

PERIPHERAL NERVOUS SYSTEM

INTERNAL EAR & CN VIII

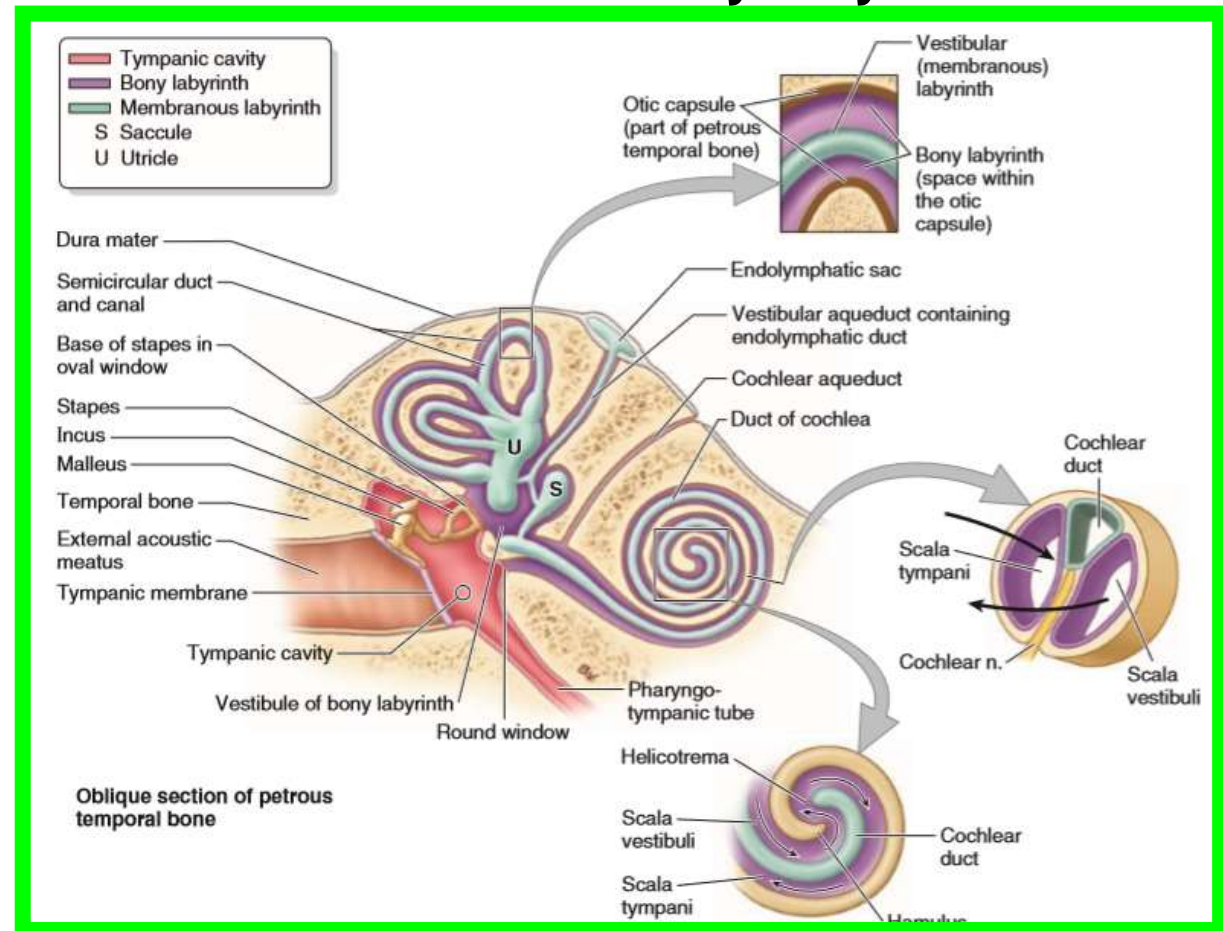
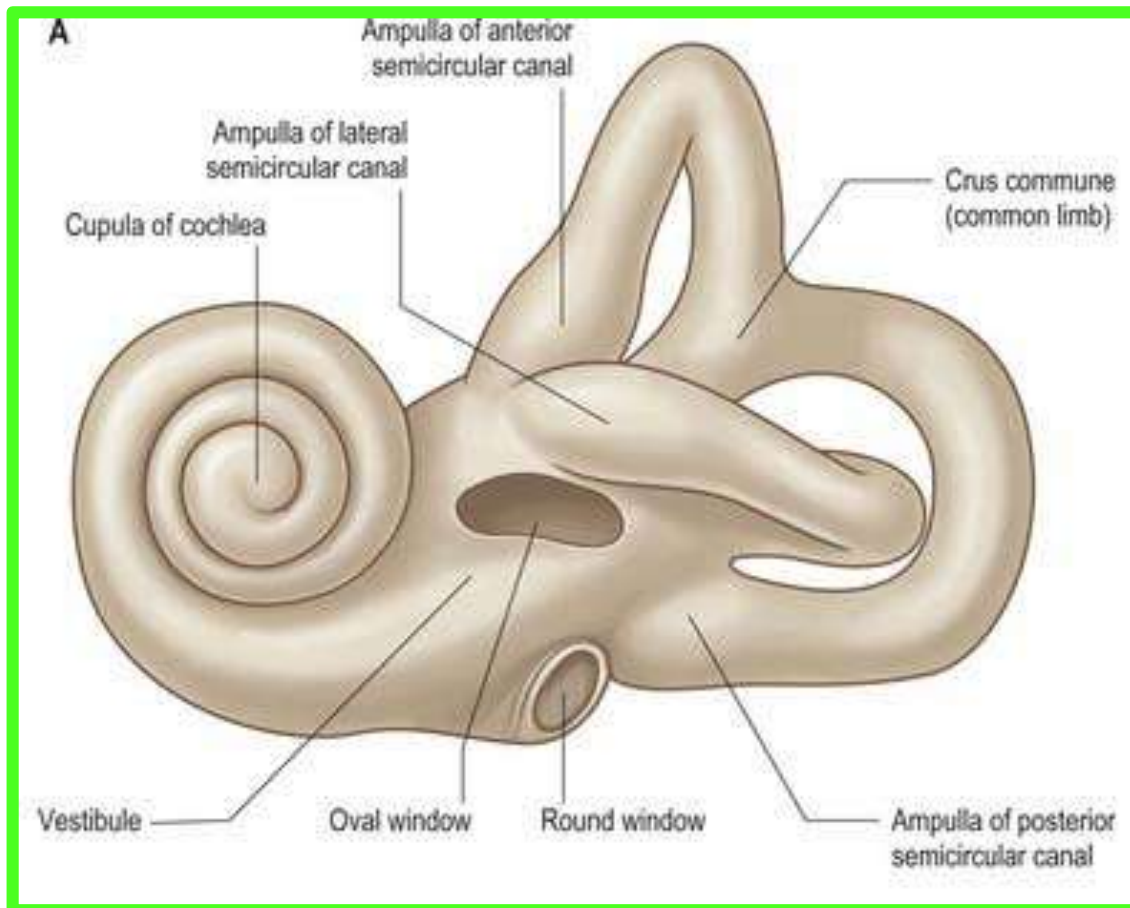
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Thursday 16 March 2023

INTERNAL EAR (LABYRINTH)

- **SITE:** inside the petrous part of temporal bone.
- **Structure:** it consists of 2 parts:
 - (1) **Bony labyrinth:** boney cavities inside the petrous temporal bone.
 - (2) **Membranous labyrinth:** interconnected sacs and ducts inside the bony labyrinth.

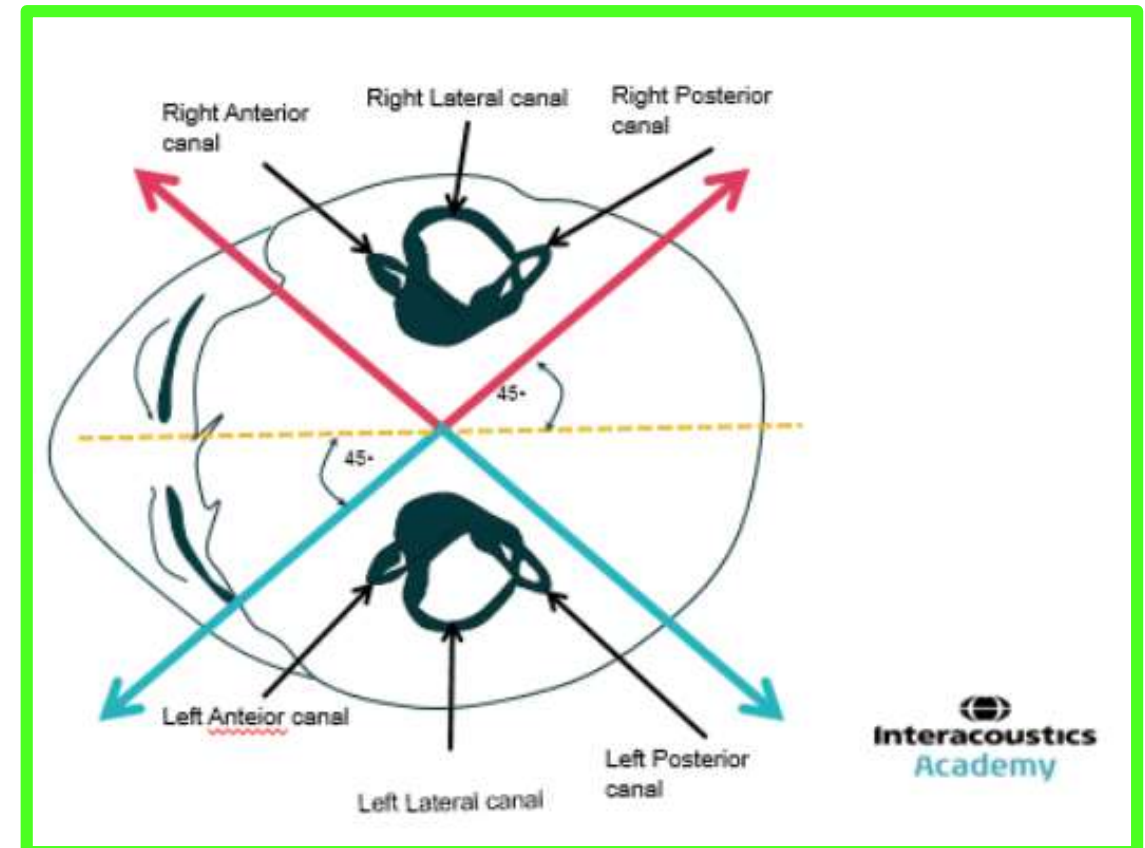
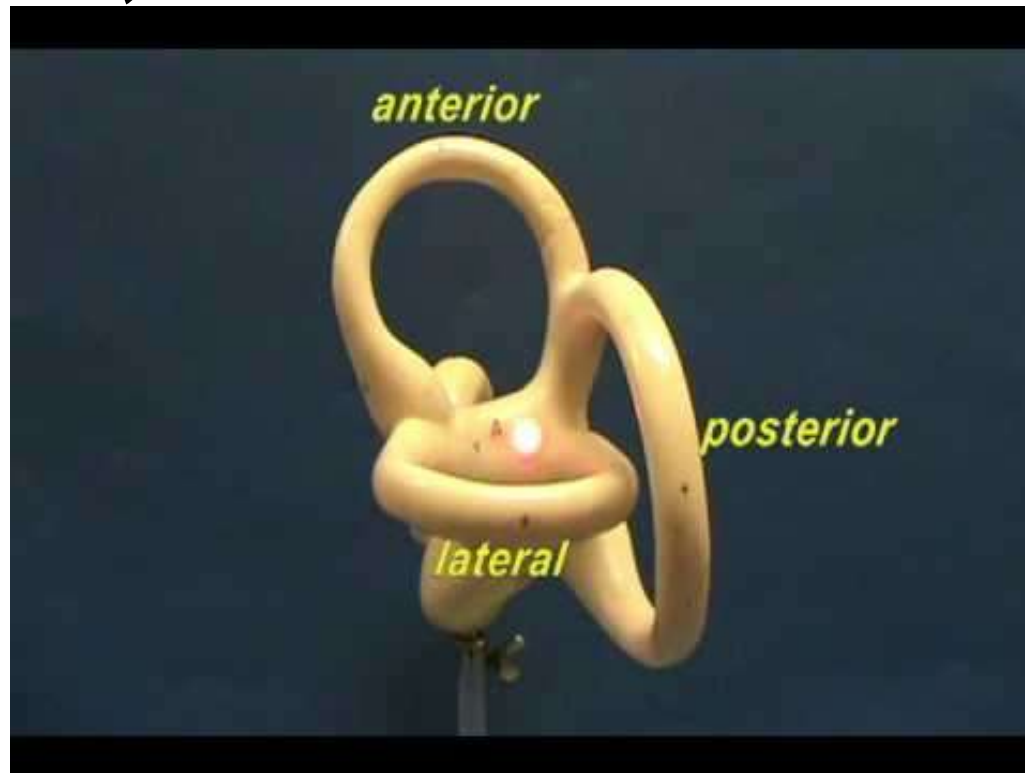


BONY LABYRINTH

I- **Semicircular canals:** are 3 arched canals set at right angles to each other.

- 1) **Superior semicircular canal:** lies in a vertical plane.
- 2) **Posterior semicircular canal** lies also in a vertical plane.
- 3) **Lateral semicircular canal** lies in a horizontal plane.

- These 3 canals open in the **posterior aspect of the vestibule** by **5 orifices** (one is common to 2 canals).

