# SOCIETIES' PROCEEDINGS

## ROYAL SOCIETY OF MEDICINE—SECTION OF OTOLOGY

### December 6th, 1935

*President*—HAROLD KISCH, F.R.C.S.

### CASES

**Mastoid Fistula treated by Insertion of Temporal Muscle Graft.**—HAROLD KISCH.

D.B., a boy, aged 9 years, was admitted to hospital 15.10.35 with a large left mastoid fistula. A mastoid operation had been performed three years previously, and the mastoid re-opened eighteen months ago. There was no discharge from the meatus, but a slight one from the fistula. The operation was performed on 22.10.35, and healing took place by first intention.

**Bilateral Retro-auricular Fistula.**—MAURICE SORSBY.

W.S., a boy, aged 9 years, came under my care on account of discharging retro-auricular fistulae three months ago. There is a history of a number of operations :

He was admitted to St. Andrew's Hospital on *January 4th*, 1932, suffering from left acute otitis media. A paracentesis was performed the same day, and a cortical mastoid operation three weeks later. One week after the operation the patient developed measles and was transferred to the Eastern Hospital.

On *February 22nd*, 1932, a right cortical mastoid operation was performed. Both ears kept on discharging for several months, in spite of treatment. On *September 27th*, 1932, the patient was admitted to Downs Hospital, where he remained for eighteen months. During that time he underwent three operations on the left ear and two on the right ear. There are now two large retro-auricular fistulae which are discharging pus.

**Retro-auricular Fistula.**—MAURICE SORSBY.

M.C., a girl, aged 9 years, came under my care five months ago on account of a right retro-auricular fistula, giving the following history :



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# Royal Society of Medicine

In *February*, 1932, acute otitis media developed in the right ear. Paracentesis was performed, followed by a cortical mastoid operation at the Prince of Wales Hospital two weeks later.

In *June*, 1932, a swelling behind the right ear appeared, which was operated on at Hackney Hospital. A month later another operation was carried out on the same ear. There is now a large retro-auricular fistula discharging pus.

### Discussion.

Mr. C. Hamblen Thomas said that when he thought an active healing reaction unlikely in these cases, he performed a Küster operation, making a funnel drainage opening through the posterior meatal wall, and sewing up the incision behind the pinna. In old cases with persistent fistula he removed the scar tissue so as to get fresh edges, undercut the skin and joined it behind the pinna. At the same time he made a drainage opening through the posterior meatal wall.

Mr. F. C. Ormerod said that he had used the temporal muscle graft many times for retro-auricular fistula. After such treatment there was usually complete healing by first intention. He suggested that in Mr. Sorsby's cases something of the kind should be done.

Mr. Holt Diggle said that many cases of persistent fistula, often with a dry middle ear and perfect hearing, were due to tubal otorrhœa. If the cavity was filled with fluid, and the patient was asked to perform a negative Valsalva, the reservoir would be emptied into the naso-pharynx.

Mr. A. Lowndes Yates said that he had followed up a series of cases of these fistulae, and found that the incision had been made rather far forward, so that it was actually over the mastoid cavity. In all the cases in which the fistulae did not develop the incision had been made much farther back, and also higher. It seemed that if the incision was made far back it tended to prevent the formation of a fistula, as a flap of dimensions sufficient to reach to healthy bone allowed the wound to heal more readily and securely.

Mr. E. H. Richards said that during eight years he had not seen such a case. In acute mastoid cases he placed the incision mostly within the hair margin, so as to prevent the skin incision overlying the possible mastoid cavity.

Mr. Sydney Scott said that there appeared to be two classes of case for discussion: the retro-auricular fistula intentionally maintained by gauze packing, and the second class, due to failure of union with sutures, and breaking down of the post-aural wound. The latter comprised acute cases of mastoiditis after Schwartze's operation, generally infants with impoverished tissues. He preserved the meatus when he could, and when the reparative operation was undertaken he would prefer to undercut the skin freely and close the wound with a double blanket suture, providing tube-drainage, rather than follow Küster's method in this kind of case.

