



Inner (Internal) Ear

Dr Ashraf Sadek *PhD, MD, MRCPCH*

Assistant Professor of anatomy and embryology



- 1-Make a list of parts making the internal ear.
- 2-Define each part .Make sure to use keywords.
- 3-Note how structures fit each other.
- 4-Describe the bony labyrinth.
- 5-Explain how the membranous labyrinth fits the bony one.
- 6-Describe the hearing receptors.
- 7-Describe the balancing receptors.
- 8-Follow the course of the VIII nerve down to its point of entry to the brain.
- 9-Follow up the central connections of the VIII nerve.–Review the list of structures making the different parts of the ear.
- 10-Define, Otic vesicle. Dorsal utricular part. Ventral saccular part. Auricular hillocks.
- 11-Discuss briefly the changes that will occur leading to formation of different parts of the ear.

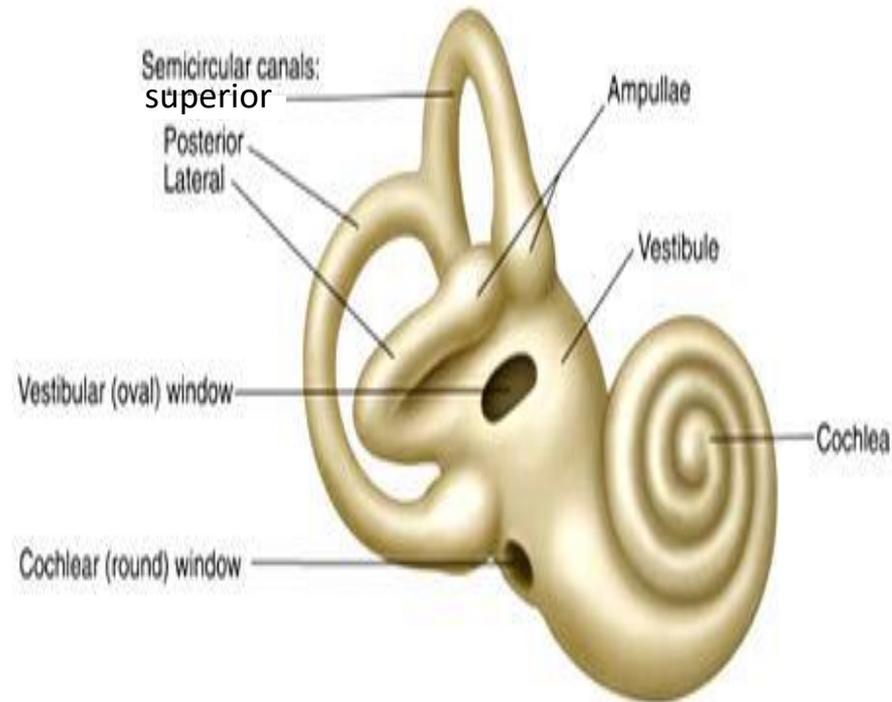


It lies in the petrous part of the temporal bone medial to tympanic cavity (middle ear).

It consists of the bony labyrinth and the membranous labyrinth.

