SECOND SERIES

OF

OBSERVATIONS

ON THE

PATHOLOGY OF THE EAR.

BASED ON ONE HUNDRED AND TWENTY DISSECTIONS OF THAT ORGAN.

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READ JUNE 27TH, 1843.

ALTHOUGH the organ of hearing consists of several distinct parts, and exhibits much structural variety, but few successful attempts have hitherto been made to trace the local causes of deafness.

In a former paper, published in the Transactions of this Society,* I gave descriptions of several dissections of the human ear, as evidence of the fact, that the lining membrane of the tympanic cavity is frequently in a diseased condition. Subsequent dissections, and a careful investigation of numerous cases of deafness in living subjects, have led me to

* Vol. xxiv. 1841.

the conclusion that the most prevalent cause of deafness is chronic inflammation of the mucous membrane which lines the tympanic cavity; and that by far the greater majority of cases commonly called nervous deafness ought more properly to be attributed to this cause. This opinion derives support from an observation made to me by Mr. Swan, that in the whole course of his multiplied aural dissections he has not encountered one single instance of disease in the internal ear; an observation which embodies the result of repeated examinations to which I have myself subjected that part of the organ.

At the same time that I advance this opinion as an inference fairly deducible from more than a hundred dissections, I am far from denying the necessity of more extended researches previous to its validity being admitted.

In the present communication it will be my endeavour to elucidate the different stages of this disease of the mucous membrane, and to point out the various morbid conditions to which it gives rise. In so doing, reference will be made as well to the cases published in my former paper, as to those which are appended to the present. And, bearing in mind the comparative novelty of the subject, it has appeared to me more desirable to state, briefly but accurately, the particulars rather than the general results of the dissections; that the very interesting facts which they will be found to contain,

may serve as a basis on which to ground future researches.

It is worthy of observation, that though some of the persons from whom the specimens were taken, were known to have been afflicted with deafness during life, and others died of diseases which produced affections of the ear, yet the greater number, while living, were not supposed to be deaf.

This frequent occurrence of pathological conditions in the organs of persons not ordinarily esteemed to be deaf during life, loses some portion of its singularity when more closely investigated. Slight defects of hearing are so common as scarcely to excite even a passing observation, and more serious cases, from the very frequency of the disease,—perhaps the most common to which man is subject,—make but a slight impression. It may therefore be presumed that the ear is often in a pathological condition, though disease may not have proceeded so far as to produce such an extent of functional derangement as would cause serious inconvenience to the person affected, or reveal his infirmity to others.

As this paper is designed to treat principally of the pathological condition of the ear, it is not my intention to enter, at present, upon the causes of the great prevalence of deafness, nor to suggest the means which might be adopted for its prevention and cure. These important points I reserve for subsequent communications, with the simple expres-

sion of my conviction, that when we shall arrive at a more accurate appreciation of the causes of deafness, the means of alleviating or eradicating the disease will more readily suggest themselves, and aural surgery, freed from the uncertainties which now beset it, will yield to no branch of professional investigation either in interest or importance.

On Inflammation of the Mucous Membrane lining the Cavity of the Tympanum.

The tympanic cavity is lined throughout by a fine membrane, forming externally the interior layer of the membrana tympani; from which it can sometimes be detached without much difficulty.* In this situation it also serves as a partial investment to the chorda tympani nerve, and as a tubular sheath to the tendon of the tensor tympani muscle. Internally it covers the surface of the promontory and the membrana propria of the fenestra rotunda; passes on to the margin of the fenestra ovalis, where it is reflected on the surface of the stapes; and, lastly, surrounds the tendon of the stapedius muscle, and envelopes the ossicula auditus, with their connecting ligaments.

In the healthy state, this membrane is so remarkably thin and transparent, that its presence is not easily detected.† It is composed of extremely fine

* In Dissection No. 47, this mucous membrane was found entire after the complete destruction of the membrana tympani.

† For a detailed account of this membrane, see Dissections Nos. 1 & 2, Medico-Chirurgical Transactions, vol. xxiv.

and delicate fibres, and in structure exhibits strong analogy to the serous membranes. Over its surface extends a layer of very minute epithelial cells: these again are covered by others, which are flat, broad and elongated, terminating in a row of well-developed and firm ciliæ. The supply of blood-vessels is abundant; but they are so minute, and so rarely distended with blood, that, in the healthy state of the membrane, they are imperceptible. In disease, however, these vessels are very much dilated and surcharged with blood. In young persons the membrane is highly vascular, and when successfully injected, appears pervaded by plexiform ramifications.

Beneath the mucous membrane lie the ramifications of the tympanic nerve from the glosso-pharyngeal. In addition to the branches of this nerve, which have been described by Mr. Swan and Professor Arnold, I have been enabled, by the aid of the microscope, to detect numerous filaments, distributed to every part of the membranous lining of the internal wall of the tympanum; and their presence seems to offer a natural solution of the cause of the very acute pain which is experienced when there is inflammation of this structure.

In a healthy state, a small quantity only of mucus covers the surface of the tympanic membrane: the constant motion of the ciliæ, already mentioned, tends no doubt to prevent its accumulation.

Inflammation of the mucous membrane of the tympanic cavity gives rise to various pathological

conditions, which it seems to me may be divided into three stages.