Mr. Leslie Powell said that he always made a forward incision in the mastoid in his cases, and he did not see these fistulae afterwards,



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therefore he did not think the position of the incision could account for the fistulae. He used a tube for drainage, but he removed it early.

Mr. SORSBY (in reply) said he doubted whether the opinion as to the site of the incision being a factor in the development of retro-auricular fistulae was valid. He had the good fortune of collaborating with the President who placed his incision relatively far back, but another colleague of his—Mr. Buckland Jones—always made the incision near the auricle, and he was satisfied that neither technique was responsible for the fistula.

**Apparently Complete Loss of Bone-Conduction in the presence of Fair Hearing by Air-Conduction.**

—W. STIRK ADAMS.

G.W., a woman, aged 26. There is total loss of hearing and vestibular reaction on the left side. On the right side, the patient says she is unable to hear any tuning-fork below C. 256 by bone-conduction, while for air-conduction she has a considerable degree of hearing throughout the tone-scale.

The symptoms date from a severe illness at the age of 11, when she lost her hearing totally during one night; the following day the right ear recovered, but the left has never recovered its hearing.

The complete absence of bone-conduction in the presence of a fair degree of air-conduction for the same tuning-forks, subjects present theories of hearing to a very severe test.

DISCUSSION.

Mr. A. LOWNDES YATES said that he had performed a differential test on this patient. She said she heard the fork of 256 DV well, opposite the auditory meatus. He then performed the differential test, placing one fork on the bone so that the patient heard by bone-conduction and the other opposite the meatus, so that she heard this by air-conduction when both were vibrating. He stopped the vibration of the one opposite the auditory meatus without her knowledge and she said she could still hear it well. She had denied hearing the fork by bone-conduction but did so if she thought she was hearing it by air-conduction. He therefore wondered whether there was a hysterical factor in the case. Possibly Mr. Stirk Adams had performed the same tests and had come to a similar conclusion. She later said that she noticed a difference between sound communicated by air and sound transmitted by bone.

The PRESIDENT asked whether, on the night of the attack which had resulted in complete left-ear deafness, there had been any vertigo. He asked this because it was possible that there had been some labyrinthine effusion. In the cases of sudden deafness resulting from labyrinthitis which he had seen, there was always a history of severe vertigo, and this helped one's conclusion. As this patient was only 11 years old at the time of the attack she might have forgotten.

Mr. F. C. ORMEROD said that he also had tested this patient; she did not seem to hear any of the forks available on the mastoid process, but she said she could feel the vibration. She seemed to be confused



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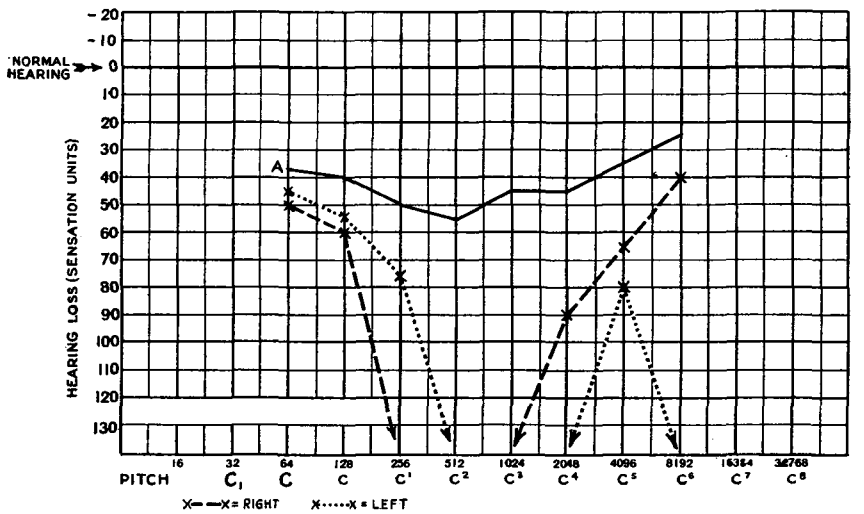
between sound and vibration. The history of the case reminded him of that of Helen Keller, who had become deaf and blind after meningitis at the age of 3 years. There might have been something in the nature of cerebrospinal meningitis which caused this marked nerve deafness. He knew of a case in which the patient was completely deaf after cerebrospinal meningitis, and later had become insane.

