

**Methods:** Mouse induced pluripotent stem cells (iPS) were used for generation of Cx26-expressing cells with proper gap junction plaque between the cells. Adeno associate virus (AAV) were used for the GJB2 gene transfer and restoration of GJP.

**Results:** By differentiation of iPS cells, we generated the Cx26-expressing cells with large gap junction plaque as cochlear cells. Cochlear delivery of Gjb2 using AAV significantly improved the auditory responses and development of the cochlear structure of Cx26f/tp0Cre mice (Iizuka, *Hum Mol Genet*, 2015, 24(13):3651–61).

**Conclusions:** Using cell therapy or gene therapy to restore hearing in the mouse models of Gjb2-related deafness may lead to the development of effective therapies for human hereditary deafness.

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### Genetics in Otolaryngology (R831)

**ID: 831.4**

#### Is Cholesteatoma heritable and how can we find the genes involved?

Presenting Author: **Mahmood Bhutta**

Mahmood Bhutta

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**Learning Objectives:** To review evidence that cholesteatoma is heritable, and to discuss methods that can be used to ascertain genetic pathways involved.

Abstract is for the round table on “Genetics in otology”

The aetiology of cholesteatoma remains elusive. Those with a history of chronic mucosal disease are susceptible, but only a few such individuals will develop cholesteatoma. What evidence is there that cholesteatoma is a heritable disorder, and what methods can we use to elucidate genetic susceptibility?

I will discuss evidence from a recent systematic review of the heritability and genetics of cholesteatoma. This evidence includes reports of familial clustering of disease, and family history in the Kibutz population of Israel. Presence of disease in certain syndromes, in particular congenital malformation syndromes of the head or ear, also suggests genetic pathways are perturbed in cholesteatoma, and that a relatively small number of loci may be relevant.

I will introduce the other speakers for this session, and outline epidemiological and laboratory methods that can be exploited to further research molecular and genetic pathways involved in cholesteatoma. I will discuss how the discovery of such pathways could lead to potential clinical benefit.

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### Free Papers (F832)

**ID: 832.1**

#### Anatomical understanding in canal wall down mastoidectomy using a medical image processing system – simulation and education of ear surgery

Presenting Author: **Kazunori Nishizaki**

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**Learning Objectives:** To understand surgical anatomy of the temporal bone using a medical imaging processing system.

**Introduction:** Although canal wall down mastoidectomy still plays an important role in treatment of cholesteatoma, the chance of performing this procedure appears to be decreasing by appropriate intervention for ear diseases that develop cholesteatoma. The decreasing chance to master this technique should be compensated by other methods. As one of the alternatives we introduce a simulation and education method of ear surgery using a medical image processing system.

**Methods:** Sagittal 2 and 3 dimensional reconstructive images (DRI) of the temporal bone CT scan are made for this purpose using a three-dimensional image analysis system volume analyzer (SYNAPSE VINCENT, Fuji Film Co, Tokyo, Japan).

**Results:** Sagittal 3DRIs introduced here show, in the order from lateral to medial, the antrum cavity, the prominence of the lateral semicircular canal, the incus body, the malleus head, the bridge being formed, the second genu of the facial nerve canal, the bridge resected at the level of the malleus neck, the mastoid segment of the facial nerve canal, the completely resected bridge, the lateral semicircular canal, and the completely opened facial recess. These images also show that the lateral wall of the attic has anterior-posterior and superior-inferior slants. 2DRIs parallel to the lateral wall of the attic show that the resection of the bridge parallel to the lateral wall is safe without risk of injury to the ossicles, the facial nerve, and the inner ear. However, sagittal 2 and 3DRIs should be evaluated for each patient due to individual differences in the temporal bone anatomy and bone structural changes affected by the disease.

**Discussion and Conclusions:** Since ear surgery usually progresses from lateral to medial, sagittal 2 and 3DRIs from lateral to medial simulate ear surgery including canal wall down mastoidectomy. Medical imaging processing systems are a useful and inexpensive tool to

understand complicated anatomy about ear surgery, especially for novice surgeons.

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## Free Papers (F832)

**ID: 832.2**

### Intraoperative Assessment of Ossicular Fixation

Presenting Author: **John Peacock**

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*Learning Objectives:* The middle ear ossicles can be driven with a coil and magnet and the tiny vibration amplitudes can be measured with a laser vibrometer. Some information on the degree of ossicular mobility can be extracted by measuring the velocity ratios between different measurement points.

*Introduction:* Pathologies such as otosclerosis and sequels of chronic otitis media may cause fixation of the middle ear ossicles, leading to hearing impairment. Knowledge of the degree of ossicular mobility is useful in order to determine the best course of surgical treatment. Routine assessment of mobility is often performed by manual palpation during surgical exploration, but this is subjective and imprecise, and a more objective method would be welcome.

*Methods:* A method was developed that makes use of a small magnet and coil to vibrate the ossicles in surgery after the tympanic membrane has been elevated. The method allows the ossicles to be driven at acoustic frequencies while simultaneously allowing free visual access for a laser vibrometer.

The method was evaluated with measurements on human temporal bones. Ossicular fixation was simulated by applying glass ionomer cement to the anterior malleolar ligament, and to the stapes footplate. Measurements were made of the vibration response of the umbo, the incus long process, and at points on the stapes, before and after artificial fixation.

*Results:* The velocity ratios between different measurement points varies with the severity of the fixation. In the unfixed state the velocity ratios remain fairly consistent between temporal bones, but with increased fixation of the footplate the ratios diverge further from the unfixed.

The ratio of stapes to umbo velocity decreases when the degree of fixation increases, and may reduce by as much 40 dB in case of complete footplate fixation.

*Conclusions:* It is possible to drive the ossicles with a magnet and coil and measure ossicular motion with a laser vibrometer. Information on the degree of ossicular fixation could be gathered by examining the velocity ratios between different points on the ossicular chain. Since the results can be

displayed immediately after the measurements, the method may even be used to assess the results of an intervention intraoperatively.

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## Free Papers (F832)

**ID: 832.3**

### Tympanoplasty: does dry or wet temporalis fascia graft matter?

Presenting Author: **Gautam Singh**

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*Learning Objectives:* To evaluate whether dry or wet temporalis fascia graft influences the outcome of tympanoplasty. Recent review of literature cites shrinkage of temporalis fascia graft as an important cause for failed tympanoplasty i.e. a dry graft rehydrates in the physiological environment of middle ear and shrinks. This might lead to alteration in the anatomical position of the placed graft, thereby surgical failure.

*Objective:* To evaluate the success rate of tympanoplasty type I by underlay technique using dry and wet temporalis fascia graft and to determine the role of fibroblasts.

*Study design:* A prospective, randomized study with control. Hundred adult cases of either sex of Chronic Suppurative Otitis Media-mucosal disease were divided into two groups of 50 each - Group A [underwent dry graft tympanoplasty] & Group B [underwent wet graft tympanoplasty]. Fibroblast count was also calculated in dry and wet grafts.

*Results:* An overall surgical success rate of 82% and 90% was observed in Group A and Group B respectively which was not found to be statistically significant. Further, a statistically significant high fibroblast count was observed in wet grafts, but it did not correlate with surgical success.

*Conclusions:* The nature of the graft, whether dry or wet does not influence the outcome of tympanoplasty type I.

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## Free Papers (F832)

**ID: 832.4**

### MRI evaluation of endolymphatic hydrops for middle ear surgery

Presenting Author: **Michihiko Sone**

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