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Cells in focus

# The auditory sensory epithelium: The instrument of sound perception

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**Abstract**

The auditory sensory epithelium is the specialized region of the cochlear epithelium that transduces sound. It is composed of a highly ordered, repeated array of mechanosensory hair cells and nonsensory supporting cells that run along the length of the cochlea. On the apical surface of the hair cells is a specialized structure called the hair bundle that deflects in response to sound vibration, resulting in depolarization of the hair cell and neurotransmitter release. Formation of the auditory sensory epithelium during embryogenesis involves strict control of both cell proliferation and cell patterning. Misregulation of these events can lead to congenital hearing loss, and damage to the auditory sensory epithelium during adult life can lead to adult-onset deafness. This paper reviews recent data on the formation of the auditory sensory epithelium during embryogenesis, the identification of components of the sound transduction apparatus, and advances in the treatment of hearing impairment.


**Cell facts**

- The auditory sensory epithelium is composed of a repeated array of mechanosensory hair cells and nonsensory supporting cells.
- The auditory sensory epithelium converts the mechanical motion of sound vibration into neuronal impulses.
- The mechanosensory cell is the hair cell which contains on its apical surface a hair bundle, a structure made up of multiple finger-like extensions called stereocilia that deflect in response to sound vibration. Deflection of the hair bundle towards the tallest row of stereocilia (excitatory direction) leads to depolarization of the hair cell and neurotransmitter release.
- Cells that comprise the auditory sensory epithelium exit mitosis prior to differentiation.
- Loss of function of the cells that comprise the auditory sensory epithelium can lead to deafness.

*Keywords:* Hearing; Inner ear; Cochlea; Organ of Corti; Auditory sensory epithelium

## 1. Introduction

In 1851, the Italian anatomist, Alfonso Giacomo Gaspare Corti, using improvements in the light microscope and in tissue fixation methods, first visualized cellular features in the auditory sensory epithelium, which

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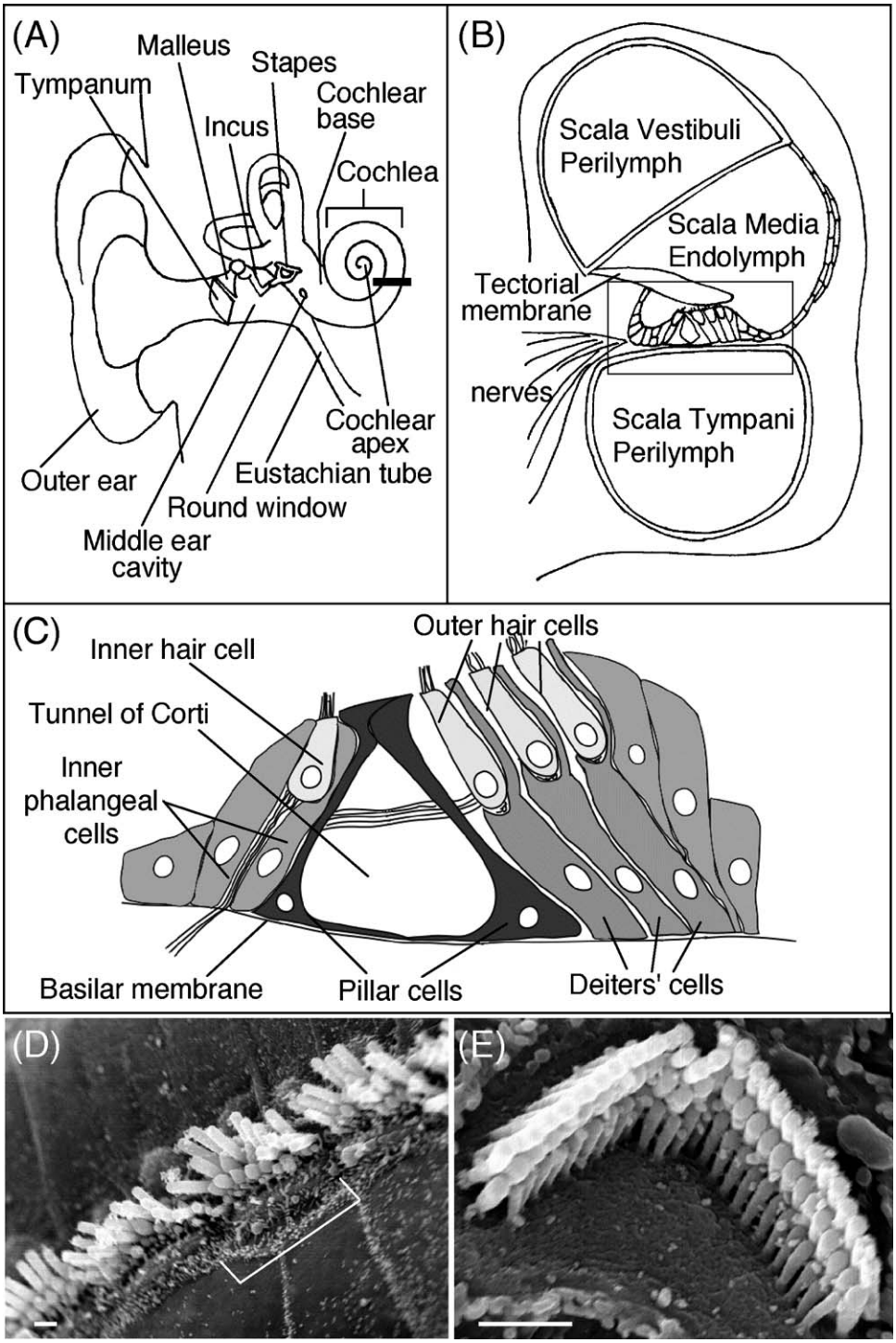


Fig. 1. Morphology and organization of the organ of Corti of the cochlea. (A) Diagram of the structure of the ear showing the external, middle and inner ear components. (B) Cross-section through the cochlea (thick line in (A)). The three fluid-filled (endolymphatic or perilymphatic fluid) compartments, scala vestibuli, scala media, and scala tympani are indicated. (C) Higher magnification diagram of the area boxed in (B) showing the cellular organization of the organ of Corti. (D) Scanning electron micrograph (SEM) showing the stereocilia of a row of inner hair cells. Bracket indicates the width of a single inner hair cell. (E) SEM of the stereocilia of a single outer hair cell. Scale bars in (D) and (E): 1 μm.