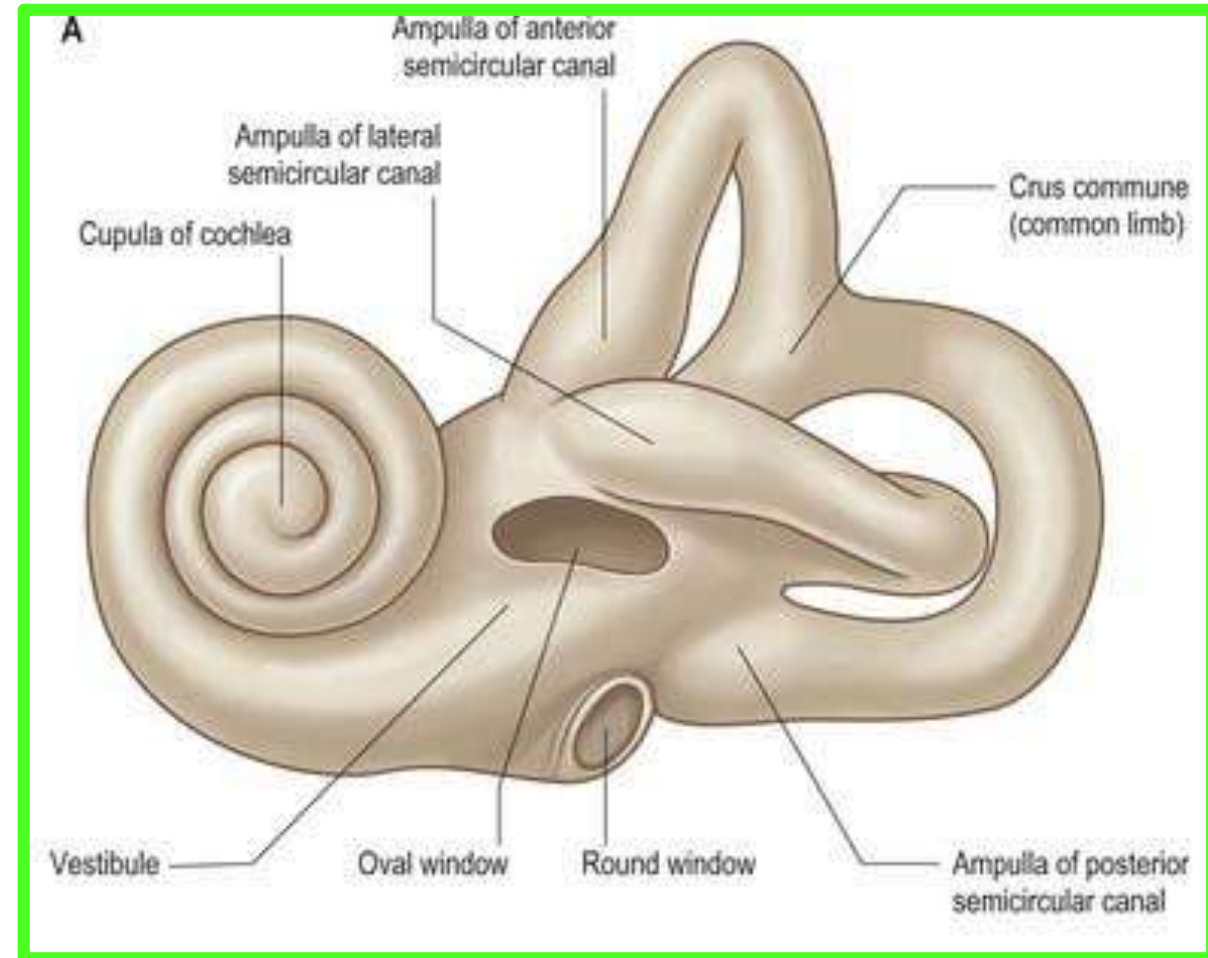
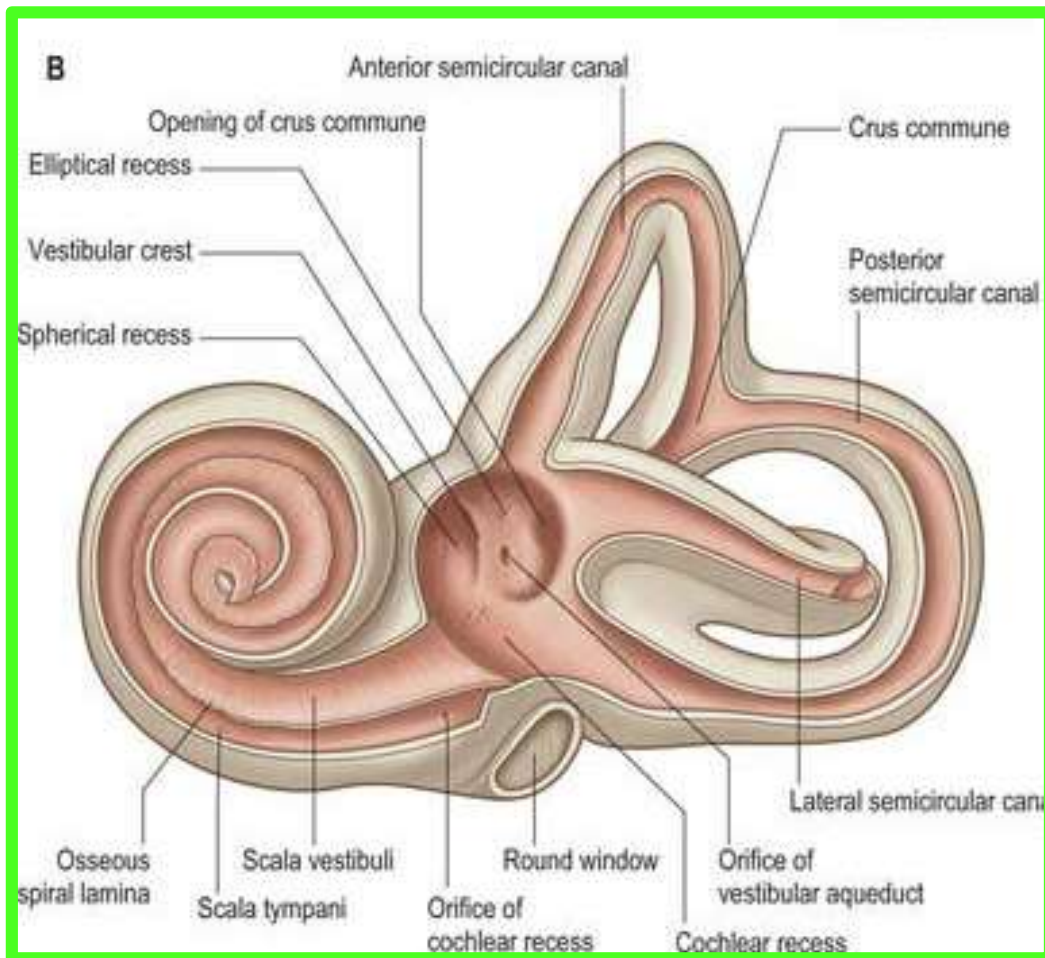


BONY LABYRINTH

II- The vestibule: is the central part of bony labyrinth.

a- Its anterior wall shows the opening of **the scala vestibuli of the cochlea.**

b- Its posterior wall receives the **5 openings of the 3 semicircular canals.**

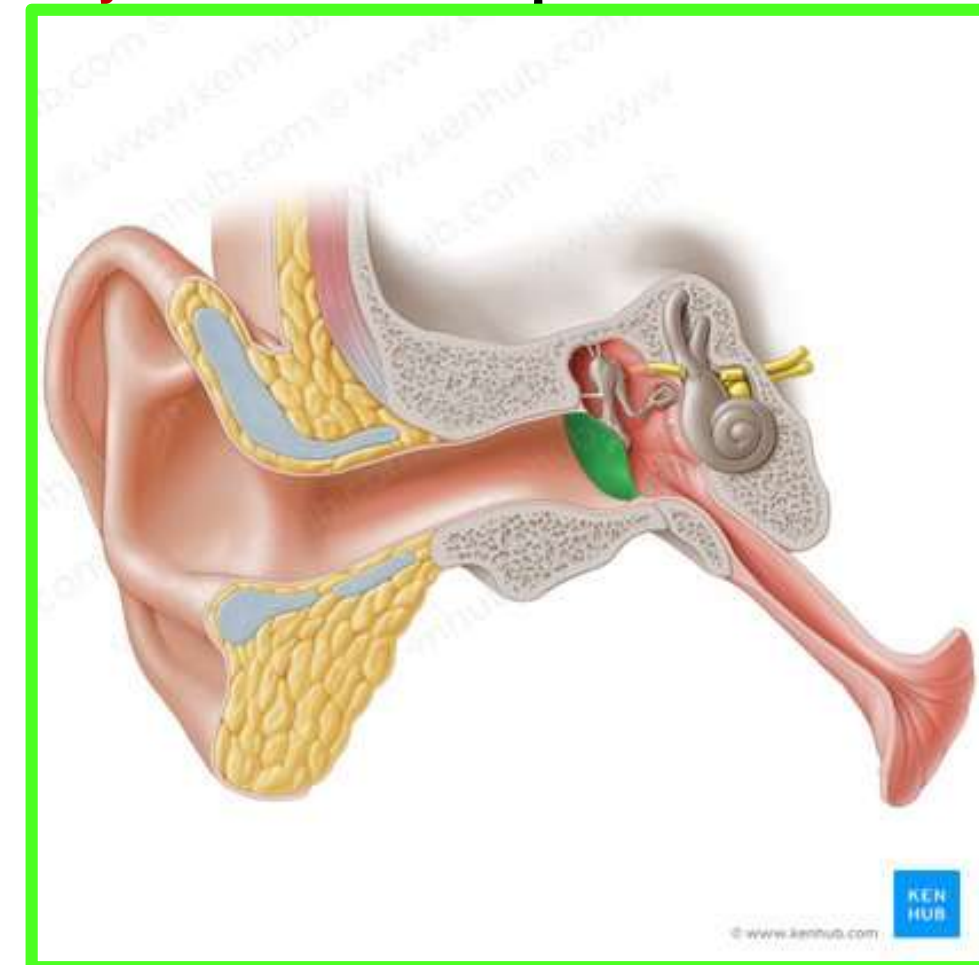
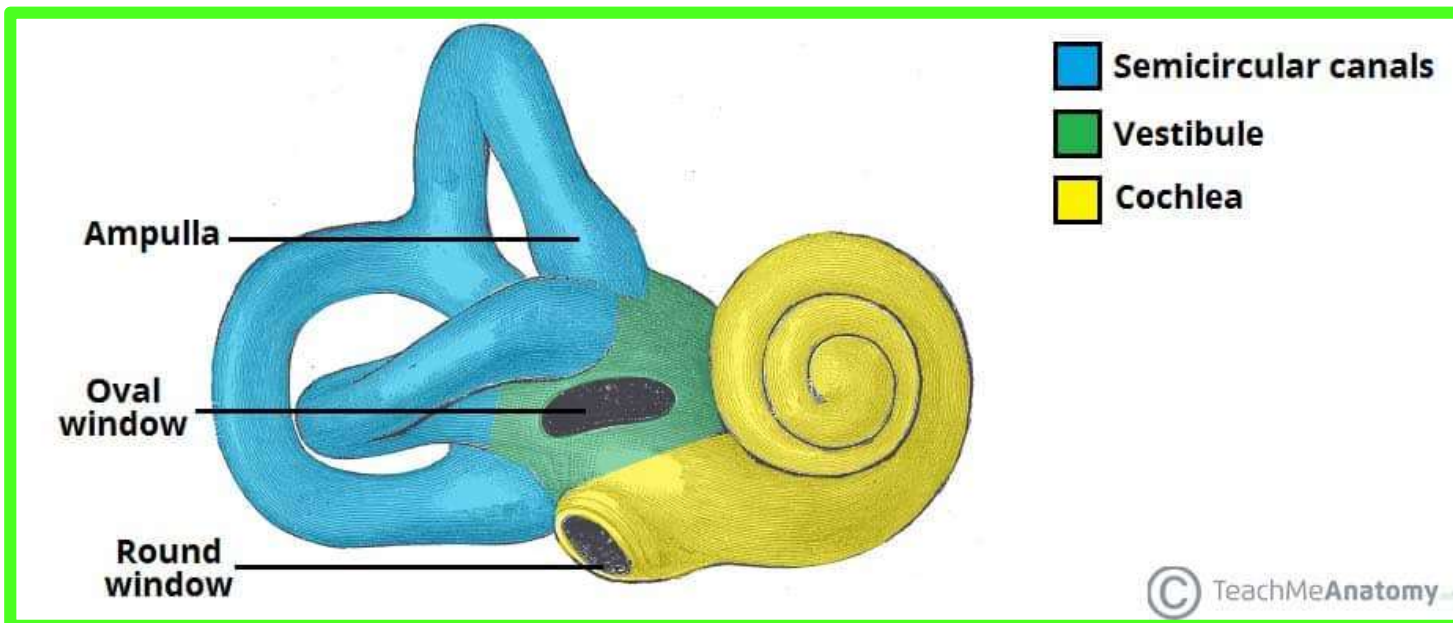


BONY LABYRINTH

II- The vestibule:

c- Its lateral wall is related to the middle ear and shows **fenestra vestibuli** which is closed by the **foot of stapes**.

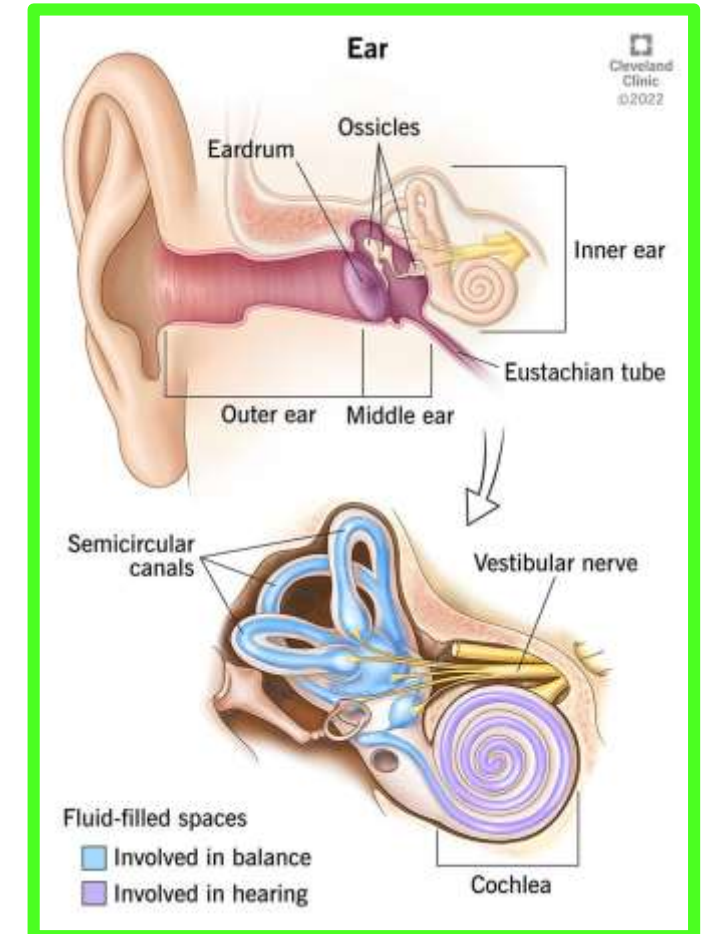
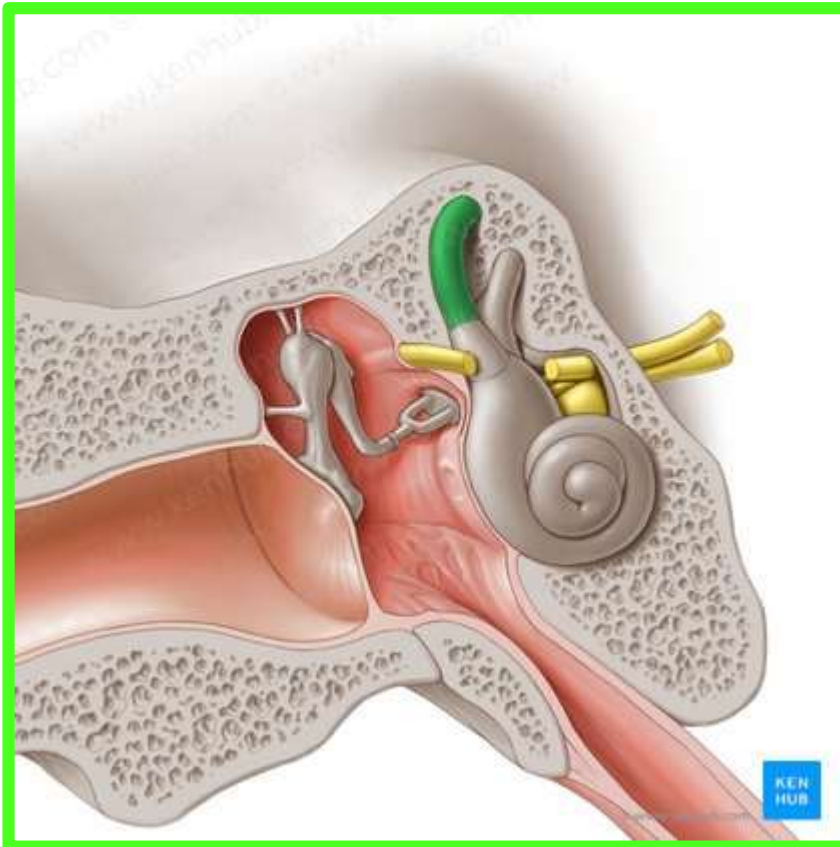
d- Its medial wall forms the **bottom of the internal auditory meatus** and is perforated by **the 8th cranial nerve**.