In the first stage the membrane retains its natural delicacy of structure, though its blood-vessels are considerably enlarged and contorted (Nos. LII. LIII. and LXIV.), and blood is effused into its substance, or more frequently at its attached surface (Nos. LXXVI. and LXXVII.). Blood has also been found between the membrane and the membrana propria of the fenestra rotunda (No. LXXXIX.), and in very acute cases lymph is effused over its free surface (Nos. LXXVIII. and LXXIX.). Instances of the presence of these conditions will be found detailed in the appended account of dissections.

The second stage is characterized by a variety of very important pathological phenomena; the principal of which are the following:—

1st. A very considerable thickening of the substance of the membrane, which is often pulpy and flocculent. In this state the tympanic plexus of nerves becomes concealed; the base and crura of the stapes are frequently entirely imbedded in it; while the fenestra rotunda appears only like a superficial depression in the swollen membrane. Occasionally there is also a collection of mucus.

2nd. Concretions of various kinds are visible on the surface of the thickened membrane. In some cases these have the consistence of cheese, and are analogous to tuberculous matter; in others they are fibro-calcareous, and exceedingly hard.

3rd. But by far the most frequent and peculiar characteristic of this second stage of the disease, is the formation of membranous bands between various parts of the tympanic cavity. These bands are at times so numerous as to occupy nearly the entire cavity (Nos. XLVIII. and XLIX.). They are found connecting the inner surface of the membrana tympani to the internal wall of the tympanum (Nos. LXIX. and LXXXIX.); to the stapes (Nos. XVI. and XCI.); and to the incus (No. XXXI.). They have also been detected between the malleus and the promontory (Nos. XXVIII. and LXVIII.); as well as between the incus, the walls of the tympanum and the sheath of the tensor tympani muscle (Nos. XIV. and XCVIII.): and they so connect various parts of the circumference of the fenestra rotunda, as to form a network over the membrana propria (Nos. LXXXVI. and LXXXVII.). But the place where these adhesions are most frequently visible, is between the crura of the stapes and the adjoining walls of the tympanic cavity: this, for example, was the case in twenty-four instances out of a hundred and twenty dissections—being a fifth of the number. In one dissection, the bands of adhesion were five in number; and in other instances they were so strong, that, in removing the stapes, the mucous membrane was torn from the surface of the promontory (No. LXXXVIII.). Sometimes, so broad and expanded have been these adhesive bands, as to have assumed the appearance of a membranous veil (Nos. LXX. and LXXI.).

They have also been known to contain blood and scrofulous matter (Nos. XXXVIII. XXXIX. LXVII. LXVIII. and LXIX.). In some examples the surface of the promontory is rough, and in two instances (Nos. XL. and XLI.) the membrane attached to the base of the stapes was ossified, and the anchylosis of the latter to the fenestra ovalis was complete.

It must appear obviously impossible, that many of the remarkable phenomena which have just been pointed out can be present, without the co-existence of functional derangement, more or less serious, in the organ of hearing. The thickening of the mucous membrane, and deposition of mucus, must necessarily interfere with the course of sonorous vibrations towards the membrane of the fenestra rotunda, and hinder the free action of the stapes.

The bands of adhesion connecting the stapes with the walls of the tympanum, cannot do otherwise than impede the natural movements of the former, which has very frequently been found so firmly attached to the fenestra ovalis, as to require considerable pressure with the scalpel to disengage it. Morgagni states, that he found the cavity of the tympanum intersected by numerous membranes, which impeded the movements of the ossicula;* and it appears highly probable, that these bands of adhesion produce irregular movements in the ossicula. I am inclined to ascribe deafness, and many

* Epist. Anatom. vi. § 4.

of the distressing symptoms that often accompany it, as noises like the rushing of waters, &c. &c., to the continued pressure exerted on the contents of the labyrinth by the stapes being drawn inwards, as a consequence of the formation and subsequent contraction of the adhesions. In this opinion I have been strengthened by the examination of living persons, having frequently observed, that where the membrana tympani has been removed by disease, or where the contents of the vestibule have not received any impression through the stapes (as in the instance of the latter bone being anchylosed), the patients have heard better than those where satisfactory evidence existed, that the disease consisted in the thickened and adherent state of the membrane under consideration.

Another effect resulting from the pathological conditions apparent in this stage of the disease, seems to be deserving of very attentive consideration. From the interesting researches of Dr. Wollaston,* and the more recent admirable and satisfactory experiments of Professor Müller on the Physiology of Hearing,† it would appear that too high a state of tension of the membrana tympani is an obstacle to the transmission of the sonorous vibrations to the internal ear.‡ In several of the

* Philosophical Transactions, 1820.

† Physiology, vol. ii. p. 1259.

‡ If the membrana tympani be rendered tense, either by forcing air into the tympanic cavity, or by exhausting it, a considerable degree of deafness will be produced.

dissections, it will be observed that the membrana tympani was bound to various parts of the tympanic cavity by firm bands of adhesion; that in others, the tendon of the muscle was surrounded by thick membrane, while occasionally both it and the substance of the tensor tympani muscle were atrophied. All these changes must most certainly exert an injurious influence upon the membrana tympani; and from them doubtless arise many of the phenomena observable in deafness.*

In the third stage of inflammation of the tympanic mucous membrane, it becomes ulcerated, the membrana tympani is destroyed, and the tensor tympani muscle atrophied. The ossicula auditus are diseased, and ultimately discharged from the ear, and the disease not unfrequently communicates itself to the tympanic walls, affecting also the brain and other important organs. Of this class of diseases I am about to treat at length in a separate communication.

