



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allah, the most gracious, the most merciful

DEVELOPMENT OF INTERNAL EAR

BY

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DEVELOPMENT OF EAR

The ears are composed of three anatomic parts:

External ear:

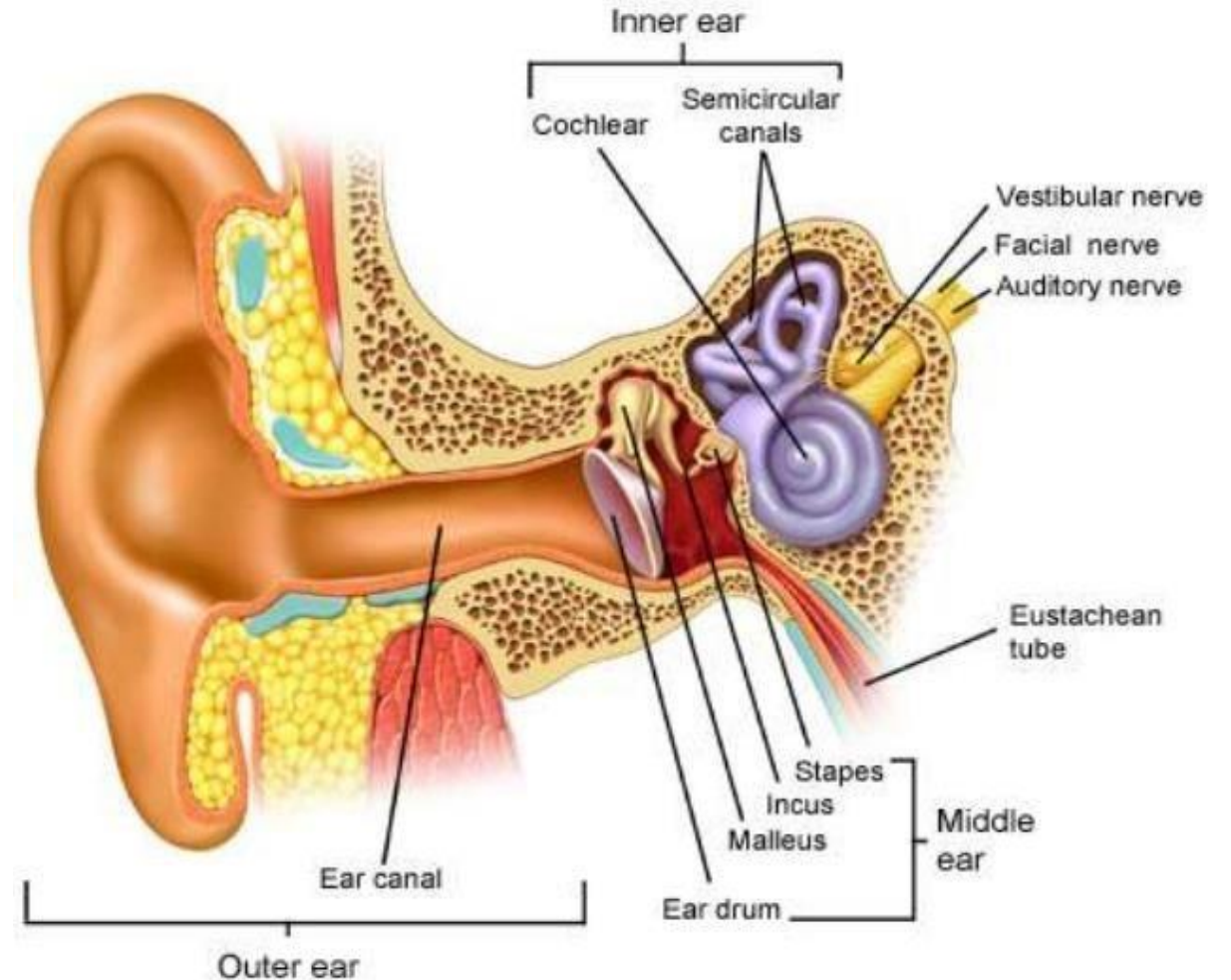
- Consisting of the auricle , external acoustic meatus, and the external layer of the tympanic membrane.

Middle ear:

- The internal layer of the tympanic membrane, and three small auditory ossicles, which are connected to the oval windows of the internal ear.

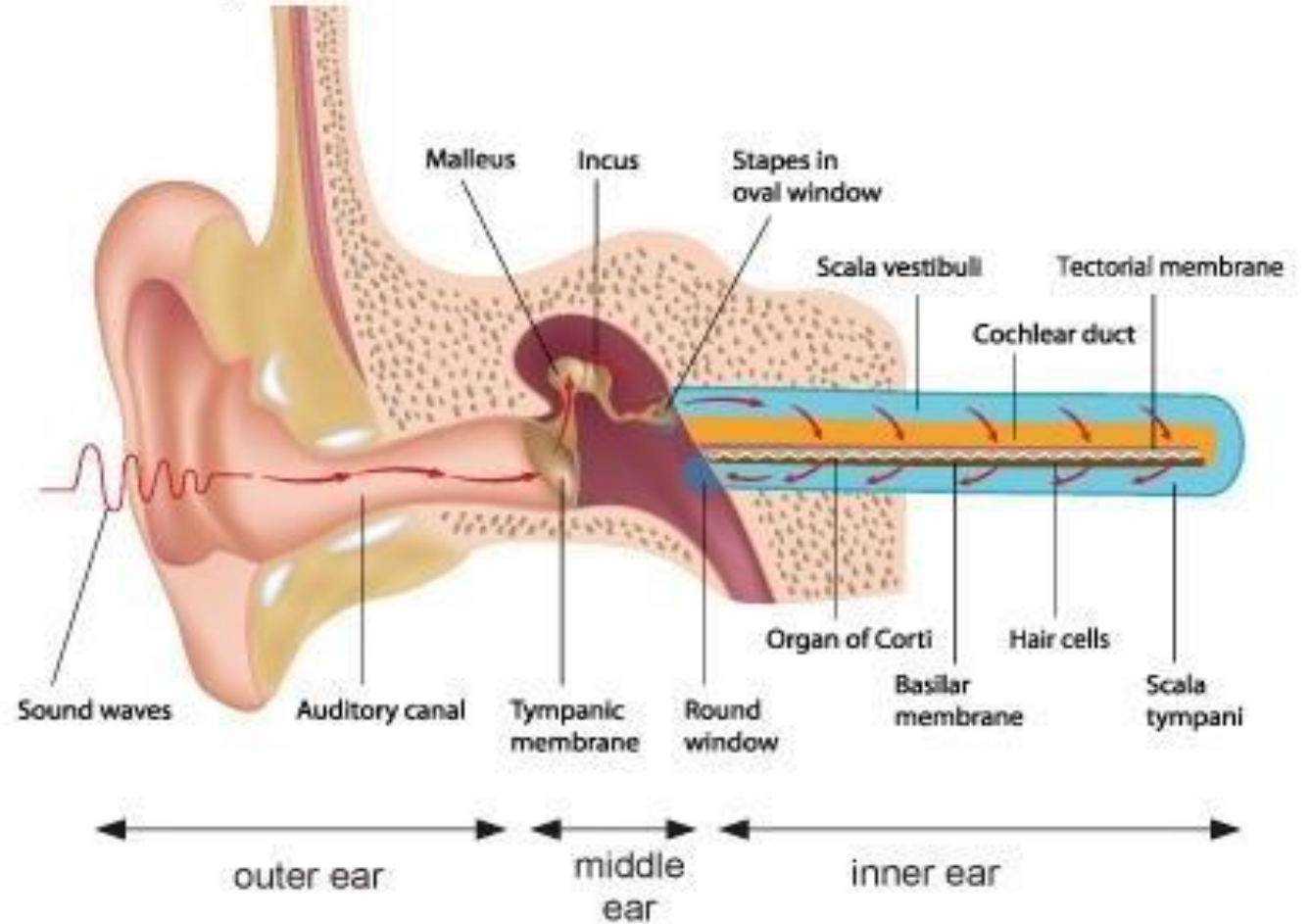
Internal ear:

Consisting of the vestibulocochlear organ, which is concerned with hearing and balance.



- The external and middle parts of the ears are concerned with the transference of sound waves to the internal ears, which convert the waves into nerve impulses and registers changes in equilibrium.