BONY LABYRINTH

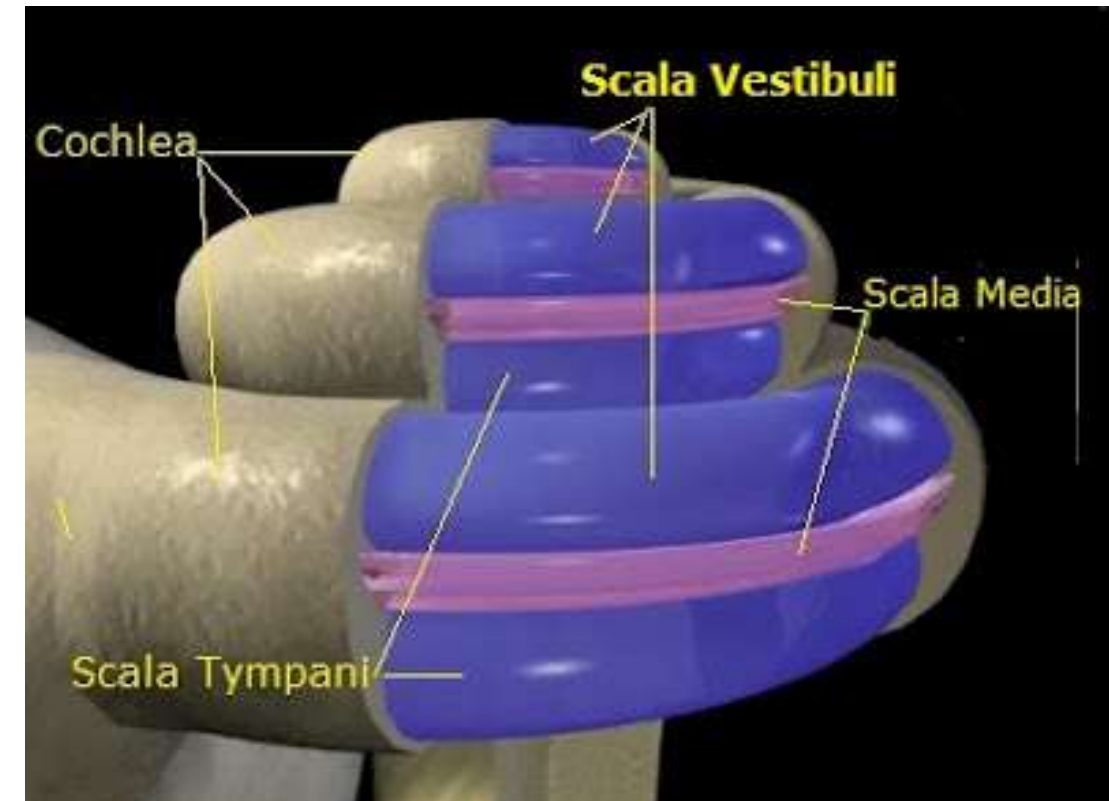
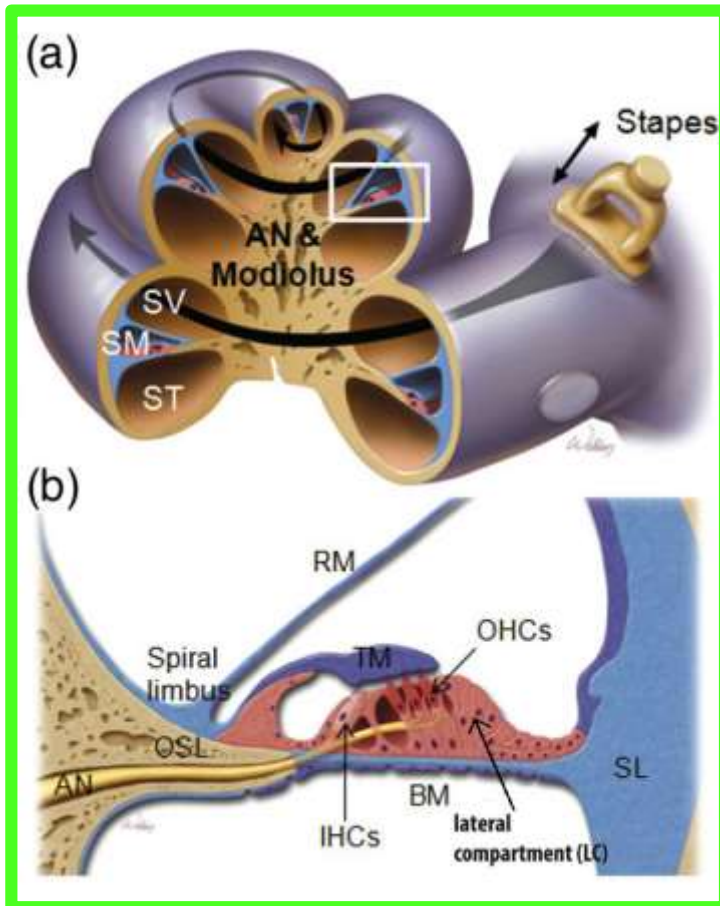
III- **The cochlea:** is the anterior part of the bony labyrinth:

- It resembles the shell of a common snail forming **2 and 1/2 turns** around its axis called **modulus**.
- **Its base is directed medially** towards the **bottom of the internal auditory meatus** and is perforated by the fibres of the **cochlear nerve**.



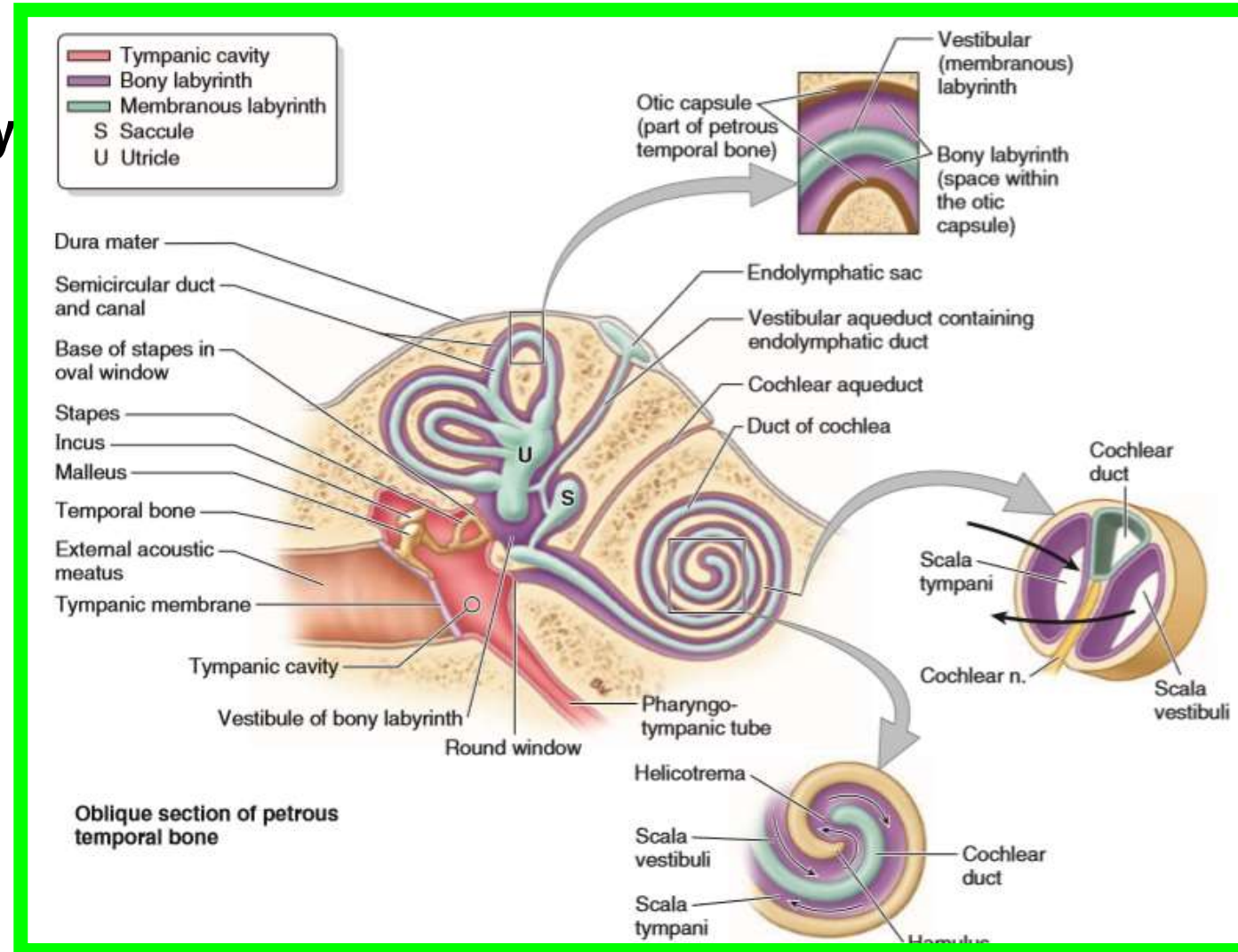
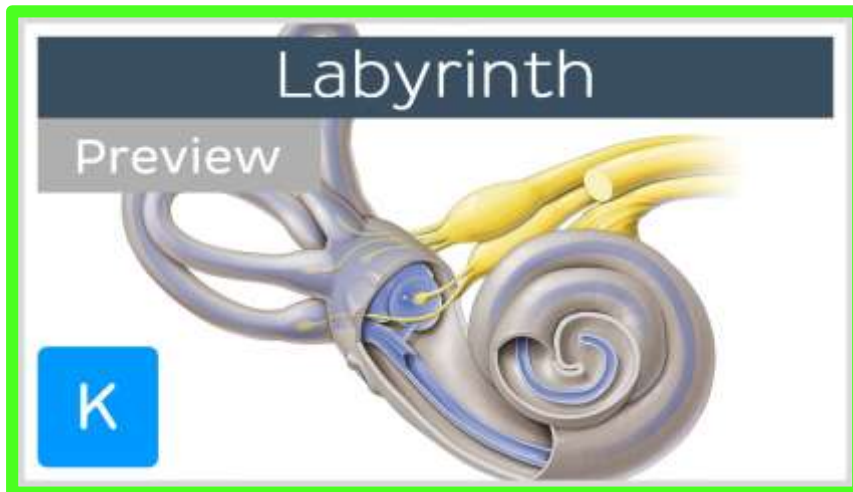
BONY LABYRINTH

- Its apex is directed **laterally** towards the medial wall of the tympanic cavity.
- The cochlear canal lodges the cochlear duct.
- **Spiral bony lamina** projects from **the modiolus** dividing the cochlear canal into **scala vestibuli** above and **scala tympani** below.



MEMBRANOUS LABYRINTH

- **Structure:** it consists of number of **membranous cavities** inside the bony labyrinth.
- These cavities are filled with fluid called **endolymph**.
- They are separated from the bony labyrinth by fluid called **perilymph**.