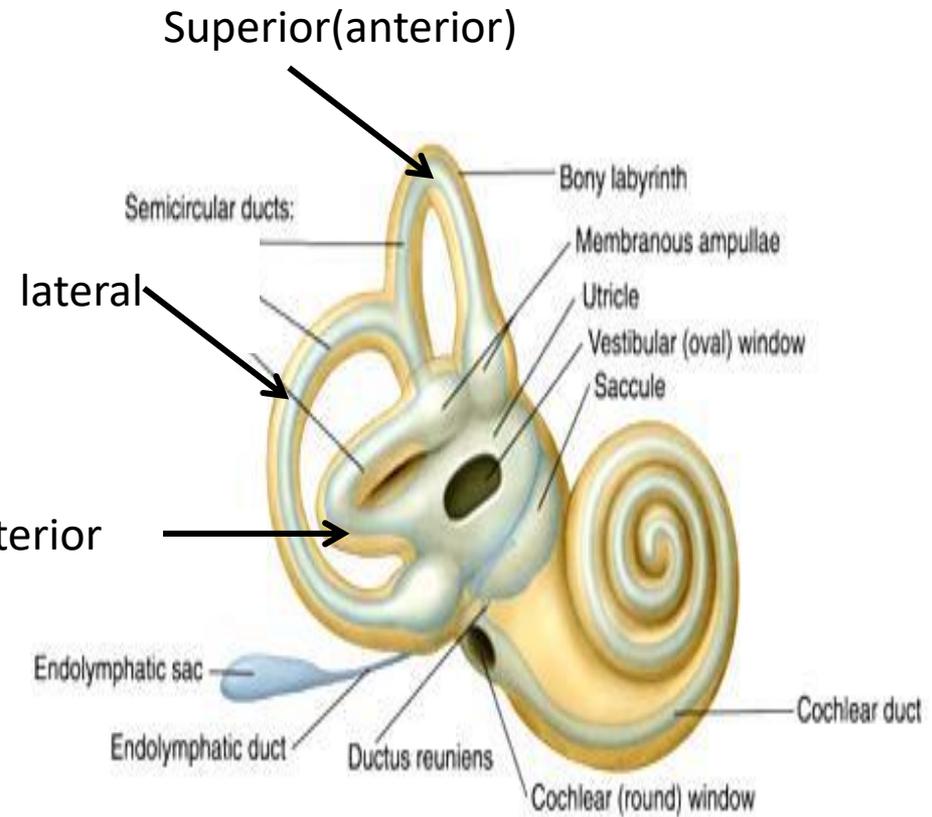
A) Bony Labyrinth: It includes the vestibule, cochlea and 3 semicircular canals. It contains the perilymph in which the membranous labyrinth is suspended.

They contain perilymph in which the semicircular ducts are suspended.



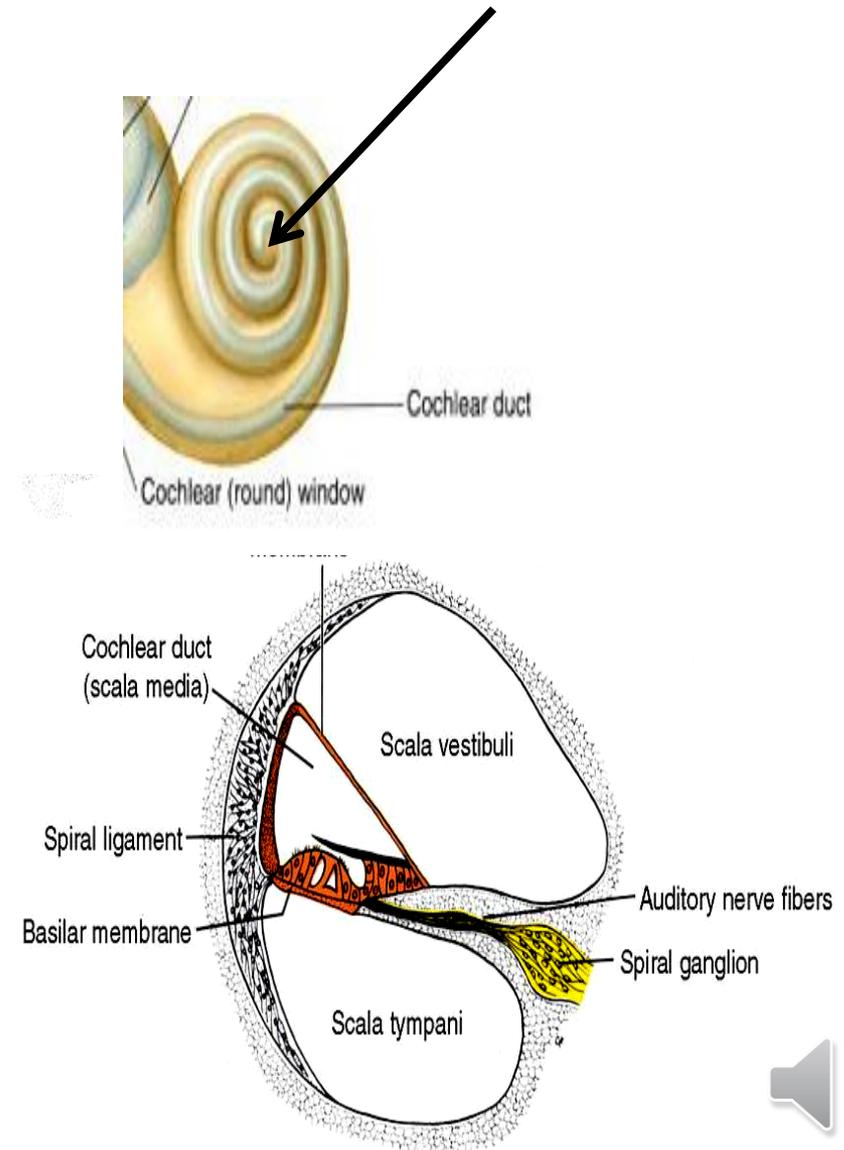
1- Vestibule: It is the central part of the bony labyrinth. Anterior to it lies the cochlea and posterior to it lies the semicircular canals.

