contracted by sitting at an open window while perspiring; by making a sea voyage in stormy weather (sailors consequently, have very severe empyemas); by getting drenched, especially when the head gets wet (in bathing); by wetting, and habitual sweating of the feet (the latter condition is to be treated by foot-baths, at first lukewarm, afterwards cooler); and by the hair being cut too often and too closely, the bad effect of which can easily be demonstrated.

(*To be continued.*)

ON PATHOLOGICAL CHANGES IN THE LABYRINTH.

By Prof. POLITZER (Vienna).

Read before the International Congress of Otology, Florence, September, 1895.

A KNOWLEDGE of the pathological changes in the labyrinth dates scarcely further back than the second half of the present century. The cause of this hiatus in science is to be found particularly in the imperfection of the methods of microscopical examination, which has only been remedied about the time mentioned, as is shown by the fact that it was only at this date that the histological structure of the cochlea was discovered by the celebrated Italian, Prof. Corti, as also by the subsequent remarkable and well-known works of Boetticher, Moos, Steinbrügge, Habermann, etc. Further, other difficulties, such as the inability to perform autopsies sufficiently early, and in sufficient observation of labyrinthine affections during life, have up to the present prevented us from establishing the anatomical conditions of labyrinthine pathology. Their knowledge will only acquire great value when we shall be able to compare them with the clinical phenomena which they produce. Unfortunately, we have before us only a very small number of anatomical demonstrations on individuals submitted to clinical observation during life.

The pathological changes in the labyrinth comprise—

1st. Hyperæmia.

2nd. Hæmorrhagic extravasations into the labyrinth.

3rd. Inflammations of the labyrinth, both primary and secondary, with their results.

I. *Hyperæmia.*—Easy to observe anatomically, hyperæmia of this part has its practical importance from a clinical point of view, because it may give rise to subjective noises, to vertigo, and to disturbances of hearing. The present investigations, made by Dr. Eichler, in the laboratory of Prof. Ludwig at Leipsic, on the physical system of the labyrinth, have established that the labyrinth possesses a whole special system of vessels, of which the arterial ones derived from the internal auditory artery penetrate by numerous ramifications into the different parts of the labyrinth, break up into capillary branches in the cochlea, the vestibule, and the semi-circular canals, and pass then into the venous capillaries which unite into several veins and terminate in the venous system of the brain. This special vascular system of the labyrinth has

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numerous anastomotic relations with the neighbouring parts, especially with the tympanic cavity, and Prof. Politzer was the first to establish, by means of microscopical sections treated with osmic acid, that the vessels of the mucous membrane of the cavity of the tympanum pass through the osseous portion of the promontory, and enter into an anastomotic communication with the vessels of the coats of the labyrinth, an anatomical fact which has been confirmed by pathological sections from dead subjects.

It is this special vascular system which is the normal seat of hyperæmia, such as is produced in particular in certain infectious forms of otitis, but especially in typhoid and in diphtheritic scarlatina.

But another frequent cause is to be sought for in certain obstacles which prevent the reflex of venous blood from the labyrinth towards the cavity of the cranium, such for example as cerebral tumours and the pressure which they exercise on the venous channels of the brain, more particularly the tumours at the base of the brain proliferating into the internal auditory meatus, and compressing thus the internal auditory artery and vein.

Labyrinthine hyperæmias are also due to the influence of the nerves, especially the sympathetic nerve, and of this there is no doubt in view of the symptoms produced, a rapid blush suffusing the face, the external meatus and the tympanum, and disappearing with equal rapidity, noises in the ears, and vertigo.

There are also certain forms which are transitory after acute inflammation of the tympanum, or nervous influence, and which are not followed by functional disturbances, but the lasting hyperæmia caused by chronic inflammations of the drum or by obstructions in the circulation give rise to various disorders and to lasting disturbances. The changes which result from it are dilatation of the vessels, pigmentary exudation, thickening of the membranous parts of the labyrinth and of its capsule. We shall return to this further on.