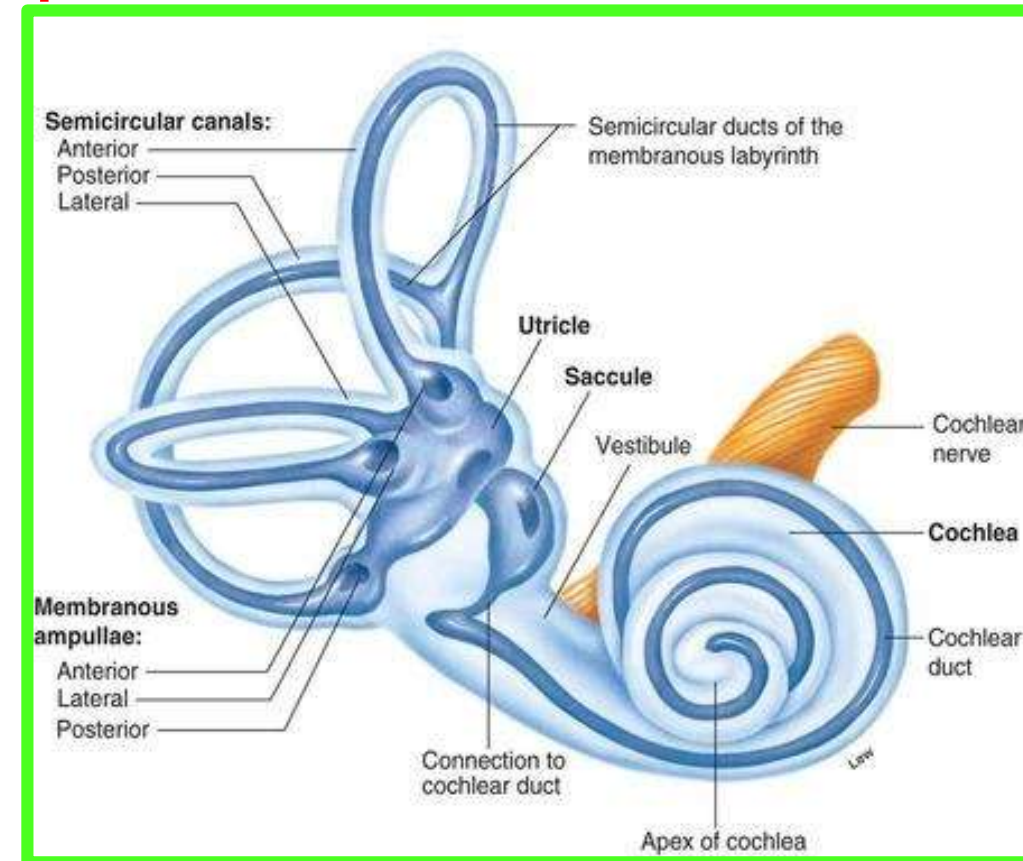
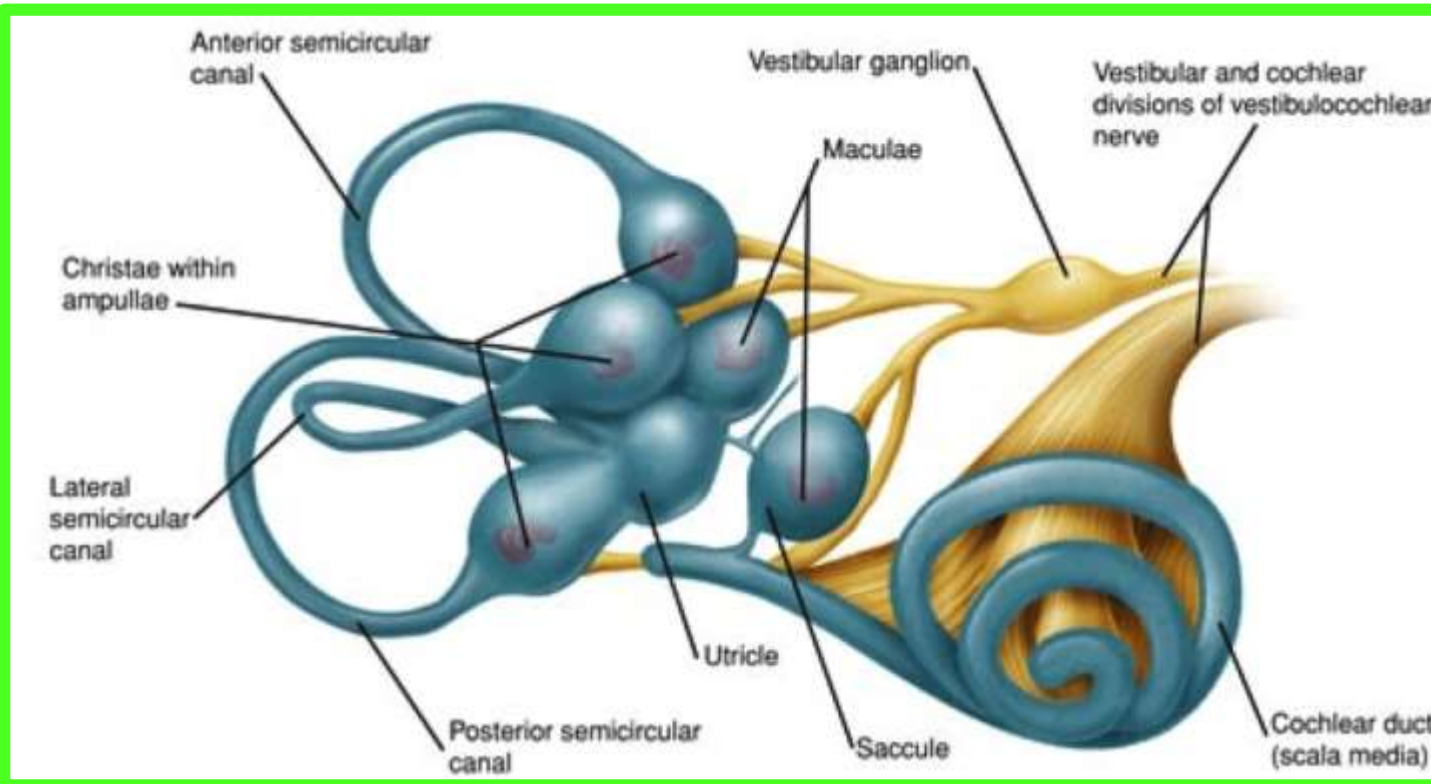


MEMBRANOUS LABYRINTH

Parts:

(1) The 3 semicircular ducts :

- They **lie within** the corresponding **bony canals**.
- They open in the **utricle**.
- Each duct has a dilatation at one of its ends called **ampulla**.

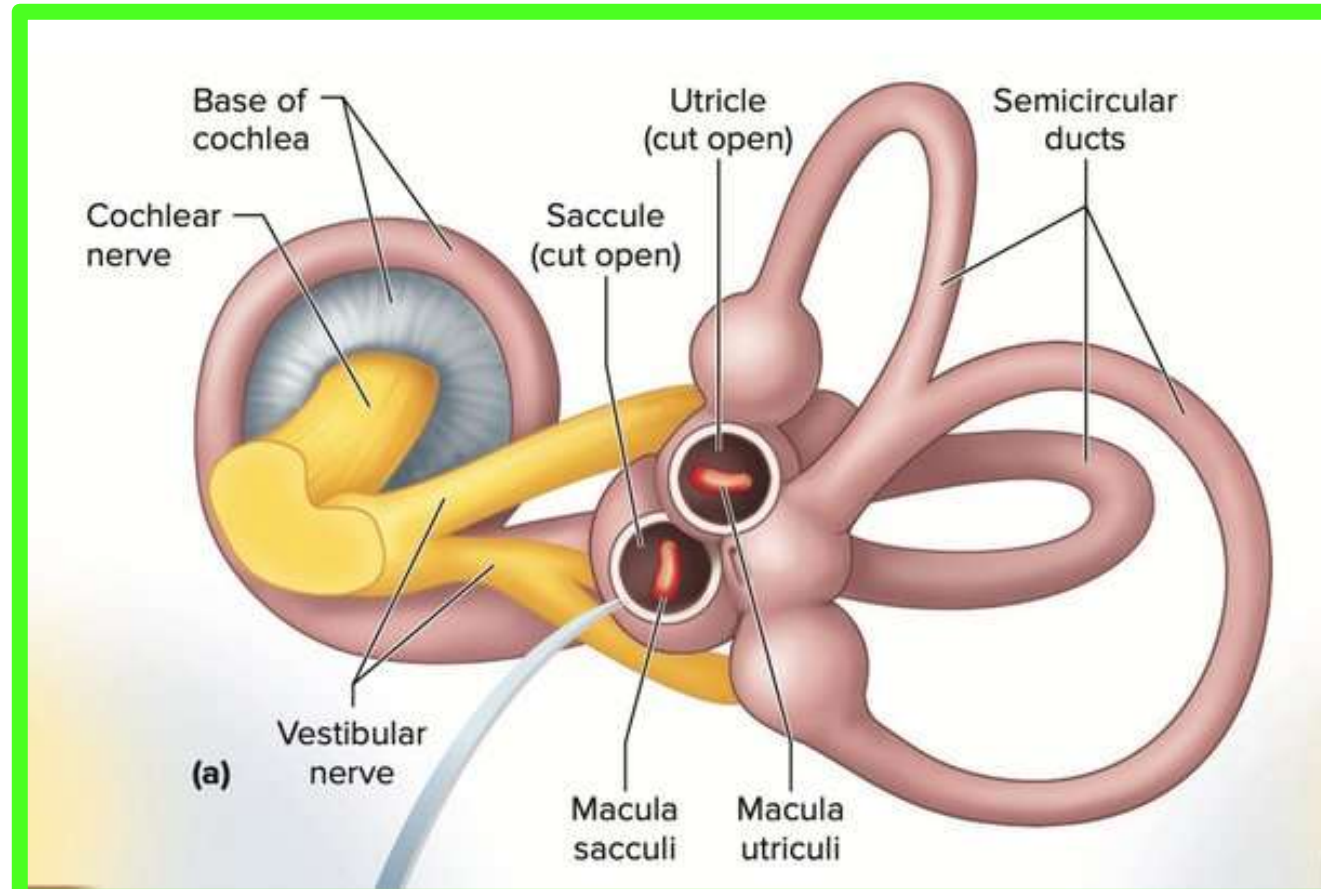
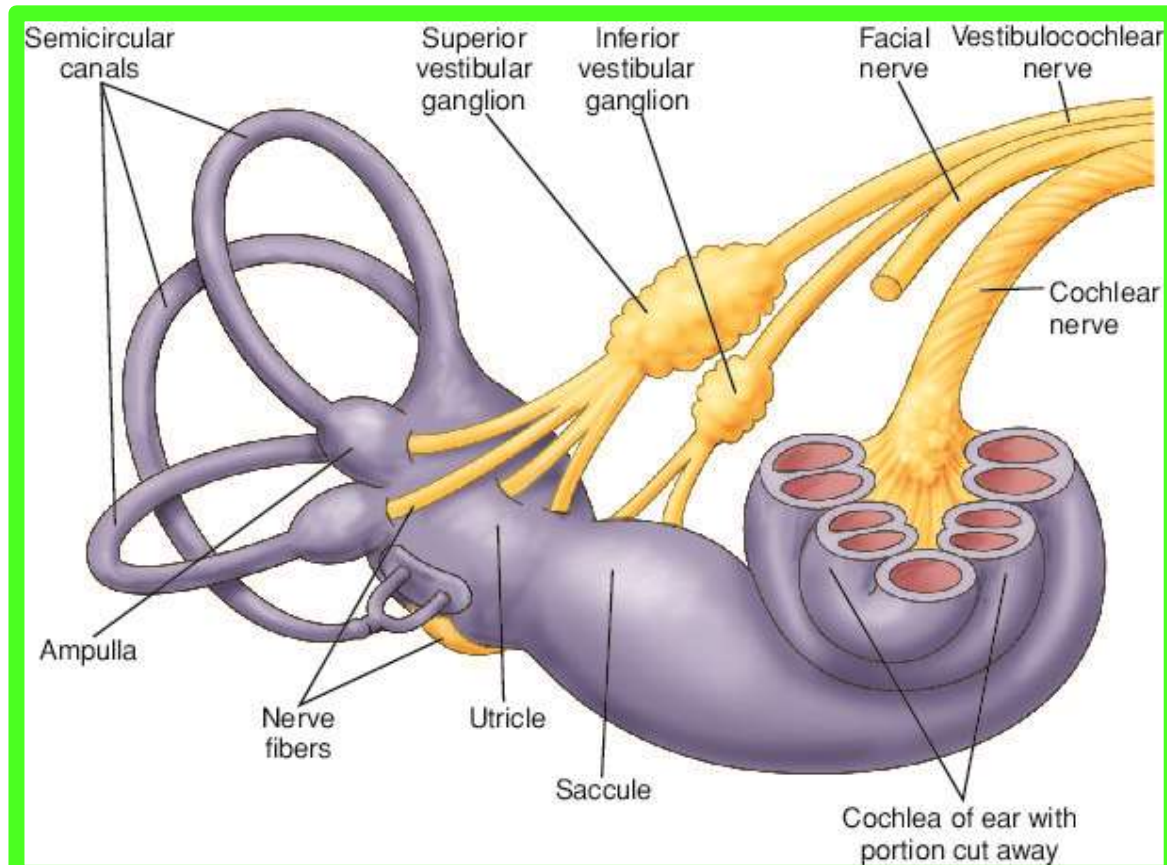


MEMBRANOUS LABYRINTH

(2) The utricle and saccule: they are 2 small sacs which lie **in the vestibule**.

A. Utricle: receives the **3 semicircular ducts**.

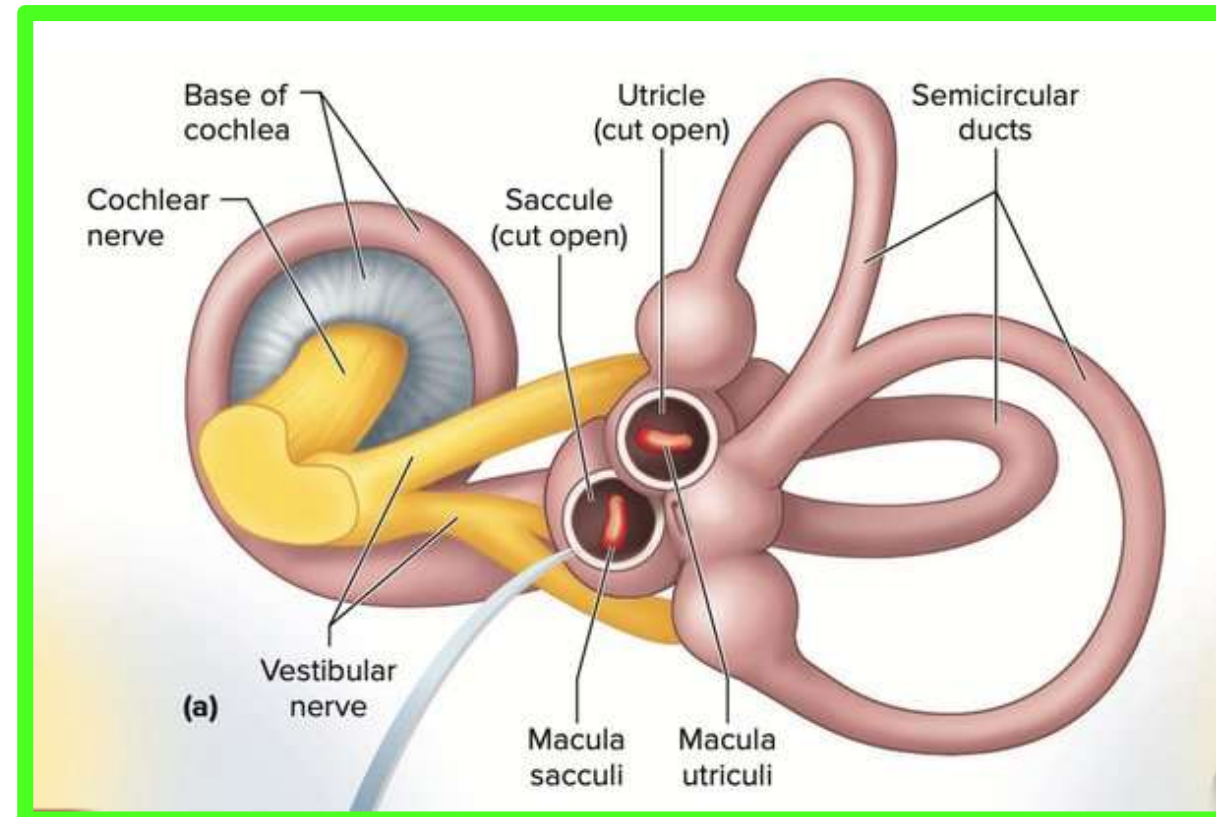
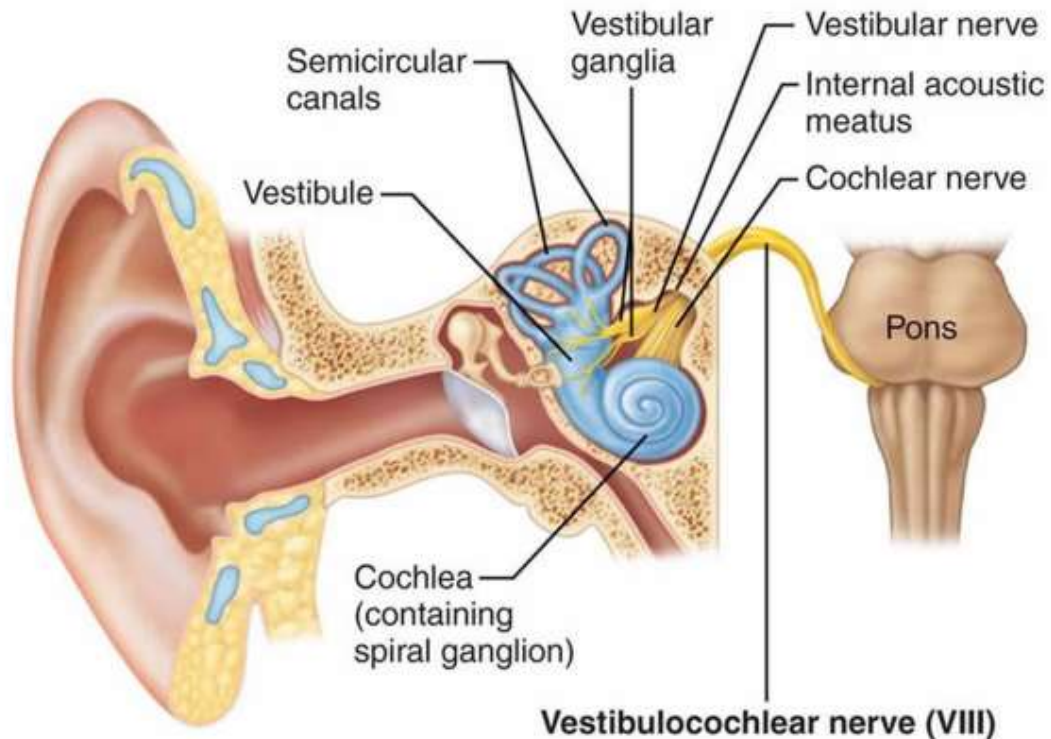
- Its lateral wall is thickened to form **a macula**.



