

Development of the Ear

Internal Ear

Firstly at approximately 22 days of development a thickening of the surface ectoderm on each side of the rhombencephalon can be seen. These are defined as the Otic Placode, with further development they invaginate forming otocysts. Moreover, each vesicle splits into a Ventral Component, gives rise to the saccule, cochlear duct and ductus reuniens. The Primitive Dorsal Component gives rise to the utricle, endolymphatic duct and semicircular canals.

Cochlea, saccule and organ of corti

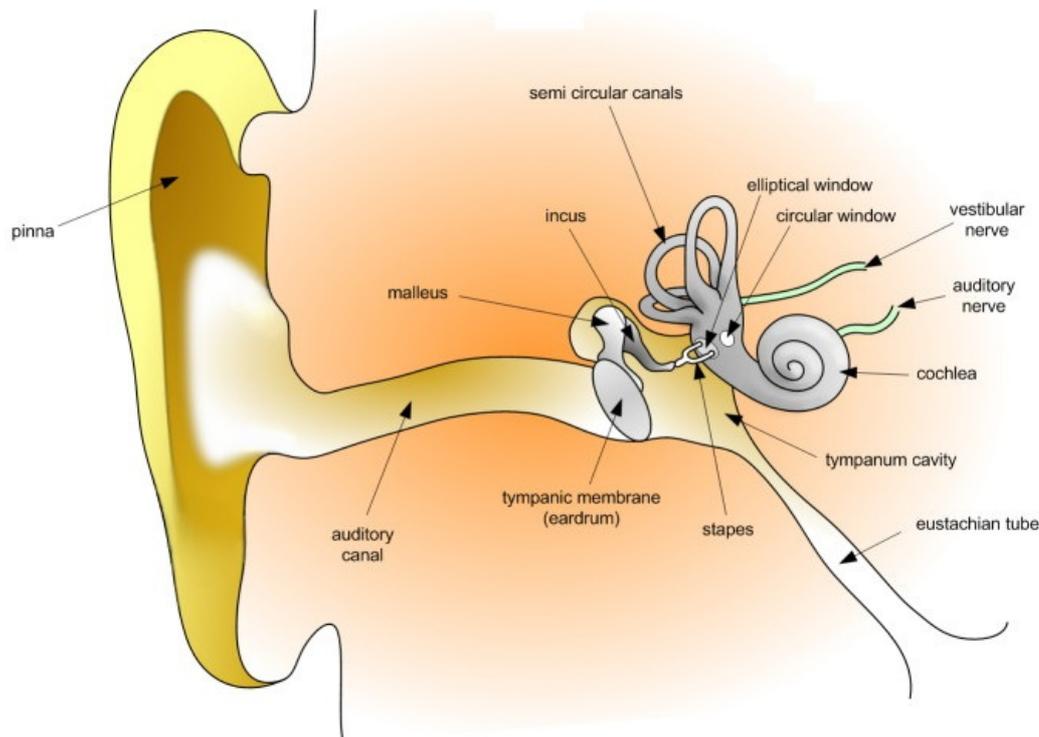
On the 6th week of embryonic development, the saccule forms a tubular outgrowth at its lower border. This is the primitive Cochlear Duct. The surrounding mesenchyme is penetrated by this duct till the end of the 8th week of development. The ductus reuniens is the narrowing that forms of this duct connecting it to the Saccule. Later Mesenchymal condensation occurs surrounding the cochlear duct, this will differentiate into cartilage later forming the bony labyrinth. Moreover, During the 10th week within this cartilaginous shell vacuolization occurs that gives rise to the perilymphatic spaces these are the scala tympani and scala vestibule. Vestibular membrane also known as Reissner's membrane is known to separate the scala vestibuli from the cochlear duct. And the Basilar membrane separates scala tympani and cochlear duct. Moreover, The Lateral wall of the cochlear duct remains is attached to the cartilage by the spiral ligament, today some authors believe that the cells within spiral ligament have neural crest cell origins.

Utricle and Semicircular Canals

Approximately during the 6th week, impulses generate within cristae and maculae triggered by changes in body and head position, these are carried to the brain via vestibular fibers of cranial nerve VIII. Moreover, the statoacoustic ganglion derived neural crest cells has also fully developed by this embryonic stage. This Ganglion subsequently divides into the cochlear and vestibular divisions that supply sensory cells in organ of corti, saccule, utricle and semicircular canals.

Middle Ear- Tympanic Cavity and Auditory Tube

Endoderm from 1st pharyngeal pouch gives rise to the Primitive Tympanic Cavity. This pouch found laterally to the primitive pharynx later expands laterally coming into close contact with the floor the 1st pharyngeal cleft. With further development, the distal portion of this primitive cavity expands to form the tubotympanic recess. And the Proximal portion stays narrow to give rise to the auditory tube which allows the nasopharynx to communicate with the tympanic cavity.



Ossicles

As the Pharyngeal arches begin to form during the 4th week of embryonic development, it is visible to see the 1st and 2nd pharyngeal arches. The cartilage within these arches give rise to the ossicles of the ear. The Malleus, Incus and Stapes. Ossicles appear during the 1st half of fetal life however in contrast to their position they remain

embedded in this ectomesenchymal tissue until the 8th month. Once complete mesenchymal condensation has occurred around the ossicles, the endodermal epithelium connects them in a mesentery like fashion to the wall of the cavity. This is the supporting ligaments of the ossicles develop later within these mesenteries. Tympanic cavity grows dorsally by vacuolization of surrounding tissue giving rise to the primitive tympanic antrum.

External Ear- External Auditory Meatus the Pharyngeal Cleft are of ectodermal origin, they form during the 5th week of embryonic development in sequence with the pharyngeal arches. At the beginning of the 3rd month a meatal plug forms at the bottom of the cleft, this is a proliferation of epithelial cells of surface ectoderm origin. Moreover, with further development during the 7th month this plug disappears and this epithelial lining contributes to the development of the definitive eardrum

Eardrum/ tympanic membrane

As the 1st Pharyngeal Cleft and its complementary pouch never come into complete contact, the tympanic membrane forms which is a Tridermal Layer. However in the case of parahyletic organisms most commonly Fish, this cleft and pouch come into contact obliterating the mesenchyme inbetween and thus giving rise to gills.

Auricle

During approximately the 6th and 8th months the auricles form from 6 Mesenchymal condensations in the 1st and 2nd Pharyngeal Arches, these are known as the auricular hillocks. Around the external acoustic meatus, three of each of these auricular hillocks can be found on each side. With further development they form the definitive auricle.

Sources

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The Developing Human: Clinically Oriented Embryology, 9e, Keith L. Moore MSc PhD FIAC FRSM FAAA (Author), T. V. N. Persaud MD PhD DSc FRCPath (Lond.) FAAA (Author), Mark G. Torchia MSc PhD (Author) ISBN-10: 1437720021