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

ANSWER: The organ of Corti is a long structure present in the cochlear duct. The organ of Corti has hair cells which are large areas of columnar sensory mechanoreceptors and are located in specialized regions of the epithelial lining. The organ of Corti is located at the vestibular membrane or the basal wall of cochlear duct. The vestibular membrane separates the scala tympani from the cochlear duct. The cochlear duct is present in the cochlear and the cochlear is for auditory functions. Cochlea has bony and membranous labyrinth. The cochlear is the bony labyrinth and the cochlear duct is the membranous labyrinth. Membranous labyrinth includes vestibular organs and cochlea. The cochlea is for sense of hearing. All regions of bony labyrinth are filled with perilymph and membranous labyrinth is filled with endolymph.

COCHLEAR DUCT AND SPIRAL ORGAN

Wedge-shaped duct of the membranous labyrinth suspended in the middle of the tubular, osseous cochlea. Position of the cochlear duct separates the bony cochlea into three subdivisions.

Scala vestibuli: This subdivision of the cochlea is continuous with the vestibule and lies above the cochlear duct, separated from it by the vestibular membrane.

Cochlear duct: Contains the receptor for sound. The cochlear duct is located in the middle of the cochlea and is continuous with the saccule through a small duct. Its roof is the vestibular membrane separating it from the osseous scala vestibuli. Its floor is formed by the basilar membrane that is continuous with the osseous spiral lamina; both separate the cochlear duct from the scala tympani.

Scala tympani: Subdivision of the bony cochlea lying beneath the cochlear duct. The scala tympani is continuous with the scala vestibuli at the helicotrema, located at the tip

of the cochlea. The scala tympani terminates at the round window where pressure on the perilymph in this scala, initiated at the oval window and transported through scala vestibuli to scala tympani, is released.

The spiral organ is located on the basal wall of the cochlear duct. The cochlear duct is located in the center of the cochlea. The cochlear duct communicates indirectly with the saccule. The receptor in the cochlear duct, the organ of Corti, responds to sound vibrations. This duct is filled with endolymph produced in the stria vascularis (STV), an unusual association between the columnar epithelial cells which have numerous basal infoldings and the capillaries in the periosteum of the bone. On either side of the cochlear duct are the scala vestibuli (SV) and scala tympani (ST), which are filled with perilymph and are continuous at the apex of the cochlea. Cell bodies of bipolar neurons in the spiral ganglion (SG) send dendrites to the hair cells of the spiral organ and axons to the cochlear nuclei of the CNS. In the lateral wall of the cochlear duct is the stria vascularis, a unique epithelium responsible for production and maintenance of the endolymph for the entire membranous labyrinth. The stria vascularis encloses a network of capillaries and consists of cells with many deep basal infoldings of their plasma membranes, where numerous mitochondria are located. Fluid and K+ ions pumped from the capillaries by these epithelial cells are released in the cochlear duct as endolymph.

In the wall that separates the cochlear duct from the scala tympani is the complex structure called the spiral organ (organ of Corti) which contains special auditory receptors in the form of hair cells that respond to different sound frequencies. The spiral organ rests on a thick basal lamina—the basilar membrane.

Two major types of hair cells are present. Outer hair cells (OHC) occur in three rows near the oval window, increasing to five rows near the apex of the cochlea. There is a single row of inner hair cells (IHC). The latter have one linear array of short stereocilia, while OHC each have a curved row of longer stereocilia. No kinocilium is present on cochlear hair cells, allowing symmetry on the cells that is important for their role in sensory transduction. The tips of the tallest stereocilia of the OHC are embedded in the tectorial membrane, an acellular layer extending over the spiral organ from the modiolus. The tectorial membrane consists of fine bundles of collagen (types II, V, IX, and XI), associated proteoglycans and other proteins and is formed during the embryonic period from secretions of cells that come to line the adjacent region called the spiral limbus. It is also a gelatinous membrane that extends over hair cells.

Both outer and inner hair cells have afferent and efferent nerve endings, with IHC much more heavily innervated. The cell bodies of the afferent bipolar neurons are located in a

bony core of the modiolus and constitute the spiral ganglion.

Two major types of columnar supporting cells are associated with the hair cells of the spiral organ. **Pillar cells** are stiffened by bundles of keratin and outline a triangular, tunnel-like space between the outer and inner hair cells—another structure important in sound transduction. **Phalangeal cells** intimately surround and directly support both inner and outer hair cells, almost completely enclosing each IHC but only the basal ends of the OHC.

