1883. Pp., 392. Price, $3.00.

Whether or not another treatise on diseases of the ear is needed in addition to the seven native American and several foreign which are already accessible to the English student, is a question which must be settled between the publishers and their reading public. It is a matter of supply and demand which may be safely left to itself. It interests us only so far as it points to the ardor with which the field of otology is being worked by American practitioners. The treatise of Dr. Pomeroy is designed, he tells us, for the general practitioner, though he hopes the young otologist may find it of assistance.

The first thing that will strike the reader is the absence of any consideration of the anatomy or physiology of the organ of hearing. In some particulars this may be of an advantage, since it enables the author to give more attention in the same space to matters of diagnosis, etiology, and therapeutics; but the general practitioner, for whom the work is mainly intended, is the very one who stands most in need of such knowledge, and has less time to hunt it up from the various text-books on anatomy and physiology.

The interest of the book to specialists will, of course, be in getting the opinions of a well-known aurist of a wide experience on those points in otology which are still the subjects of discussion.

The author holds no extreme views on any of these points, and his judgments are for the most part conservative in their character. He is not yet willing to throw away the syringe; indeed, he has devised one which, on account of its flange protection,

renders the performance of this operation entirely free from the opprobium of "sloppiness" that has been laid up against it in certain quarters. Dr. Pomeroy seems to have quite a mechanical turn of mind, and several of the instruments figured in his book bear his name. We wish that all practising otologists could acquire the dexterity he seems to have in the use of his "faucial catheter." His favorite astringent and antiphlogistic is nitrate of silver, and he uses it in all strengths from 2 grs to ℥ i, to a saturated solution. He does not ignore others, however, and has a good word to say for the "dry treatment" by means of boracic acid in chronic purulent discharges. In the treatment of polypi he removes them by torsion, in preference to the snare, but has not found alcohol so satisfactory as some others seem to have done. His treatment of mastoid disease is that which will be approved by the majority of aurists.

Considerable space is given to the consideration of perichondritis auriculæ.

While the specialist of experience will probably not refer to it often, the general practitioner will find it a safe and reliable guide in the treatment of those affections of the ear which are likely to fall under his observation. Some of the original wood-cuts are bad, and there has been very careless proof-reading, particularly as to proper names; otherwise the "get up" of the book is very creditable. S. M. B.

REPORT ON THE PROGRESS OF OTOLOGY DURING THE FIRST HALF OF THE YEAR 1883.

I.—NORMAL AND PATHOLOGICAL ANATOMY AND HISTOLOGY OF THE EAR.

By H. STEINBRÜGGE, Heidelberg..

Translated by Dr. J. A. Andrews, New York.

1. Biological investigations. Edited by Prof. Gustav Retzius Second year, 1882. Eight plates. (*a*) The structure of the membranous portion of the organ of hearing in man. Plates i. and ii. (*b*) On a vascular epithelial membrane in the membranous portion of the ear. (*c*) On the histology of the membranous cochlea of rabbit. Plates vii. and viii. (*d*) On the manner of termination of the auditory nerves in the maculæ and cristæ acusticæ (1871).

2. Three cases of fatal ear-disease, with contributions to the pathological anatomy of the ear. By Dr. K. Bürkner, Göttingen. *Arch. f. Ohrenheilk.*, Bd. xix, 4, p. 245.

3. A case of cholesteatoma of the temporal bone without caries. Death from abscess of cerebellum. By Dr. L. Katz. *Berl. klin. Wochenschr.*, 1883, No. 3.

4. On osseous fistulæ in the mastoid process. By Dr. W. Kirchner, Docent of Otology in Würzburg. With plate ii. *Virchow's Archiv*, Bd. xcl, p. 77.

(1, *a*) In this first essay the author describes the membranous labyrinth of a human embryo of from five to six months, and furnishes two enlarged explanatory illustrations, which give a view of the labyrinth from before outward, and inward and backward.

The preparation was made by removing the bone and cartilage, and then hardening in a $\frac{1}{4}$-$\frac{3}{4}$ per cent. solution of hyperosmic acid. In a preceding plate the author reviews the illustrations of the schemata of the membranous labyrinth by Breschet, Ibsen, Reichert, Middendorf, Luschka, Rüdinger, Waldeyer, Krause, Weber-Liel, Wiedersheim, and Hensen. In regard to the obscure description of the preparation, of which no figures are given, we must refer to the original, and shall only observe that the author subdivides the acoustic nerve into an anterior and posterior ramus, the former supplying the macula of the utriculus, as well as the ampullæ of the sagittal and horizontal semicircular canals, while the ramulus basilaris of the posterior branch enters the modiolus of the cochlea, the ramulus medius of the same belonging to the macula of the saccule, and a third branch passes from it to the crista of the ampulla of the frontal semicircular canal. The ramulus neglectus is absent in man. According to the author, the nerve-twig described by Reichert and Henle as passing to the septum between the utriculus and sacculus does not exist. While, according to this statement, by the addition of the ramulus neglectus, fishes have seven nerve-terminations, amphibia, reptiles, and birds, with the nervous termination in the lagena, have eight nerve-terminations ; the higher mammalia have only six, but in their stead there is the higher development of the nervous apparatus in the cochlea. In volume II., the author furnishes further illustrations of the above-mentioned preparations, and also of the perilymphatic spaces. The latter is especially gratifying, because the view of the structure of the membranous labyrinth, removed from its natural position, does not suffice to explain the topographico-anatomical relations of the labyrinth.

(1, *b*) On the external shank of the frame of the cochlea in the alligator, the author found a mound of cylinder epithelium, between whose cells are branching capillary vessels with a thin wall, consisting of a single layer, with isolated flat-oval granules on the inner surface. Connective-tissue elements could not be detected. This state of things is striking, because true epithelial tissues have no blood-vessels. The author believes that these latter are related to the secretion of the endolymphatic fluid, and compares the mound with the stria vascularis of mammalia.

(1, *c*) Retzius confines himself to communicating the results of his recent investigations with reference to certain important parts in the cochlea of the rabbit. The preparations were made by the

employment of osmic acid and chloride of gold, according to a method to be described later. Chromic-acid salts act, especially upon the hair-cells, in such a varied way that they can be employed only in exceptional cases.

In regard to the preparation of the epithelium of the crista spiralis by the silver-staining method, Retzius found a beautiful mosaic-like marking on the surface of the crista, extending from the insertion of Reissner's membrane to the outer margin of the teeth. It is produced by the contours of cells whose granules lie in the depth of the interdental furrows. The free surfaces of these cells are, therefore, turned toward the surface of the crista, and project somewhat beyond the margin of the teeth. The epithelium is then continued into the sulcus spiralis, and the cell-fields become more extensive, and terminate in the inner hair-cells in an almost straight boundary line. The inner hair-cells, seen from above, appear oval, the longitudinal axis lies in a spiral direction; the fine hairs situated on them form outward a slightly convex arch-line. Besides the familiar layers on the membrana basilaris, the author distinguishes a second homogeneous layer overlying the chordæ. This layer begins in the region of the inner and middle thirds of the membrana basilaris, and extends to the lig. spirale. According to this, in the rabbit the sides of the zona pectinata lie between two homogeneous layers.

In regard to the pillars of Corti's organ, it is to be observed that their bodies and feet appear longitudinally striped, the stripes of the feet extending into the external pillars, but not into the fibres of the zona pectinata. Every foot-plate consists of about 5-6 fibres of the zone mentioned. The connective-tissue supporting fibre-system in the tunnel described by Deiters and Lavdowsky is questioned by Retzius. He refers the lines mistaken for it to the contours of epithelial cells sparsely supplied with granules. These correspond to the formerly so-called basement cells; their protoplasm invests the pillars up to the heads; outward they project above the external foot-plates; here, with a somewhat serrated line, they border upon the rows of the hexagonal fields, which, according to Retzius, support Deiters' cells.

The cells of Corti (outer hair-cells of Retzius) are cylindrical; their surface appears finely granular, and supports a horse-shoe-like hair-border. Its lower extremity never forms a process; it contains a large spherical nucleus. Retzius has been unable to find Hensen's capsules.

Deiters' cells are not connected with the former; we have to deal with two separate kinds of cells. Its upper, tapering, thread-like extremity extends with a cone-like expansion into a phalanx of the lamina reticularis. When in situ, the cells appear spindle-shaped, and contain a spherical nucleus. Their inferior process is inserted in the centre of the hexagonal field, and is surrounded by protoplasm which, in all probability, is limited by the outlines of these fields. Between the rows of Deiters' cells, on their inner surface, extend the three rows of the outer spiral nerve-fibres. Their origin and termination are unknown ; perhaps they originate in the radial fibres.

Inward from the internal pillars is an inner spiral nerve-channel, a second in the tunnel on the outer surface of the internal pillar, which is designated a " tunnel-cord." Both nerve channels are united by connecting fibres. From the tunnel-cord spring the nerve-fibres, which radiate through the tunnel. Their termination in the outer hair-cells is still unknown.

Concerning Corti's membrane, the author refers to the oblique direction of its fibres. On the periosteum of the scalæ are endothelial cell-markings, readily demonstrated with silver staining.

(1, *d*) This essay is, in part, comprised in the monograph on the organ of hearing in fishes (compare G. Retzius' anatomical investigations, first edition, Stockholm, 1872). The author shows that after losing their myelin-sheath, the nerves enter the epithelial layer of the maculæ and cristæ acusticæ without forming an anastomosing net-work. The cells are subdivided into true epithelial cells and supports of the nerve-terminations. The former, with a conical base, are generally attached to the connective-tissue layer, and contain a nucleus in their inferior part. Occasionally they are more spindle-shaped (fibre-cells of Schultze) ; then the nucleus is placed higher. Above the nucleus they become contracted, to give place to a neighboring nerve-cell ; then they spread out again, funnel-shaped, toward their free extremity. They are firmly attached to the neighboring cells, and are isolated with difficulty. The nerve-end supporting cells are bottle- or club-shaped, and have a pretty large, round nucleus at the point of union with the nerve-fibres, and above it a somewhat narrow neck, with brownish-yellow pigment granules, and finally a flat, round surface, from which the auditory hair projects. This is not homogeneous, but consists of from 10–15 very fine cylindrical, straight fibres. The hairs are destroyed by osmic acid.

