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ASSIGNMENT: With the aid of a diagram, write an essay on the histology of an 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 an alpha-tectorin, which encodes a protein specific to the tectorial membrane, cause deafness.

The organ of corti, is also known as the spiral organ and it is the receptor organ for hearing. It is located in the cochlea. This highly specialized epithelial cells allow for transduction of auditory signals into nerve impulses. Transduction occurs through vibrations of structures in the inner ear causing displacement of cochlear fluid and movement of hair cellsat the organ of Corti to produce electrochemical signals.

The organ of Corti is located in the sclera media of the cochlea of the inner ear between the vestibular duct and the tympanic duct and is composed of mechanosensory cells, known as hair cells. Strategically positioned on the basilar membrane of the organ of Corti are three rows of outer hair cells and one row of inner hair cells. Separating these hair cells are supporting cells: deiters cells, also called phalangeal cells which separate and support both the outer hair cells and the inner hair cells.

Projecting from the tops of the hair cells are tiny finger like projections called stereocilia, which are arranged in a graduated fashion with the shortest stereocilia on the outer rows and the longest in the center. This gradation is thought to be the most important anatomic feature of the organ of Corti because this allows the sensory cells superior tuning capability.

The organ of Corti is overlain by the gel-like tectorial membrane, produced and maintained by the columnar cells found atop the spiral limbus just medial to the organ of Corti. Only the stereocilia of the outer hair cells appear to be in contact with the tectorial membrane. Shearing movements between the basilar membrane with the sensory epithelium and the tectorial membrane cause receptor potentials to be produced in the hair cells, by means of deflections of their stereocilia.

The Inner hair cells are flask-shaped with a globular cell soma tapering into a thinner elongated neck. Their nucleus is rounded and located halfway along the length of the cells, so dividing them into two topographic domains. At the basal end are found synaptic contacts from afferent cochlear nerve fibers, hence this pole is also referred to as the neural pole. The neural pole receives about 90–95% of all afferent contacts with cochlear nerve fibers. The apical pole is characterized by a bundle of stereocilia in nearly straight rows and is synapse free. The Outer hair cells rest on the supporting cells (called Deiter’s cells) that comprise 75–80% of all hair cells. The Outer hair cells are cylindrically shaped and possess a large spherical nucleus located at the neural pole. Outer hair cells are characterized by having several cisterns of endoplasmic reticulum distinctly located under the cellular membrane in a laminar fashion extending from the nucleus up to the apical pole.

The most conspicuous supporting cells in the organ of Corti are the inner and outer pillar cells. They form the tunnel of Corti between the Inner hair cells and Outer hair cells. These cells rest upon the basilar membrane.

SUPPORTING CELLS OF THE ORGAN OF CORTI

Inner and outer pillar cells

Tall cells with wide bases and apical ends that are attached to basilar membrane

The central portions are deflected to form the walls of inner tunnel; apical portion contact each other.

Phalangeal cells

Outer phalangeal cells

Tall columnar cells that are attached to basilar membrane

Apical portions are cup-shaped to support the basilar portions of outer hair cells along with efferent and afferent nerve fibers

Do not reach the free surface of organ of corti

Space of Nuel: a fluid-filled gap around unsupported regions of the outer hair cells

Communicates with inner tunnel

Inner phalangeal cells

Located deep to the inner pillar cells

Completely surrounds the inner hair cells

Border cells

Delineate the inner border of the organ of Corti

Slender cells that support inner aspects of the organ of Corti

Cells of Hensen

Define the outer border

Located b/w outer phalangeal cells and cells of Claudius

FUNCTION OF THE ORGAN OF CORTI

The function of the organ of Corti is to change (transduce) auditory signals and minimize the hair cells’ extraction of sound energy. It is the auricle and middle ear that act as mechanical transformers and amplifiers so that the sound waves end up with amplitudes 22 times greater than when they entered the ear.

CLINICAL HISTOLOGY

Hearing loss: The organ of Corti can be damaged by excessive sound levels, leading tonoise induced impairment.

The most common kind of hearing impairment, [sensorineural hearing loss](https://en.wikipedia.org/wiki/Sensorineural_hearing_loss%22%20%5Co%20%22Sensorineural%20hearing%20loss), includes as one major cause the reduction of function in the organ of Corti. Specifically, the active amplification function of the [outer hair cells](https://en.wikipedia.org/wiki/Outer_hair_cell) is very sensitive to damage from exposure to trauma from overly-loud sounds or to certain [ototoxic](https://en.wikipedia.org/wiki/Ototoxicity%22%20%5Co%20%22Ototoxicity) drugs. Once outer hair cells are damaged, they do not regenerate, and the result is a loss of sensitivity and an abnormally large growth of loudness in the part of the spectrum that the damaged cells serve.