II. *Hæmorrhagic Extravasations.*—These hyperæmias of themselves often give rise to extravasations of this kind in the labyrinth : but these may also be produced without pre-existing hyperæmia. They are met with most frequently in infectious diseases, such as typhus, scarlatina, diphtheria, small-pox, acute tuberculosis, chronic nephritis, diabetes, leukhæmia, and, besides, in all the circulatory troubles which arise from organic affections of the heart and lungs. In this last case the hæmorrhages must be attributed to faults in the circulation. On the other hand, in infectious diseases they are due to changes brought about in the vessels by the action of the specific microbes, and which lead to a diminished resistance of the walls of the said vessels. In all these cases these extravasations appear in the form of circumscribed hæmorrhages or of sanguineous effusions of a more considerable size in the different parts of the labyrinthine cavity. As has been perceived by Messrs. Knapp and Politzer, as the result of *post-mortem* examination, they are found much more often than is generally supposed in chronic suppuration of the tympanum, especially in those which are complicated with caries, and the frequency of their occurrence shows how numerous must be the anastomoses between the vessels of the middle ear and those of the

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labyrinth. The most interesting ones described by Moos, Steinbrügge and Politzer in cases of hæmorrhagic peri-meningitis and of hæmatoma of the dura mater, then in tubercular meningitis, were found in part along the vessels and nerves, and in part between the layers of the lamina spiralis ossea, and in the spiral ganglion, besides hæmorrhagic effusions in the trunk of the auditory nerve and thromboses in the internal auditory artery.

As regards the labyrinthine hæmorrhages, which bear the name of "Ménière's disease," their enumeration is reduced to the single case observed by this scientist after death, that of a young girl attacked during life with vertigo, nausea, and disturbances of co-ordination: but no other similar case having been observed since then, the anatomical basis of Ménière's disease is entirely wanting, and hence we are unable to speak of Ménière's disease, but only of Ménière's group of cerebral symptoms from the clinical point of view which he, in any case, was the first to demonstrate as related to labyrinthine disease.

It has not yet been demonstrated that the *labyrinthine symptoms* frequently observed after the internal administration of certain drugs, such as quinine, salicylic acid, etc., are produced by hæmorrhages into the labyrinth; in this respect we have only presumptions to deal with, based upon experiments made by Kirchner on rabbits. Similarly to hyperæmia of long duration, sanguineous extravasations frequently produce in the labyrinth pigmentary exudations; the hæmoglobin is deposited both upon the membranous part and the walls of the labyrinth in the form of irregular spots, either brown or blackish, and firmly adhering to the tissues of the organ. These pigmentary deposit undoubtedly exercise an exciting effect on the extremities of the auditory nerve, and in consequence they lead to loud subjective noises.

III. *Inflammations of the Labyrinth.*—They are primary or secondary. We have more information in regard to them from a pathological standpoint than with regard to the changes already mentioned. As far as the primary inflammations are concerned, our information applies only to their issues and not to the changes effected in their earlier stages.

As for the pathological changes resulting from *secondary inflammation*, regarding which we have more precise information, they are the result either of acute or chronic infectious diseases, or of inflammations of the same kind affecting the cavity of the tympanum.

As Politzer and other authors have been able to establish it, the most pronounced of these changes *are seen in particular in the lower parts of the cochlea*, while the upper portion of this organ is found relatively little changed. We are reduced to hypotheses with regard to the cause of this state of matters. The most probable is that of Steinbrügge, who thinks that inflammations propagated from the cranial cavity to the labyrinth along the ramifications of the nerves of the cochlea reach in the first place the lower convolution, as is seen in cases of cerebro-spinal meningitis when these changes are manifested first in the lower part of the tympanic scala of the cochlea.

The first case of *primary inflammation* of the labyrinth was described and demonstrated by Politzer at the congress at Milan. It concerned a

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boy, thirteen years of age, who had become deaf and dumb at the age of two and a half years as the result of a labyrinthine otitis, and in the preparation there could be seen by means of artificial light the complete invasion of the labyrinth by osseous tissue and ossification of the cochlea, whose outlines could be distinguished in the surrounding bone.