(2, *a*) *Otitis media suppurativa chron. dextra; caries of temporal bone; purulent meningitis; death.* A man, æt. thirty-six years, had otorrhœa for eleven years. Sudden pain in right ear and in head, hardness of hearing, diminution of discharge, convulsions, delirium, coma. Œdematous swelling on the superior boundary of sterno-cleido-mastoid muscle. A probe passed through granulation tissue in the postero-superior wall of the ext. auditory canal reaches a carious cavity. Drum-head thickened, and rosy-red. Death after three days. Autopsy (incompletely reported to author): Temporal bone over tympanum and external auditory canal is black, thin, and friable; dura mater in region of temporal bone is injected, thickened, and covered with pus; greasy, pappy mass in tympanic cavity.

(2, *b*) *Otitis media suppurativa chron. bilateralis; thrombosis in consequence of phlebitis of left bulbus venæ jugularis; death.* A man, æt. twenty years; bilateral otorrhœa for thirteen years. Sudden pain in left ear. Cessation of discharge; chills, vomiting, and vertigo, which rendered locomotion impossible. High fever; discharge from right ear continued. Bilateral perforation of membrana tympani. Left external auditory canal contracted and filled with cheesy crusts. In the course of left jugular, up to three fingers' breadth below mastoid process, a thrombus can be felt. Hearing distance: r. e., $\frac{1}{4}$; l. e., $\frac{1}{10}$. Repeated chills; increased pain, especially in neck; apathetic condition; left mastoid process red and swollen; veins of face and left exter. jugular enlarged; death after seventeen days. **Autopsy** of left temporal bone: oval defect of ossification in antero-inferior wall of external auditory canal; firm reddish-brown thrombus in transverse sinus, and in bulbus venæ jugularis,—the latter was cut off in the preparation; red points and minute holes in the thin fossa jugularis (dehiscence in the floor of the tympanum), at this spot corresponding to the discoloration and infiltration of the membranous venous wall of the bulbus. Purulent mass in tympanum. The phlebitis resulted from extension of the inflammation from the floor of the tympanum to the bulbus ven. jugularis. No metastases in other organs.

(2, *c*) *Otitis media suppurativa acuta (?) sin.; caries; meningitis; death.* A man, æt. seventeen years. Otorrhœa on left side for eight days; facial paralysis on same side since three days ago; uvula deflected toward right. Left meatus reddened and swollen; three small granulations in front of the postero-inferior

perforation in drum membrane. Hearing distance, $\frac{1}{12}$. Œdematous spot in front of granulations on the postero-superior wall of canal. Removal of granulations and cauterization with lapis inf. Four weeks later nearly all the symptoms disappeared ; general condition good ; no facial paralysis ; profuse otorrhœa, which gradually diminished under treatment with boracic acid. One month later pain developed suddenly in left ear ; otorrhœa stopped ; relapse of the facial paralysis ; loss of perception for tuning-fork on left side, notwithstanding return of otorrhœa ; contraction of left pupil ; nystagmus of both eyes ; total deafness on left side ; paralysis of abducens on left side ; somnolence ; paresis of left leg ; pain in all the branches of the trigeminus ; vomiting ; death about fourteen weeks after beginning of the ear-trouble. **Autopsy** : Purulent infiltration around chiasm. The anterior extremity of left lobe of cerebellum is adherent to posterior margin of temporal bone, around the meatus auditorius inter.; at the site of this adhesion there is a gelatinous, gray mass sprinkled with yellow spots, extending on the one hand between the pons and cerebellum toward the medulla oblongata, on the other hand into the internal ear ; left abducens flattened ; left trigeminus less white than right. Left facial and acoustic nerves consumed in the gelatinous mass. In the cerebellum, corresponding to the point of adhesion, is a node consisting of the same mass, about the size of a cherry-seed. Abscess, the size of a cherry, in the flattened left pons ; the left striæ acusticæ forced apart by projection of abscess, and grayer than on the right side. At the superior border of the temporal bone are three small carious places, communicating with an irregular cavity, involving the entire posterior portion of the temporal bone ; this cavity is filled with greasy, shining, yellowish-white masses (cholesteatoma ?), which infiltrate the posterior wall of the temporal bone just above the sigmoid sulcus, and is also connected with the vestibule. The ossicles are wanting. Internal ear destroyed by the gelatinous mass. Author directs attention to the rapid destruction of the auditory apparatus, and supposes that the intercurrent improvement was brought about by the removal of the granulations and the thorough cleansing of the ear thereby facilitated. In regard to the severe neuralgic pain in the region of certain branches of the trigeminus on left side, it is to be regretted that nothing is said about the Gasserain ganglion.

(2, *d*) *Sarcoma of brain originating in fourth ventricle.* A man,

æt. thirty-six years. Increasing weakness in legs; vertigo, headache, blindness since six months ago, deafness on left side, bilateral neuro-retinitis; paresis of ocular muscles, *i. e.*, on right side; paralysis of right facial; disturbance in course of right trigeminus; complete deafness on right side, with negative appearance in ext. and middle ear. Disturbance in course of vagus, paresis of accessorious, deflection of tongue, interrupted speech, abnormal sensation of taste. Each half of body paretic, more on right side than on left; no disturbance of sensibility; tendon-reflex preserved. Death sixteen weeks after admission to hospital. **Autopsy:** A tumor extending from the right anterior half of pons, firmly adherent to the posterior wall of temporal bone, and extending into the external auditory canal. It terminates in front at the anterior boundary of pons, and projects posteriorly 1½ *cm.* Right half of pons almost completely destroyed; right facial and acoustic gray, and in the enlarged porus acust. inter. they are lost in the growth. The latter is grayish-yellow, uneven, and gelatinous in the centre. Cerebral ventricles enlarged, ependyma thickened. In the white substance of the right corpus striatum, in the vicinity of its posterior extremity, is a deposit about the size of a hazel-nut infiltrated with minute hemorrhages reaching close up to the convolution of the lobus temporalis. Cochlea normal. The tumor was a round-celled sarcoma. There was therefore pure nervous deafness, with the auditory organ intact.

(2, *e*) Description of a preparation from the author's collection. Head of an old man; caries of temporal bone, with fistulous opening outward. Oval opening in right mastoid process 4 *mm.* behind porus acust. ext. This leads into a large cavity in the mastoid and temporal bone filled with masses of cholesterine, communicating through a smaller opening with the transverse sinus, and further with the tympanum and ext. aud. canal. The descending portion of the facial is almost completely destroyed. Drum-head and ossicles are wanting. The tympanum also contains masses of cholesterine. Cause of death unknown.

(3) Man, æt. thirty-eight years. Had typhoid in 1868, variola in 1871. A polypus was removed from the left ear five years ago. Came under treatment Sept. 20, 1882, with profuse otorrhœa and pain in left ear. Superior cartilaginous wall of ext. meatus much depressed, in consequence of which the canal is constricted. The meatus was dilated by means of a tent, after which a perforation

was revealed in the postero-superior quadrant of the drum-head. Pressure over mastoid process is not painful; skin covering mastoid, normal. Small polypoid excrescence removed from posterior part of external aud. canal. Treatment: Tents soaked in carbolized oil. After feeling well for eight days, pain occurred suddenly in left side of occiput. Ice-bag, bromide of potass.; later cataplasms, without benefit. Taken to hospital. Meatus aud. ext. again completely closed, in consequence of sinking of its upper wall. Pulse slow, paralysis of left abducens, rhythmical contraction of both sterno-cleido-mastoid muscles. Sensorium clear. Chill, and sudden death. **Autopsy:** In the left cerebellum is a cavity containing thick, green pus. The dura mater on the posterior surface of the petrous bone is thickened and grayish-red, and at this place the perforation in the bone by masses of cholesterine forms an expansion of from 2–2½ *cm.* Rupture of tegmen tympani and of the postero-superior wall of ext. aud. meatus. No caries anywhere. Author believes that after recovery from the previous otorrhœa, inspissated pus remained in the upper cells of the mastoid process. "This formed the nucleus for the further excessive proliferation of the epidermoidal cells of the mass of cholesterine." The sinking of the upper wall of the ext. aud. meatus is very remarkable, and the author expresses the opinion that this projection should be incised early and energetically.

(4) The author first discusses the origin of the osseous affections of the mastoid process, which may arise partly indirectly as a result of disease of the mucous lining of the middle ear, and partly later when the purulent process in the tympanum has ceased for some time. For the better understanding of the different courses which the pus may take in perforating the walls of the mastoid process, the author thus discusses the development of the mastoid cells in the child from the antrum mastoideum described by Schwartze and Eysell, the fissura mastoideo-squamosa (Gruber), the vasa emissaria and the subdivision of the air-containing and spongy spaces. Then follows the description of an interesting preparation, which exhibits a division of the mastoid process into three parts formed by two bony septa. Only the anterior portion communicated with the antrum, while the pneumonic spaces of the posterior and inferior portions were completely closed, to which condition attention was directed in regard to the dangers of an eventual development of a purulent inflammation.

The spontaneous evacuation of the pus and the formation of a fistula occurs either through the inner wall of the mastoid process which is very often thin, through its outer wall, or through the posterior wall of the ext. aud. meatus. The former mode, to which Bezold was the first to direct attention, is illustrated by a case and drawing of the preparation. When perforation takes place through the outer wall, the swelling is generally on the upper portion of the mastoid process and toward the occipital region ; the board-like induration along the neck—which is characteristic in cases of perforation of the pus through the inner wall—is wanting, and the auricle is considerably pushed out from the head. Should the pus force a way into the ext. aud. meatus, we find long tortuous fistulous tracts in the soft parts, which open at some distance from the defect in the bone.

The author further mentions that in the fully developed temporal bone, the antrum lies on the postero-superior wall, next to the inner border of the ext. meatus ; while in childhood it is situated much farther outward.

In regard to the formation of a fistula in the posterior wall of the ext. meatus, its frequent extreme thinness as well as the fissure observed in consequencce of arrested development, are presented for consideration. The author also directs attention to the fact that the inflammation may spread in a reverse direction, from the ext. meatus to the mastoid cells, and give rise to the formation of fistulæ, relative to which he communicates a case.