Dissections illustrative of the First Stage of Inflammation of the Mucous Membrane of the Tympanic Cavity.

No. XLIV. From a man, æt. 40, who died from a fracture of the cranium, about twenty days after the accident.

The cavitas tympani.—The membrane lining this

* It is not improbable, that the ligaments of the articulations are, in some degree, affected by the inflammation of the membrane immediately surrounding them.

cavity is in an inflamed state; its vessels are distended with blood, so as to present the appearance of a ramification of red lines over its whole surface. The mucous membrane is thin and transparent.

Nos. LII. and LIII. From a man, æt. 45, who died of delirium tremens.

Right ear.—The meatus externus natural; mucous membrane and periosteum thin and healthy.

The membrana tympani.—Transparent and nowhere opaque. Neither this membrane nor the meatus presented the dull, white appearance, which is so frequently perceived in living persons afflicted with deafness. The short and long processes of the malleus were distinctly visible.

The cavitas tympani.—The mucous membrane was thin and delicate, presenting no bands of adhesion. It was very vascular, and the blood-vessels had a streaky character.

Left ear in a similar state to the right.

Nos. LIV. and LV. From a woman, æt. 20, who died of injury to the brain.

Right ear.—The meatus externus full of cerumen.

The membrana tympani healthy.

The cavitas tympani contained a large quantity of mucus, which was thick and very tenacious, and entirely concealed the fenestra rotunda. This mucus was composed of fine cells, very similar to those of the epithelium lining its cavity; but interspersed with a few larger masses, of a darker colour, round, and consisting of numerous granules. The mucous membrane itself was much inflamed, and numerous

blood-vessels intersected it with their ramifications. Fine bands of adhesion connected the ossicula together, and the latter to the walls of the cavity of the tympanum. A firm fold of membrane, of considerable thickness, passed from the circumference of the tympanum to the incus and malleus.

Left ear.—Healthy.

Nos. LXIV. and LXV.—*Right ear.*—The meatus and membrana tympani healthy.

The cavitas tympani presents tortuous vessels of a large size, which traverse the mucous membrane. The latter appears in other respects to be healthy.

Left ear.—Healthy.

Nos. LXXVI. and LXXVII.—From a man, æt. 45.

The right ear.—The meatus externus and membrana tympani healthy.

The cavitas tympani.—The membrane lining this cavity is very red, and thicker than natural. In some parts a sanguineous, serous fluid is effused into its substance; in others, it is found between the membrane and the walls of the tympanum. A large fold of membrane surrounds the heads of the malleus and incus.

Left ear.—The meatus externus and membrana tympani healthy.

The cavitas tympani.—The mucous membrane is thick and very vascular: blood is effused beneath it, and transparent lymph is diffused over some portion of the membrane, so that the stapes is scarcely perceptible. The presence of this lymph in the substance

of the membrane appears to be the cause of its thickened state. Fine threads of lymph connect the stapes with the membrana tympani. The membrane lining the mastoidal cells was very thick and vascular. Very vascular also was the membrane covering the ossicula; and the substance of the incus is penetrated with orifices as though it were worm-eaten.

Nos. LXXVIII. and LXXIX. From a woman, æt. 45, who died of an extensive burn over the body, face and head. The ears were also burnt, and the cuticle had desquamated from their surface.

Right ear.—The meatus externus.—The membrane was very vascular.

The membrana tympani is concave externally, quite firm and immovable, as if parched and contracted. It is thicker than natural, and presents a white fibrous aspect. Towards its superior and posterior part, the head of the stapes projected through a small round orifice.

The cavitas tympani was much diminished in size from the membrana tympani being drawn inwards; and its lining membrane was inflamed and thick, containing a quantity of opaque serous fluid. The membrana tympani was connected with the internal wall of the tympanum by a quantity of lymph which extended from the opening of the mastoidal cells posteriorly to the Eustachian tube, and filled the greater part of the tympanic cavity. Anteriorly this lymph entirely concealed the stapes, the head of which was found to extend, as already noticed, into an orifice of the membrana tympani. The

incus was separated from the malleus and stapes, and was free in the mastoidal cells. Several white spherical masses, of the size of a small pin's head, adhered to the mucous membrane, and were found to consist of fine globules of various dimensions, some of which floated in the serum.

Left ear.—The meatus externus is much inflamed.

The membrana tympani is of an opaque white; presents an orifice at the anterior part; is very concave externally, and evidently much drawn inwards.

The cavitas tympani is greatly contracted by the attachment of the membrana tympani to its internal wall, to the membrane of which, as well as to the stapes, which it conceals, it tenaciously adheres. The lining membrane is thick and very vascular, and a quantity of serous fluid and soft lymph are effused over its surface.

The Eustachian tube.—The mucous membrane is healthy to the extent of an inch from the cavity of the tympanum, where it reddens, and is filled by a clot of lymph.

Nos. LXXX. and LXXXI. From a man æt. 40.

Right ear.—Healthy: but the mucous membrane of the tympanic cavity is very vascular, and the vessels tortuous.

Left ear.—Healthy: except that a membranous adhesion connects the upper surface of the stapes with the tympanic wall.

The cavitas tympani.—The inferior osseous wall of the cavity is wanting, in this specimen, and ap-

pears never to have been developed. The origin of the internal jugular vein frequently corresponds with the inferior wall of the tympanum; but in this instance, the cavity of the tympanum is separated from that of the vein by the walls of the latter only, and the blood which it contains imparts a darker hue to the membrane occupying the lower wall of the tympanum.