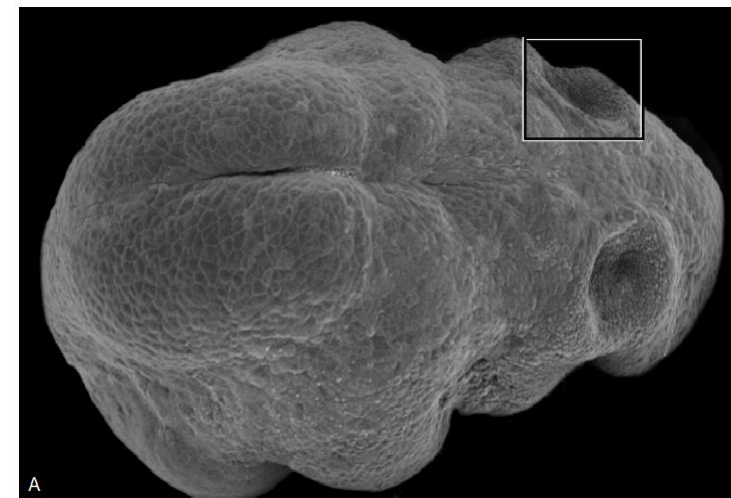
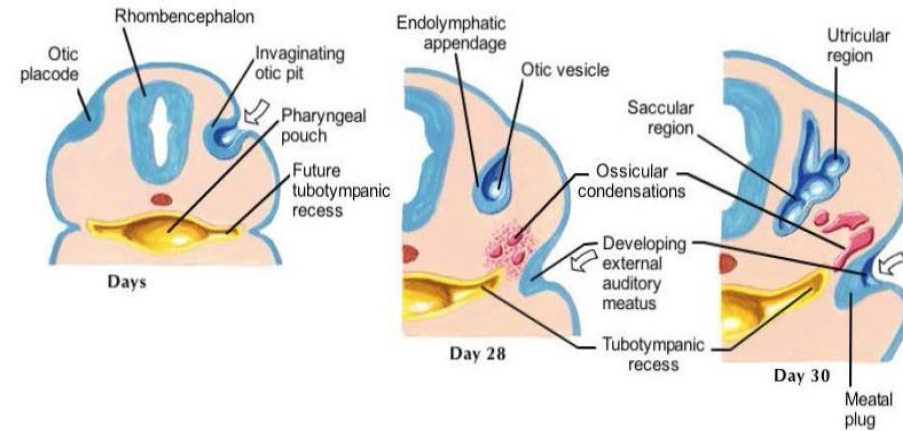
figure 401: anatomy of the human ear

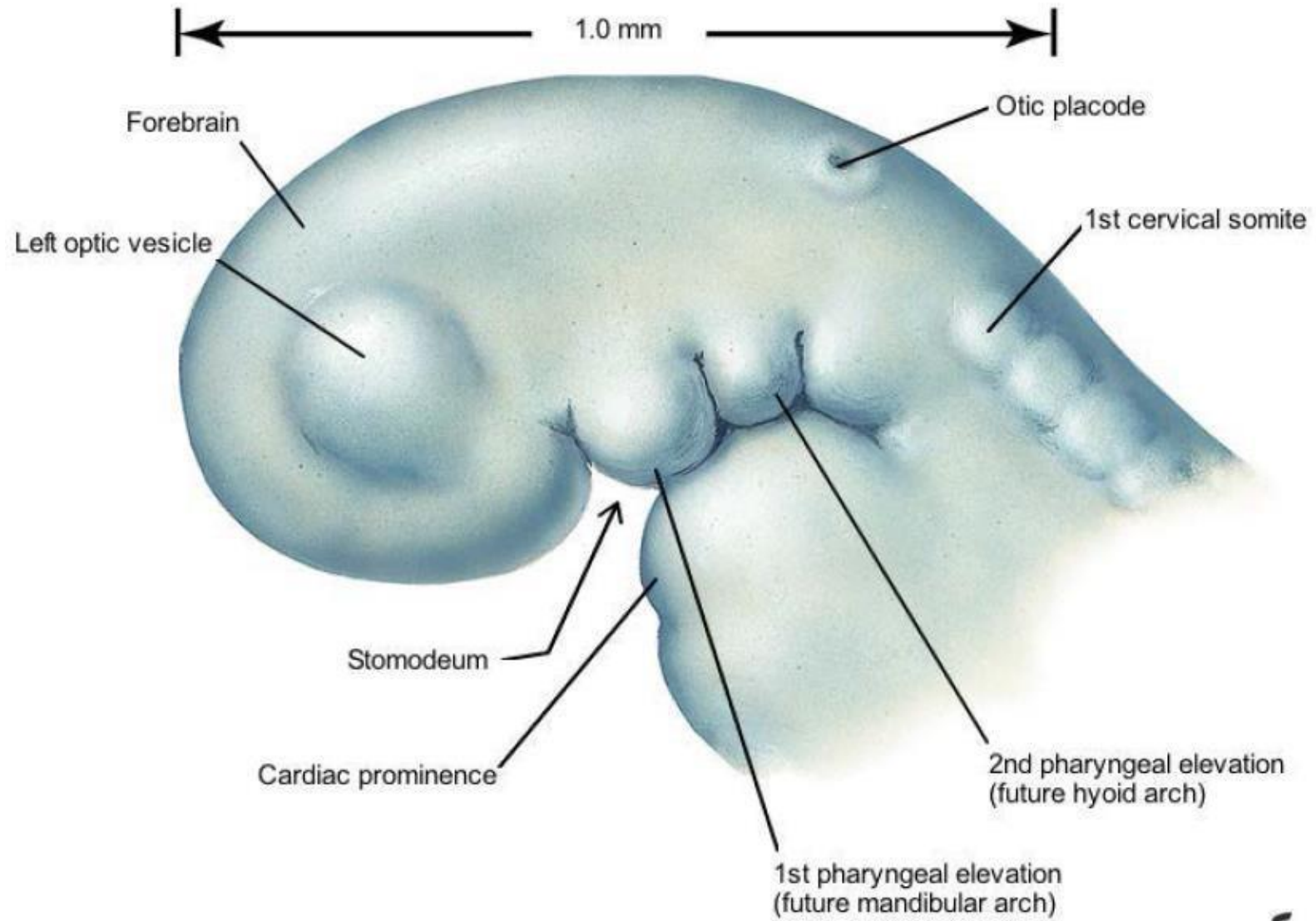


DEVELOPMENT OF INTERNAL EAR

The internal ears are the first to develop.

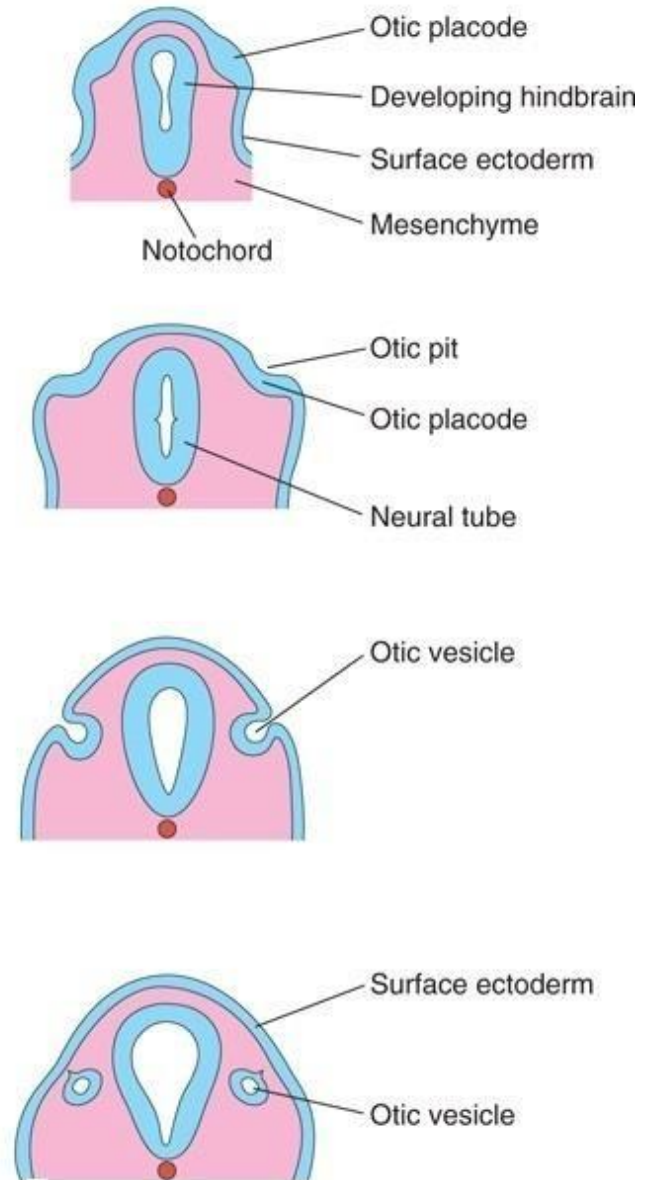
- **Otic placode:** Early in the 4th week, a thickening of surface ectoderm takes place on each side of the *myelencephalon*, the caudal part of the hindbrain.
- Inductive signals from the paraxial mesoderm and *notochord* stimulate the surface *ectoderm* to form the placodes.