MEMBRANOUS LABYRINTH

- B. Sacculle:** lies close to the base of the cochlea.
- It is connected to the basal turn of cochlea by **ductus reunines**.
- Its anterior wall is thickened to **form a macula**.
- The **macula** receives the **fibres of the vestibular nerve**.

The Vestibulocochlear Nerves - VIII



MEMBRANOUS LABYRINTH

- (3) The cochlear duct (inside the cochlear canal)
 - It contains endolymph and organ of corti (sensory end organ of hearing).
 - It extends between scala vestibuli above and scala tympani below.

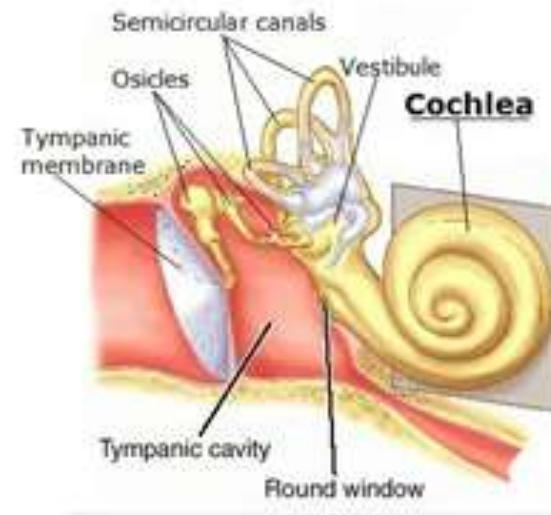
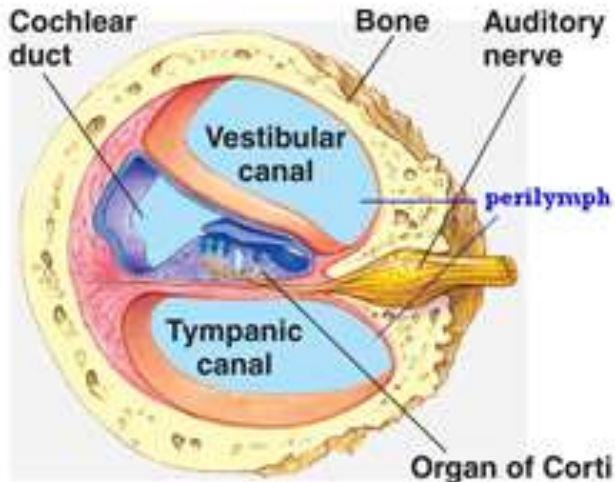
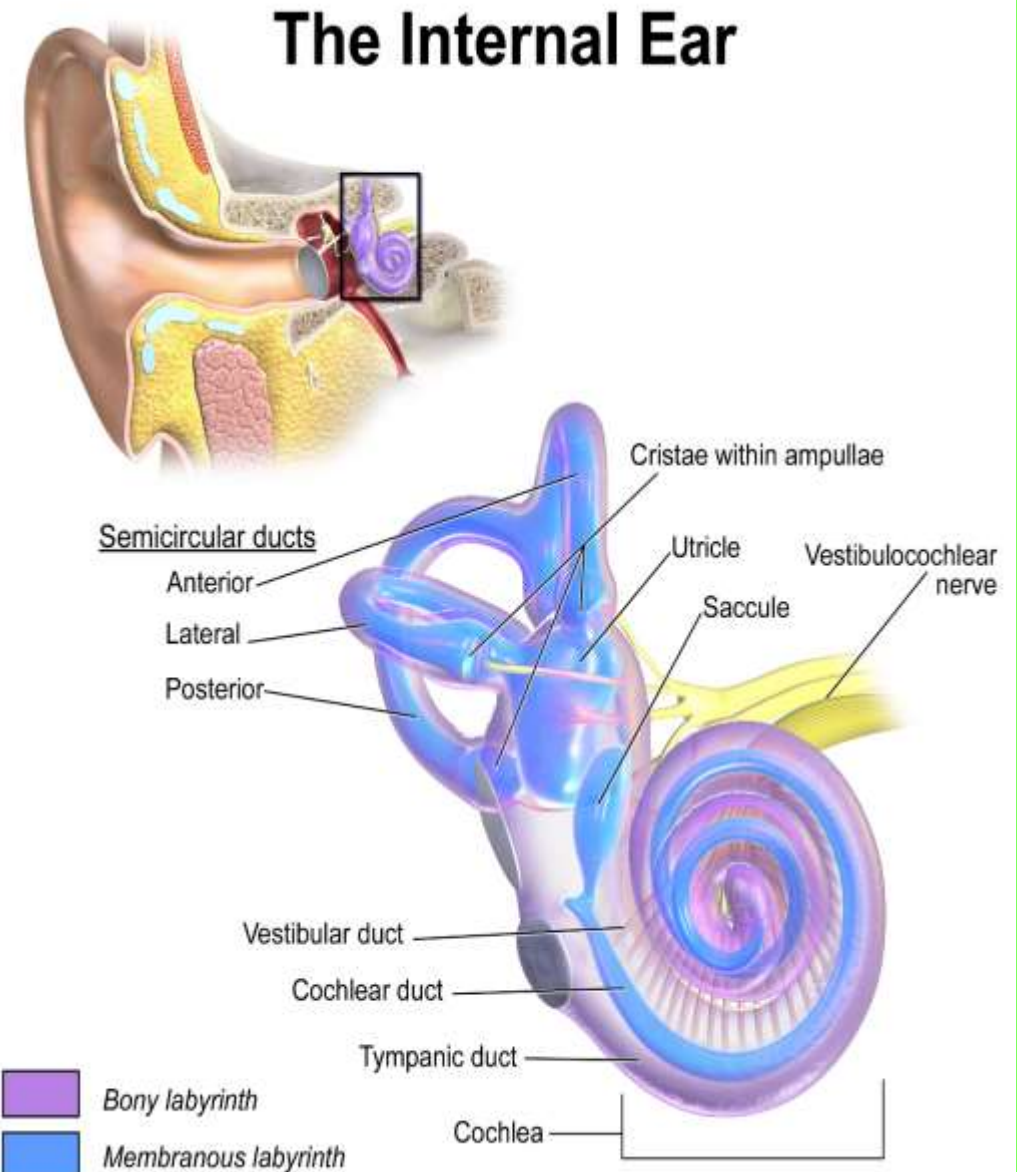
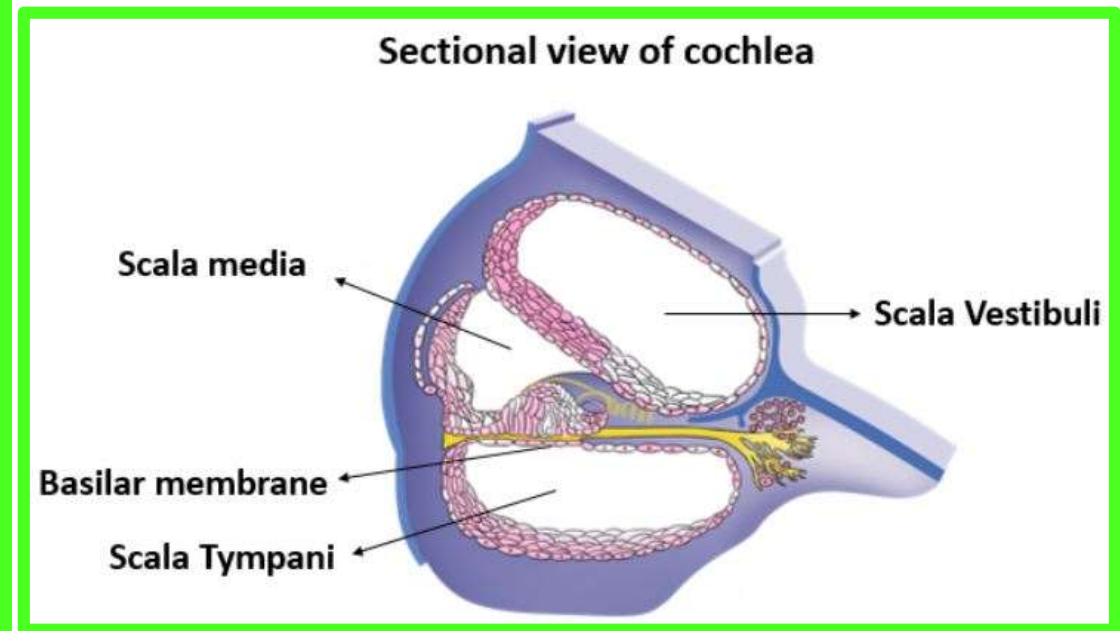
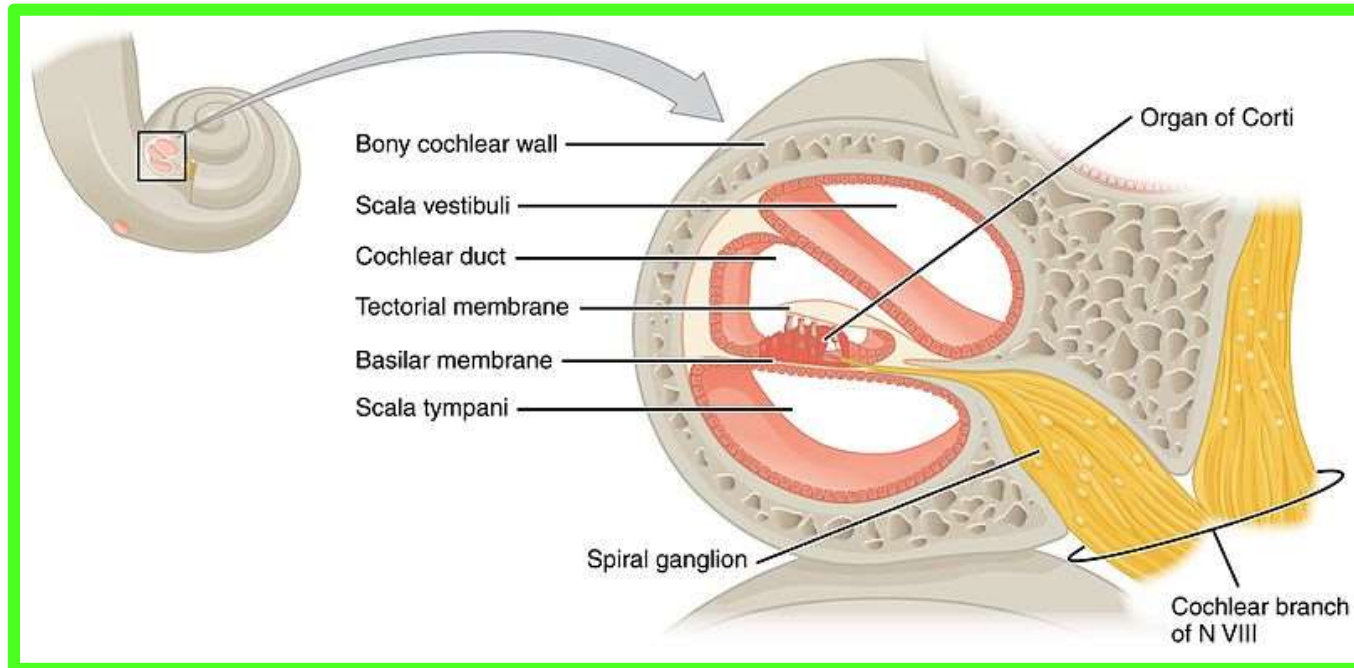