No. LXXXIII. From a man æt. 48, who died of fever.

Right ear.—The blood-vessels of the tympanic cavity are very much enlarged and tortuous.

No. LXXXIX. From a man æt. 33, who died in fits, from the effects of a malignant tumour situated in the posterior part of the right lobe of the cerebrum.

Left ear.—The meatus externus and membrana tympani healthy.

The cavitas tympani.—The blood-vessels of the mucous membrane are ruptured in several places, and numerous particles of effused blood are visible beneath various parts of the membrane. There is effused blood also surrounding the base and crura of the stapes, and a further quantity is perceptible in the substance of a band of adhesion which connects the posterior crus of the stapes to the wall of the tympanum, as well as between the proper membrane of the fenestra rotunda and that of the cavity of the tympanum.

Nos. CI. and CII. From an adult man, who died of inflammation of the brain.

Right ear.—The meatus externus and membrana tympani are healthy.

The cavitas tympani.—The dura mater on the upper surface of the petrous portion is much inflamed, and the numerous blood-vessels are much distended. This vascularity extends from the dura mater into the substance of the bone, and thence into the membrane coating the cavity of the tympanum, the vessels of which are greatly enlarged, while beneath it, in places, there is an effusion of blood. The bands of adhesion connecting the membrana tympani with the surface of the promontory, and the stapes with the wall of the tympanum, are numerous and tough, though nearly transparent.

The Eustachian tube contains a quantity of thick but transparent mucus.

Left ear.—This presents the same appearances as the right. The meatus externus and the membrana tympani are perfectly healthy; the tympanic mucous membrane is permeated by numerous blood-vessels continuous with those of the bone and dura mater: small patches of blood are seen beneath it, and the adhesive bands are very numerous.

Nos. CIX. and CX. From a man æt. 50, who died with effusion of serum in the ventricles of the brain.

Right ear.—The cavitas tympani contains a considerable quantity of serum tinged with blood, and its lining membrane is thick, soft, and vascular. The bone has also a dark hue. That portion of the inferior wall which is formed by the upper surface

of the carotid canal is porous, and distinctly permeated by vessels from the carotid artery. On inspection of the carotid canal, its tympanic portion is perceived to be dark-coloured, porous, and having a slightly irregular surface.

Nos. CXIII. and CXIV. From a woman æt. 25.

The tympanic membrane was thick and vascular, and blood was effused into its substance.

Nos. CXVII. and CXVIII. From a young man æt. 20, who died of epilepsy. No disease was found in the brain, but the cranium was intensely hard.

Right ear.—The meatus externus healthy.

The membrani tympani is rather opaque, having an orifice at its centre of about half a line in diameter, the margins of which are much attenuated.

The cavitas tympani.—The mucous membrane is highly inflamed, its vessels gorged with blood, and a large quantity of pus covers the membrane at the lower part of the cavity, which corresponds to the fossa jugularis. The vessels proceeding from the internal carotid artery are very large, and surcharged with blood.

There is a thick band of adhesion, soft and vascular in its character, between the lower part of the stapes and the promontory.

Left ear.—The periosteum of the meatus, near to the membrana tympani, is highly vascular. The blood-vessels of the latter membrane are distended, and there is an orifice at the anterior and superior part, of about half a line in diameter. The membrane is thin and soft.

The cavitas tympani.—The lining membrane is very much inflamed, and adhesions surround the stapes, connecting its head with the membrana tympani. The lower osseous wall of the tympanic cavity is deficient in one place, so that the jugular vein is separated from the cavity merely by its own coats.

Dissections illustrative of the second stage of Inflammation of the Mucous Membrane of the Tympanic Cavity.

Nos. XLV. and XLVI. From a man æt. 60.

Right ear.—The meatus externus contains a considerable quantity of dark-coloured cerumen in contact with the membrana tympani.

The membrana tympani is healthy.

The cavitas tympani appears in a healthy condition: but the crura of the stapes would seem to have been fractured and subsequently re-united.

The Eustachian tube.—The mucous membrane is rather rough; and is lined with a white adhesive mucus.

Left ear.—The meatus externus is lined with a thick layer of white epithelium: and its periosteal coating is very thin.

The membrana tympani is healthy.

The cavitas tympani.—The membranous lining is rather thicker than natural, and somewhat pulpy.

No. XLVIII.—*Left ear.*—The meatus externus is healthy.

The membrana tympani is rather thicker than natural; and, towards the centre, there is an appear-

ance of redness, arising, most probably, from the presence of blood in the tympanic cavity.

The cavitas tympani contains a small quantity of secretion, dark in colour and nearly solid in consistence. The investing membrane is flocculent, and a considerable portion of the cavity is occupied by fine membranous expansions, by which the stapes is almost entirely concealed.

The Eustachian tube is healthy.

No. XLIX. From a man, æt. 50, who is said to have heard well during life. The right ear only could be obtained.

The meatus externus.—Lined by epithelium as far as the circumference of the membrana tympani. The investment of the meatus bordering on the latter is healthy.

The membrana tympani.—The only vestige of this membrane adheres to the inferior and posterior surface of the osseous ring; and consists of a narrow slip, about half a line in depth, white and opaque, having its free border smooth and defined. Owing to the entire disappearance of the membrane from the upper and anterior part of the tympanic ring, the epithelium of the meatus is here continuous with that of the cavity of the tympanum.