In conclusion, KIRCHNER considers the period at which the complications in the mastoid process arise. These complications directly follow the acute purulent inflammation in the tympanum, or they occur after some time from cold or excitement ; then again, they are developed in consequence of exacerbations of the affection in the tympanum. It is known that sero-mucous exudation of the tympanum may result in serious disease of the mastoid cells (Zaufal). The author describes three interesting cases in which a catarrhal exudation, after having been forced into the mastoid cells by violent blowing of the nose, gave rise to an inflammatory affection in them, which receded in one case, but leading, in the other two, to the formation of an abscess, which, in the case of one of the patients, necessitated the opening and scraping out of the diseased bone. Kirchner, therefore, advises the perforation of the drum membrane before Politzerization, when inflammation in the mastoid is threatened.

EMBRYOLOGY.

CARL V. NOORDEN. The development of the labyrinth of Teleosts. From the Physiological Institute at Kiel. *Arch. f. Anatomie u. Physiologie v. His.*, etc., 1883, *Anatom. Abtheilung*, 3. Heft, p. 235.

The author examined clupea harengus (herring), gobius niger (gudgeon), gasterosteus aculeatus (bansticle), cottus scorpius (sea scorpion), salmo salar (Rhine salmon), and salmo fario (salmon trout). Soon after the rudiment of the eyes, a small roundish epithelial thickening appears behind them, as the rudiment of the organ of hearing, which is pocket-like, invaginated, and is contracted into a vesicle forty-eight hours after conception. Neither at this time nor in later stages, did the author find a diverticulum of the vesicle corresponding to the recessus vestibuli, as has been observed in the embryos of birds and mammalia (contrary to Vogt). The epithelial covering of the vesicle is thin and has but one layer, until the latter is enlarged in the parts lying toward its ventrum, at which time the epithelium found here has increased in height, while in the rest of the parts of the vesicle it is level, with cubic or flat cells. At two points on the prominent medio-ventral aspect of the epithelial border, the primary deposits of otoliths take place ; here appear also the hairs which, at first very fine, later increase in thickness, support the otoliths, and belong to the macula acustica. Soon after the rudiment of the otoliths, the epithelium becomes thickened in three places, on the external wall of the vesicle, into oval eminences which indicate the first appearance of the cristæ acusticæ of the ampullæ. These, therefore, appear before there is a trace of the semicircular canal. Upon these appear now also the rudiment of the hairs, in the form of the smallest, at first very spare cones, which then rapidly increase in number and size. The origin of the semicircular canals takes place in such a manner that a tri-pointed thickening projects from the surface of the internal wall of the vesicle (in the salmon). Upon these three points arise three cristæ, and opposite these, on the anterior and posterior walls of the vesicle as well as upon the base of the vesicle three smaller cristæ are developed, which grow toward the former and unite over a crest into rods. At the point of the union a raphe persists. These cristæ are made up in part of a nearly homo-

geneous mass, which is interposed between the epithelium and the connective tissue surrounding the vesicle. This is to be regarded as a secretory product of the epithelial cells, coming from the base of the latter (membrana prima, Hensen). The author, therefore, calls this a basement-mass in contrast with the cuticular secretions which proceed from the free surface of the cells. This mass, which is at first completely homogeneous and somewhat firm, is separated more and more into lamellæ, while from the boundary of the connective tissue it is penetrated by cells supplied with offshoots. Under the influence of these cells the basement-mass is liquefied, dissolved, and its place taken by embryonal connective tissue in which capillary vessels develop later. In a few days the entire trabeculæ consists of connective tissue. Therefore, the actual construction is derived from the basement-mass and not from the connective tissue. The author emphasizes this condition in order to express the belief that the constructive capacity proceeds from the middle blastoderm and that the latter only approaches the external blastoderm. Soon after the transformation of the basement-mass into connective tissue, cartilage enters the trabeculæ from the vicinity of the vesicle. In some fishes this is persistent, in others it passes into osseous tissue. In regard to the development of cartilage, the author observes (with Hensen) that this is always genetically united with the sheath of the cord. The cord itself is not concerned in this; its sheath, on the other hand, becomes thicker, and wherever groups of cartilage cells were observable in the microscopic section, the direct connection with the sheath of the cord was demonstrable. The trabeculæ which overarch the three cristæ, accordingly form three tunnels, which open into a space above the otoliths. The posterior otolith-mass sinks more and more to the bottom, whereby a wide-sacked diverticulum, the future sacculus, is formed, while the space which lodges the other otoliths becomes the utricle. "Up to the time when the semicircular canals are fully developed, there is no trace of the rudiment of the ductus endolymphaticus; its formation undoubtedly takes place at a very late period of the development."

II.—PHYSIOLOGY AND PHYSIOLOGICAL ACOUSTICS.

By OSCAR WOLF, Frankfort.

Translated by Dr. J. A. Andrews, New York.

1. Dr. J. Baratoux, of Paris. De l' audition colorée. Revue mensuelle de laryngologie, d'otologie et de rhinologie. No. 3 Paris: chez Octave Doin, 1883.

2. Dr. W. Bechterew, of St Petersburg. Effects of division of the acoustic nerve, with discussion of the importance of the semicircular canals for the equilibrium of the body. *Pflüger's Archiv f. d. gesammte Physiologie*, Bd. xxx., pp. 312–347.

3. Dr. W. Baginsky, Berlin. On the physiology of the cochlea. Report of the meeting of the Royal Prussian Academy of Sciences, in Berlin, 1883. Vol. xxviii., pp. 686-688.

4. Dr. V. Urbantschitsch, Vienna. On the effect of irritation of the trigeminus on the organs of the senses. *Pflüger's Arch. f. d. gesammte Physiologie*, Bd. xxx., pp. 131-175.

5. Sulla fisiologia dell' orrechio, tre lezioni del Dottor E. de Rossi. Estratto dell' *Archivio Medico Italiano*, fasciculo Marzo e Aprile, 1882. Historical review of the application of acoustics to the organ of hearing, on the part of the different physiologists of the last decade, from Johannes Müller to Helmholtz and Hensen, with reference to the physiology of the labyrinth; concluded by a brief consideration of the question of the formation of the semicircular canals or the organ of equilibrium.

6. Dr. P. McBride, M.D., F. R. C. P., Edin. A new theory as to the functions of the semicircular canals. *Journal of Anatomy and Physiology*, vol. xvii.

7. Dr. P. McBride, M.D., C. M., F. R. C. P. E. Physiology of auditory vertigo and some other neuroses produced by ear-disease. Address delivered in the section of otology at the annual meeting of the British Medical Association, in Worcester, August, 1882. *British Med. Journal*, Dec. 30, 1882.

8. Dr. C. H. Burnett. Is the corda tympani a separate and distinct cranial nerve? *Med. Times*, Feb. 24th.

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(1) Baratoux calls the phenomenon of chromatopsy in certain tone-perceptions discovered by Nussbaumer (1873) "audition colorée." Bleuler and Lehman [see these Archives (German), Bd. x., p. 256] selected the term, "sound-photisms" (Schallphotismen), while the English call it "color-hearing." Baratoux

reproduces an observation by M. Pedrono, which this author has recently published in the *Annales d'oculistique.* This "color hearer," a professor of rhetoric, perceived certain color-images when certain sounds were produced. The ordinary conversational tone of voice gave rise only to a faintly declared perception of color; but it was settled that certain distinctly and loudly pronounced vowels produced several colors. When the deepest vowel, U, was sounded, the person examined perceived the darkest color, while the higher vowels, A and O, produced a brighter color-picture. Among the consonants, only the sibilants gave rise to noticeable perception of color. A chord produced mixed colors; discord isolated certain colors. The tone-tint had a very powerful effect; it gave various colors to music played on different instruments: on the piano it appeared of a blue color, and red on the clarionet. When, finally, the particular color-hearer says that agreeable voices appeared yellow to him, the reviewer must wonder at the man's imagination, which, at all events, was abnormally sensitive (he is designated in the report as "ce malade"), and such subjective statements should be accepted with a certain amount of caution; at all events, we should be on our guard against deducing physiological laws therefrom.

(2) After a brief review of the investigations on the functions of the semicircular canals, W. Bechterew furnishes us with results of division of the acoustic nerve, which he practised on dogs. He selected this genus of animals because Flourens' phenomena had hitherto been very little investigated in dogs. Division of the acoustic nerve without injury to the contiguous parts of the brain, is exceedingly difficult. Bechterew adopted the following method: The animal being narcotized, the occipital muscles are divided obliquely, down to the bone, below and parallel to the crest extending from the tuber occipitale to the mastoid process: then an opening is made somewhat higher up and at the side of the articulation between the occipital bones and the atlas; through this opening is passed a round, thin style, with its extremity bent at an angle. When the foramen auditorium inter. (? Rev.) is reached, the nerve is divided. The author presents a series of results from his own experiments and those of other investigators, the essential points of which are as follows:

(*a*) Unilateral division of the acoustic nerve in dogs gives rise to forced rotatory movements about the longitudinal axis of the body toward the side of the division, of the same character and

peculiarities (divergence of the eyes, nystagmus, rotation of the head) as in unilateral destruction of the olivary bodies, or injury to the central gray substance in the postero-lateral portion of the third ventricle, or, finally, in separation of one of the peduncles of the cerebellum.

(*b*) The forced rotatory movements which occur after division of the acoustic nerve, as obtains in all other eases, are persistent only for a short period after the operation, but at that time they are performed almost without interruption ; later, however, they occur in paroxysms, which are relieved by pauses, during which the animal's movements are restrained on the side corresponding to the injury. In time, however, the rotary movements cease, and circular movements, mostly toward the operated side, take their place and are accompanied by distinct disturbances in the equilibrium of the body, which manifest themselves in a constant inclination on the part of the animal to fall toward the side on which the division was made.

(*c*) All the phenomena noted must be regarded as reflex, because they also occur in animals whose cerebral hemispheres have been destroyed or placed in a state of functional inactivity by narcotization.

(*d*) After bilateral division of the auditory nerves, the animals exhibit principally marked disturbances in the equilibrium of the body, which are expressed in an inabillty to stand and walk, with complete absence of paralysis of the extremities.