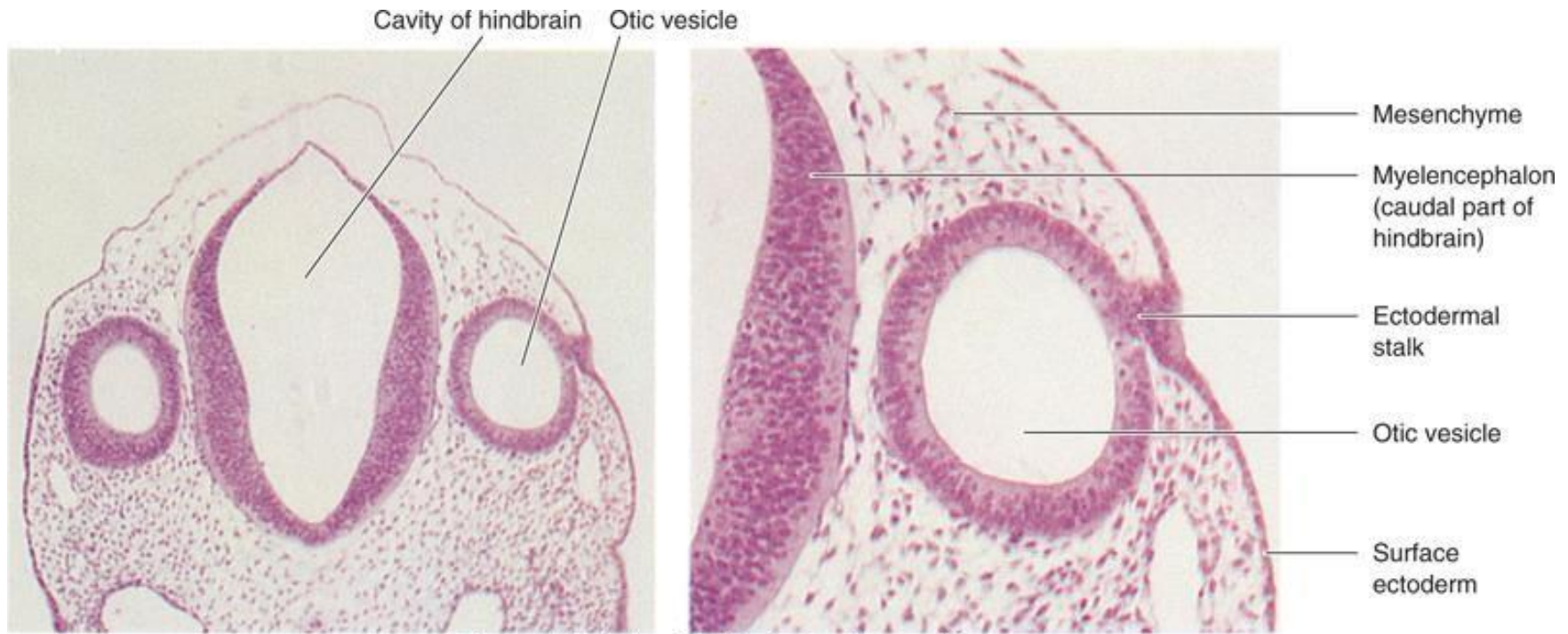




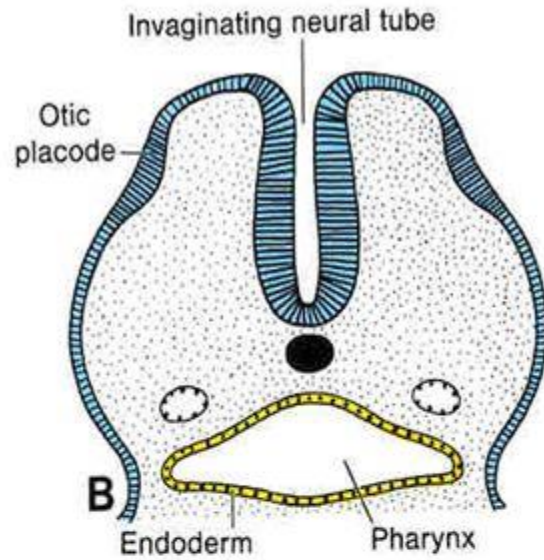
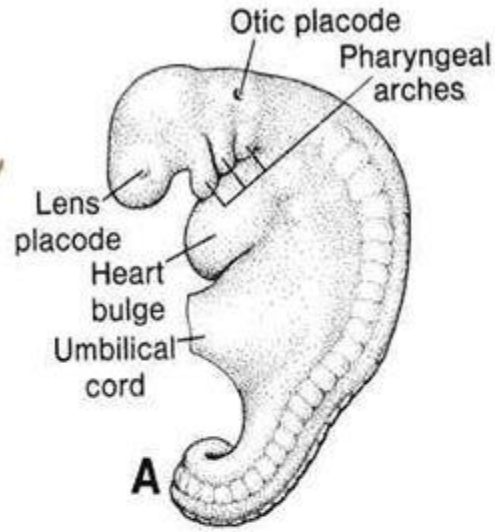
A. Netter

- Each otic placode soon invaginates and sinks deep to the surface ectoderm into the underlying mesenchyme.
- In so doing, it forms an otic pit.
- The edges of the pit come together and fuse to form an **otic vesicle** the primordium of the membranous labyrinth.

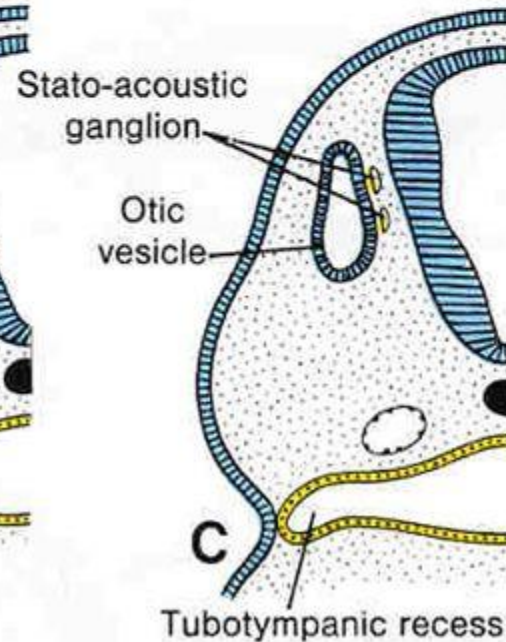
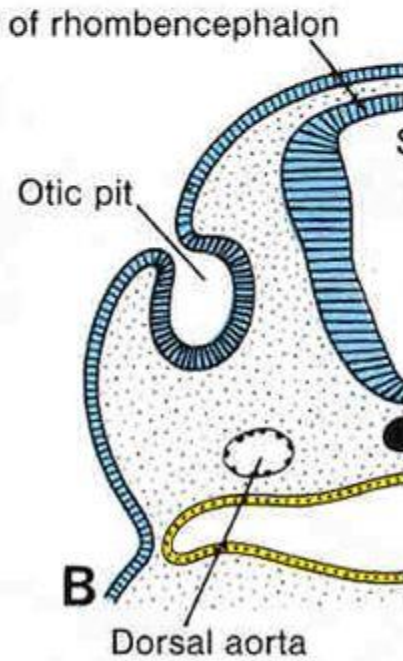
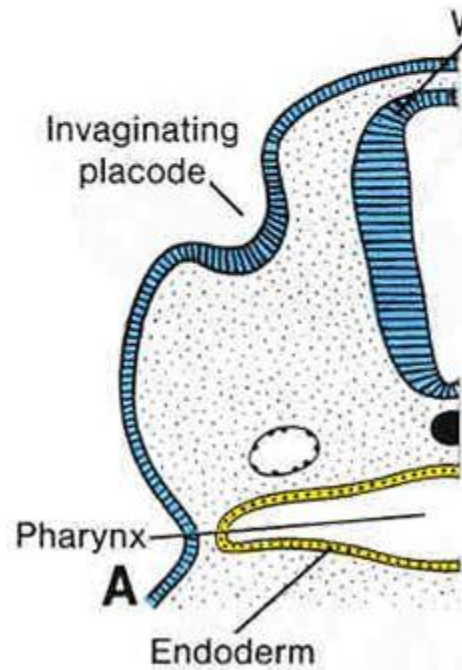