The cavitas tympani.—The investing membrane is very thick and white, and white masses of concrete epithelium fill its depressions. There was no appearance of any ossicle in the cavity; but at its inner wall an elevated portion of thickened white membrane was observed. This being carefully re-

moved, the long and short processes of the malleus, the long process of the incus, and the head of the stapes, were found to be closely compressed together, and surrounded by a cellulo-fibrous tissue, firmly connecting them to the circumference of the cavity. The head of the malleus and the body of the incus had been thrust upwards into the mastoidal cells; and were not visible till the latter were laid open. The stapes is completely surrounded by the cellulo-fibrous tissue.

The Eustachian tube is pervious, but contains a large quantity of mucus.

Nos. LVI. and LVII. From a man, æt. 40.

Right ear.—Healthy.

Left ear.—Adhesions between the stapes and the circumference of the tympanum. Mucous membrane very vascular and slightly thickened.

Nos. LVIII. and LIX.—*Right ear.*—Healthy: except some slight adhesions from the base of the stapes to the surrounding mucous membrane.

Left ear.—Healthy.

Nos. LX. and LXI. From an adult.

Right ear.—The meatus externus is healthy.

The membrana tympani has a dull leaden hue, and is externally more concave than is natural, while a thick opaque band, ¾ths of a line in breadth, is visible at its circumference.

The cavitas tympani is in a great measure occupied by a white, solid substance, which firmly adheres to the circumference of the membrana tympani, and projects from it to the internal wall of the

tympanic cavity, over which it is so abundant as completely to obstruct the view of the stapes. A firm band of this substance connects the central portion of the membrana tympani with the internal wall of the tympanum. In some parts this white substance has an elastic firmness, like cartilage; in others it is quite hard and calcareous: the latter is the case where it is adherent to the circumference of the membrana tympani. The mucous membrane of the tympanic cavity is thin and transparent; but the osseous surface of the promontory is rough. A large isolated portion of bone extensively occupies the mastoidal cells. The tendon of the tensor tympani muscle had been divided in its canal, to the circumference of which it was adherent. The hard mass found in the tympanic cavity consisted of a delicate membrane with dense calcareous granules dispersed through it, bearing a strong analogy to articular cartilage, when it has undergone calcareous degeneration.

The left ear.—The membrana tympani is somewhat opaque; but in other respects the organ appears to be healthy.

Nos. LXII. and LXIII.—*Right ear.*—The meatus externus contained a large quantity of thin epithelium.

The membrana tympani is rather thicker and more opaque than is natural.

The cavitas tympani contains a considerable quantity of thick mucus; and its lining membrane is opaque, white and thick.

Left ear.—Healthy.

Nos. LXVI. and LXVII. From a child, æt. 12 years, who died of tubercle of the cerebellum. The lungs and intestines were also tuberculous.

Right ear.—The meatus externus healthy.

The membrana tympani.—The upper half is so thin and transparent, that the stapes, promontory, and fenestra ovalis, are distinctly visible through it. The lower half is opaque. The superior border of the membrane is imperfectly connected with the osseous ring.

The cavitas tympani contained a quantity of translucent viscid mucus, which occupied a large extent of its cavity, especially at the upper part.* The mucous membrane is congested; its blood-vessels are very tortuous; it is thicker than natural, and somewhat pulpy. Large and numerous adhesive bands connected the cervix of the stapes with the upper wall, and its crura and base to the internal wall, of the tympanic cavity.

The Eustachian tube.—The mucous membrane is thick, pulpy and vascular.

* This mucus consisted of a transparent gelatinous fluid, through which were interspersed numerous rounded cells, composed of granules in a circular form In some of the cells the granules were very minute, in others their size was considerable. Not unfrequently a granule of much larger size than the rest seemed to serve as a nucleus. The granular components of these cells were strikingly analogous in their substance to a structural arrangement found in the tuberculous matter of the cerebellum and lungs.

Left ear.—The meatus and membrana tympani healthy.

The cavitas tympani contains a considerable quantity of mucus, similar in character to that of the right ear. The mucous membrane is thick, soft and vascular. A large fold of it connects the cervix of the stapes and the orbicular process of the incus to the upper and back part of the tympanic cavity. On the upper surface of the cervix of the stapes, and beneath the mucous membrane a small opaque mass was observed, having the appearance of tuberculous matter. When subjected to the microscope it was found to present granules, and cells composed of granules, similar to those in the mucus.

The Eustachian tube.—The mucous membrane was thickened, its blood-vessels congested, and within it was a large quantity of mucus.

Nos. LXVIII. and LXIX. From a young woman who died of tuberculous disease.

Right ear.—The meatus externus healthy.

The membrana tympani is rather hazy.

The cavitas tympani contains a large quantity of thick granulated mucus. The mucous membrane was thick, and almost concealed the stapes. A firm band of adhesion, of considerable dimensions, passed from the extremity of the malleus to the internal wall of the tympanic cavity. This adhesive band was observed to enclose a white opaque matter. The mucous membrane was very congested.

The Eustachian tube appeared to be healthy, with

the exception of its tympanic orifice; at which point the mucous membrane was much congested.

Left ear.—The meatus externus is healthy.

The membrana tympani is rather dull.

The cavitas tympani is much diminished in size by the adhesions which pass between the membrana tympani and the inner wall of the tympanum. These adhesive bands are firm and broad, and in several places patches of white tuberculous matter are discernible beneath the mucous membrane.