Fig. Structure of internal ear



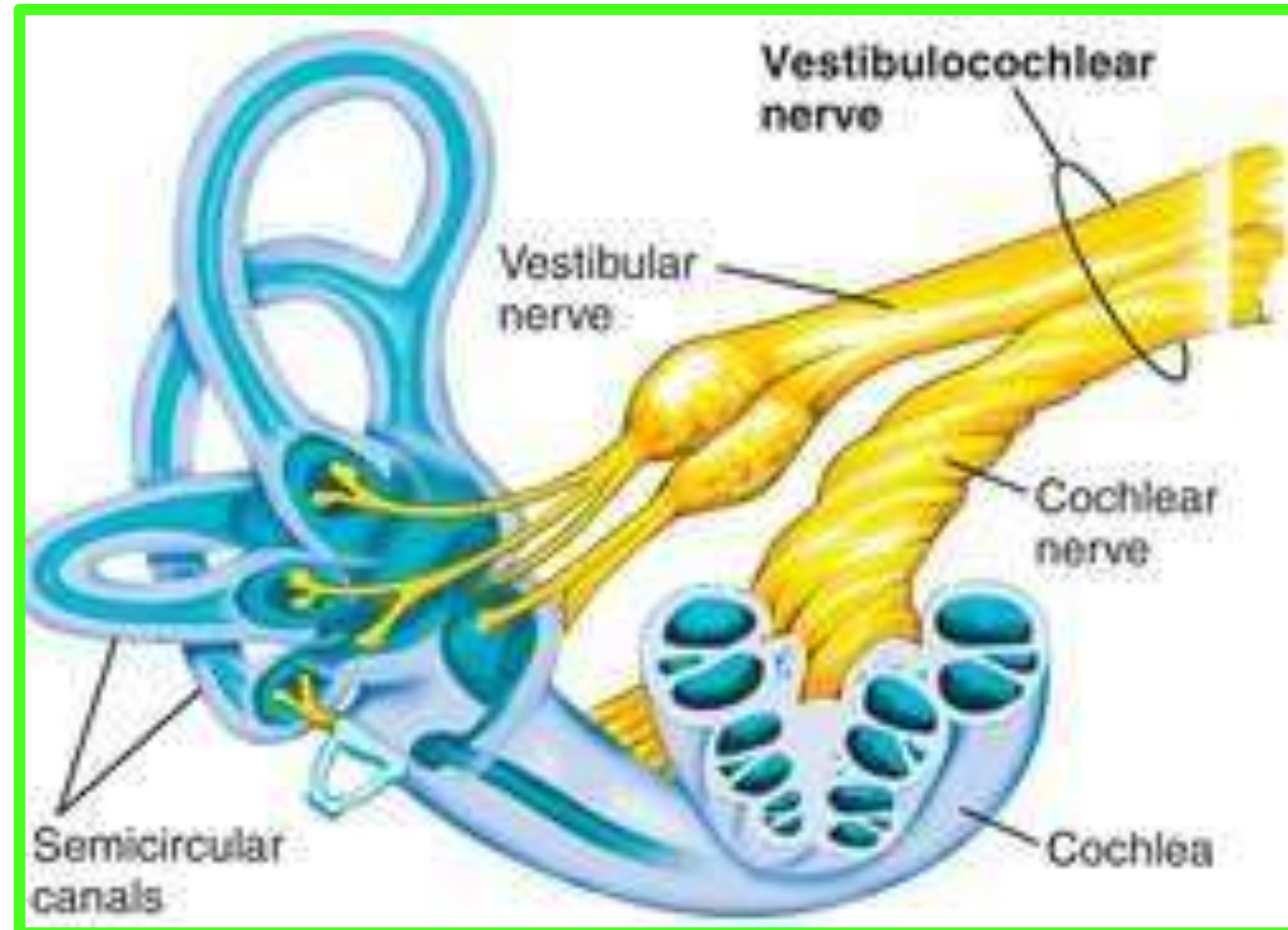
MEMBRANOUS LABYRINTH

- It is separated from the **scala vestibuli** by **the vestibular membrane**.
- It is separated from the **scala tympani** by **the basilar membrane**.
- **Spiral ganglion**, the peripheral processes pass to the **organ of corti** and the central from the **cochlear nerve**.



• Nerve supply of the labyrinth

- It is supplied by the vestibule-cochlear nerve as following:
 - Its cochlear division for the hearing.
 - Its vestibular division for the equilibrium.

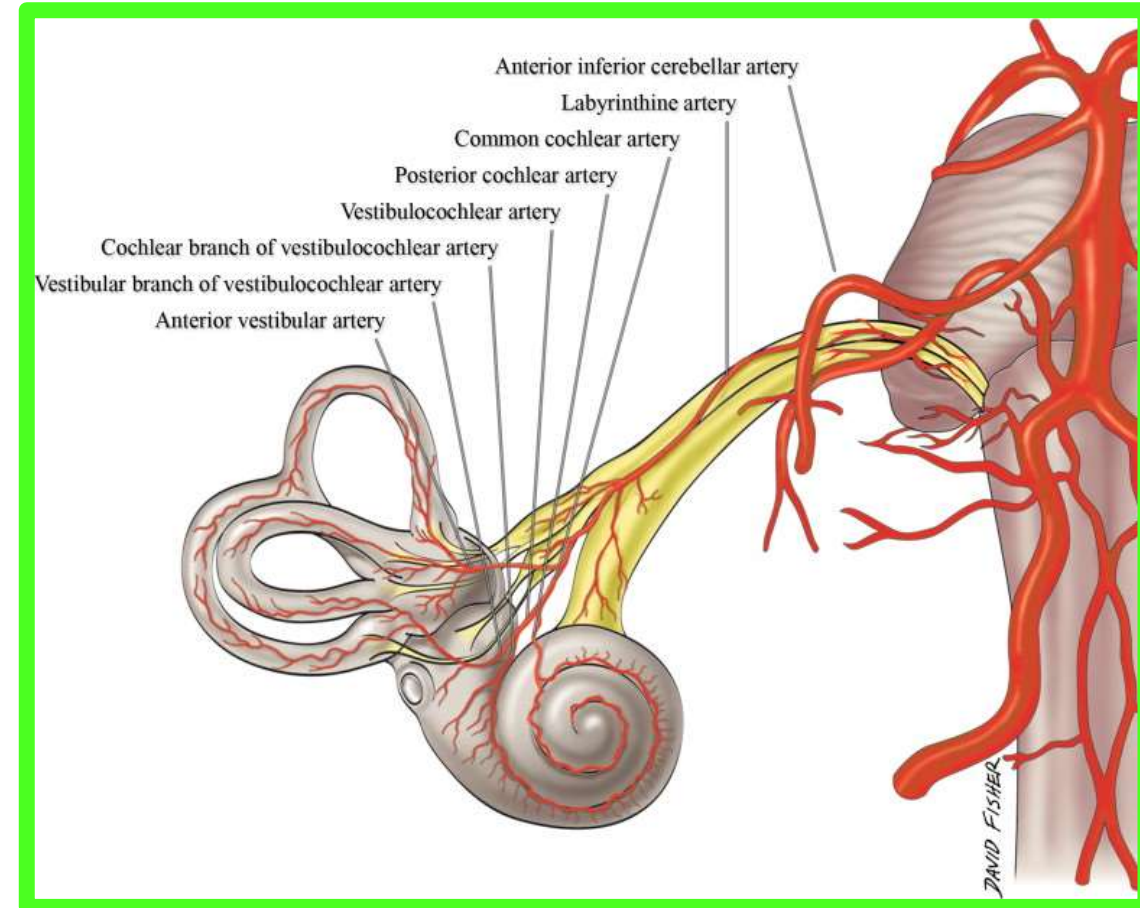
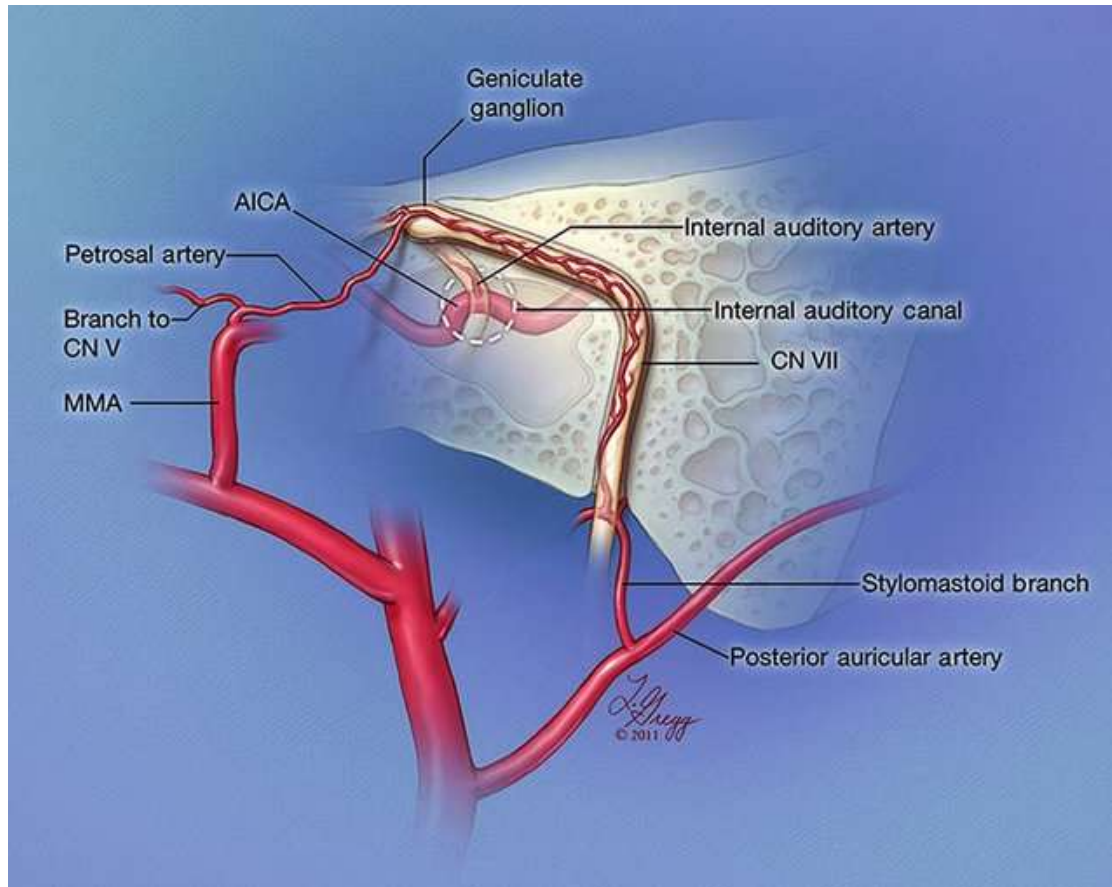


• Blood supply of the labyrinth

Arterial supply: (1) Labyrinthine branch of basilar artery.

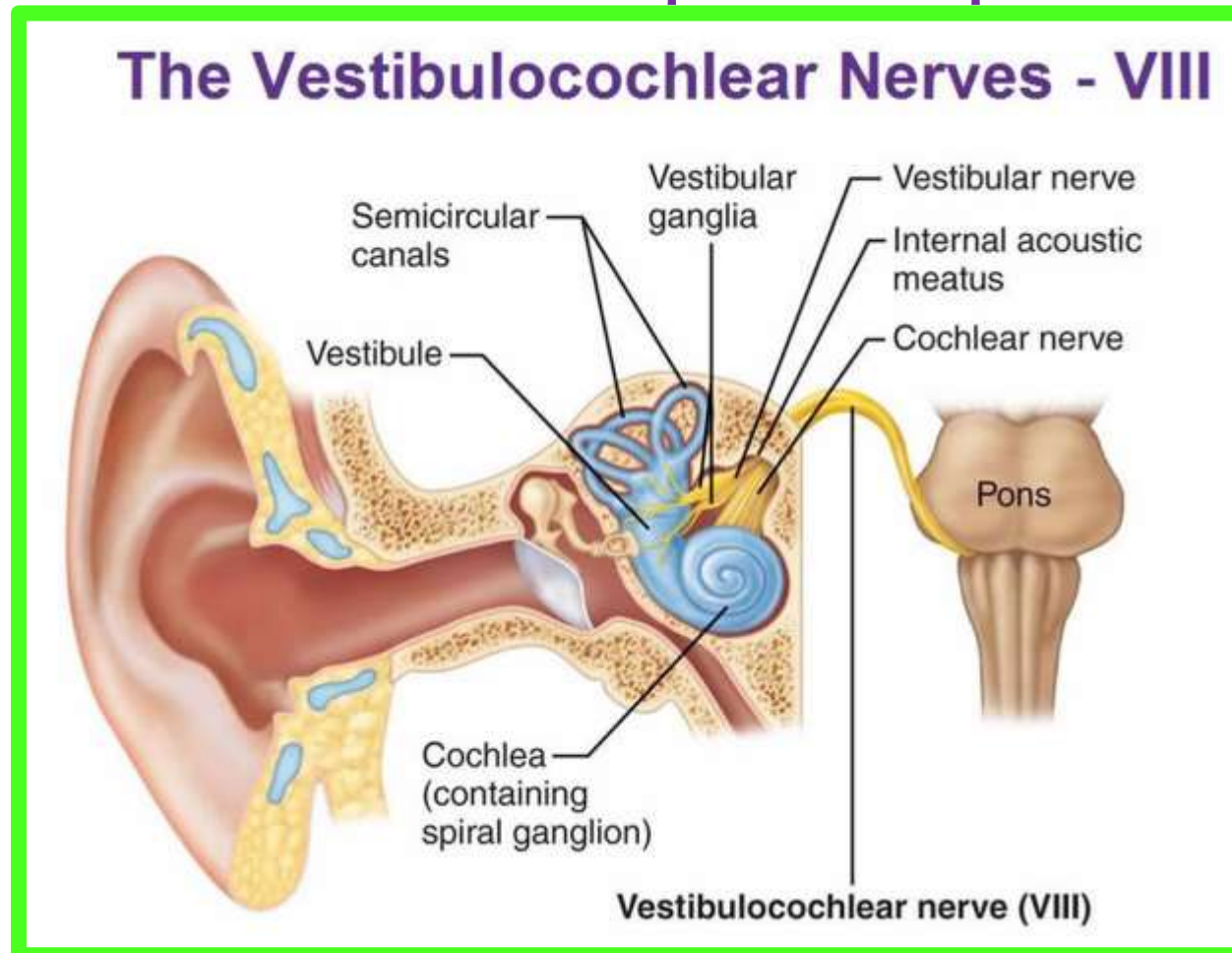
(2) Stylomastoid branch of posterior auricular artery.

Venous drainage: into superior Petrosal sinus or transvers sinus.