Mr. STIRK ADAMS (in reply) said he had not carried out the differential tests described by Mr. Lowndes Yates. He thought that the patient's statements were accurate, and had found no reason for suspecting a hysterical cause. On three separate occasions he had tested her hearing throughout the tone-scale with tuning forks. Her replies varied for the exact duration of the sound by air-conduction and for the upper tone limit, as found by the monochord. This variation was not of the order that would lead him to suspect simulation. Throughout she had always maintained that she heard nothing by bone-conduction on either side.

In reply to the President: The patient was certain that no vertigo had occurred in her illness of fifteen years previously.

POSTSCRIPT.—After the meeting the patient's hearing was charted by audiometer at the Ferens Institute (see charts).

CHART OF BONE-CONDUCTION, DECEMBER 6TH, 1935.




Line at " A " indicates reading of audiometer when testing a person of normal hearing with the D.80904 bone-conduction receiver.

Mr. R. J. Sullivan of the Ferens Institute reports:

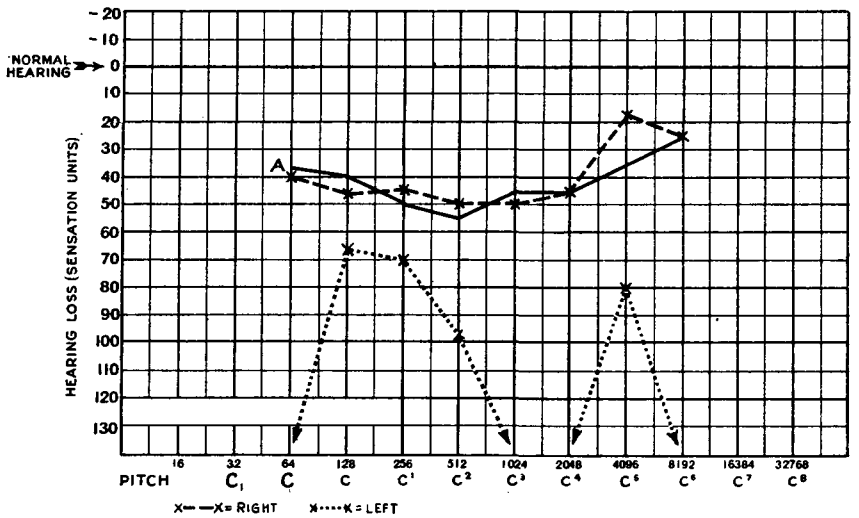
By air-conduction there is a loss for speech frequencies of 38·6 per cent. in the right ear. Loss for the left ear is complete. By bone-conduction there is an absence of hearing in the right ear at 256, 512, and 1024, in the left ear at 512, 1024, 2048 and 8192.



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With the noise-box at the right, her hearing ear, the bone-conduction readings from the left mastoid at C.64, 128, and 256, disappear. This would appear to indicate that the patient was feeling the vibrations with her fingers or in the skin over the mastoid, rather than hearing by bone-conduction. The reading at 4096 double vibrations for the left mastoid by bone-conduction persisted with the noise-box at the right ear. From the bone-conduction chart it is evident that by audiometer no bone-conduction was perceived by the patient on the right side at 256, 512 and 1024 double vibrations.

CHART OF AIR-CONDUCTION, DECEMBER 6TH, 1935.




Line at " A " indicates reading of audiometer when testing a person of normal hearing with the D.80904 bone-conduction receiver.

The fact that the patient recorded hearing by bone-conduction at C.64, C.128, C.2048, C.4096, and C.8192, would appear to show that her reliability as a witness is good and disposes of the suggestion of hysteria. Mr. Yates's test was carried out with the C.256 fork opposite the ear, and the C.512 fork on the mastoid.