Nos. LXX. and LXXI. From a man, æt. 45, who died of dropsy and effusion on the brain, resulting from renal disease. His urine was albuminous for a long period previous to death.

Right ear.—The meatus externus and membrana tympani had been accidentally removed.

The cavitas tympani.—The mucous membrane was rather thick and soft; and that portion of it which, in a healthy organ, is inflected over the external surface of the membrana fenestræ rotundæ, formed here a broad lamella, extending from the anterior surface of the promontory to the mastoidal cells, and effectually concealing the fenestra rotunda. This membranous veil is attached superiorly to the posterior crus of the stapes, and partakes of the movements of that bone. Another membranous band connects the anterior crus of the stapes with the tendon of the tensor tympani muscle.

The Eustachian tube is healthy.

Left ear.—The meatus externus and membrana tympani are healthy.

The cavitas tympani.—The mucous membrane is slightly thicker than natural. A membranous veil, similar to that of the right ear, passes from the inferior surface of the crura of the stapes, where they join its neck, to the lower part of the tympanic cavity; fine bands of adhesion connect the upper surface of the tympanum; and the mucous membrane which lines the mastoidal cells, is gathered into a number of fine fibres like a spider's web.

The Eustachian tube.—The mucous membrane is softer and more lax than natural.

Nos. LXXXVI. and LXXXVII. From an adult.

Healthy: except that in the right ear fine adhesions pass from different parts of the circumference of the fenestra rotunda, so as to form a network over its surface.

No. LXXXVIII. From a man, æt. 33, who died in fits, from the effects of a malignant tumour situated in the posterior part of the right lobe of the cerebrum.

Right ear.—The meatus externus contained a considerable quantity of hardened cerumen.

The membrana tympani is healthy.

The cavitas tympani.—The mucous membrane appears white and somewhat thickened. The upper surface of the posterior crus of the stapes is almost in contact with the wall of the tympanum, to which

it is attached by a short thick band of adhesion,* which prevents the descent of the former bone.

No. XC. From an adult.

Left ear.—The meatus externus and membrana tympani perfectly healthy.

The cavitas tympani.—The mucous membrane is vascular, and presents numerous bands of adhesion, connecting the membrana tympani with the internal wall of the cavity, and the chorda tympani nerve with the long process of the incus.

The Eustachian tube is five or six times its natural size, and near the cavity of the tympanum the bone is rendered rough by the presence of fine osseous spiculæ, which however are covered by the mucous membrane, and appear to be an original conformation. Within about two lines of the cavity of the tympanum the Eustachian tube is so dilated, that its upper wall projects towards the cavity of the carotid canal, from which it is separated merely by a delicate layer of bone.†

Nos. XCI. and XCII.—*Right ear.*—Healthy, with the exception of a band of adhesion connecting the internal surface of the membrana tympani and the chorda tympani nerve with the neck of the stapes. The latter bone was very firmly fixed in the fenestra ovalis.

* This band was so firm that upon removing the stapes, the membrane which covered the latter was lacerated and remains continuous with the adhesion.

† This specimen is now in the museum of St. George's Hospital.

Left ear.—Healthy.

Nos. XCIII. and XCIV. From a man, æt. 26, who died of consumption. He had scrofulous glands in the neck.

Right ear.—The meatus externus and membrana tympani have been removed.

The cavitas tympani.—The lining membrane is thick and white, and covered by a thick tenacious mucus which completely chokes up the fossa of the fenestra rotunda, and surrounds the base of the stapes. The mastoid cells are also filled with this nearly solid mucus, intermixed with oleaginous globules.

Left ear.—The meatus externus is healthy.

The membrana tympani is vascular and rather clouded, and presents two white bone-like patches, of which the one situated at its upper and anterior part is a line in length and half a line in breadth, while the other, at its posterior part, is two lines in length and one in breadth. These white patches are hard and friable, being apparently composed of fine calcareous granules.

The cavitas tympani contained a quantity of pus-like matter, which on being subjected to examination by the microscope presented characteristics analogous to those of tubercle, and the scrofulous matter of the enlarged gland in the neck. The lining membrane is very vascular and soft, and so is that of the Eustachian tube.

Nos. XCV. and XCVI. From a boy, æt. 10, who died of low fever.

Right ear.—The tympanic mucous membrane is slightly thickened, and the surface of the promontory is rough and cellular.

Left ear.—Adhesions connect the stapes to the circumference of the fenestra ovalis, and the surface of the promontory presents several ridges.

Nos. XCVII. and XCVIII. From a man, æt. 40, who died of a diseased heart. A large quantity of serum was found in the sac of the arachnoid.

Right ear.—The meatus externus and membrana tympani very vascular.

The cavitas tympani.—A broad fold connects the inferior surface of the stapes to the adjoining wall of the tympanum.

The Eustachian tube.—Its cartilaginous extremity has a worm-eaten appearance.

Left ear.—Healthy, excepting the presence of a band of adhesion in the cavity of the tympanum, connecting the long process of the incus with the sheath of the tendon of the tensor tympani muscle.

Nos. XCIX. and C. From a man æt. 40.

Right ear.—The cavitas tympani. The mucous membrane was thick, soft, and vascular. The fenestra rotunda is remarkably large.

Left ear.—The membrana tympani around the point of attachment of the malleus, is quite white and opaque. At the anterior and inferior part is an oval spot, about a line in length, and half a line in breadth, which is white and hard to the touch, like

bone.* The rest of the membrane is of a leaden hue.