2- Semicircular canals: They are 3 in number, the superior and posterior ones are vertical in position while the lateral one is horizontal in position. They open into the vestibule.



3- Cochlea: -It resembles a snail and is formed of a central pillar called **modiolus** and around it a hollow bony tube forms $2\frac{3}{4}$ turns.

The bony spiral lamina winds around the modiolus and divides the canal into **scala vestibuli** and **scala tympani**.



B) Membranous Labyrinth:
It lies within the perilymph of the bony labyrinth.

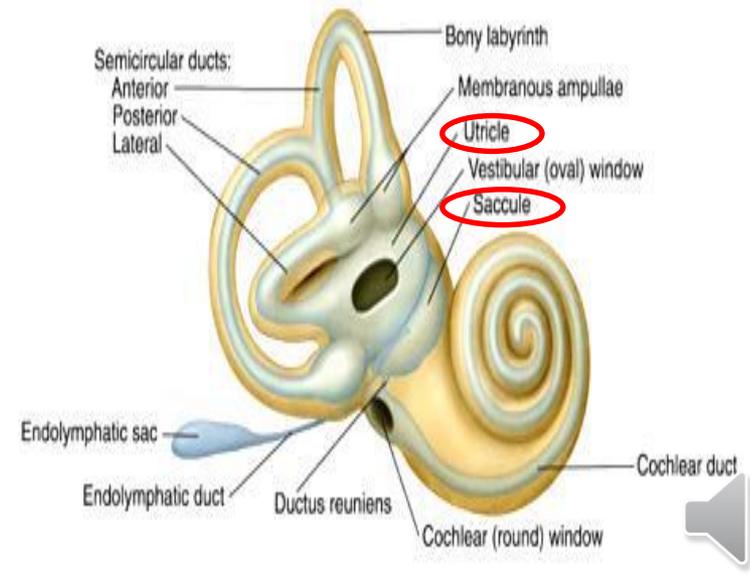
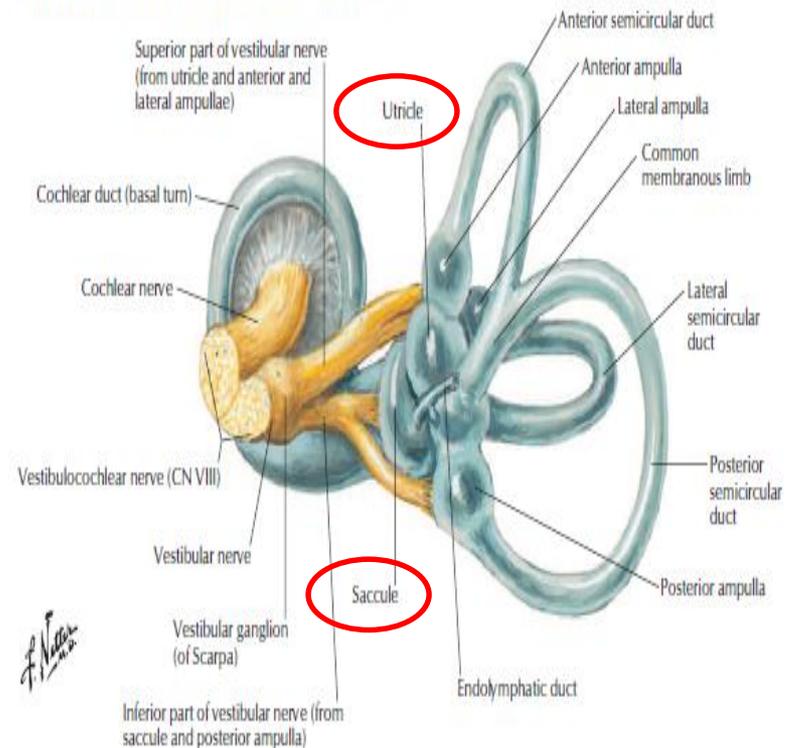
It is filled with endolymph & consists of:

1- Utricle and saccule in the bony vestibule.

2- Semicircular ducts in the semicircular canals.

3- Cochlear duct in the cochlea.

Right membranous labyrinth with nerves: medial view



All of them *communicate* with each other.

Receptors present in the wall of the **utricle and **sacculle** are sensitive to orientation of the head to gravity and acceleration forces.**

Receptors in the wall of the **semicircular ducts are sensitive to movements of the head i.e. acceleration and deceleration.**

The **organ of Corti in the cochlea contains receptors for hearing.**

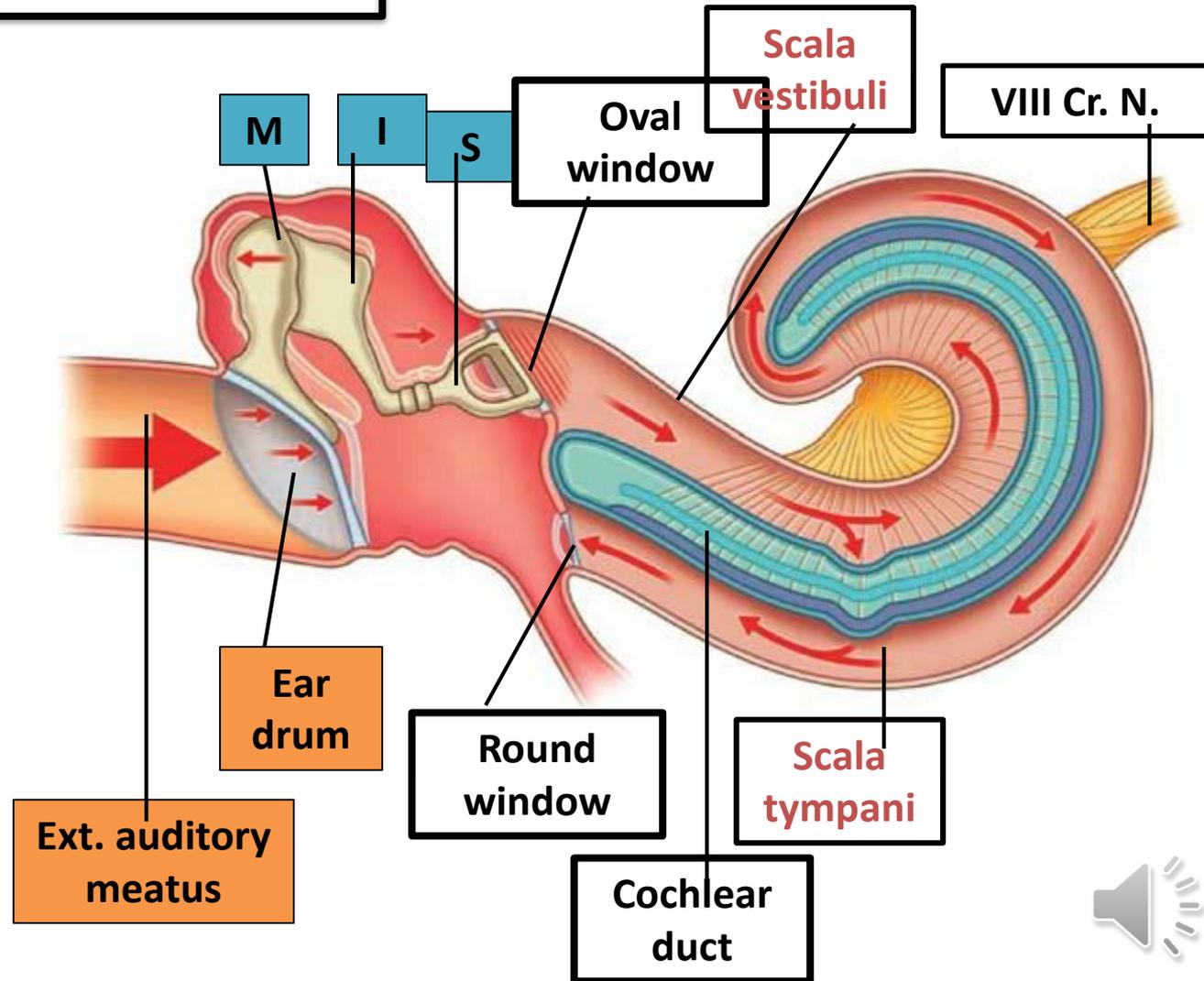


Vestibulocochlear (8th cranial nerve)

- ✓ combined nerves (**cochlear and vestibular**) which enters the brain stem in the **pontocerebellar angle**.