(*e*) The hypothesis of Goltz, in regard to pressure-fluctuation of the endolymph, satisfactorily explains the function of the canals as that of a peripheral organ which is directly related to the maintenance of the equilibrium of the body, although this needs more confirmatory facts.

(*f*) The semicircular canals are organs which serve to maintain the equilibrium not alone of the head, but of the entire body. At the same time, functionally, they are very closely related to the function of the organ of hearing.

(*g*) In all probability, the influence of sound-impression on the movements and equilibrium of the body takes place through the medium of the semicircular canals.

The reviewer regrets that the foregoing work does not finally settle the important question regarding the function of the semicircular canals. The author confines himself more to a critical estimate of the views of other investigators, rather than to furnishing

proof in support of his own conclusions. We neither find a complete description of the condition and final behavior of the animals operated on, nor an indication of their number. Not a single report of an autopsy is furnished ; at the same time, the author's method of operating described above, furnishes no security against injury of other important adjacent structures in division of the acoustic nerve. A complete report of a post-mortem dissection would have shown what changes, if any, had taken place in the central organ and its membranes in consequence of the operation.

(3) The investigations of W. BAGINSKY, furnish us with a very valuable addition to our knowledge of the cochlea. He seeks to prove experimentally in dogs that the vibrating parts of the membrana basilaris increase in width from the base toward the apex of the cochlea ; consequently the vicinity of the round window would react to high tones, that of the apex of the cochlea to low tones. After opening the bulla ossea in the animals experimented on, one cochlea was widely broken open, in order to produce complete deafness, and thus exclude this ear ; a small portion of the cochlea on the other side was injured by being opened or bored into. The hearing capacity of the dogs was then tested (with organ-pipes from C to c^v)[1] and after a few weeks, when no further changes had taken place in the hearing power, the animal was killed, and the labyrinth examined. At the points of injury was a cicatricial formation, and destruction of the auditory-nerve fibres, while the rest was normal. Therefore, the anatomical examination of the cochlea, whose apex had been injured by being penetrated with a punch, showed the upper turn and the greater part of the middle turn to be filled with fibrous cicatricial tissue, with destruction of the normal contents ; the inferior rest of the turns and the remainder of the labyrinth were normal. On the other side the cochlea was either almost completely filled with cicatricial tissue, and at those places where, in the other cochlea, the former soft parts were demonstrable, all the nerve fibres and ganglion cells were degenerated. After a few days, the dogs whose cochleas had been wounded at the apex by means of a punch (after the ear had been rendered deaf) were roused simply by a report. But at the close of the first week they reacted distinctly to c^v, occasionally to c^{iv}. In the course of the second week, reactions to c^{iv} and c^{iii} only, occasionally c^{ii}, were

[1] The reviewer would have wished that the author had stated more precisely the manner and method of testing the hearing, as well as the precautions for excluding sources of error.

added. So long as the animals lived, deeper tones, as c^{iii} rel. c^{ii} were not heard. Dogs in which the base of the cochlea was injured by breaking away a piece of the promontory, were also temporarily deaf. Sometimes in these cases, not the entire cochlea, but only the inferior turn either in both scalæ or in the entire scala vestibuli, and a portion of the scala tympani was filled with fibrous cicatricial tissue, and the membrana basilaris was destroyed there. In the more fortunate cases (dogs), after a few days, reaction occurred to tones; in a number of dogs no difference was observed in regard to the beginning and strength of the reactions between high and low tones. A second equally large number of dogs began simultaneously to react to high and deep tones, but the reactions to low tones were distinctly stronger at first than were the reactions to high tones. Finally, in a third smaller number of dogs, there were at first reactions only to low tones (the lowest 3–4 octaves), and reactions to high tones did not occur until after 8–14 days. The author explains this circumstance by saying that after the operation the fluid contents of the cochlea escaped, and that the inflammation spread from its starting-point over the membranous parts of the cochlea, but that in consequence of the slight injury, the wound soon healed, and the inflammation receded in an inverse direction up to a certain limit.

(4) The observation that ear-patients experience an improvement in the acuity of vision during the treatment of the ear, led URBANTSCHITSCH to make a number of experiments in such a manner that the vision was tested in every case at the beginning of treatment, also in the different stages of the ear-affection. Among twenty-five ear-patients, vision was improved in twenty-one cases, and this improvement occurred in the majority of cases within the first days of treatment. The experiments further showed the interesting fact that unilateral ear-disease influenced not alone the eye of the corresponding side, but also its fellow; at least, in the majority of cases of unilateral ear-disease, there was improvement in the vision of the eye on the opposite side, which was sometimes much more considerable than that of the other eye corresponding to the affected eye.

Inasmuch as no changes were observable in the fundus oculi, the author refers the phenomenon to reflex origin. He was strengthened in this view by further experiments, in which he found that irritation of the ear influenced the vision. The passage of a bougie through the Eustachian tube, by irritating the tri-

geminal branch frequently improved the hearing without Politzerization; this was likewise brought about by reflex action through the medium of the auditory centre.

(6) In this essay the author endeavors to prove that the function of the ampullary nerve-terminations is not alone that of a space- and equilibrium-sense, but that they are likewise concerned in every act of hearing. The former physiological proposition would suffice if the ampullæ and semicircular canals constituted a system in themselves, isolated from the organ of hearing, and hence less exposed to external influences. However, the connection with the utriculus, whereby some of the sound-waves are transmitted to them; further, the undeniable stimulation of the ampullary nerves by every acoustic impression, which declares itself in certain reflex movements, lead us to suppose that they serve other purposes. These reflex movements consist in an involuntary rotation of the head and eyes toward the side whence a loud sound proceeds. The author alludes to the instantaneous muscular actions of game when frightened by a noise; further, to the experiments of Cyon and Högyes, who demonstrated the connection between the vestibular nerve and the centre which presides over the movements of the eyes; and to the fact that in abnormal experimental as well as pathological irritation of the labyrinth, rotation takes place toward the affected side (cites only Spamer), and finally reaches the conclusion that (1) the nerve terminations in the ampullæ are sympathetically excited by every sound-impression, and (2) the effect of the irritation consists in a rotation of the head, eyes, and trunk toward the irritated side, with active tension and increased activity of the muscles thereby concerned.

STEINBRÜGGE.

(7) In this discourse, McBRIDE first considers the different nerve-tracts which connect the ear with the central organ; then the familiar reflex phenomena which may be excited through the terminations of the ram, auricul. n. vagi, trigeminus, chorda tympani, vestibular nerve, and directs attention to the circumstance that reflex effects are most marked when several nerves are irritated simultaneously. For example, injections of cold water into the external aud. meatus gave rise to more marked vertigo than when warm water was used, because in the former case, besides the irritation of the trigeminal fibres, the pressure upon the labyrinthine fluid should also be taken into consideration. If we further bear in mind the physiological law that the shorter the nerve-tracts

leading to the central organ are, the more powerful will be the reflex actions, it will be easy to understand that pathological irritations of the organ of hearing may be accompanied by very active reflex symptoms, in support of which, cases of epilepsy, psychical disturbances of various grades, as well as auditory vertigo, are adduced. With respect to the latter, which, in pronounced cases is accompanied by nausea, vomiting, and syncope, the author refers the order of these symptoms to a greater labyrinthine irritation primarily transmitted to the vertiginous centre, and is there propagated to the vomiting-centre, as well as to the cardiac inhibitory centre. In the case of gastric vertigo dependent on gastric irritation, the stimulation of the centres takes place in a reverse order. The author maintains that the pathological symptoms are not due to vaso-motor influences, but are of direct reflex origin (opposed to Woakes). In order to prove that reflex actions may depend on propagation of the irritation of sensitive and motor tracts, but also on their transmission to other sensitive nerves, the author alludes to cases of pain in the knee in hip-joint affections, pain in the ear from toothache, pain in the shoulder and mammary gland in dental neuralgia. STEINBRÜGGE.

(8) An exposition of Sapolini's theory that the corda tympani —the thirteenth cerebral pair—is the nerve of speech. B. thinks this supposition substantiated, to some extent at least, by clinical experience. If a child under six years old loses hearing in both ears it is apt to lose, at the same time, its power of speech, either entirely or partially. In such cases B. thinks the ear-disease must have been accompanied by injury to the corda tympani.

BURNETT.

III.—PATHOLOGY AND THERAPEUTICS.

By A. HARTMANN, Berlin.

Translated by SWAN M. BURNETT.

GENERAL.

1. E. DE ROSSI, Rome. Eleventh annual report of clinic, 1881–1882.

2. MARIAN, Aussig. Report of ear cases treated from October, 1880, to October, 1882. *A. f. Ohrenheilk.*, B. xx., p. 13.

3. CHRISTINNECK. Statistical report of the ear-clinic at Halle a. S., from October 15, 1881, to October 15, 1882. *Ibid.*, p. 24.

4. K. BÜRKNER. Report of cases treated at my policlinic for diseases of the ear in 1882. *Ibid.*, p. 43.

5. H. DENNERT, Berlin. Remarks on the report of Dr. Jakobson. *Ibid.*, B. xx., No. 1.

6. L. BLAU, Berlin. Communications from the department of diseases of the outer and middle ear. *Ibid.*, B. xix., Nos. 2 and 3.

7. GRAF. Antisepsis in otology. *Berl. klin. Wochensch.*, No. 14, 1883.

8. R. ARIZA, Madrid. Resena del segundo ejercicio del instituto de terapeutica operatoria del Hospital de la Princesa, 1882.

9. SAML. THEOBALD, Maryland. Hints in regard to the treatment of a few of the commoner middle-ear affections. *Med. Journ.*, March 1, 1883.

10. SCHILLING, Munich. Prophylaxis against the toxic effects of salicylic acid and quinine. *Artzl. Intell.-Bl.*, No. 3, 1883.

11. FUERSTNER, Heidelberg. Psychic disturbances in ear-diseases. *Berl. klin. Wochensch.*, No. 18, 1883.

12. NOQUET, Lille. Hereditary syphilis; loss of substance in the velum palati; ulceration on the left tonsil, etc. *Rev. mens.*, No. 5, 1883.