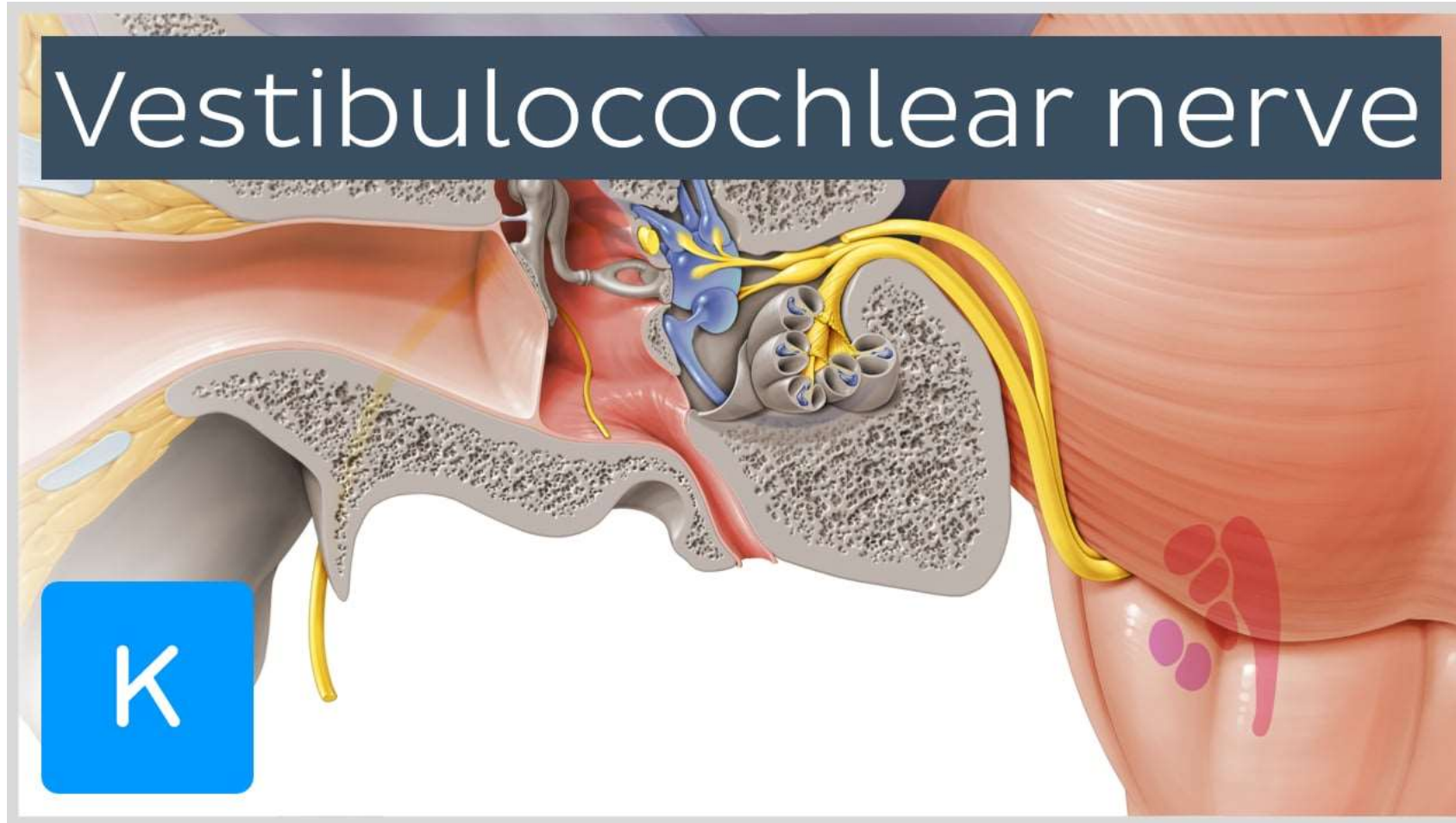
VESTIBULO – COCHLEAR NERVE

- **Type: special sensory nerve** (purely sensory) formed of 2 parts .
 - i. **Cochlear part:** carrying hearing impulses.
 - ii. **Vestibular part:** carrying equilibrium impulses .
- **Exit from the brain stem:** from the **anterior aspect at the ponto-medullary junction.**



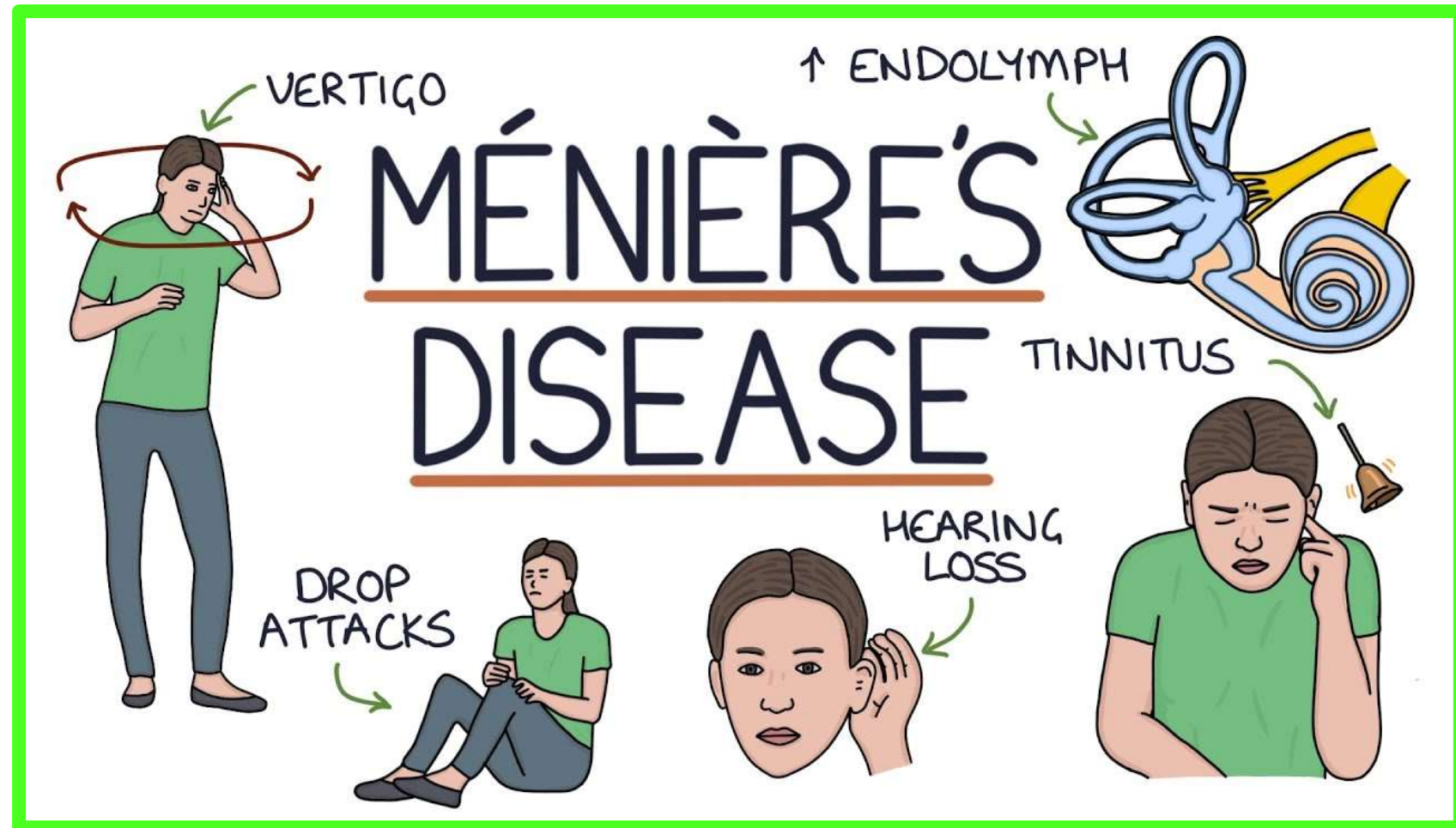
VESTIBULO – COCUHLEAR NERVE

- **Course:** it enters the internal auditory meatus (with facial nerve) where:
 - 1) **Cochlear part** ends in **the cochlea**.
 - 2) **Vestibular part** ends in **the utricle, saccule and 3 semicircular canals**.



Applied anatomy; Meniere's disease

- It is characterized by **vertigo** (giddiness, nystagmus, nausea and vomiting), associated with tinnitus and deafness.
- It is caused by **distension of endolymph** (due to disturbed fluid or allergy) with **degenerative changes in the organ of Corti**.



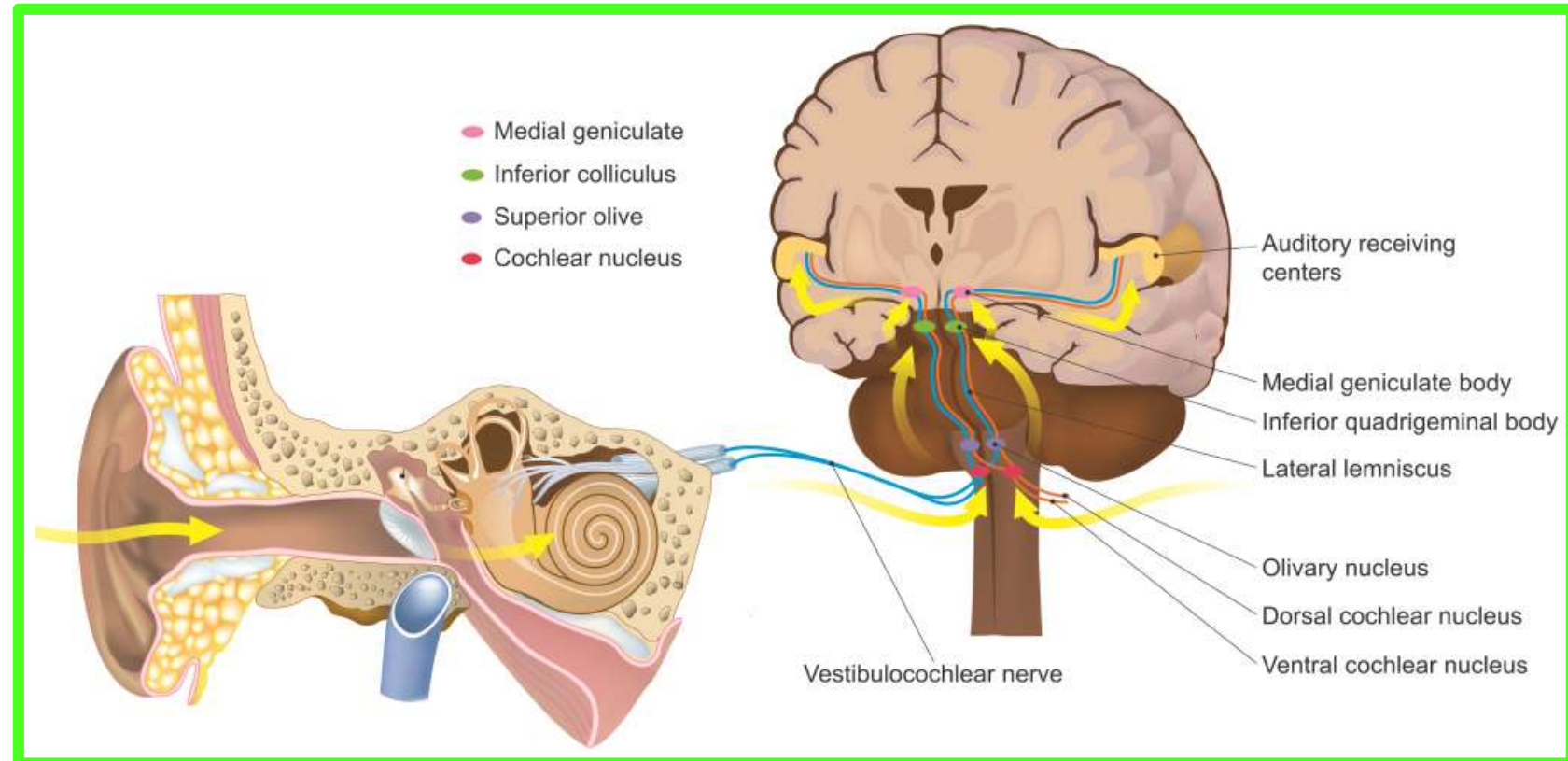
• AUDITORY (Hearing) PATHWAY

**** Receptors:** the organ of corti in the cochlear duct.

1- First neuron: bipolar cells of the spiral ganglion of the cochlea.

- The peripheral processes receive the sensation from the receptors.

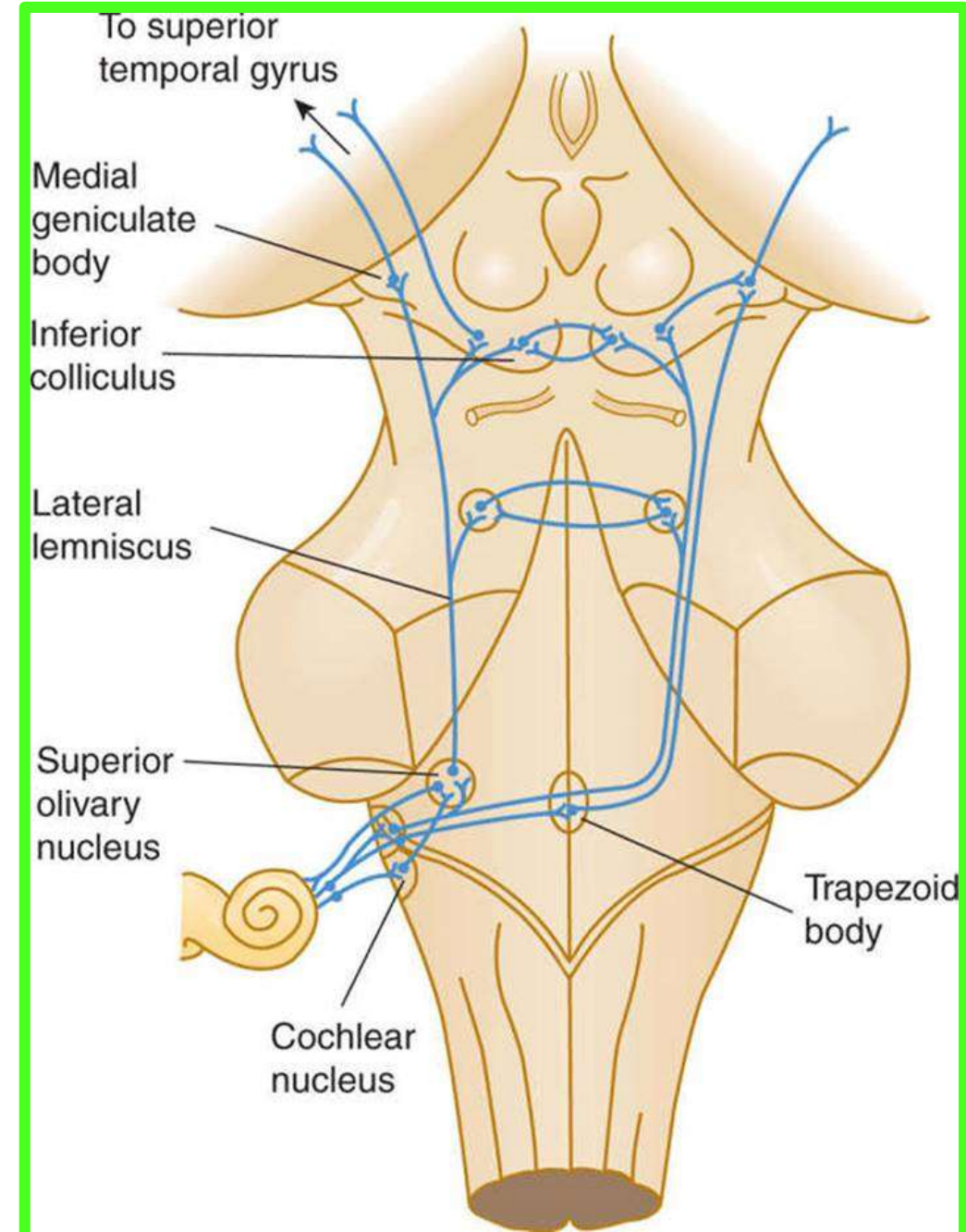
- Their axons form **the cochlear nerve** which ends in **the ventral** and **dorsal cochlear nuclei**.