Stereocilia of cochlear hair cells detect movements of the spiral organ. Sound waves collected by the auricle of the external ear cause the tympanic membrane to vibrate, which causes movement of the ossicles in the middle ear. The large size of the tympanic membrane compared to the oval window and the mechanical properties of the ossicle chain connecting these two membranes allow for optimal transfer of energy between air and perilymph, from sound waves to vibrations of tissues and fluid-filled chambers.

The cochlear is an osseous tube that connects with and lies anteromedially to the vestibule. Tube is coiled into a spiral shape with 2.5 turns, resembling a snail shell.

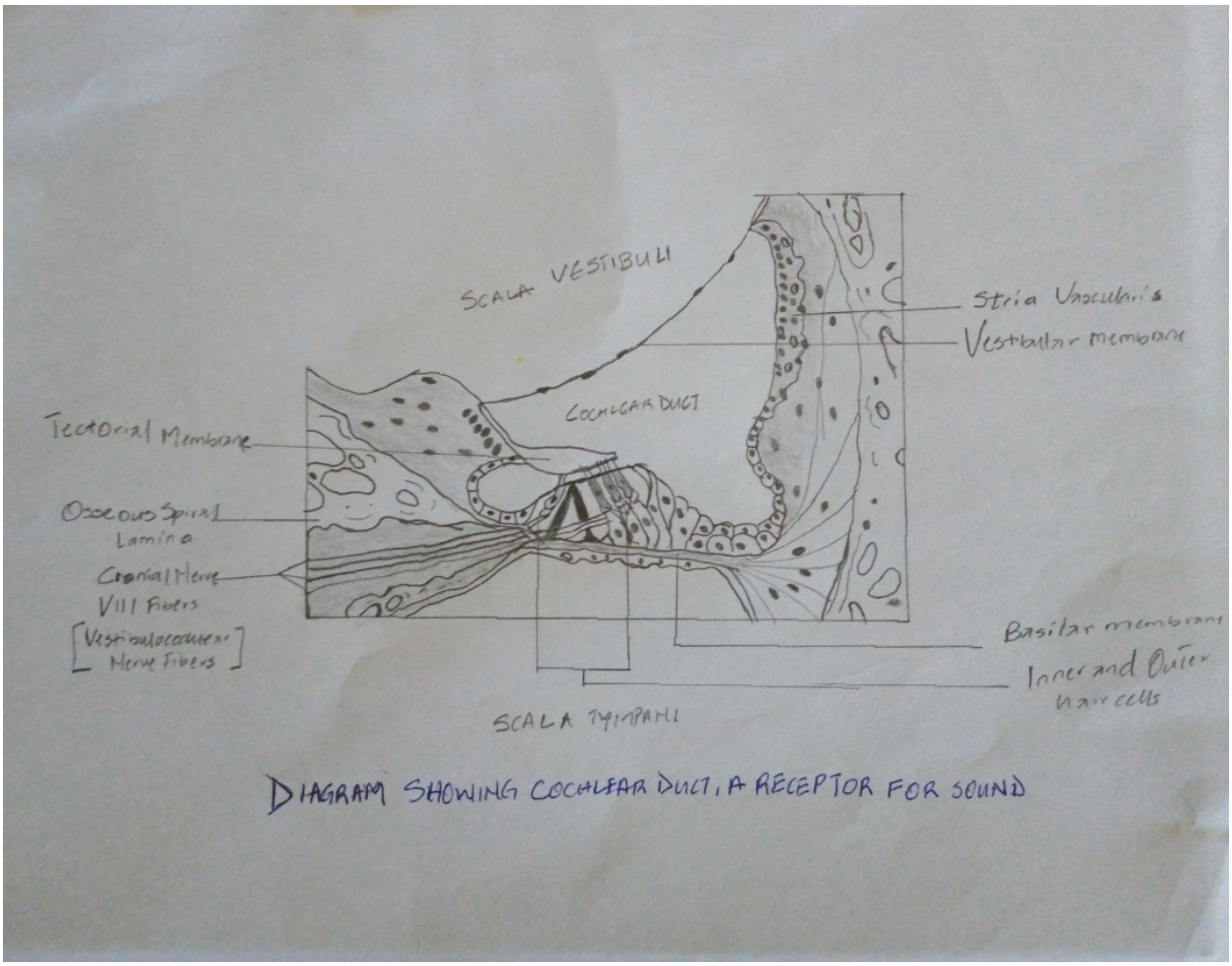

DIAGRAM SHOWING COCHLEAR DUCT, A RECEPTOR FOR SOUND