13. SCHWABACH, Berlin. Deaf-mute statistics and deaf-mutism. *Real.-Encyc. d. ges. Heilk.*

14. S. SEXTON. Tubercular syphilide of the ear. *Journ. Cut. and Ven. Diseases*, June.

15. S. SEXTON. The significance of the transmission of sound to the ear through the tissues in aural disease. *N. Y. Med. Record*, July 28, 1883.

16. J. P. WORSELL. Deafness among school-children. *Trans. Ind. State. Med. Soc.*, 1883.

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(1) The eleventh annual report of Rossi's otological clinic shows 569 cases arranged in a systematic method. A detailed account is given of twenty cases of acute or chronic purulent middle-ear disease attended with more or less serious complication. In case No. 6 the tragus was missing, and there remained of the external meatus only a small canal, from which by pressure a thin purulent discharge came. After an incision into the cicatrix, there was found behind it a large cavity from which the sequestra were removed by means of a sharp spoon. Case 11 was that of a boy of eleven years, who, after an aural discharge in childhood, could hear neither the watch nor voice. The tuning-fork was heard through aërial conduction on the right side. The membrana tympani was cicatricial, atrophic, and calcareously degenerated; the hammer handle immovable. Under chloroform, Rossi made a flap on the right side from the posterior upper quadrant of the *Mt*, with its base below, and loosened the anchylosis between the stapes and anvil. After the operation, they stood 1 *mm.* apart. No improvement in hearing. The flap in the *Mt* healed rapidly. Among the other clinical histories there were many mastoid affections in which operative measures were resorted to.

(2, 3, 4) These three statistical reports, which appeared in the *Archiv f. Ohrenheilkunde*, contain tables showing the form of disease, the age and sex of the patient, and the course of healing. On the worthlessness of statistics of the latter kind it has been remarked at another place. Ideas regarding healing and material improvement are so different, that results are not comparable. Though it is pleasant to learn that with Marian only 6.3 %, in Halle only 2.8 %, and with Bürckner only 3.5 % remain uncured, we are by no means able from these figures to draw any conclusions as regards the prognosis of ear-affections in general. The report from the policlinic at Halle contains many important observations. In forty-three cases of paracentesis of the *Mt* there was 41.2 % of subsequent inflammation. Since no unfortunate results have been reported from other quarters, the opinion of CHRISTINNECK appears correct—that the method of after-treatment must be held responsible for the unfortunate difference. The after-treatment consisted in injection per tubam, and was the cause of the irri-

tation. The treatment of otorrhœa by iodoform has not proved efficacious. In a two-and-a-half-year-old girl a round-celled sarcoma was observed which undoubtedly originated from the dura mater or from the outer periosteum of the mastoid region. The first symptom was facial paralysis, which manifested itself after acute febrile symptoms. Soon there appeared a swelling in the mastoid region which spread gradually beyond the ear to the temporal region. There was never any discharge from the ear. Later on there were chills, hemiparesis, and convulsions. On section there was found an external tumor the size of a man's fist. The greater part of the temporal bone was destroyed, and the tumor mass connected itself directly with the temporal lobe of the brain. The excision of the *Mt* with the hammer was performed without result in one case on account of a tormenting tinnitus. Healing took place with a remaining large perforation of the *Mt*. Loosening of the auricle for the purpose of removing a sequestrum in the external meatus was performed once. In conclusion five cases of operation on the mastoid are reported.

(5) In his remarks on Jakobson's report, DENNERT criticises the objections made against his method of testing the hearing power. Our space will not allow us to go into a detailed consideration of the author's views, for which we must refer the reader to the original.

(6) From BLAU'S observations we select his description of otitis externa circumscripta. B. describes a special form of disease which differs from the ordinary furuncle in this, that the very extensive swelling and excessive pain are not relieved by incision. If, moreover, the parts about the ear and the neighboring lymph-glands are swollen, it is easy to be led to supposing a retention of pus in the middle ear. B. has observed ten such cases, eight on the lower and two on the upper posterior wall of the meatus. In treatment he limits himself to the employment of ice and iodine preparations. B. has not demonstrated the connection between diabetes and furunculosis.

The treatment of purulent middle-ear inflammation is treated of in detail.

(7) GRAF speaks of the presence of micro-organisms in ear-diseases, and of the hyphomycetes in otomycosis as well as of schizomycetes in otorrhœa, diphtheria of the ear, the presence of micrococci in furuncles, and comes to the conclusion that the aurist as well as the surgeon should employ asepsis and antisepsis, and recommends for the latter boracic acid.

(8) The otological division of the report of the Hospital of the Princess is from ARIZA, and contains, besides a description of the methods of examination, a large number of clinical observations on various ear-diseases.

(9) T. has sometimes succeeded in aborting furuncular inflammations of the meatus by a liberal application of the yellow oxide of mercury ointment. For the relief of pain he has found instillations of the baume tranquille of the French Codex very efficient. He does not resort to incisions, except when they are likely to give vent to pus. In the diffuse inflammation of the meatus due to aspergillus, he has found a powder of equal parts of boracic acid and oxide of zinc efficacious. In acute inflammation of the middle ear, he finds instillations of a four-grain solution of sulph. of atropia useful for the relief of pain. Incisions of the *Mt* are not to be made too hastily. They should be deferred until there is a marked bulging. In the treatment of chronic otorrhœa no one remedy has given him such satisfaction as the powder of boracic acid and oxide of zinc in equal parts. He prefers this to the boracic acid alone. He applies it by means of an insufflator. BURNETT.

(10) SCHILLING, in accordance with the data obtained from Kirchner's experiments on animals, and the clinical symptoms observed after the administration of large doses of salicylic acid and quinine, employs, as an antidote, preparations of ergotine, and has obtained excellent results from the administration of an infusion of ergot and salicylic acid equal parts, or quin. two parts, and ergot three parts.

(11) FÜRSTNER relates that two women, one anæmic and the other strumous, but both having an hereditary psychic taint, were affected with subjective noises to such an extent that they sank into melancholy, with hallucinations of hearing. When the cause was removed, the ear-symptoms and psychosis were abolished. He mentions the cases reported by Moos and Tuczek, and calls to mind the condition of irritation in acute middle-ear inflammation, which he refers to a meningeal irritation or an increase of intracranial pressure. Finally, he mentions a case of psychosis which suddenly subsided on the appearance of a profuse otorrhœa. In this connection there are other observations which Fürstner has not mentioned.

"Insanity often makes its appearance as one of the symptoms of suppurative middle-ear inflammation," says Moos on page 54

of his paper on epidemic cerebro-spinal meningitis, and relates a case in point.

(12) A ten-year-old boy came under the care of NOQUET, with a destroyed uvula and a triangular defect in the soft palate. On the left tonsil there was a round ulcer with a gray bottom and sharp edges. The teeth were opaque, brown, small, obliquely set, and with irregular surfaces. The submaxillary glands were somewhat swollen. With the destruction of the palate there appeared a high degree of deafness, which was somewhat improved by inflation. Other signs of syphilis were not present, nor did the clinical history give any positive data for such a diagnosis; but from the character of the teeth and the appearance of the ulcer, Noquet felt justified in diagnosing syphilis. The general treatment consisted in the administration of the syrup of Ghibut (containing mercury and iodine), while the local applications consisted in pencilling the ulceration with a strong solution of nitrate of silver and the employment of the nasal douche. After three months' treatment, healing took place, with normal hearing and cicatrization of the ulcer. The results of the treatment, N. thinks, sustain the diagnosis. A previous anti-scrofulous treatment had proved valueless.

(13) SCHWABACH has worked up very carefully and completely the statistics on deaf-mutes and deaf-dumbness in Eulenburg's "Encyclopedia." The information furnished by the latest publications is made use of, and the statistical part contained in sixteen tables is based on the results of the last census.

(14) The histories of three cases of tubercular syphilide of the ear are given in detail with illustrations of the appearance in two. From these histories it appears that this affection is among the tertiary forms of syphilis. BURNETT.

(15) S's conclusions are: (1) The fact that the sound is heard better through the tissues of one side simply indicates that the better ear wholly or in part excludes such transmission. It does not prove that the auditory nerve in either is affected. (2) When the conducting apparatus is damaged or destroyed, there will be no air-transmission on that side, whereas the tuning-fork will be heard best or altogether on that side. (3) In labyrinthine disease pure and simple, the tuning-fork will be heard best by air-transmission. (4) The tuning-fork is, therefore, of less value in diagnosing between middle-ear and nerve disease than has been supposed. BURNETT.

(16) There were 491 children examined. Among these there were 72 who had impairment of hearing in both ears, and 53 in which it was limited to one. BURNETT.

EXTERNAL EAR.

17. WEIL, Stuttgart. Contribution to the knowledge of othæmatoma. *Mon. f. Ohrenheilk.*, No. 3, 1883.

18. HOLLAND. Case of foreign body remaining in the ear for twenty years. *Brit. Med. Journal*, Feb. 3, 1883.

19. J. M. BOOTH, Aberdeen. On ceruminous accumulations in the external meatus. *Lancet*, March 10, 1883.

20. BAUDRIMONT. Fracture of the anterior wall of the meatus and luxation of the lower jaw. *Bull. et. mem. de la soc. de chirurg. de Paris*, 7, viii, p. 487.

21. C. J. BLAKE. Accumulation of epidermis in the external auditory canal. *Bost. M. and S. Journal.* May 10, 1883.

(17) WEIL observed in a child of five years an athæmatoma the sice of a hazel-nut on the inner side of the concha. Recovery by means of massage and compression.

(18) HOLLAND removed a small iron ball from the ear of a patient who reports that it had remained in the depths of the ear for twenty years.

(19) BOOTH observed in three workmen from the same workshop impaction of cerumen occurring at the same time. The men had been worked hard for three months before, and all were affected with catarrh. The author is of the opinion that the catarrh was in a causal relation to the accumulation of the cerumen.