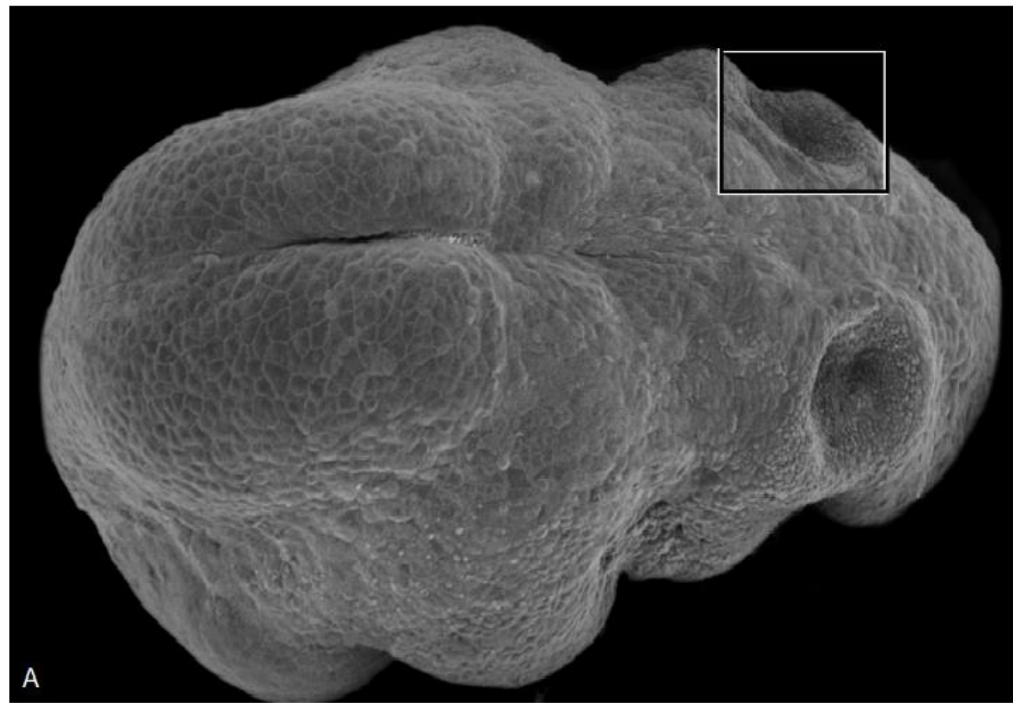


Moore et al: Before The Developing Human, 9e.
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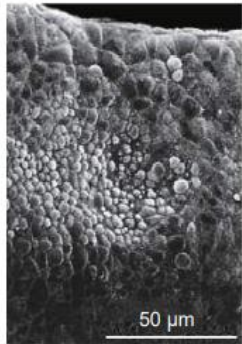


Rhombencephalon
region:otic placode ,
otic pit and otic
vesicle

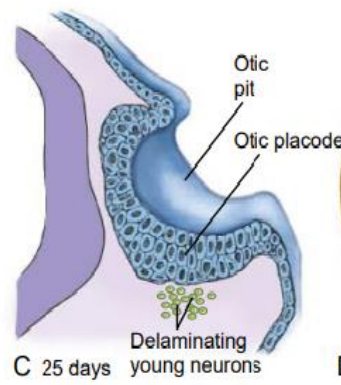




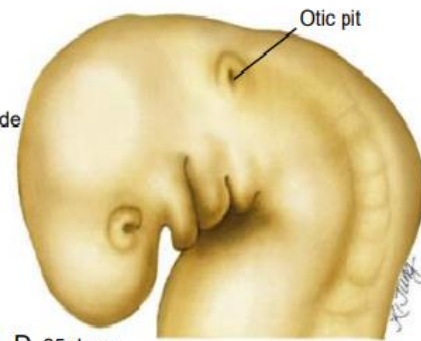
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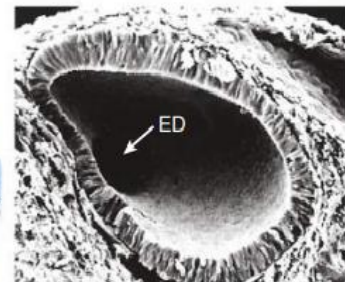
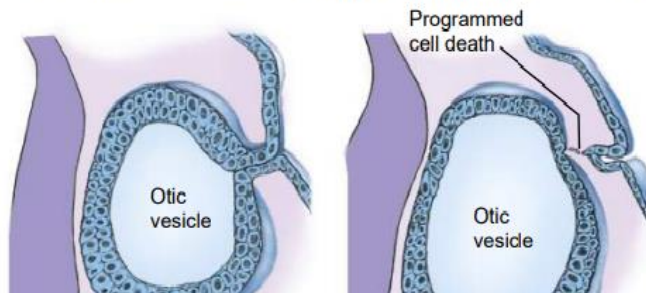
B 25 days



