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**COURSE TITLE: HISTOLOGY OF SPECIAL SENSES AND NEUROHISTOLOGY**

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**ASSIGNMENT**

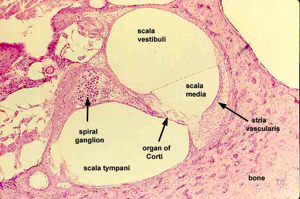
QUESTION

With the aid of a diagram, write an essay on the histology of an organ of Corti.

**DEFINITION**

### ORGAN OF CORTI

The organ of Corti is a specialized sensory epithelium that allows for the transduction of sound vibrations into neural signals. The organ of Corti itself is located on the basilar membrane. The organ of Corti rests on the basilar membrane and contains two types of hair cells: inner hair cells and outer hair cells. Inner hair cells transduce sound from vibrations to neural signals via the shearing action of their stereocilia. Outer hair cells serve a function as acoustic pre-amplifiers which improve frequency selectivity by allowing the organ of Corti to become attuned to specific frequencies, like those of speech or music. The fibrous tectorial membrane rests on top of the stereocilia or the outer hair cells. Mutations in a alpha-tectorin, which encodes a protein specific to the tectorial membrane, cause deafness.



The **cochlea** houses an elaborate configuration of [membranous labyrinth](" \l "memblab) and [hair cells](" \l "haircells), called the [organ of Corti](" \l "corti), designed for auditory reception.

The basic shape of the cochlea is that of a snail-shell, or tapering helix.

The human cochlea is short and broad; micrographs at this website (and in many other references) show the cochlea of a laboratory rodent which is proportionately taller and narrower.

The spiraling tunnel (**blue**, in image at right) that forms the cochlea of the [bony labyrinth](" \l "bonylab)is divided into **three distinct channels** by portions of the [membranous labyrinth](" \l "memblab) attached to bony ridges.  Each of these channels is called a "*scala*", meaning "ramp" or "incline" (think of a musical "scale").

* The **scala vestibuli** ascends from the [vestibule](" \l "vestibule) (hence *vestibuli*in the name) to the tip of the cochlea.
  + The scala vestibuli contains [perilymph](" \l "perilymph).
* The **scala tympani** descends from the tip of the cochlea to the round window.  (There is an elastic energy-dissipating membrane covering the round window (hence *tympani*in the name).
  + The scala tympani, like the scala vestibuli, contains [perilymph](" \l "perilymph).
  + At the tip of the cochlea, the scala vestibula and the scala tympani are connected through the *helicotrema*.
* The **scala media,**also called the *cochlear duct*, lies along the length of spiral cochlea, in a "medial" position between the scala vestibuli and scala tympani.
  + The scala media contains [endolymph](" \l "endolymph).
  + The [organ of Corti](" \l "corti) lies within the scala media.
  + The scala media is separated from the scala vestibuli by the very thin *Reissner's membrane*.
  + The scala media and the scala tympani are separated by the *basilar membrane*.   
    - **Clinical note:**  A [cochlear implant](http://www.nidcd.nih.gov/health/hearing/ear_coch_img.htm" \t "_blank) is inserted into the scala tympani, where it lies close to the organ of Corti and can artificially stimulate axons of the auditory nerve.

* The organ of Corti is contained within the [scala media](" \l "scalamedia).  
  + The organ of Corti is a long strip of tissue that extends the length of the [scala media](" \l "scalamedia), from the base of the [cochlea](" \l "cochlea) to its apex.
  + The organ of Corti is usually illustrated in cross-section.  Tissue sections of the [cochlea](" \l "cochlea) typically contain several appearances of the organ of Corti, as the organ is sliced in each turn of the helix.
* The fluid environment for the organ of Corti is [endolymph](" \l "endolymph), which fills the [scala media](" \l "scalamedia).  ([Endolymph](" \l "endolymph) is secreted by cells of the [stria vascularis](" \l "stria).)
* Within the complex strip of tissue that comprises the organ of Corti are specialized sensory [hair cells](" \l "haircells).   
  + The entire complex (the whole organ of Corti) rests on the *basilar membrane*.
  + This basilar membrane supports the basal ends of the [hair cells](" \l "haircells) in the organ of Corti.
  + The apical ends of [hair cells](" \l "haircells) touch the *tectorial membrane*, a "shelf" of jelly that is supported immovably on the [spiral lamina](" \l "spiralganglion).

When the *basilar membrane* flexes in respond to sound waves (i.e., pressure waves delivered to inner-ear fluid by the middle-ear ossicles), the organ of Corti, including its hair cells, also moves.

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The **scala media**, or cochlear duct, is located between scala tympani and scala vestibuli and it is filled with endolymph. This structure is delimited by the basilar membrane and Reissner’s membrane. The Organ of Corti covers the **basilar membrane** and it is under the **tectorial membrane**, an acellular gel into which hair cell stereocilia are immersed. The peripheral process of acoustic nerve fibers provides synaptic connections between hair cells and cochlear nucleus.  
The upper portion of the cochlear duct is formed by the stria vascularis, which contains numerous capillary loops and small blood vessels and produces endolymph.

Organ of Corti consists of different types of cells:

\*Inner hair cells

\*Outer hair cells

\*Supporting cells

Inner Hair Cell

These cells are specialized in the mechanoelectrical transduction. There are almost 3500 cells disposed in one line along all the basilar membrane. They are connected to type I neuron peripheral fibers of spiral ganglion, these connection are very divergent (10/1). The luminal part of the cell is immerged in endolymph, the basal one is immerged in normal extracellular fluid. The luminal portion is formed by bundles of stereocilia (inner-ear), whose tips are connected by filamentous structures called tip-links.

Outer Hair Cell

These cells are acoustical pre-amplifiers. They are almost 12000, disposed in three parallel lines. These cells are connected to type II amyelinic neurons, the connections are very convergent. They have also an afference from superior olivary nucleus. They have contractile activity.

Supporting Cells

These cells are of four different types: Corti pillars, Hensen cells, Deiters cells and Claudius cells.