• AUDITORY (Hearing) PATHWAY

2- Second neuron: ventral and dorsal cochlear nuclei.

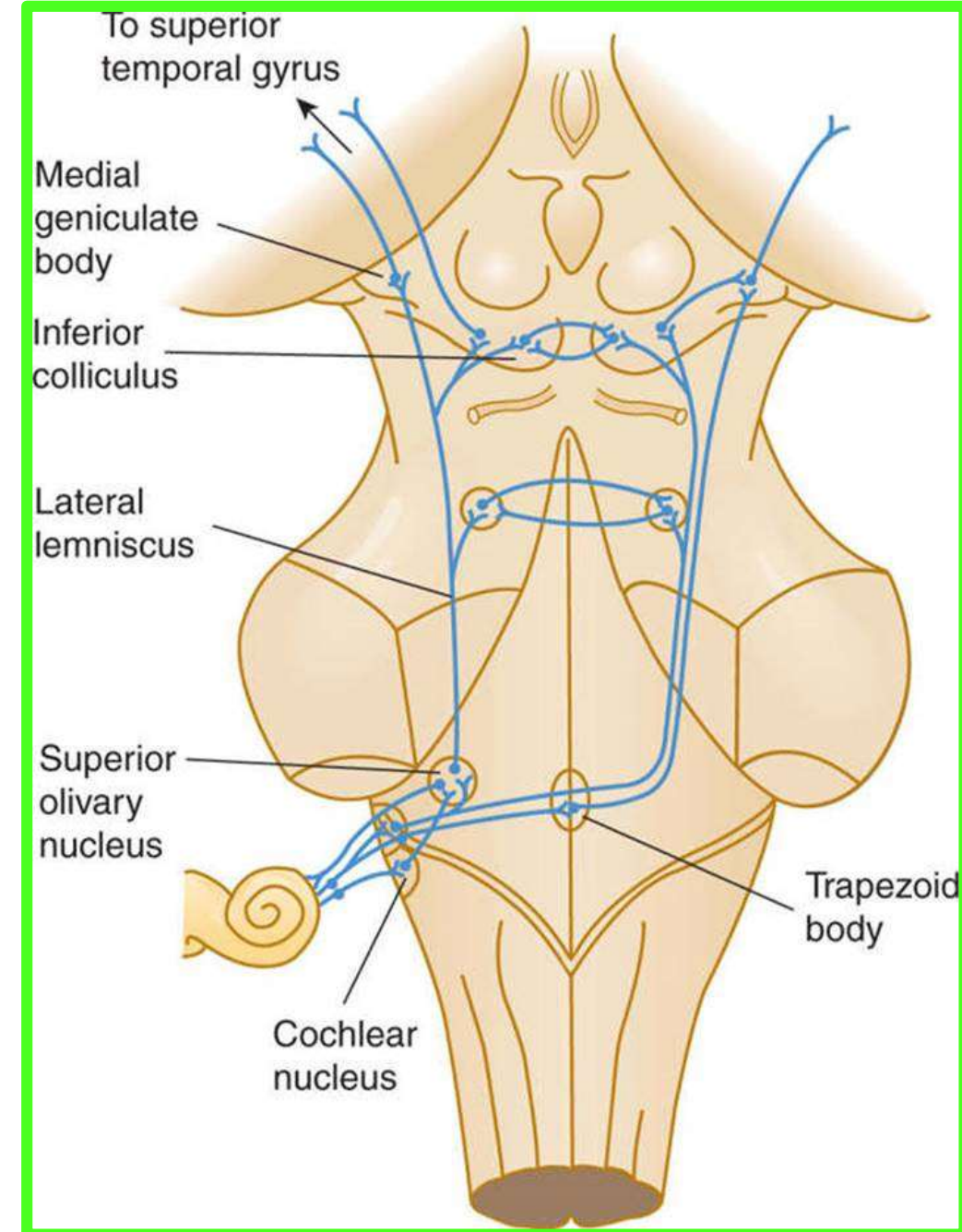
- Most of the axons of these cells cross to the opposite side → **trapezoid body** → ascend as a **lateral lemniscus** with some fibres from the same side.
- Few fibers do not cross but ascend in the **lateral lemniscus** of the same side.
- Many of them relay in the **superior olivary nucleus** and **nucleus of the trapezoid body**



• AUDITORY (Hearing) PATHWAY

3- Third order neuron (superior olivary nucleus and nucleus of the trapezoid body)

- The axons of their cells ascend as the **lateral lemniscus**.
- On reaching the midbrain;
 - a- most of the fibers terminate in **the inferior colliculus**.
 - b- The remainder of fibres pass through the inferior brachium to end in **the medial geniculate body**.

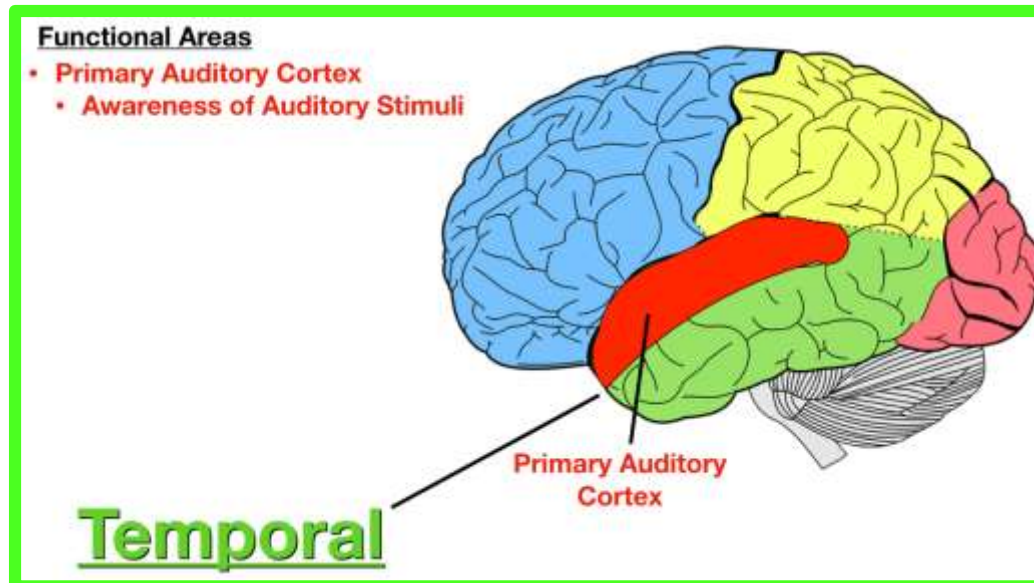
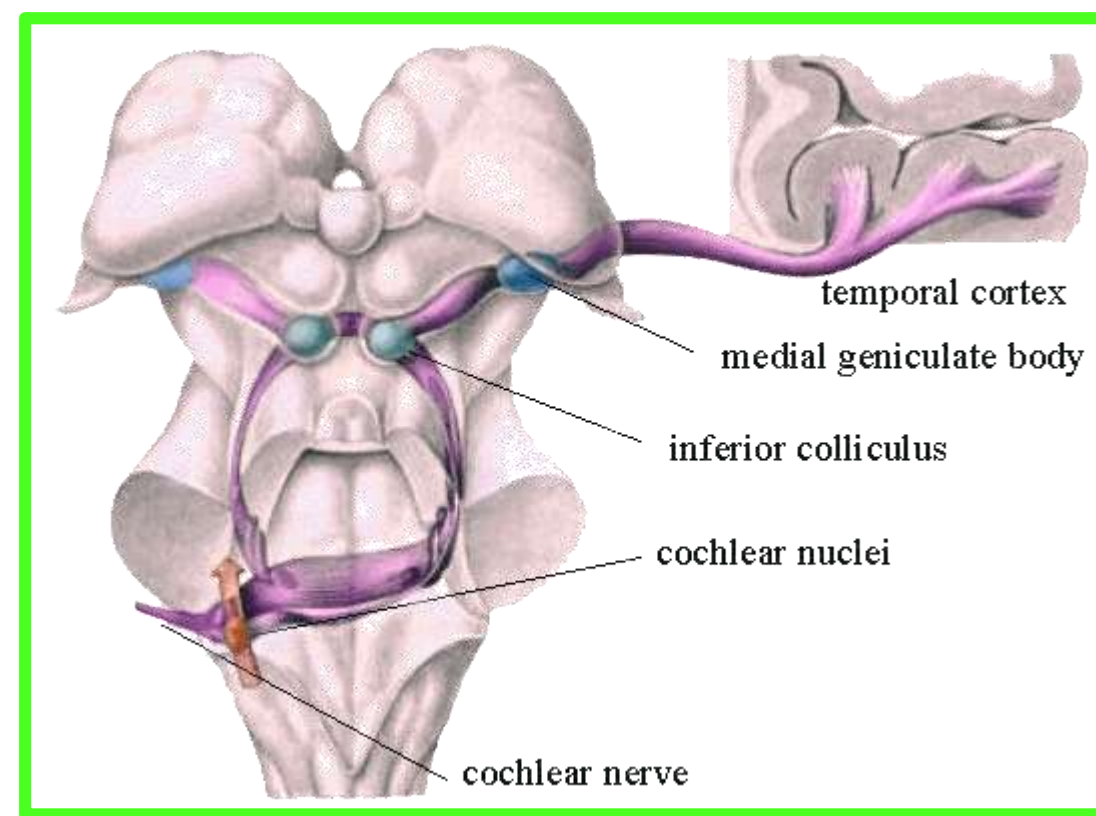


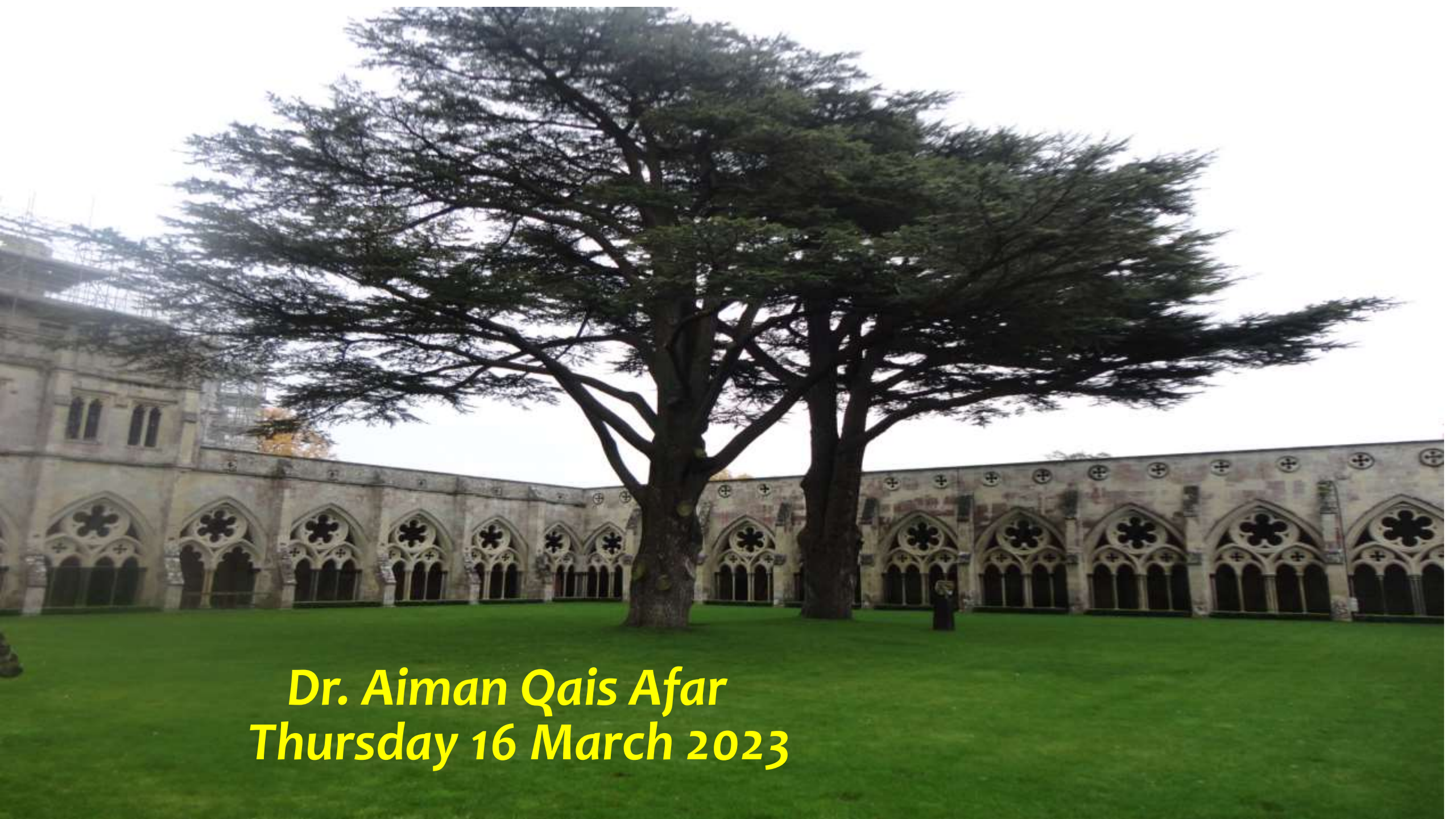
• AUDITORY (Hearing) PATHWAY

4- The 4th order neuron (Medial geniculate body):

- Their axons form the **auditory radiation** which passes through **the sublentiform** of internal capsule to end in the **auditory area of cerebral cortex**.

* **Auditory area:** (Heschl's gyrus) lies in the middle part of superior temporal gyrus





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