(*a*) The anatomical changes *produced as the result of infectious diseases* arise either from the invasion of specific microbes or from that of purulent matters into the labyrinth. There results from these invasions an inflammation of the capsule and of the membranous portions of the labyrinth, which lead either to destruction of tissue or to proliferations of the connective tissue, which are sufficient to fill up either entirely or in part the cavities of the organ in question and to terminate in ossification. These changes appear more or less intense according to the more or less advanced degree of inflammation, slight swelling, thickening of the labyrinthine capsule, or numerous filaments extending between the osseous walls and the membranous structures to such an extent as to fill the cavities completely with osseous substance. It is to Moos that we are indebted for the demonstration of the anatomical changes resulting from infectious diseases, such as scarlatina, diphtheria, measles, from the proved invasion of specific micro-organisms into the labyrinth through the lymphatic channels leading from the tympanum to this organ. The action of these micro-organisms has for effect the production of connective tissue, with its ossification as a sequel; then a necrosis, with degeneration of the said tissue, brought about either by thrombosis of the capillary vessels or by the direct action of the virus on the tissues themselves.

(*b*) The nature of the severe changes thus produced is in general, and with the exception of a few modifications, the same as that which one can demonstrate as resulting from diphtheria, the first object of a special study by Prof. Moos. Even if he has not been able to demonstrate the presence of the specific microbes of diphtheria, he has in any case established the fact of the secondary infection by the streptococcus, which is found in almost all the tissues, as well in the endo- and peri-lymphatic cavities as in the aqueductus vestibuli, the ramifications of the auditory nerve and the osseous cavities of the petrous bone itself. The destructive changes brought about by this invasion are the same as those already described. We cannot be surprised at their severity if we know the destructive effects of the presence of streptococci in mass.

(*c*) Very nearly the same holds good with regard to the effect of infectious labyrinthine disease developing *in the course of measles*, or after the disappearance of these, and similarly set forth with a whole series of histological observations by Prof. Moos, as holds good of the causes of destructive changes in the labyrinth attributed by him, as the sequel of these affections, to the invasion of the streptococcus into this organ. The disorganizing action of this microbe has been manifested by a fatty degeneration of the endothelium of the blood-vessels, which has brought about coagulation and thrombosis of these vessels, and an engorgement giving rise to colloid changes in the labyrinthine tissue,

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then of other destructive alterations in the periosteum, the osseous portions of the cochlea and the ramifications of the auditory nerve.

(*d*) The changes which follow cerebro-spinal meningitis have been demonstrated by Heller, who was the first to prove that the deafness which resulted from them was produced by a suppurative inflammation of the labyrinth. It is the aqueduct of this organ which allows of the passage of these purulent invasions, and notably the aqueductus cochleæ which is in direct communication with the cerebro-spinal space where the exudation takes place. These changes consist chiefly in destruction and atrophy of the membranous parts of the labyrinth, and of ramifications of the auditory nerve, in partial or total disfigurement of Corti's organ, atrophy of the cells of the spiral ganglion, and the deposit of amorphous detritus mixed with a very few cells, and, further, as the residuum of the original inflammation, the new formation of connective tissue with partial ossification of this latter.

(*e*) Politzer in his turn demonstrated the frequency of *secondary affections resulting from chronic suppuration in the middle ear* arising either after the destruction of the labyrinthine fenestræ by the propagation of the inflammation to the membranous portions of the labyrinth, or without appreciable lesion of the labyrinthine wall by extension of the pathological changes by means of the blood-vessels and lymphatics, the routes of anastomosis between the tympanic cavity and the labyrinth. As regards the first form of these affections, it recalls a case described by Politzer at the congress at Brussels, in which the footplate of the stapes had been destroyed by an overgrowth of connective tissue, subsequent to suppuration, in which also the proliferation had extended into the vestibule of the labyrinth, as shown by a preparation which he exhibited in confirmation.

He afterwards demonstrated the second form of inflammation described by means of another preparation taken from a deaf woman, aged ninety-three, in which the external auditory meatus and the cavity of the tympanum were filled with cholesteatomous masses, resulting from a previous suppuration.