## The Anatomy of the Middle Ear

By A. LOWNDES YATES

THE observations of which I am giving an account were made during micro-dissections of a number of decalcified temporal bones and by a study of photographs in which the structures are enlarged. The investigations were made possible by the courtesy of the directors



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of the Ferens Institute of Otology, who provided the material and laboratory accommodation. Although the observations were made on many points in each dissection, it is convenient to group them under the following headings as :

(1) The facial nerve. (2) The folds of the mucous membrane in the middle ear. (3) The ossicles and their suspensions and attachments. (4) The intrinsic muscles. (5) The Eustachian tube, the middle ear and the aditus, considered as one tract.

## The Facial Nerve

Plate I shows a temporal bone in which the external auditory meatus and outer surface of the mastoid process have been removed to display the tympanic membrane and the mastoid cells. The nerve demonstrated in the specimen showed an outward curve so that in making a straight cut through the bone it was divided twice, and the divided ends are seen in the specimen. In front of the tympanic membrane the corda tympani nerve is shown escaping from the Glaserian fissure.

Plate II shows the facial nerve dissected in another specimen. The apparent width of the nerve was about 3 mm., but on opening the sheath the nerve itself was found to be about 1 mm. in diameter. The sheath in this and other specimens is difficult to recognize, for it is closely incorporated with the bone and of a similar colour. The nerve itself is recognized more easily, but is adherent to its sheath and is easily torn across by undue traction on the sheath.

In Plate III the nerve has been exposed in its descending portion and it can be seen that the patches on the sheath have been torn away in removal of the overlying bone.

There are certain areas in which the nerve appears to be particularly liable to damage during operation on the mastoid.

(1) The nerve may be covered by bone less thick than normal in the following situations :

(*a*) In its course across the inner tympanic wall.

(*b*) At a point where it effects the turn from its horizontal (intratympanic) portion to its descending portion (Plate IV).

(*c*) In its descending portion in two situations. (i.) At a point behind the round window a prolongation of the cavity of the tympanum is often present. This may pass backwards so as to lie internal to the facial nerve. (ii.) In the sinus jugularis. The jugular bulb may be well developed and the nerve may make an outward bend, avoiding it, or may continue without bending, and in the latter case may lose its bony covering, being separated from the jugular bulb only by the periosteum.



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(2) The nerve, though covered with bone of normal thickness, may have a course which differs from that customarily described in textbooks of anatomy, as to the character and position of the bend between the horizontal (intratympanic) and the descending portion.

(*a*) The horizontal portion may be short and the bend take place in the middle ear. This is rare.

(*b*) The horizontal portion may be long and continue on into the aditus and reach nearly to the antrum before the bend occurs. In such a position it is more liable to accidental damage.

(*c*) The horizontal portion, on reaching the aditus, may bend outwards and then downwards, so that the nerve occupies a position more outward than the normal.

(3) The course of the descending portion of the nerve: This is generally represented by a straight line, but curvature of this part of its course is not uncommon and may expose the facial nerve to risk of injury at the time of operation.

The following curves have been observed:

(*a*) The descending portion of the nerve may form an outward bow so that a straight cut through the bow divides it twice, leaving an arc of nerve in the severed portion of the bone.

(*b*) A sudden backward inclination may be present in the lower portion of the nerve.

(*c*) A sudden outward inclination of the nerve may be present in its lower portion.

(*d*) The nerve may run in the sheath of the jugular bulb.

(4) The sheath of the nerve.

The nerve with its sheath is about 3 mm. wide, but on division of the sheath the nerve is seen to be about 1 mm. in diameter. The sheath is attached irregularly to the overlying bone in such a manner that the removal of this may tear the superficial layers of the sheath. The sheath also forms attachments to the nerve itself, and the traction on the sheath which results from rapid removal of the bone may damage the nerve by indirect traction. In one specimen it was possible to effect an indirect division of the nerve by traction made during dissections, but it has to be remembered that the bone has been decalcified by immersion in acid for long periods.