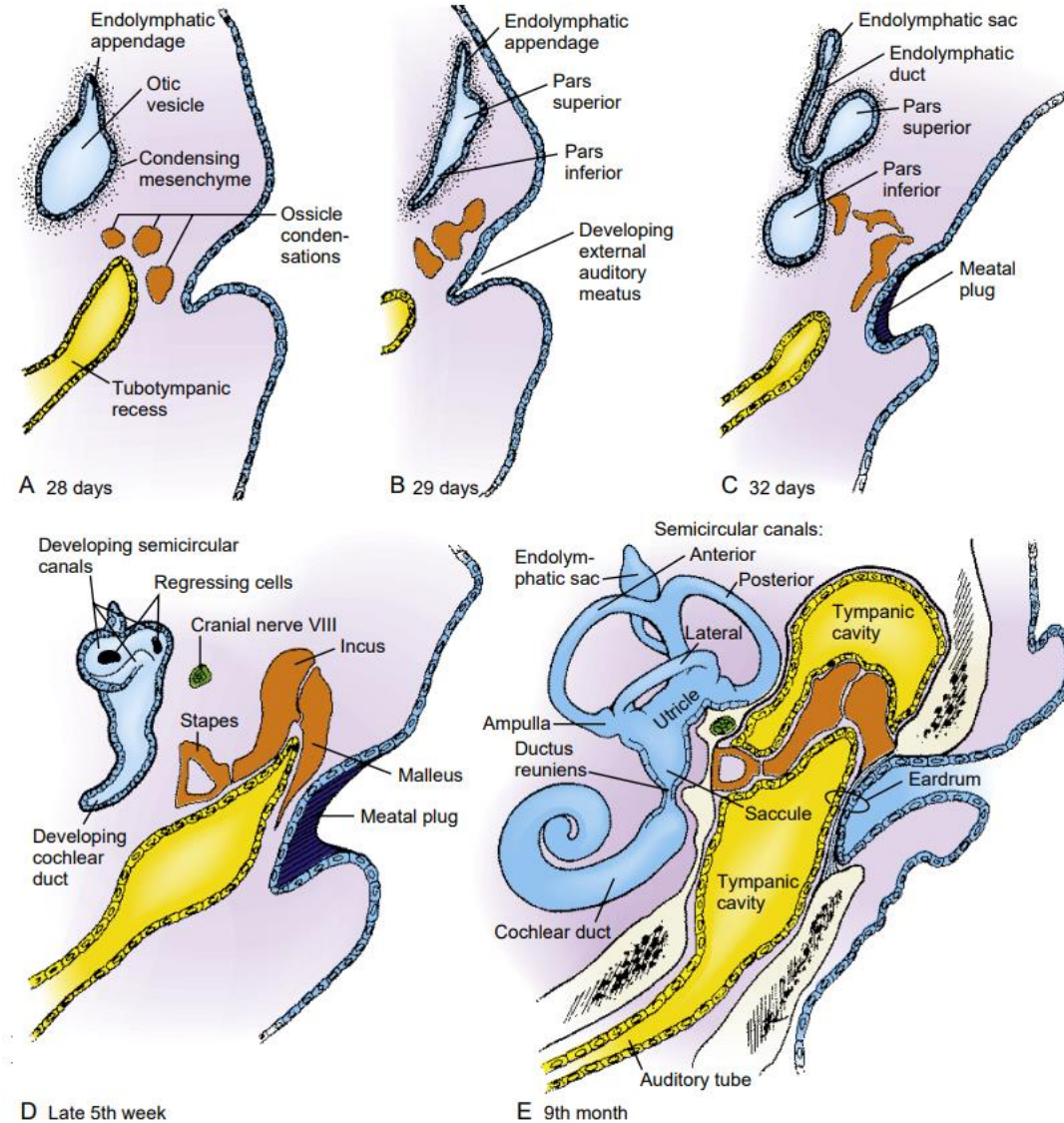
C 25 days



D 25 days

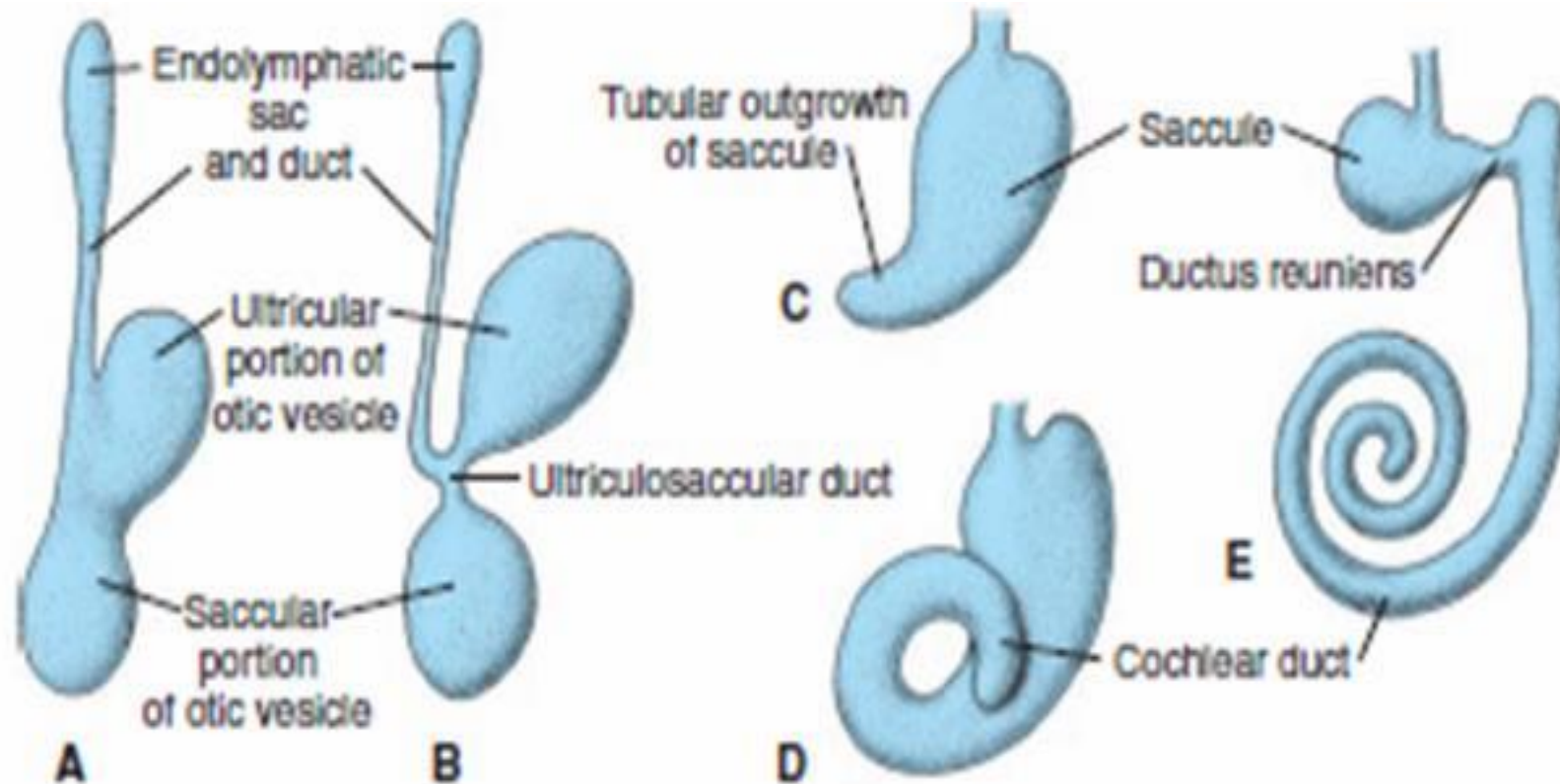


- The otic vesicle soon loses its connection with the surface ectoderm.
- A diverticulum (endolymphatic appendage) grows from the vesicle and elongates to form the *endolymphatic duct* and *sac*.