In the former preparation the external wall of the labyrinthine vestibule was covered with tubercular epithelial proliferations, which were found equally on the lateral wall and at the fundus of the utricle. In both cases pronounced labyrinthine symptoms were completely absent. Prof. Politzer has further exposed, in a certain number of cases of chronic suppuration, the results of chronic in ammation of the cochlea taking the form of a proliferation of connective tissue, with partial simultaneous ossification found most frequently in the scala tympani of this part.

(*f*) Another form of exudation into the labyrinth little known up to the present, and demonstrated by him, is that which is brought about by the presence of an obstacle of some form or another in the internal auditory meatus, comprising the blood-vessels therein, and producing exudation as the result of the driving back of the blood current. Politzer quotes in this connection the conclusive example of an observation made by him on a woman, aged sixty-three, affected with deafness of the left

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ear in the course of a cancerous affection of the lateral region of the neck, an affection which had penetrated through the base of the brain into the cranial cavities. The cancerous mass advanced in the direction of the left petrous bone, surrounding and compressing the carotid artery and the jugular vein, then proliferating in the interior of the internal auditory meatus. The exudation, consisting of a granular mass, was situated in part on the capsule of the labyrinth, or of the wall of the labyrinth, and partly on the spiral laminæ. The tympanic cavity and the Eustachian tube showed no appreciable change.

(*g*) The labyrinth may be similarly affected in cases of leukhæmia, and there can then be produced in the organ pathological changes which lead to complete deafness. The first demonstration with regard to this was brought forward by Politzer at the congress at Brussels in the case of a young man of thirty-two years who was affected long previously with a suppurative otitis of the left middle ear, and who became deaf a year before his death.

The preparations from this case show :—

1st. A new formation of connective and osseous tissue in the tympanic scala of the cochlea.

2nd. Complete invasion of the semi-circular canals by connective tissue.

3rd. The accumulation of lymphatic cells in the interior of these canals, in the vestibule and in the vestibular scala of the cochlea.

Another similar case has been described by Prof. Gradenigo, who has found sanguineous extravasations in the mucous membrane of the tympanic cavity affected previously by suppurative inflammation, but nothing similar in the labyrinth. Then another by Prof. Steinbrügge, who demonstrated changes very similar to those indicated above by Politzer in the case of a young man of twenty-five years of age who died as the result of myelogenic leukhæmia, and who had been previously affected with syphilis, the changes being as follows : adhesions in the tympanic cavity, thickening of the membrane of the fenestra rotunda, invasion of the cochlea by hæmorrhagic extravasation, and almost complete ossification of the semi-circular canals.

(*h*) Changes of the same nature are produced also in the labyrinth as the result of syphilitic affections. There have been brought forward in this respect, as the best known up to the present, cases of hyperostosis of the temporal bone with narrowing of the labyrinthine cavities, and of the internal auditory meatus produced by chronic syphilis ; and, further, as has been already pointed out, a proliferation of the labyrinthine capsule with narrowing of the fenestra ovalis terminating in anchylosis of the stapes ; then a case of acute suppurative inflammation observed by Schwartze in a syphilitic woman, who died of acute purulent meningitis. Among the few anatomical preparations demonstrating the results of syphilis, Politzer has found some showing atrophy and destruction of the ganglionic cells of the spiral ganglion, as well as the fibres of the auditory nerve in the cochlea, the former having been observed and described by him in the case of a man aged fifty, who had been deaf for ten years, and affected with syphilis, whereas the latter were demonstrated by Moos and Steinbrügge.

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Politzer has drawn attention further to an interesting case of Prof. Kirchner's dealing with the pathological changes of the blood-vessels of the labyrinth as the result of syphilis in a patient affected with the tertiary disease, and consisting in an infiltration of the walls of the vessels with small cells identical with that described by Heubner in the cerebral vessels of syphilitic subjects.

The corollaries of these changes are manifested in the form of fatty degeneration and pigmentation of the endothelium: proliferation of the connective tissue, and obliteration of the vessels in certain localities.

These changes present further in general the same characters as the results of chronic inflammation mentioned above. Thus in two cases of syphilis Moos has demonstrated the thickening of the periosteum of the vestibule: hypertrophy of the connective tissue attaching the membranes to the osseous parts of the labyrinth, and even in one of the cases the presence of calcareous concretions in the wall of the vestibule. Prof. Gradenigo has also shown in the further development of this connective tissue the possibility of its ossification, which he attributed to the results of hereditary syphilis in a young girl of tuberculous diathesis, of the age of fifteen.