The cavitas tympani, at its upper part, is completely filled with a mass of calcareous and fibrous matter, exactly similar to that described in Dissection No. LX. The incus appears to have degenerated into this substance, and the stapes is buried in it. It adheres externally to the membrana tympani, and internally to the surface of the promontory, to which it forms a dense coating, and from which it is not to be separated without the exertion of considerable force. The tensor tympani muscle is atrophied, and appears of less than half its usual size; a condition to which it has probably been reduced by the immoveable state of the malleus and membrana tympani.

Nos. CIII. and CIV. From a man æt. 40.

Right ear.—A thick band of adhesion connects the long process of the incus to the membrana and chorda tympani. It is fibrous in structure, and very vascular.

Left ear.—In the same state.

No. CVIII.—*Left ear.*—Healthy; with the exception of the presence of bands of adhesion, completely surrounding the crura and base of the stapes, and connecting them with the adjoining tympanic wall. In both specimens the membranous labyrinth appears to be much atrophied.

* This substance, and that described in Dissection No. LX. have great similarity to the hard deposit in the tunics of arteries.

No. CX.—*Left ear.*—The cavitas tympani. The mucous membrane is thin; but innumerable bands of adhesion connect the membrana tympani and ossicula with the walls of the tympanum.

Nos. CXI. and CXII. From a man æt. 80, who died of inflammation of the lungs. Tubercles were found in the lungs and in the kidneys.

Right ear.—The meatus externus.—The periosteum of the posterior and exterior part was inflamed, and the orifices for blood-vessels were large.

The cavitas tympani.—The mucous membrane is thick and vascular, and a thick membranous band, of a line in diameter, and almost as firm as the membrana tympani itself, connects the latter with the promontory.

Left ear.—The meatus externus is healthy.

The membrana tympani is slightly atrophied.

The cavitas tympani.—The mucous membrane is slightly thickened. A broad fold of membrane connects the tendon of the tensor tympani muscle with the anterior crus of the stapes, while a second fold proceeds from the promontory to the inferior surface of the crura of the stapes. Bands of adhesion also link the membrana tympani and incus to the inner wall of the tympanum.

Nos. CXV. and CXVI. From a man æt. 40, who died of consumption.

Right ear.—The meatus externus contained a large collection of cerumen.

The membrana tympani.—The long process of the incus is firmly attached to this membrane by a band

of adhesion. A thick membranous layer conjoins the under surface of the stapes with the surface of the promontory.

The cavitas tympani.—The mucous membrane is thick, and very vascular; and the layer of bone dividing the tympanic cavity from the carotid canal, is dark and full of blood.

Left ear.—The meatus externus full of cerumen, by which the membrana tympani is discoloured. A strong band of adhesion connects the membrana tympani with the long process of the incus, and the stapes is bound to the surface of the promontory by a thick membranous veil.*

Nos. CXIX. and CXX. From a boy æt. 12, who died of disease of the heart.

Right ear.—The membrana tympani presents an orifice of about two lines in diameter at its anterior and upper region. The greater part of the remaining portion is converted into bony laminæ, as in the two other specimens already described.

The cavitas tympani.—The lining membrane is thick and red, and presents a number of fine vascular adhesions, one of which, nearly a line in depth, connects the malleus and inner surface of the membrana tympani to the promontory, and draws the two almost into contact with each other.

Left ear.—The membrana tympani is opaque.

The cavitas tympani.—The lining membrane is

* It is interesting to observe the remarkable symmetry in the diseased appearances of the two ears.

thick, soft, and very vascular, presenting numerous bands of adhesions, connecting the stapes with the surrounding membrane, and entirely concealing its base. Some of these bands, which fill the intercrural space of the stapes, contain tuberculous matter.

Dissections illustrative of the Third Stage of Inflammation of the Mucous Membrane of the Tympanic Cavity.

Nos. XLVII.* and XLVIII. From a woman æt. 36, who died of dropsy. She was very deaf of both ears, but could hear when spoken to very loudly. No discharge perceived.

Right ear.—The meatus externus contained no cerumen. The glandular integument is white, smooth, and shining, and lined with a slight quantity of discharge. The internal periosteal layer is thicker than natural, white, and rather soft; and is covered, at the floor of the meatus, close to the membrana tympani, by a mass of epithelium and coagulated blood.

The membrana tympani is entirely destroyed, except a small semilunar-shaped remnant, about half a line in depth, adhering to the inferior margin of the meatus.

The cavitas tympani.—This cavity does not communicate with the meatus externus; for the mucous

* For the account of Dissection XLVII. see those illustrative of the second stage of the disease.

membrane lining the internal surface of the membrana tympani remains entire. It is very soft and transparent, and having lost the support of the membrana tympani, it now covers that portion of the mucous membrane which lines the internal wall of the cavity of the tympanum; between the two portions, however, a small quantity of mucus is interposed. The incus, and the head of the malleus have disappeared, and their place is supplied by a soft, white membrane, a fold of which maintains the cervix of the malleus in its position, and connects it to the circumference of the tympanic cavity. The mucous membrane lining the internal wall of the latter, is rather thick and opaque; but still the nervous plexus can be discerned through it.

The Eustachian tube is healthy.

Nos. LXXII. and LXXIII. From a man æt. 50, who was stated to be deaf of the left ear.

Right ear.—The meatus externus contained a large quantity of thick purulent matter.