(20) BAUDRIMONT makes the following categories in cases of fracture of the auditory canal : 1. The canal may be fractured, and yet its lumen may remain intact. 2. By the fracture the anterior wall may be driven backward and the lumen diminished. 3. By a luxation of the condyle of the lower jaw the canal may be completely closed. The fracture may occur from a fall or blow on the chin. Swelling in the vicinity of the ear is not present in the beginning ; sometimes it comes to an inflammation of the joint, associated in one case with anchylosis. The hemorrhage is sometimes considerable. The wound of the soft parts is at right angles to the axis. Very frequently there was a concomitant fracture of the lower jaw and of the condyle. Fracture of the anterior wall was most frequently observed in absence of the

back teeth. One case is related which proves that a complete luxation of the lower jaw with impaction of the condyle in the external meatus can occur without a fracture of the head of the condyle. It occurred in the person of an old man of sixty-three years, who fell heavily on his chin. There followed pain in both ears, inability of closing the mouth, complete deafness, and hemorrhage from the ears. The angle of the jaw lay on the edge of the sterno-cleido-mastoideus, and the place of the head of the condyle was vacant. The lumen of the canal was filled with a hard mass. The reduction of the lower jaw was effected on both sides, with attendant improvement in hearing and normal movement of the jaw. The healing was tedious and accompanied by suppuration.

(21) BLAKE. In those quite rare cases, where the mass of epithelium fills the canal, and its centre has undergone fatty degeneration, making it impossible to seize the mass or any part of it with the forceps, B. bores into the mass with a cotton-tipped probe dipped into caustic potash. This converts the mass into a soluble soapy substance which can be washed away with the syringe. Of course this may have to be repeated a number of times. BURNETT.

MIDDLE EAR.

22. Dr. E. J. MOURE. Acute middle-ear catarrh, with facial paralysis. *Revue mens. de laryn.*, etc., No. 4, 1883.

23. Dr. A. BING, Vienna. Catarrh of the middle ear. *Wiener Med.-Blat.*, No. 4, 1883.

24. Dr. T. BOBONE, St Remo. Some observations on purulent otitis in phthisis. *Boll. delle mall. dell orecch.*, etc., No. 3, 1883.

25. E. MARPURGO, Trieste. Contribution to the pathology and therapeutics of perforation of Schrapnell's membrane. *Archiv f. Ohrenheilk.*, B. xx., p. 264.

26. C. H. BURNETT, of Phila. Advantages of the dry treatment of otorrhœa. *Amer. Jou'l Med. Sci.*, Jan., '83.

27. H. SCHWARTZE. Second series of fifty cases of surgical opening of the mastoid. (Conclusion.) *Archiv f. Ohrenheilk.*, B. xix., p. 217.

28. A. H. BUCK, New York. Sclerosing otitis of the mastoid. *Med. Record*, March 10, '83.

29. V. URBANTSCHITSCH. On dilatation of the Eustachian tube. *Med. Presse*, 1883.

30. Dr. VOLTOLINI. Two peculiar ear-diseases. *Mon. f. Ohrenheilk.*, No. 1, 1883.

31. BÖKE. Two otological communications. *Archiv f. Ohrenheilk.*, B. xx., p. 47.

32. Dr. B. ST. J. ROOSA. A lecture on the treatment of chronic suppuration of the middle ear. *N. Y. Med. Jou'l*, May 19, '83.

33. S. SEXTON. Earache in children. *Med. Record*, May 5, '83.

34. O. D. POMEROY. A case of chronic suppurative otitis media illustrating the action of boracic acid in its treatment. *The Planet*, July 15, '83.

35. E. D. SPEAR. Otitis media purulenta. *Bost. M. and S. Jou'l*, May 24, '83.

36. L. TURNBULL. Observations on caries of the mastoid process of the temporal bone in children. *Phila. Med. Times*, July 14, 1883.

37. W. J. MARTIN. A case of mastoid disease, producing phlebitis and death. *N. Y. Med. Times*, Aug., 1883.

(22) MOURE describes a case of facial paralysis which made its appearance in the first stage of an acute inflammation of the middle ear. The paralysis remained after the closure of the perforation in the *Mt*, and disappeared only after a period of four months. After the subsidence of the otorrhœa, the treatment consisted in the employment of the electric current and derivative applications to the mastoid. Moure thinks that the facial paralysis was due in part to mechanical pressure of the secretion, and partly to the swelling and hyperæmia of the mucous membrane of the drum cavity.

(23) BING describes an ordinary case of catarrh of the middle ear, and accumulation of secretion in the drum cavity without inflammatory appearances on the *Mt*. Relief by means of inflation and gargles without perforation of the *Mt*.

(24) BOBONE gives his observations on purulent inflammation of the middle ear in phthisis. He discriminates between cases which appear before the lung affection, or in its first stages, and those in which the lung affection is far advanced. A characteristic appearance of the otorrhœa of consumptives is its symptomless appearance. The opening in the *Mt* is small only in the beginning of the affection; later it increases in size, but the *Mt* is not inflamed. On the mucous membrane of the drum cavity there are small torpid granulations. In the first stages of phthisis heal-

ing can be expected; in the advanced stages we can only disinfect the middle ear. The antiseptic treatment of Bobone is that of Bezold. Healing is also hastened by a residence at St. Remo. Bobone thinks that climate has as favorable an influence on the ear-disease as upon the lung affection.

(25) MARPURGO prefaces his extensive work with a review of all previous publications on the perforation of Schrapnell's membrane, and communicates eleven observations of his own. In perforation of Schrapnell's membrane, the *Mt* is dry and lustreless, not swollen. The perforation is sometimes greater, sometimes less. In the first case it is frequently the result of a carious process on the upper edge of Rivini's notch. The perforation whistle is frequently lacking, because the space above the short process where the perforation opening is found communicates with the remaining part of the drum cavity only by a small opening. Pathological alterations close this opening. As a further peculiarity of this perforation, Morpurgo mentions frequent acute exacerbation of the inflammatory process. In regard to the course and prognosis of the affection, all authors are agreed as to its long duration and the infrequency of complete cure. In treatment, Morpurgo recommends in the first place intra-tympanal injections, for which he employs Weber's tympanal catheter. A healing of the perforation cannot even then be counted upon, and the duration of treatment is very long. The injections are combined with the alcohol treatment. In conclusion, his own individual observations are communicated with statistics of the cases reported hitherto.

(26) In cleansing the ear, B. has not entirely discarded syringing, but he would have it done generally by the physician. The patient may keep the ear clean by means of a twisted pencil of absorbent cotton. The "dry method," of course, consists in the application of powders to the diseased surface after it has been thoroughly cleansed and dried. He condemns powdered alum on account of its tendency to produce furuncles in the ear. The author has found the mixture of powdered boracic acid and calendula, as recommended by Sexton, very efficacious. He has also used with satisfaction: Resorcin, ʒ i; boracic acid, ʒ i, and salicylate of chinoline, ʒ ss–ʒ i. These powders he applied by insufflation, and not by pouring them into the meatus through a speculum. As a matter of statistics, he gives fifteen consecutive cases treated by the "moist" method, in which the average dura-

tion of treatment was 212 days, while in fifteen consecutive cases treated by the dry method the average duration of treatment was seventeen to eighteen days. BURNETT.

(27) SCHWARTZE communicates the clinical histories of a second series of fifty cases of opening of the mastoid, and adds some remarks on the general results of his operation. Of the one hundred cases operated on seventy-four were cured, six remained unchanged, and twenty died. Schwartze concludes from these results that the fatality, so far as regards the operation, is very small indeed. Among the twenty fatal cases there were many in which death was entirely independent of the operation. Making abstraction of these, the fatal cases amounted to only six per cent. Schwartze protests against the strictures made by Politzer, that a number of his cases would have recovered without operation. The hearing power was completely normal in nine cases of the second series; in the remaining favorable cases it was more or less reduced. In thirty-three cases, after the subsidence of the suppuration, there was cicatrization of the defect in the *Mt.*

(28) Under this title B. treats of that rather uncommon form of mastoid disease which is known also under the names, hyperostosis, sclerosis, or osteo-sclerosis of the mastoid. He gives Dr. C. R. Agnew credit for being the one to first call attention to the fact that inflammation of the mastoid cells need not necessarily tend toward caries of its bony structures. Only two cases, which were undoubtedly of this nature, have come under the observation of the author, and these he gives in very great detail; also one from the practice of Dr. J. Orne Green.

The characteristics of this form of mastoiditis he sums up as follows: 1. Decided and persistent pain in and around the mastoid, though there may be an adequate outlet for any pus secreted in the antrum, and nothing like acute inflammation of the middle or external ear, and despite the employment of means which usually allay inflammations in these parts. 2. Redness, swelling, and tenderness of the outer mastoid. Actual enlargement of the bone is, of course, positive evidence. 3. A previous chronic purulent inflammation of the drum-cavity leads us to suppose that the cells have been obliterated or greatly reduced in size by earlier attacks of subacute ostitis. In treatment he recommends trephining. Even if no pus is found, as is usually the case, the mere opening of the bone seems to exercise a good influence on the progress of the inflammation, probably in the manner of a counter-irritant. BURNETT.

(29) According to URBANTSCHITSCH there remains after a chronic middle-ear catarrh a narrowing of the tube, especially frequent at the isthmus, although the entrance of air is not apparently hindered. For purposes of diagnosis in chronic middle-ear catarrh U. as regularly inserts bougies into the tube as he inspects the *Mt* with the mirror. He employs the French bulbous bougies. The bulb of the bougie makes the examination less painful, and facilitates the accurate determination of the locality of the stricture of the tube. He holds that it is necessary to dilate the tube in all cases of diminished hearing power, and subjective noises in which a bougie of one and one-third *mm.* thickness cannot be made to enter the osseous tube, or only enter with great difficulty. He begins with small numbers, and a four weeks' treatment is generally sufficient to produce a satisfactory dilatation of the canal. The dilatation may be made daily, or every two or three days, according to the sensitiveness of the patient. He has frequently seen persons who are affected with migraine, trigeminus and occipital neuralgias relieved of their troubles by these dilatations. He has also frequently seen subjective noises and deafness which were not improved by the air-bath, remarkably improved by a few dilatations. The improvement produced by the dilatation is not to be referred to a mechanical or local action, but to reflex influence which is generated by the irritation of the sensitive twigs of the trigeminus, especially the tubal branches, and which thence extends to all the senses, and of course to the ear.

A successful result of dilatation is also apparent in chronic purulent middle-ear inflammation when it is associated with narrowing of the isthmus of the tube.