(*i*) Another series of labyrinthine affections is that which shows itself as the result of tuberculosis, without, however, the demonstration, up to the present, of a primary tuberculous disease of the part. The few observations extant with respect to this have been made on individuals in whom the middle ear was already destroyed by tuberculosis, and in whom the tuberculous ulceration had already established itself on the capsule of the labyrinthine cavity. As symptoms of these affections, it is remarked that, as soon as the capsule is perforated by the ulceration, inflammation spreads over the walls of the cavity and the membranous parts of the labyrinth, producing thus, on the one hand, necrosis of the tissues, and, on the other, proliferation of newly-formed connective tissue, which entirely fills up the spaces.

(*j*) To the list of pathological changes of the labyrinth must be added the primary affection of the labyrinthine capsule already described by Politzer at the congress of Rome. He demonstrated then that in a large number of cases, looked upon as dry chronic catarrh of the middle ear, there were osseous proliferations of new formation in the said capsule round the fenestra ovalis, and extending in the direction of that fenestra, and leading to an anchylosis of the stapes or to complete occlusion of the opening. When the affection is at an advanced stage the time comes when the osseous proliferation penetrates also into the cavity of the labyrinth, notably into the scala tympani, and carries with it complete disorganization of the membranous parts of the labyrinth and of the organ of Corti.

(*k*) In the last place Politzer draws attention, among the affections of the same kind demonstrated and treated by him, to the depression of the membrane of Reissner as the result of an increase of extra-labyrinthine pressure on the organ of Corti, brought forward first by Steinbrügge, and afterwards by other authors, including himself, and he cites the case mentioned by Steinbrügge of a boy twelve years old who died as the result

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of a cerebral tumour, in whom the increase of the intra-cranial pressure manifested itself during life by the appearance of optic neuritis; likewise another, narrated by Gomperz, in a tuberculous subject, who died of internal pachy-meningitis and cerebral œdema, with the observation that in both cases the membrane of Reissner was found so much depressed that there remained only a very slight fissure between it and the membrane of Corti.

If all these observations have inculcated the importance of the study of labyrinthine affections, not only for the appreciation of anatomical changes in the ear, but, further, for the diagnosis of auditory disturbances taking their rise in the labyrinth, it must be kept in mind that at present we are only on the threshold of scientific knowledge of these affections; nevertheless, we have reason to be proud of the results obtained so far, as being so many landmarks and points of departure for future discoveries destined to throw fresh light on the clinical character, the diagnosis and the therapeutics of all the affections of the auditory organ. *Dundas Grant* (*Trans.*)

ADDRESS IN COMMEMORATION OF THE LATE PROFESSOR MOOS.

Delivered before the Fifth International Congress of Otology at Florence, 1895,

By Prof. ADAM POLITZER.

Gentlemen,—Few weeks have passed since the shadow of death has fallen upon one of the most eminent founders of modern otological science, one whom we have been accustomed to see constantly in the foremost rank in our assemblies, whose lofty scientific productions we have never ceased to admire, and on whose lips we were, as it were, suspended from the moment when he commenced to place before us his clear and instructive views, whose wit, always young and facetious, animated with its brilliance all our reunions.

Moos is no more. The hope of seeing him again among us in this assembly, of hearing again the new discoveries which he reserved for each congress, this hope has been prematurely snatched from us by death, and it only remains for us to fulfil the last duty to his memory by bearing testimony to all his merits and his virtues.

It is upon me, gentlemen, as one of his oldest and most intimate friends, that devolves the sad honour of tracing before you the picture of his life, a life made up of work, of abnegation and of devotion. The life of Prof. Moos is in fact a magnificent model of a whole career of labour and incessant effort practised for the sake of reaching the highest point of scientific knowledge.

Born in 1831, at Randegg, in the Duchy of Baden, in a position of life which was more than modest, and completely unendowed by any of the blessings of fortune, he carried on during his life a hard struggle for existence, and it was only by enduring innumerable privations that

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