The membrana tympani had entirely disappeared.

The cavitas tympani enclosed much purulent matter, and the mucous membrane was soft and pulpy, so that the internal wall and the stapes were completely concealed. The malleus had disappeared, and the incus was separated from the stapes. The tendon of the stapedius muscle was soft and easily lacerated, and the tensor tympani muscle was much atrophied, while its tendon was pulpy.

The Eustachian tube was in the same state as that of the left ear.

Left ear.—The meatus externus contained no cerumen; and its fibro-mucous membrane is soft and friable.

The membrana tympani was covered with a brown coloured matter, of the consistence of cream, apparently consisting principally of pus, which, being cleared away, disclosed a large orifice in the situation of the anterior and upper part of the membrana tympani. The long and short processes of the malleus were exposed, together with the chorda tympani nerve; the surface of the former being somewhat rough. The lower half of the membrana tympani is thin.

The cavitas tympani contained a large quantity of purulent fluid, and its mucous membrane was dark and quite pulpy, so as to prevent the stapes and the internal wall of the cavity from being perceived. The external surface of the long process of the incus was rough. The tensor tympani muscle was wasted to one half its usual size, and the tendon, at the point of attachment to the malleus, was soft and easily lacerated.

The Eustachian tube.—The mucous membrane was slightly thicker than natural towards its faucial orifice, and towards the tympanum it was soft.

Nos. CVII. and CVIII. From an old man who was very deaf, and who died of gangrena senilis.

Right ear.—The meatus externus and membrana tympani healthy.

The cavitas tympani is very large, and the lining membrane, which is dark in colour, contains thin

purulent matter. The tendon of the tensor tympani muscle is very soft, and disconnected from the malleus.

The following is a tabular view of the state of the mucous membrane of the tympanic cavity, in the 120 dissections related in the present and former papers.

A. *In the First Stage of Inflammation.*

1	With simple inflammation of the mucous membrane; its vessels being enlarged, tortuous, and distended with blood (44, 52, 53, 64, 80, 81, 83, 113, 114, 118) .	10
2	Ditto with an accumulation of mucus (54)	1
3	Membrane inflamed, with effusion of blood into its substance (89, 101, 102) . .	3
4	Membrane inflamed, with effusion of serum tinged with blood into the tympanic cavity (109)	1
5	Membrane inflamed, with lymph effused into the tympanic cavity (78, 79) . . .	2
6	Membrane inflamed, with blood and lymph effused into the tympanic cavity (76, 77)	2
7	Membrane inflamed, with effusion of pus into the tympanic cavity (117) . .	1

B. *In the Second Stage of Inflammation.*

1	With simple thickening of the lining membrane of the tympanic cavity (29, 62, 93, 94, 99)	5

2	The membrane thick and pulpy (45, 46) .	2
3	The membrane thick and flocculent (13) .	1
4	Ditto, and the cavity full of bands of adhesion (48)	1
5	Membranous bands connecting the membrana tympani to the inner wall of the tympanum (89, 101, 102, 110, 112) .	5
6	Membranous bands connecting the membrana tympani to the promontory and the chorda tympani to the stapes (90) .	1
7	Membranous bands connecting the membrana tympani to the incus (116) . .	1
8	Ditto connecting the membrana tympani to the stapes (16, 118)	2
9	Ditto connecting the membrana and chorda tympani nerve to the stapes (91) . .	1
10	Ditto connecting the membrana tympani and malleus to the promontory (119) .	1
11	Ditto connecting the membrana and chorda tympani to the incus (103, 104) . .	2
12	Ditto connecting the membrana tympani and ossicles to the inner wall of the tympanum (110)	1
13	Ditto connecting the malleus to the inner wall of the tympanum (28, 68) . .	2
14	Ditto connecting the incus to the inner wall of the tympanum (14)	1
15	Ditto connecting the stapes with the promontory (15, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 30, 32, 35, 36, 37, 57, 58, 66, 88, 108, 115, 117, 120) . . .	24

16 Anchylosis of the stapes to the fenestra ovalis (40, 41) 2
17 Membranous bands forming a network over the fenestra rotunda (86, 87) . . 2
18 A broad membrane passing from the promontory to the mastoid cells (70, 71) . 2
19 The cavity of the tympanum full of bands of adhesion (49) 1
20 Membranous bands containing scrofulous matter (67, 68, 69) 3
21 The cavity of the tympanum full of calcareous concretion (10, 11, 60, 100) . 4
22 Ditto full of caseous concretion (30, 39) . 2
23 With ridges of the bone projecting from the surface of the promontory (95, 96) . 2

C. *In the Third Stage of Inflammation.*

1 With ulceration and thickening of the mucous membrane attended by the formation of pus (33, 34, 107) . . . 3
2 With ulceration of the membrane and loss of one or more of the ossicula (47, 72, 73) 3

It thus appears that of the 120 dissections there were:—

20 Ears in the first stage of inflammation of the tympanic cavity.
65 Ditto in the second stage.
6 Ditto in the third stage.
29 Ditto in a healthy state.

I have much pleasure in expressing my thanks to the numerous friends, who have so materially assisted me, in obtaining the specimens necessary to the pursuit of this subject. I shall always be happy to show the preparations which form the groundwork of this paper to any members of the profession, to whom I again take the opportunity of stating, I shall feel much indebted for every opportunity they can afford me of dissecting the organ of hearing, especially when it is diseased.

12, Argyll Place, St. James's,
May 1843.