(30) A twenty-year-old patient of VOLTOLINI's had for five or six years a feeling as if a valve were suddenly closed in front of his ear, which occurs quite frequently and lasts for some time. An examination made when the "valve" was down discovered the thin atrophic *Mt* bulged forward like a sack and filled with foam. By negative Valsalva's experiment the valve disappears and the *Mt* reposes against the labyrinth wall. By the smallest movement of the muscles of deglutition the former condition returns. The diagnosis was made of dilatation of the tube with exudation into the drum cavity. After repeated paracentesis of the *Mt* the phenomenon disappeared. The dilatation of the tube was confirmed by the insertion of catgut bougies. On the *Mt* each respiration could be observed. It was drawn inward during the inspiration

and bulged outward at expiration. During the pronunciation of each vowel V. saw the *Mt* make a small but clearly distinguishable excursion. On pronunciation of the letter *R* it had a fluttering vibratory motion. The author finds in this observation a confirmation of his former experiments, according to which, during the pronunciation of various vowels and consonants, a complete occlusion of the cavum pharingo-nasal by means of the soft palate does not take place. The reviewer holds that this observation is not conclusive, since the movements of the *Mt* can also be brought about by contractions of the palatal muscles.

(31) Böke shows in his first communication that fatal hemorrhage from the ear is not always from the internal carotid. In two of the cases described by him previously, the bleeding continued for fourteen days, but was stopped by cold water. In one case the blood came from the bulbus venæ jug. and apparently also from the stylo-mastoid artery ; in the second case from the sinus petr. inferior. Lately it has happened to Böke to be able to stop a profuse arterial hemorrhage by means of alum powder and a charpie tampon, and essentially to improve the otorrhœa by subsequent treatment. On the basis of his experience Böke feels justified in concluding that " profuse hemorrhage from the ear is always an important symptom ; the prognosis is always to be held in reserve, and ligation of the carotid has no scientific basis." The second communication is a case in which a high degree of vertigo, inclination to vomit, and facial paralysis accompanied an acute middle-ear inflammation. These symptoms disappeared after paracentesis of the *Mt* and evacuation of mucus from the middle ear by means of the catheter.

(32) The author is not yet ready to discard the syringe properly and carefully used as a means of cleansing the ear. Nor does he adopt, to the exclusion of other means, the so-called dry treatment. The solutions he has found of most benefit are sulph. zinc and sulph. alum 1 to 4 grs. to an ounce of water. In removing granulations he employs fuming, nitric and chromic acid and nit. silver in solution of 20 to 60 grs. to an ounce. He finds alcohol valuable. Burnett.

(33) In the treatment of acute inflammations of the ear in children, Sexton does not find much relief from leeches, thinks myringotomy seldom necessary, but places much reliance on the internal administration of aconite, gelseminum, pulsatilla, and sulphide of calcium. (! Ed.) Burnett.

(34) As a result of a rather extensive experience in the employment of boracic acid, POMEROY is an enthusiastic advocate of its use in chronic suppurative otitis, where there are no polypi or granulations. Where these occur as complications, no benefit follows the use of the acid until they are removed. For their removal he uses nitrate of silver in strong solution, or fused on a probe. BURNETT.

(35) Nothing new on this subject is offered. Granulations are treated by caustics—nitrate of silver being preferred. The so-called dry treatment also receives recommendation at his hands. BURNETT.

(36) Some general considerations regarding the nature of the affection and the usual methods of treatment are given. This is followed by the recital in detail of a case of encephaloid cancer involving the temporal bone, mastoid cells, and the antrum, showing itself first in the external osseous meatus as a polypoid growth from diseased bone. It was in a boy four years of age. It was removed three times, but recurred, and finally killed the patient. BURNETT.

(37) The patient was a boy seven years of age who had a purulent discharge from the right ear for some years. During an acute attack the mastoid region became painful and swollen. Soon a discharge of offensive pus took place from the ext. meatus. This was followed by swelling of the neck, forehead, and eyelids. There was exophthalmus and congestion of the conjunctiva; the parts around the right jugular vein were hard and sensitive. Temp., 104°. He died on the eighth day. No post-mortem. BURNETT.

NERVOUS APPARATUS.

38. G. C. HARLAN. A case of sudden deafness after mumps. *Med. News*, March 24, 1883.

39. Dr. BÜRKNER, Göttingen. A case of sudden loss of hearing-power in one ear during mumps. *Berl. klin. Wochenschr.*, No. 13, 1883.

40. Dr. SELIGSOHN, Berlin. Deafness after mumps. *Deutsche med. Wochenschr.*, No. 4, 1883.

41. H. KNAPP. A case of double-sided deafness after mumps. These ARCHIVES, vol. xi, p. 385.

42. Dr. BRUNNER, Zurich. Otitis labyrinthica infantum (Voltolini). *Corresp.-Bl. f. Schw. Aertze*, No. 10, 1883.

43. Dr. GELLÉ. A clinical study of Ménière's vertigo in its

relation to alterations of the oval and round windows. *Archiv. de Neurol.*, No. 12, 1883.

44. P. Marié and G L. Walton. Vertigo in tabes. *Rev. de méd.*, No. 1, 1883.

45. M. Boucheron. Troubles in equilibration in small children affected with deaf-dumbness by otopiesis. *Compte rendue*, Feb. 20, 1882.

46. Dr. Grazzi. Ménière's disease and its cure. *Gaz. degl. Ospit.*, Nos. 99-100. 1882.

47. Walton. Deafness in hysterical hemi-anæsthesia. *Brain*, vol. xx.

48. Gesell, Berlin. Same in *Verh. der Phys.*, No. 8, 1883.

49. S. Moss. Neuropathological contributions. These Archives, vol. xii, p. 309.

50. Heilly. Note on a case of blindness and word-deafness. *Prog. médical*, No. 2, 1883.

51. Magnan. A case of word-deafness. *Soc. d. biol. et gaz. d. hôp.*, No. 59.

52. A. Vetter. On the sensorial function of the cerebrum, etc., from new experiments and clinical observations. *Deutsch. Archiv.*, B. xxxii.

53. H. Donkin. Left hemiplegic and left-sided deafness from brain injury, etc. *Brain*, Jan., 1883.

54. E. Gampietro, Naples. On acute hydrocephalus and otitis in children, and some trophic changes in the ear in lesions of the medulla. *Giorn. int. del. sc. med.*, An. v., p. 301.

55. D. Webster. A case of syphilitic disease of the labyrinth, etc. *The Planet*, April 15, 1883.

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(38) The patient was a female twenty-three years of age, and had mumps three years ago. The day after the commencement of the attack there was a roaring sound in the R ear, associated with complete deafness. No pain; no discharge. For more than a month afterward there were dizziness and a tendency to pitch forward. There is still a constant tinnitus, and the watch is not heard on that side. Conducting apparatus normal.

Burnett.

(39) Bürkner's case was in the person of a boy seventeen years of age who, on the second day of a parotitis, had loud subjective noises on the right side, and on the next day was completely deaf. There were, besides, vertigo of eight days' duration, vomiting, and imperviousness of the tube.

(40) Whilst in the foregoing two cases deafness made its appearance at the beginning of the mumps, in the case communicated by SELIGSOHN—a young girl of sixteen years—it manifested itself only after a lapse of two months. The author thinks in this case syphilis had something to do with the development of the deafness.

(42) BRUNNER takes up arms in defence of the existence of an otitis labyrinthica *sui generis*, and cites in support of his opinion that in the Canton of Zurich, where all his cases occurred, there has been no epidemic cerebro-spinal meningitis for twenty years or upward. He also brings Voltolini's arguments to the support of his position.

(43) GELLÉ discusses in his paper the clinical and experimental data in regard to the vertigo of Ménière's disease, and seeks to show that it is not due to labyrinth affection, but to middle-ear disease. In support of this opinion, a post-mortem examination of a case from Charcot's clinic is cited, in which an affection of the peripheral part of the organ of hearing existed with a normal labyrinth. G. hoped to find a proof of the correctness of his position in experiments instituted for the purpose of determining the movableness or immovableness of the labyrinth windows. If the air in the external meatus is compressed by means of a Politzer bag when the ear is normal, there is an alteration in the tone of a tuning-fork placed on the forehead at each compression. If the stapes is immovable, no such alteration in the tone is observable. When the ligaments are loose, on the other hand, such a compression acts very strongly, causing a shock to the labyrinth, with vertigo and subjective noises. According to the phenomena following this experiment, G. diagnoses a normal, impeded, or ankylosed condition of the conducting apparatus.

Ménière's vertigo was observed in 53 cases, in 22 of whom the same phenomena could be produced by air-compression in the external ear. In the 31 cases in which no vertigo could be produced, 11 had a suspension of sound-perception during the compression. In 20 cases sound-perception was in nowise changed during the compression. The therapeutics and prognosis of the affection are also considered.

(44) MARIÉ and WALTON examined twenty-four patients at the Salpétrière affected with tabes, and came to the following conclusions: 1. In tabes more or less pronounced vertigo analogous to

Ménière's is oftener present than is generally supposed (in two thirds of the cases examined). 2. The beginning of the trouble is often concomitant with the appearance of the tabes (in about one half of the cases; in one case it came on twenty-five years, and in three fifteen years, after the beginning of the tabes). 3. The vertiginous symptoms are not due to a degeneration of the auditory nerve analogous to that of the optic nerve, since the physiological action of the nerve is unchanged. 4. The phenomenon can be logically ascribed to a destruction of some of the fibres of the auditory nerve which go to the semicircular canals, and which may be considered as the nerve of equilibration.

(45) Boucheron considers the alteration in gait as well as the changes in disposition and sudden outbursts of anger, etc., in the deaf-mutes, as the result of a condition he terms otopiesis (*οὖς ὠτος*, ear; *πιεσις*, pressure). He thinks that through swelling of the tube a vacuum takes place in the drum cavity, causing the atmosphere to act on the *Mt* with a pressure of from 200 to 1000 *gr*, which is conveyed by the chain of bones to the labyrinth. By a few inflations the hearing-difficulty is removed, as well as the altered gait and affected disposition.