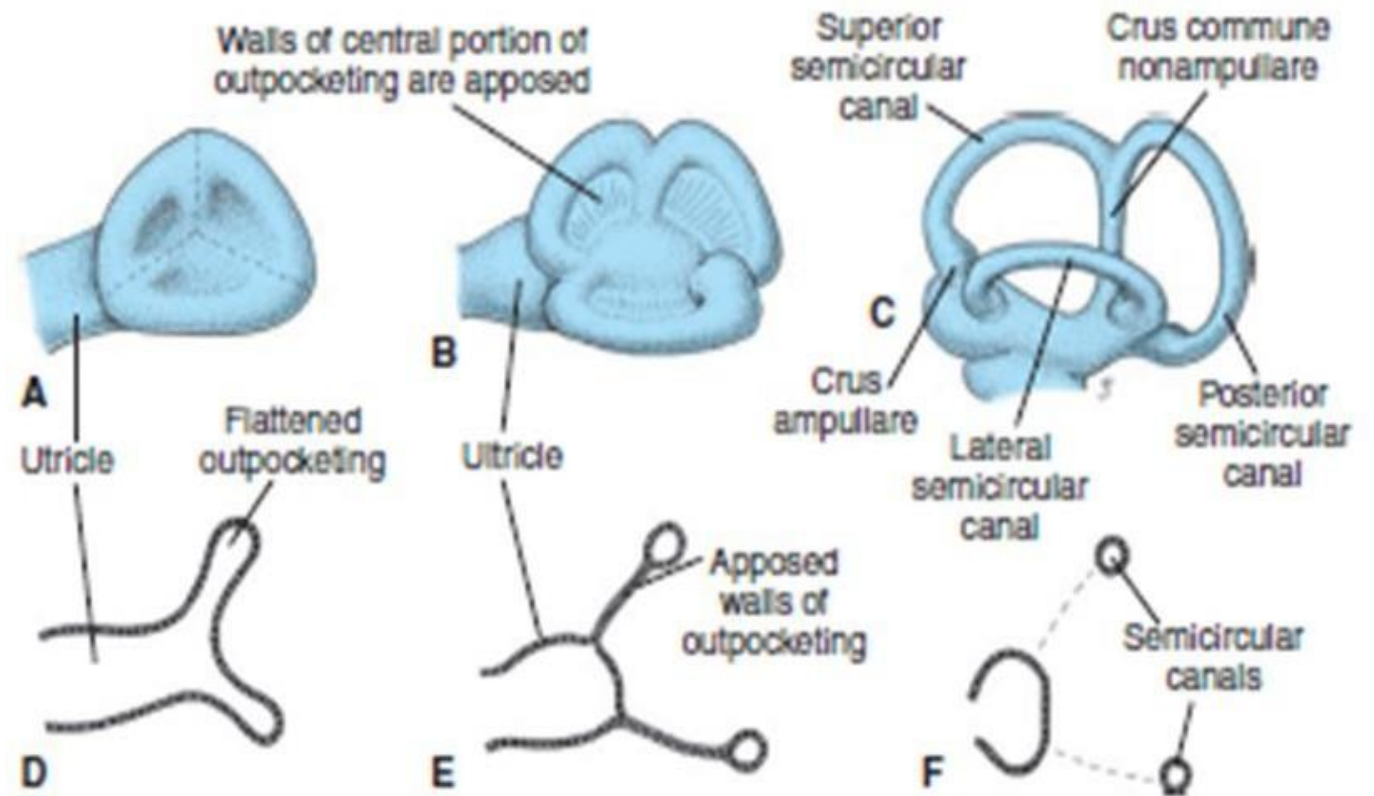


the rest of the otic vesicle differentiates into an expanded pars superior

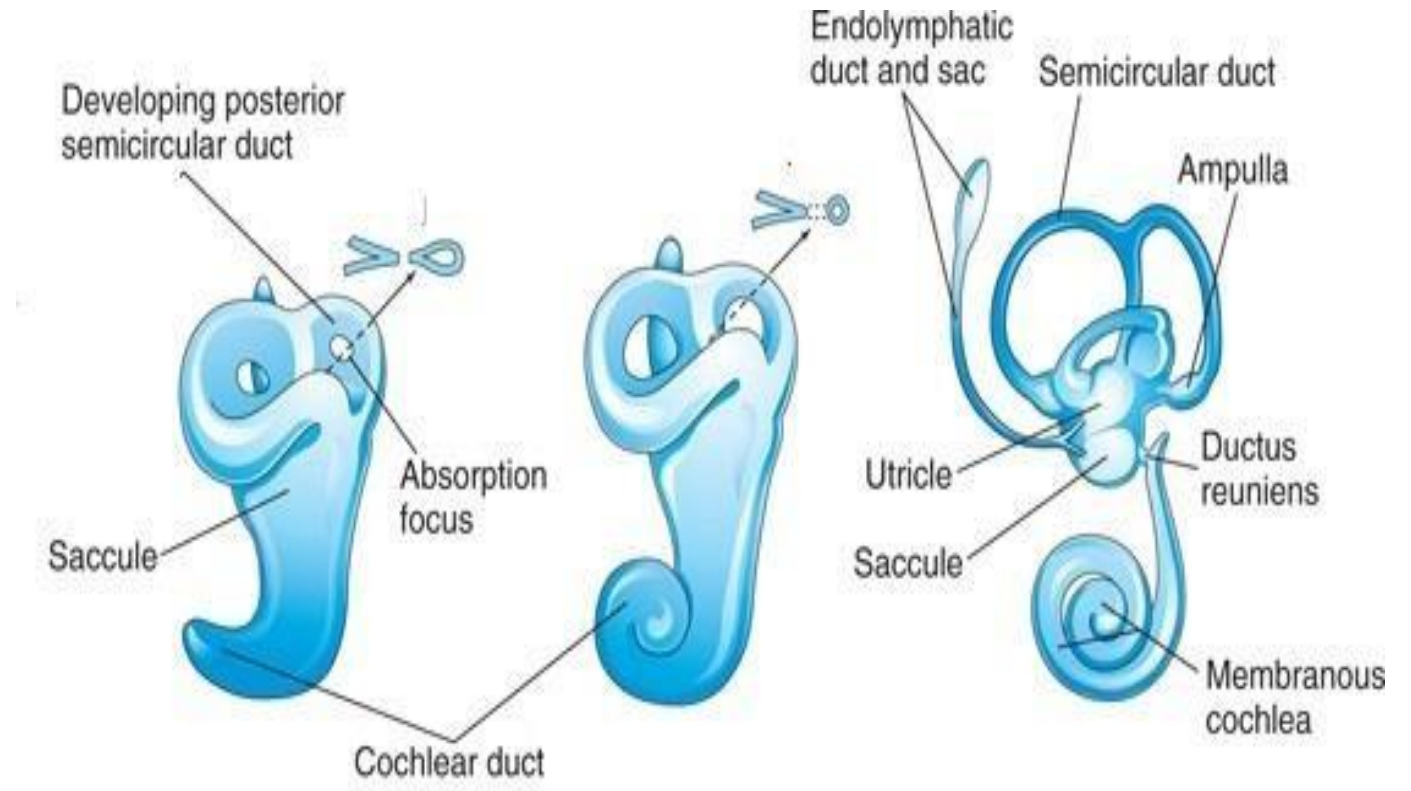
(Dorsal utricular parts, from which the small endolymphatic ducts, utricles and semicircular ducts arise) and a tapered pars inferior (Ventral saccular parts, which give rise to the sacculle and cochlear ducts).

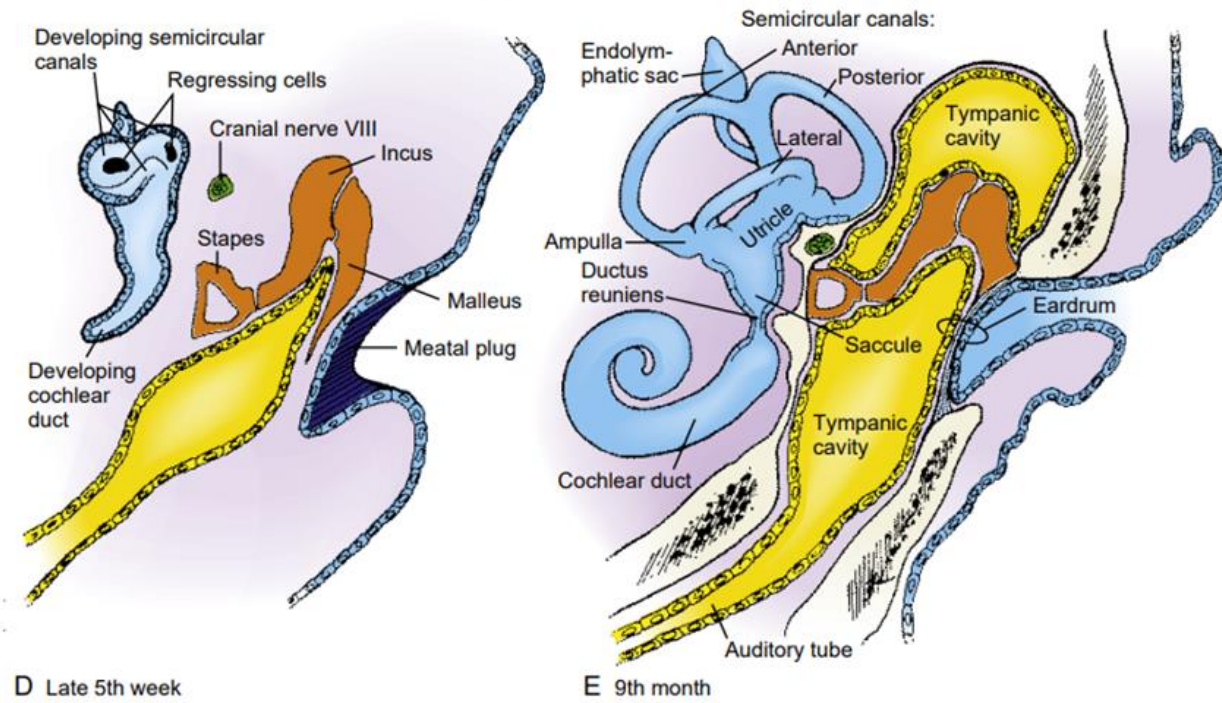
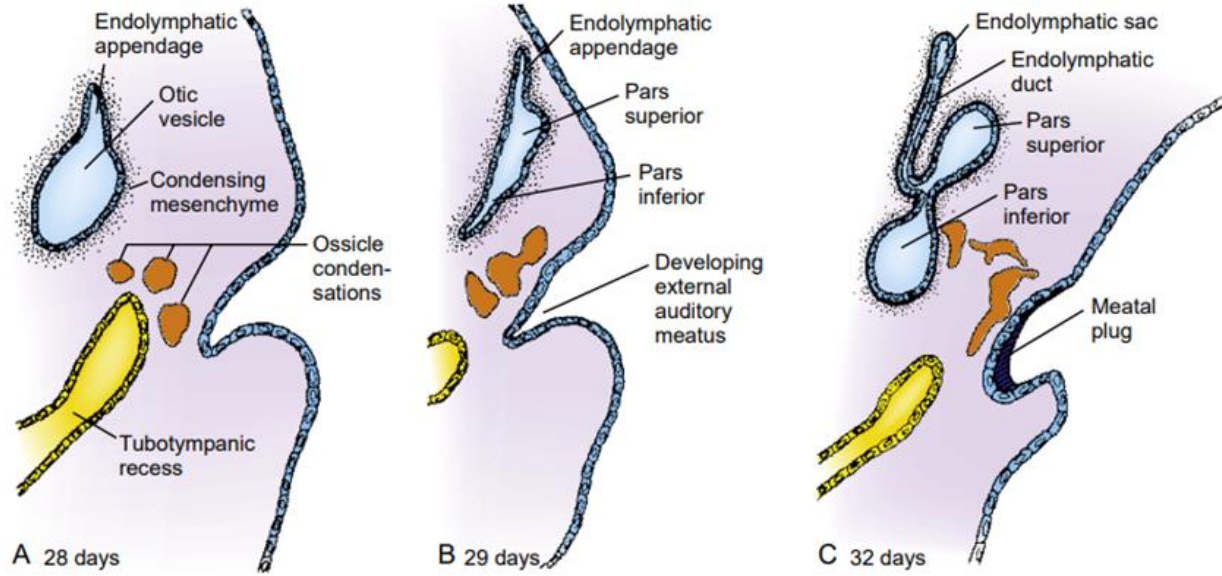


- Three disc like diverticula grow out from the utricular parts of the primordial membranous labyrinths.
- The central parts of these diverticula fuse and disappear.
- The peripheral unfused parts of the diverticula become the ***semicircular ducts***, which are attached to the utricle.
- Localized dilatations, the ampulla, develop at one end of each semicircular duct.