- ✓ **Vestibular nerve**:. This nerve enters the brain stem to relay in the vestibular nuclei and cerebellum. It is responsible for **equilibrium**.
- ✓ **Cochlear nerve**: The cochlear nerve enters the brain stem where it relays in the ventral and dorsal cochlear nuclei. It is responsible for **hearing**.



Sound waves causes vibration of the tympanic membrane. The ossicles transmit the vibrations to the oval window.



DEVELOPMENT OF THE EAR

1. THE INNER EAR:

The membranous labyrinth develops from **the otic vesicle** as follows :

vesicle as follows :

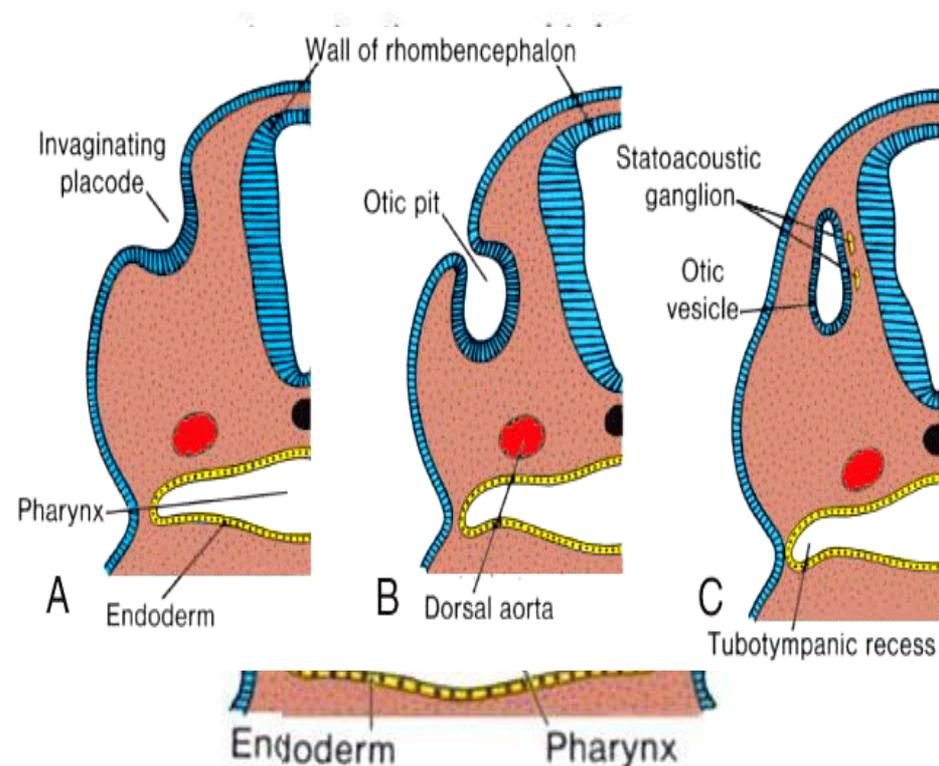
Early in the 4th wk, a thickening of the surface ectoderm "otic placode" appears on each side of the caudal part of the hindbrain.