The reviewer cannot refrain from expressing his surprise that the French Academy should allow such opinions so at variance with all known physiological and physical laws to be laid before it. According to these laws, the formation of a complete vacuum in a cavity of the body, and the one-sided operation of the atmospheric pressure on its elastic walls, seem impossible. We have no doubt that in some cases of deaf-mutism inflation is advantageous; in fact we have reported such cases ourselves, one of which Boucheron had seen. We must express our decided opposition to the theory of Boucheron.

(46) Grazzi describes the various forms of Ménière's disease, and recommends the employment of quinine, which has proved efficacious in two cases.

(47, 48) Walton examined thirteen patients in Charcot's clinic affected with hysteric hemi-anæsthesia, in regard to their hearing-power, and classifies them in the following categories: 1. In total hemi-anæsthesia the *Mt* of the affected side can be touched without causing pain or producing any reflex phenomena. Politzer's inflation (in a permeable tube) caused no sensation in the *Mt*. Sound-perception is equally reduced, nor is a tuning-fork placed on the head heard on the anæsthetic side. 2. In partial hemi-

anæsthesia (in which sensation of pain is absent, but some other qualities of sensation remain) touching the *Mt* was felt, but it was not painful. The entrance of air into the middle ear was likewise felt, but not so distinctly as on the sound side. Deafness is partial and shows itself, according to Walton's observations, in various degrees: (*a*) aërial vibrations were well, but bone-conduction badly, perceived; (*b*) the former well, the latter not at all; (*c*) the first badly, and the latter not at all. In the cases of the latter category the perception of the higher tones is the first to disappear. 3. In bilateral anæsthesia there is bilateral deafness, corresponding in degree to that of the anæsthesia. The analogy between the cases of partial anæsthesia where the bone-conduction is suppressed but aërial conduction remains, and senile deafness, seems to point to the supposition that it is erroneous to refer the latter to deficient bone-conduction. It is evidently not due to deficient bone-conduction, but to some difficulty in the perceiving apparatus.

Walton describes in his paper also the symptoms of transfer, adding an observation of his own. He arrives at the following conclusions: 1. The sensibility of the deeper parts of the ear, including the middle ear, disappears *pari passu* with the hysterical hemi-anæsthesia of the other parts of the body. 2. The degree of deafness corresponds with the degree of the general anæsthesia. 3. If the deafness is incomplete, bone-conduction is more reduced than aërial conduction. 4. In transfer, the hearing as well as the sensibility of the deeper parts of the ear increases exactly in the same degree on the one side as it diminishes on the other.

(50) In a case of word-deafness, without special interest, the autopsy revealed on the left side yellow softening occupying the upper half of the first temporal convolution, a greater part of the lobulus parietalis inferior, and the gyrus uncinatus. A thrombus was found in the corresponding branch of the art. foss. Syl.

(51) The patient of MAGNAN, aged 51, had suffered with disturbance of speech for two years in consequence of apoplectic seizures. He could understand what he read, but not what was spoken to him. The word-deafness was, therefore, unlike that of the other case of the same author (*Gaz. des hôp.*, February 12, 1880). Death occurred through tuberculosis. Post-mortem: Softening in the third frontal convolution, and a similar lesion in the first and second temporal convolutions.

Brown-Séquard brings the objection that there is no such

centre, and that he has frequently seen such lesions post mortem without a corresponding anomaly.

(52) VETTER reports a case in which there was, during an apoplectic seizure, complete right-sided hemiplegia and hemianæsthesia. The latter affected all the qualities of sensibility and the higher senses on the right side, so that the senses of smell, taste, and hearing were abolished on that side. There was right-sided hemianopsia. Post-mortem: An apoplectic cyst the size of a hazel-nut on the left side occupying the anterior part of the lenticular nucleus, and the posterior part of the internal capsule. A second, rust-colored patch was situated in the medullary substance of the occipital lobe, close to the outer wall of the posterior horn of the left lateral ventricle. Recent changes were found in addition.

The case is of especial interest in regard to the totally crossed deafness by a lesion of the internal capsule, there being no other autopsy of this condition on record.

(53) The steel wire of an umbrella was thrust near the outer corner into the right eye of a boy, æt. 12, while he was looking through a key-hole. He fell on the floor, and drew the wire out himself. In the next days he was paralyzed and completely deaf on the left side. In the course of four weeks the deafness and hemiplegia disappeared; paralysis of the right abducens remained. According to Ferrier, the instrument may have passed through the anterior part of the internal capsule, and may have penetrated into the superior end of the first temporal convolution, behind the Sylvian fissure. Ferrier, on the strength of his experiments, places the acoustic centre in that locality. As the corona radiata of the temporal lobe is situated in this vicinity, a totally crossed deafness would have to be referred to this place.

(54) GAMPIETRO'S views on the cases described by him do not correspond with general opinion. Otitis labyrinthica in hydrocephalus, he thinks, depends upon some alteration of the vasomotory centre, and is accompanied by nutritive disorders in the ear and brain. Disturbances in the equilibrium of the nutritive forces may be produced also by injuries, and the subsequent otitis interna may be caused by nervous disturbances of the vasomotor centres, the sympathetic and trigeminus. We are most surprised by the author's proposition to perform myringotomy and paracentesis of the vestibule in acute hydrocephalus if all other remedies fail. He even states that this operation had proved very

satisfactory in several severe forms of internal otitis. Unfortunately he does not communicate details of these cases.

(55) The chancre was observed in 1865. In Oct., 1876, impairment of hearing with subjective noises was first noted. Pharynx, external and middle ears in good condition. Left ear perfectly deaf in November. R side H. D. $\frac{30}{60}$. He was ordered mercurial inunctions, and large doses of brom. potass. to procure sleep. He developed "bromism," which disappeared after he ceased taking the bromide; was then ordered iodide of potassium in good doses. In Jan., 1877, the watch could be heard on contact on the left side, and his disagreeable head symptoms had subsided.

BURNETT.

NOSE.

56. LÖWENBERG, Paris. Les déviations du septum nasal, etc. *Progrès méd.*, 1883. Abstract of the author's paper in these ARCHIVES, vol. xii, p. 22, etc.

57. Dr. PETERSEN, of Kiel. Subperichondrial removal of the cartilaginous nasal septum. *Berl. klin. Woch.*, No. 22, 1882.

58. Dr. HOADLEY GABB, of Hastings. Epistaxis. Escape of blood through the lachrymal canal. *Brit. Med. Journ.*, April 14, 1883.

59. CRESWELL BABER. Cases of nasal polypus projecting into the naso-pharynx. With remarks. *Brighton Lancet*, Jan. 27, 1883.

60. Dr. SCHÄFER. A case of fatal ulcerous inflammation in the right half of the ethmoid bone. *Prag. med. Woch.*, No. 20, 1883.

61. R. WEHMER, Frankfort o.-M. Adenoid vegetations in the naso-pharyngeal cavity. *Der pract. Arzt.*, Nos. 2 and 4, 1883.

62. WILH. ROTH, in Vienna. Chronic pharyngitis. Anatomical and clinical studies. Toplitz & Deuticke, Vienna, 1883.

63. Dr. GOTTSTEIN, in Breslau. New tubular forceps for operations in the larynx, pharynx, and nose. *Berl. klin. Woch.*, No. 24, 1883.

64. Dr. LIEBIG. Nasal probang. *Münch. ärztl. Intellig.-Bl.*, No. 21, 1883.

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(57) PETERSEN reports three cases in which he removed pieces of the cartilaginous portion of the nasal septum, but preserved the perichondrium and mucosa on both sides. The detached flap was fastened at its edges to the surrounding parts, yet

not so tightly as to prevent escape of pus. The author thinks in this way to make after-treatment unnecessary ; where, however, this should be needed, he recommends the inhalation tubes of Feldbausch, especially when the distortion reaches very high up.

(58) A patient suffering from spasmodic cough bled from the nose. After stopping the hemorrhage by a plug of lint, a copious bleeding occurred through the right tear-duct.

(59) Cr. Baber describes three cases of nasal polypi extending into the naso-pharyngeal cavity, and removed by him with the cold snare. The snare was introduced through the nose and laid around the polypus with the index finger passed through the mouth into the pharyngeal space. The author dwells upon the importance of examining carefully the naso-pharynx in cases of obstruction of the nose. To diminish the secretion after operations he recommends spraying the nose with equal parts of alcohol and water. The same solution is recommended for coryza.

(60) A patient suffering with coryza and headache, had, when first seen, swelling of the eyelids, pain in the eye, pressure in the frontal and nasal regions on the right side, but only scanty secretion. In spite of lancing several abscesses developing in this locality, death ensued under distinctly meningitic symptoms. The autopsy showed ostitis purulenta orbitæ starting from the right ethmoidal cells, and causing inflammation of the pia and dura, and the formation of an abscess the size of a walnut. Purulent infiltration was present in the superior part of the nasal cavity.

(61) Wehmer, in a short discourse, treats of the adenoid vegetations in the naso-pharyngeal cavity. Among the many operative procedures he recommends, as the most appropriate for the practitioner, the sharp spoon and the ring-knife, because they require the least practice on the part of the physician and the patient.

(62) Roth gives a general description of the different forms of chronic pharyngitis. Anatomical studies, though mentioned in the title, are not contained in the paper, which is composed of the literature on the subject and clinical observations of the author. The different forms are divided into two principal groups, anomalies of secretion and anomalies of texture, each group being subdivided again, yet he states that he considers the different forms only as degrees (stages) of the same process. The paper contains nothing new, but the description of the affection is interesting and tolerably complete, so that every one who is not famil-

iar with the incident literature will read the brochure with satisfaction.

(63) GOTTSTEIN'S tubular (or canula) forceps consists of a tube and a double-branched handle. One toothed spoon is fastened to the end of the tube, whereas the other spoon is movable against the first in a joint connected with the second branch of the handle by a wire passing through the tube. The second branch of the handle is fastened to the tube itself. The advantage of the instrument is found in the fact that the portion which is introduced into the nose, the pharynx, and partially also into the larynx, does not consist of two branches, but a tube. The forceps portion can be put in any position, and by applying canulas of different size, the instrument can be used for the larynx, pharynx, and nose.

(64) LIEBIG'S nasal probang consists of a spiral of German silver.

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