### The Folds of Mucous Membrane in the Middle Ear

In the investigations, special note was made of the following folds: The anterior and posterior folds of Tröltsch, the suspensory ligament of the malleus and incus, and the folds of the mucous membrane in relation to the stapes at the oval window. All folds



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consist of two layers of mucous membrane between which lie certain nerves and vessels.

The anterior fold of Tröltsch continues the mucous membrane of the roof of the Eustachian tube up to the tendon of the tensor tympani, which it ensheathes. It then continues backwards but behind the tendon, the same two layers of mucous membrane receiving the name of the posterior fold of Tröltsch. As this is traced backwards, it is seen to be attached in its forward part in a similar manner to the anterior fold of Tröltsch, namely on the inner side to the inner tympanic wall and on the outer side to the tympanic membrane. Shortly after leaving the tendon of the tensor tympani its inner edge becomes free and passes external to the descending process of the incus to regain attachment to the inner tympanic wall close to the origin of the tendon of the stapedius from the bone. The outer edge of the posterior fold is attached throughout its length to the tympanic membrane. The fold is variable in width and in the degree of its attachment to the inner tympanic wall and hence in different specimens the space between the unattached portion of the fold and the inner tympanic wall varies greatly in width. For this reason also the chorda tympani runs at a distance from the tympanic membrane, which varies a good deal in different middle ears. The anterior and posterior folds of Tröltsch, considered together, divide the cavity of the middle ear into an upper and lower portion which communicate at the space left between the free border of the posterior fold and the inner tympanic wall (Plates V, VI, VII, VIII, IX, XVII and XIX).

The suspensory ligament of the malleus : This ligament joins the head of the malleus to the roof of the attic. It varies in width in different specimens, being in some cases a thin narrow band, while in others it is represented by two thin bands and in others by a sheet of mucous membrane which extends obliquely across the head of the malleus and incus below, and above extends obliquely across the attic roof. The length of these folds also varies greatly, for in some cases the heads of the malleus and incus are almost in contact with the attic roof, while in others a considerable area intervenes (Plates VII, XIV and XVII). In certain specimens which were dissected the results of former inflammation in the middle ear were seen. In these, around the suspensory ligament of the malleus adhesions were often present and, in these specimens there was generally evidence of a healed perforation in Shrapnell's membrane (Plates X and XIII).

The folds of mucous membrane in connection with the oval window consist of two layers which rise from the margins of the window to join the crura of the stapes. They are variable in extent in different specimens and in those which showed evidence of former inflammation in the middle ear, they are much thickened and



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evidently tend to limit the movement of the stapes in the oval window (Plates X and XII).

In Plate VIII the method of insertion of the stapes in the oval window is shown and the utricle is seen in the vestibule, its relation to the footplate of the stapes being clearly seen.

### The Method of Suspension and Attachment of the Ossicles

Ths suspension of the malleus and incus to the attic roof is effected by means of the suspensory ligament which has already been described. The malleus and incus are suspended also by the anterior ligament of the malleus, but the attachment which appears to be of chief importance is that effected by the anterior ligament of the malleus in front and the ligaments which fix the tip of the posterior process of the incus to the sides of the aditus, for the part above this axis of suspension exactly counterbalances that below it. The wide fish-tail-shaped ligament which fixes the incus behind is shown in Plate XI.

### The Intrinsic Muscles

The method of insertion and the origins of the tensor tympani and stapedius are well described in textbooks of anatomy. In specimens which show the effects of inflammation in the middle ear the fixation—and probably prevention of some degree of the action—of these muscles by thickening of the mucous membrane which surrounds them is shown in Plates X and XII.