The placodes invaginate and form the otic pits.

In the 4th wk, the otic vesicle(otocysts) splits off from the surface ectoderm

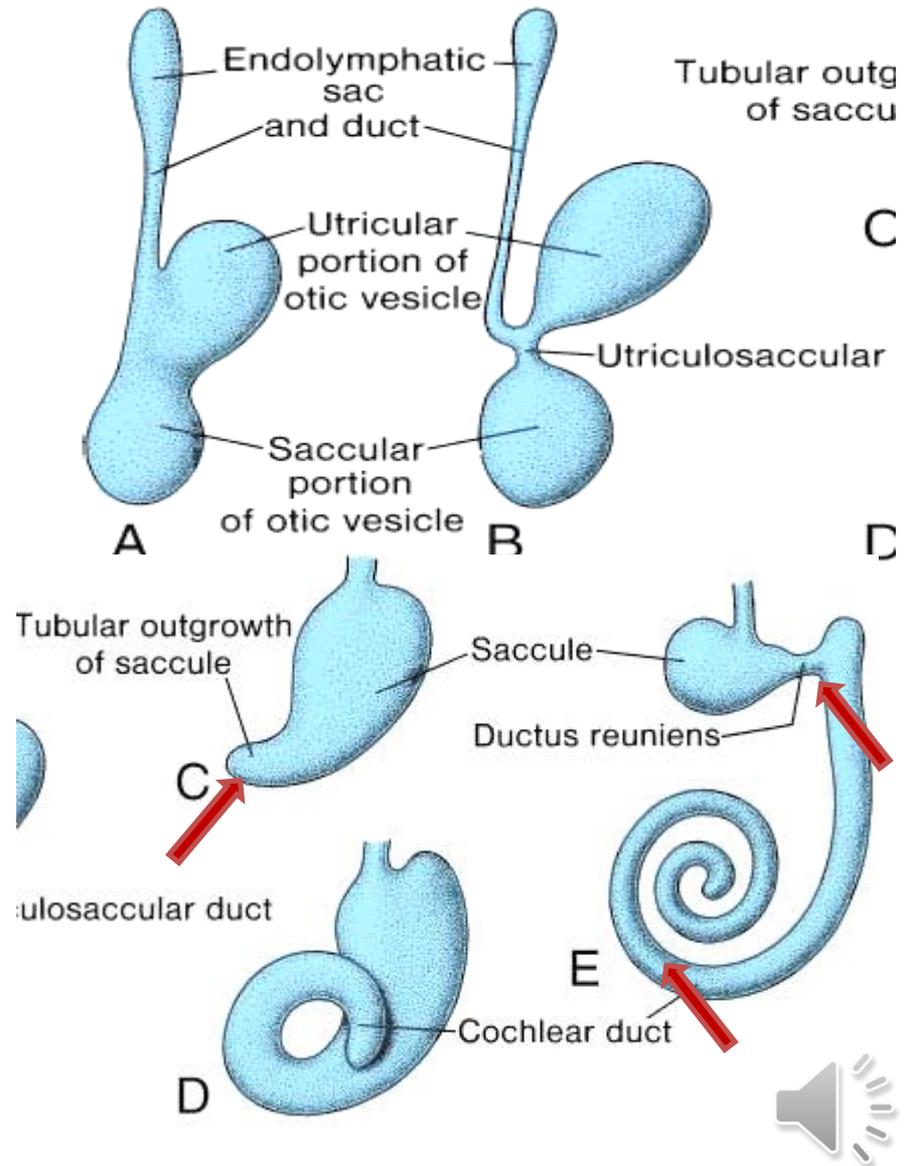
The otic vesicle divides in a ventral component "the saccule"