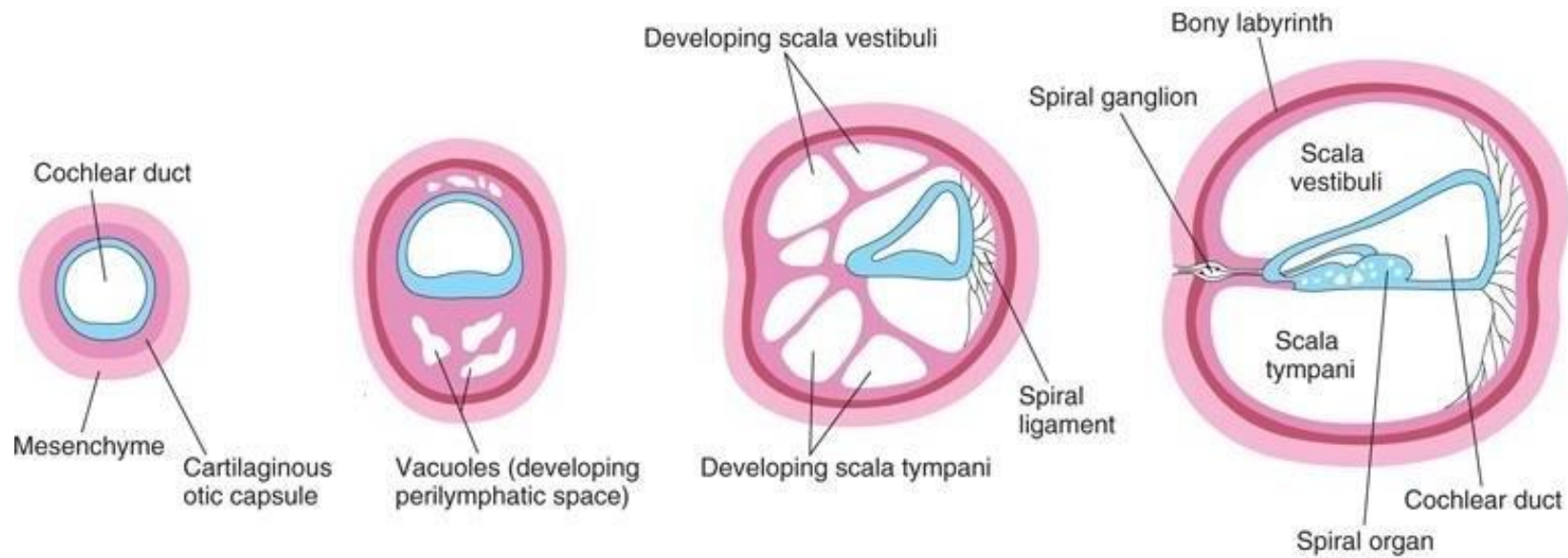


- From the saccular part of the otic vesicle, a tubular diverticulum the cochlear duct grows and coils to form the membranous cochlea.
- A connection of the cochlea with the saccule, the ductus *reuniens*, soon forms.

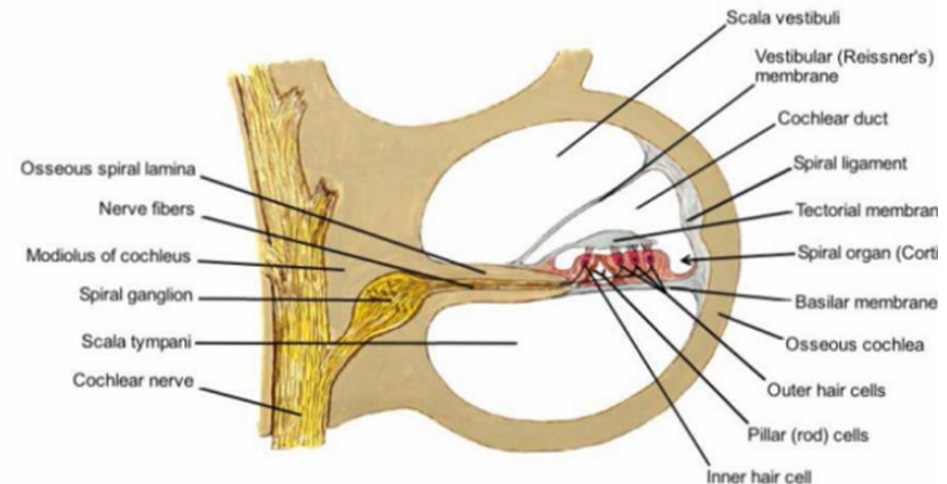
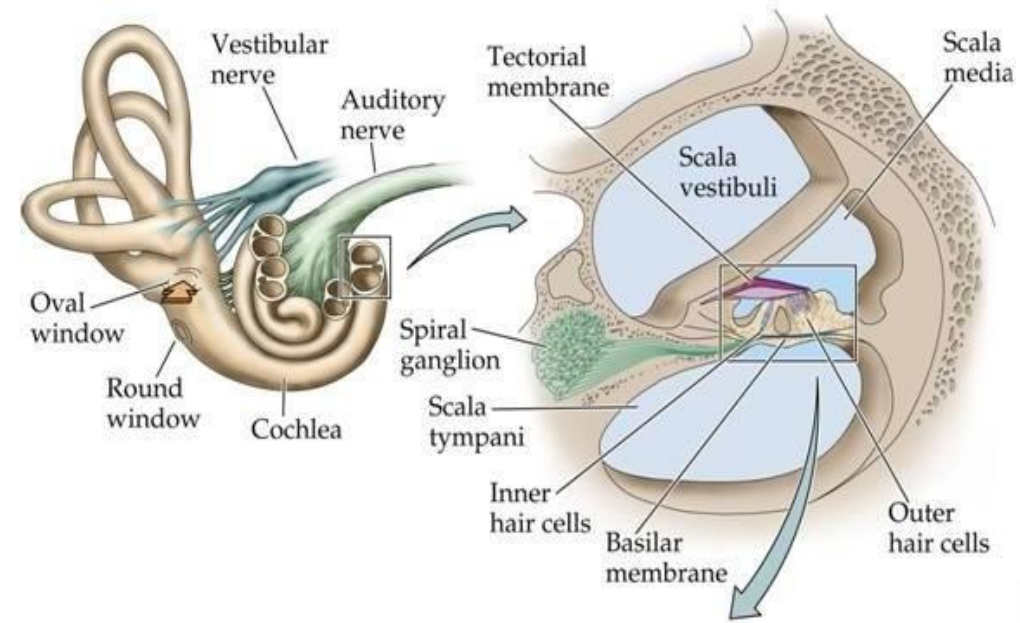