### The Eustachian Tube, the Middle Ear, and the Aditus considered as a Whole

The entry of the Eustachian tube is wide and the manner in which the mucous membrane of its roof is carried on to the tensor tympani by the anterior fold of Tröltsch has been described. From the Eustachian tube the middle ear expands into its lower compartment, which is limited above by the under surface of the folds of Tröltsch except at the opening between the inner margin of the posterior folds of Tröltsch and the mucous membrane covering the inner tympanic wall. The lower compartment of the middle ear communicates with the upper compartment through this opening; the size varies considerably in different specimens (Plates V, VI and XIX). The upper compartment of the middle ear extends from this opening in a forward direction; it is here divided into two portions, the internal and external, which communicate above. The external part is divided into an upper and lower compartment by the anterior ligament of the malleus (Plate XI) and by a fold of mucous membrane above this (Plate XVI). Between these two is Prussak's space



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(Plate XIV) which forms a forward prolongation of the upper compartment in the middle ear and which ends blindly, owing to the attachment of the anterior ligament of the malleus to the anterior fold of Tröltsch (Plates XI and XVI). The internal compartment of the upper portion of the middle ear is generally not divided (Plate XI) but occasionally a band of mucous membrane passes from the body of the malleus to join it to the inner tympanic wall (Plates XIII and XVII). Traced backwards, the upper compartment of the middle ear is seen to end blindly in its lower part, while its upper portion is prolonged through the aditus into the mastoid antrum (Plate XI). The aditus, when the incus is in place, forms a passage which is very variable in size and which is semilunar or triangular in section.

Points of importance in the anatomy of the middle ear are demonstrable in a series of specimens in which a temporal bone has been divided by sagittal section. Plate XV shows the most anterior of these sections; the Eustachian tube is seen entering the cavity of the middle ear, the cells in its floor being particularly marked; the processus cochleariformis is seen and beneath it is the belly of the tensor tympani, adjacent to which is the apex of the cochlea. It will be seen that the cells in the floor of the Eustachian tube are continuous with certain larger cells which abut on to the jugular bulb.

In Plate XVI Prussak's space is seen from in front, the boundaries of which are recognized with ease. The tendon of the tensor tympani and the manner in which this is attached to the anterior fold of Tröltsch are demonstrable. The chorda tympani nerve is seen winding round the inner surface of the body of the malleus. The malleus has been divided from the incus through the joint which intervenes between them.

In Plate XVII Prussak's space is open and inspected from behind; the chorda tympani nerve is visible in the posterior fold of Tröltsch, the sickle-like margin of which is easily recognizable. The stapes and the joint between it and the incus are well shown, as is the layer of mucous membrane covering the tendon of the stapedius.

In Plate XVIII the middle ear is seen through the aditus from behind, and the incus and its posterior ligaments are visible. The semi-circular canals and their relation to the aditus are also shown. The facial nerve is visible, and in this case makes a backward and outward turn in the lower portion of this part of its course.

In Plate XIX the middle ear is open from below, the floor having been removed. The tympanic membrane is shown in its entirety, and the folds of Tröltsch pass inwards from it, and the chorda tympani nerve is seen to lie close to the margin of the folds.

Plate XX shows the relations of the round window to the oval window; the bony covering of the facial nerve is also shown.



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## Key to Explanatory Diagrams. Plates I–XX

1. Tympanic membrane. 2. Malleus. 3. Incus. 4. Stapes. 5. Eustachian tube. 6. Inferior compartment of middle ear. 7. Superior compartment of middle ear. 8. Aditus. 9. Antrum. 10. External auditory meatus. 11. Internal auditory meatus. 12. Tendon of tensor tympani. 13. Tensor tympani muscle. 14. Tendon of stapedius. 15. External semi-circular canal. 16. Superior semi-circular canal. 17. Posterior semi-circular canal. 18. Common stem of posterior and superior canals. 19. Vestibule. 20. Cochlea. 21. Utricle. 22. Round window. 23. Oval window. 24. Facial nerve. 25. Auditory nerve. 26. Chorda tympani nerve. 27. Suspensory ligament of malleus. 28. Suspensory ligament of incus. 29. Anterior fold of Tröltsch. 30. Posterior fold of Tröltsch. 31. Lateral sinus. 32. Jugular bulb. 33. Posterior pouch of Tröltsch. 34. Adhesions. 35. Prussak's space. 36. Processus cochleariformis. 37. Posterior ligament of incus. × Mastoid cells.



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