and a dorsal component "the utricle".



Development of the cochlea

- The cochlear duct develops in the 6th wk as a tubular outpocket from the lower pole of the saccule.
- It penetrates the surrounding mesenchyme and forms 2½ spiral turns.
- Its connection with the saccule is then confined to a narrow pathway, the ductus reuniens.



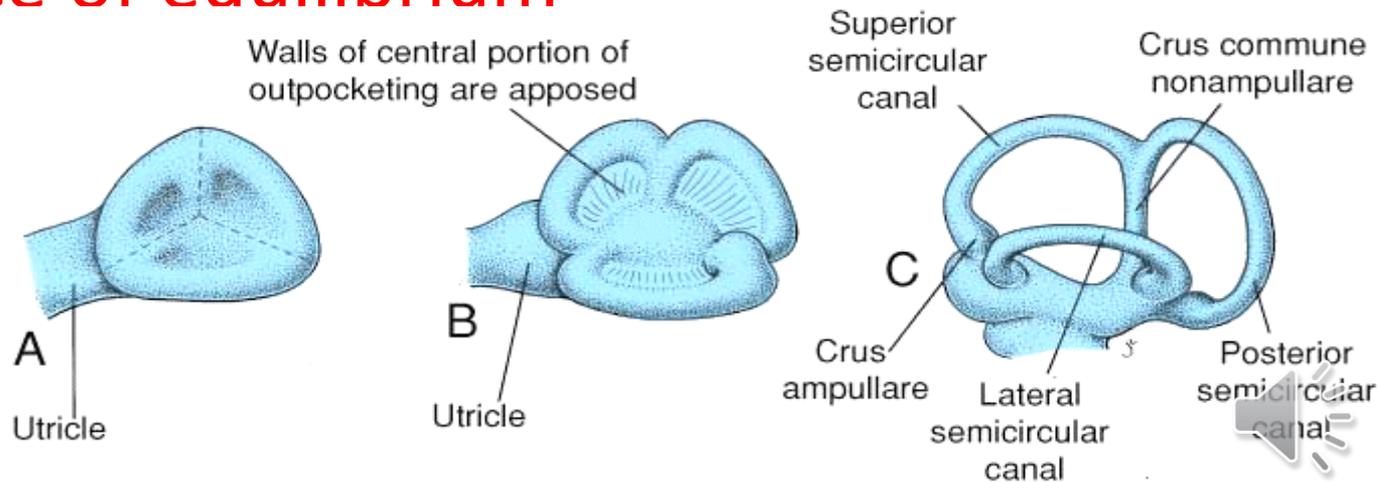
Development of the semicircular canals:

The semicircular canals appear during the 6th wk as 3 flattened disk-like outpocketings of the utricle.

3 semicircular canals.

One end of each canal dilates to form an ampulla. The cells in the ampullae form the crista ampullaris, containing the sensory cells for maintenance of equilibrium

Similar sensory areas develop in the walls of utricle and saccule and the maculae.



Thank you