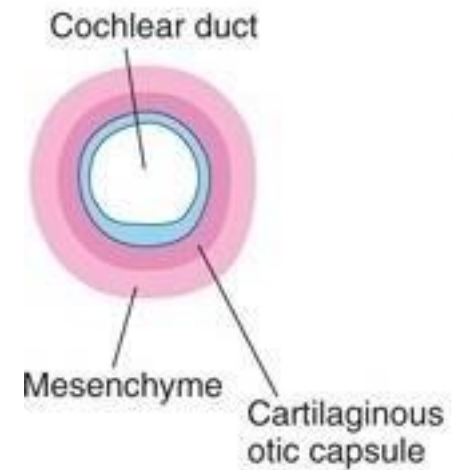
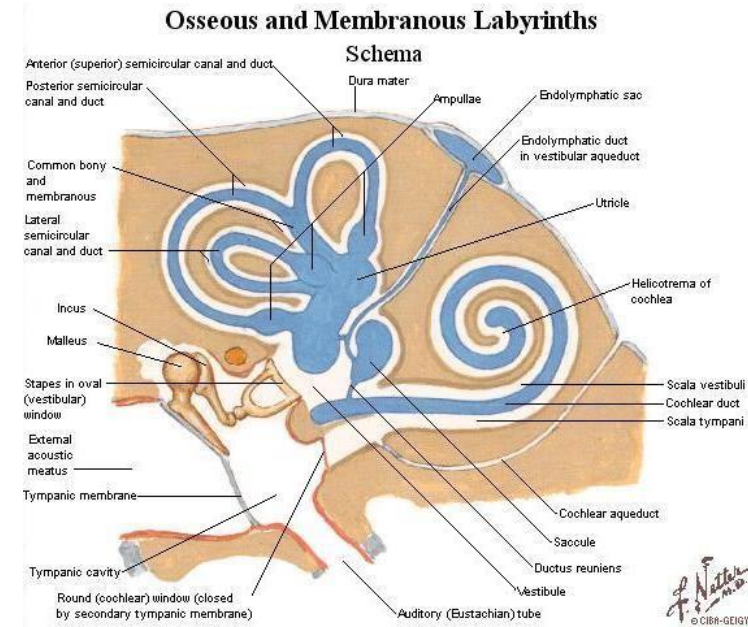
The spiral organ (of Corti) differentiates from cells in the wall of the cochlear duct.



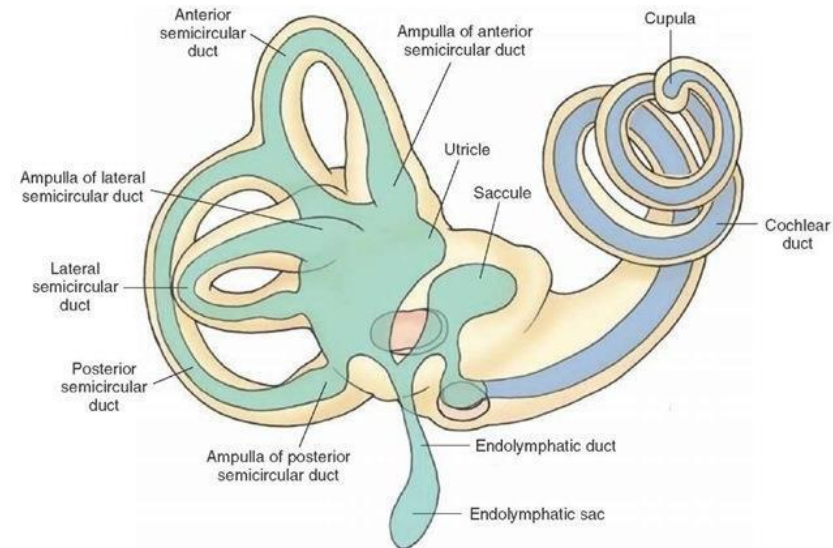
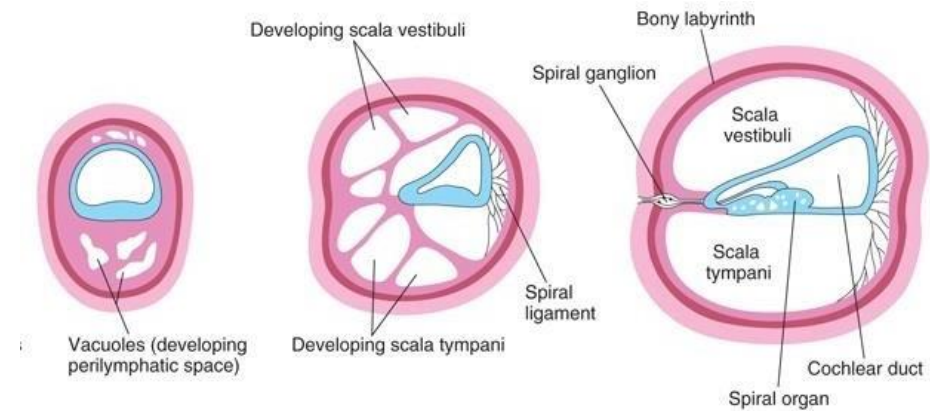
- Ganglion cells of the vestibulocochlear nerve migrate along the coils of the membranous cochlea and form the spiral ganglion.
- Nerve processes extend from this ganglion to the spiral organ, where they terminate on the hair cells.
- The cells in the spiral ganglion retain their embryonic bipolar condition.



- **Otic capsule or bony labyrinth**
Inductive influences from the otic vesicle stimulate the mesenchyme around it to condense and differentiate into a **cartilaginous otic capsule** Or **bony labyrinth**

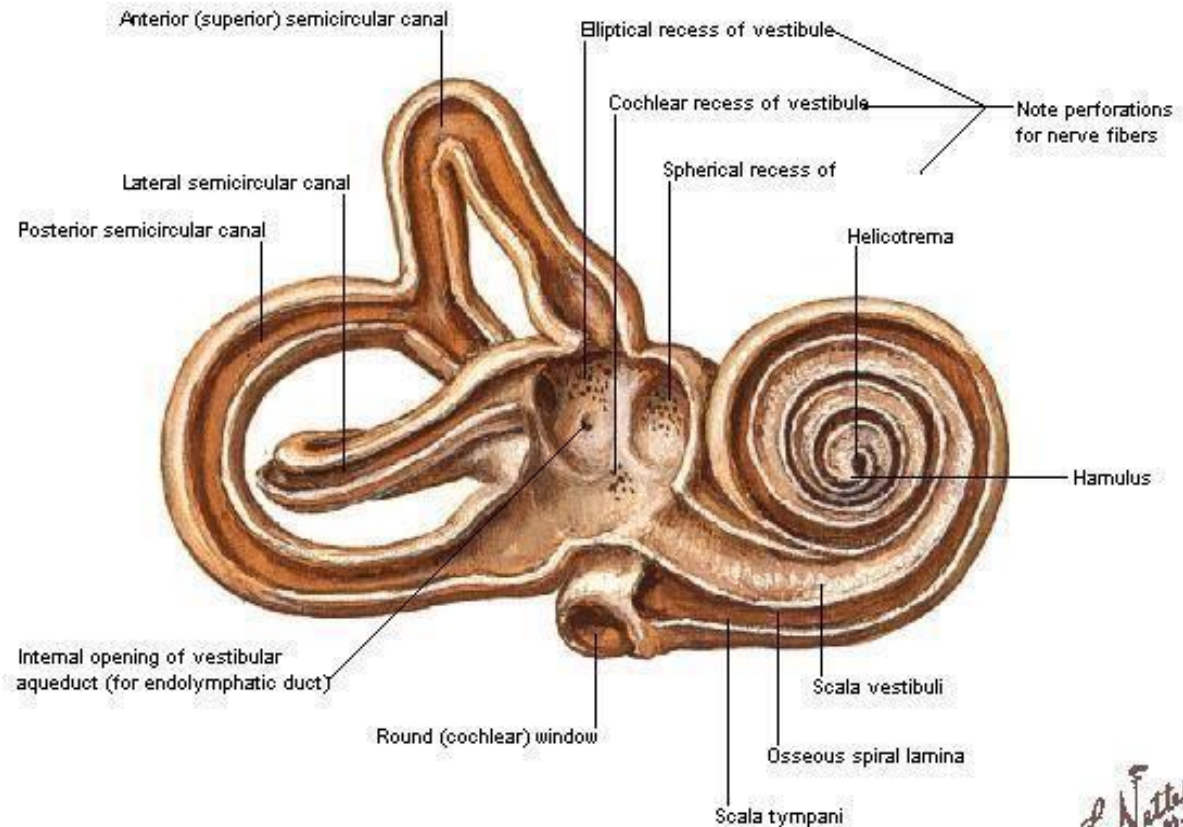


- As the membranous labyrinth enlarges, vacuoles appear in the cartilaginous otic capsule and join to form the **perilymphatic space**.
- The membranous labyrinth is now suspended in perilymph.
- The perilymphatic space, related to the cochlear duct, develops two divisions:
 - **Scala tympani**
 - **Scala vestibuli**.



- The cartilaginous otic capsule later ossifies to form the bony labyrinth of the internal ear.
- The internal ear reaches its adult size and shape by the middle of the fetal period (20–22 weeks).

Right Osseous Labyrinth - Dissected Membranous Labyrinth Removed



F. Netter M.D.

جَزَاكَ اللهُ حَيْرًا