Peripheral Nervous System

INTERNAL EAR & AUDITORY PATHWAY

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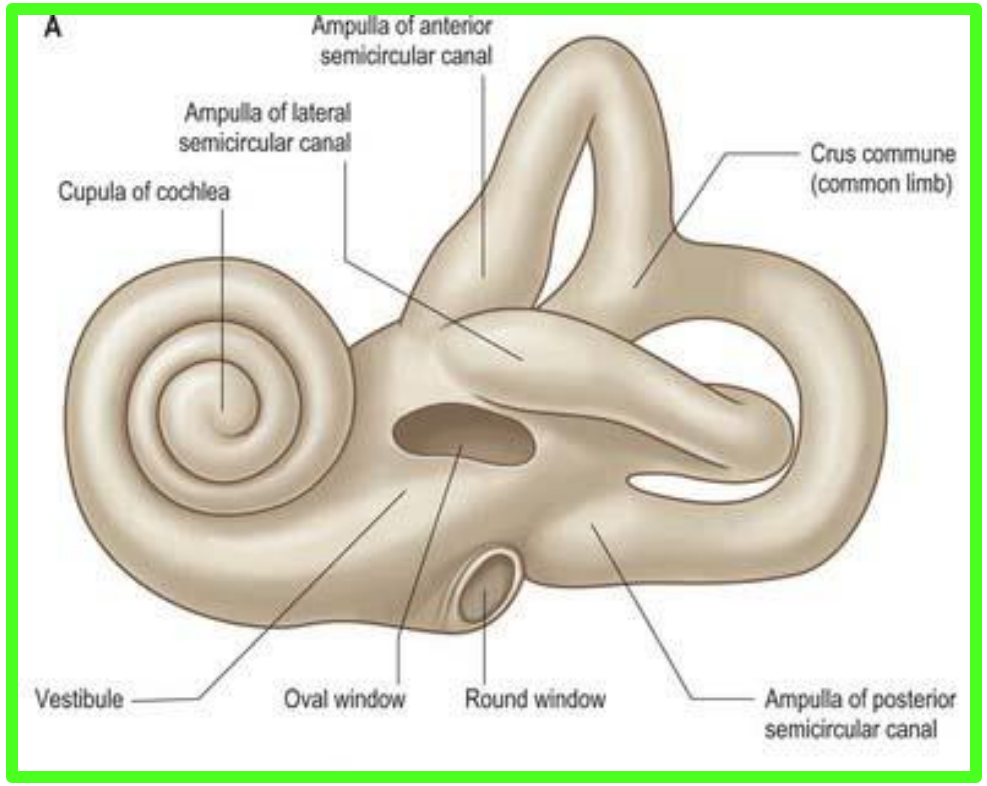
Thursday 7 March 2024

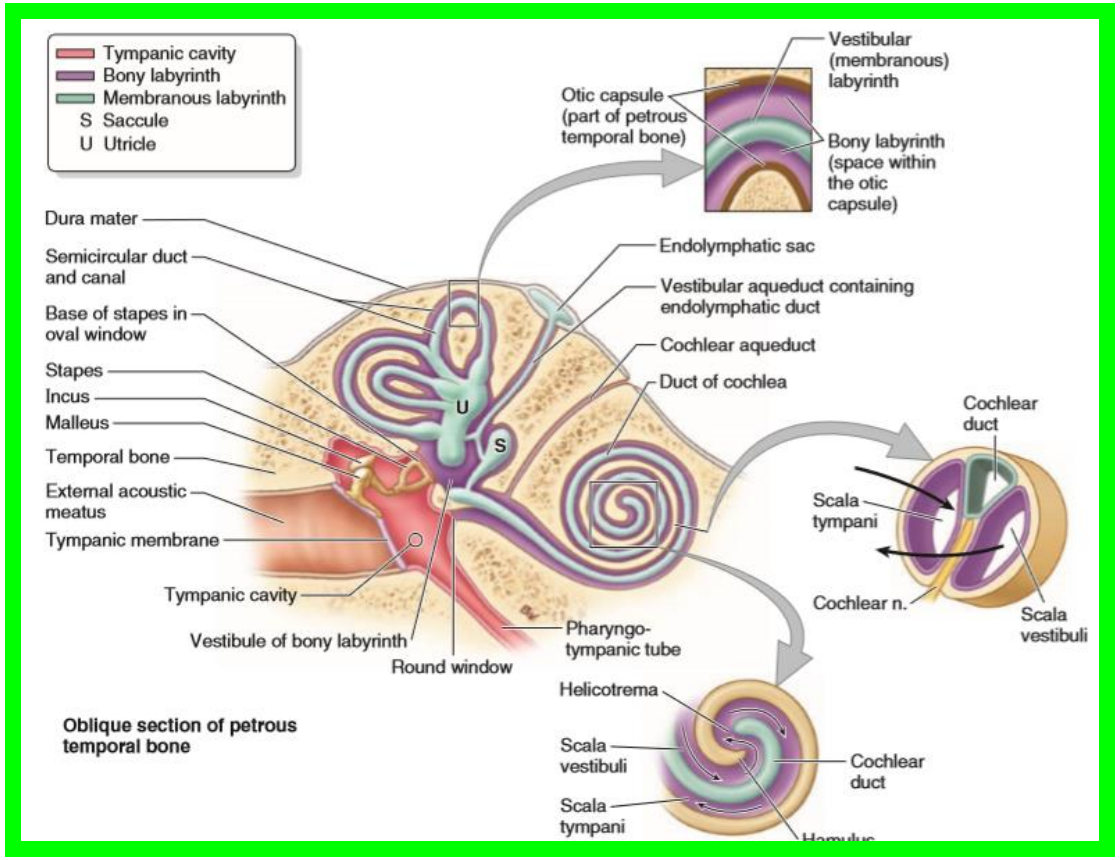
INTERNAL EAR (LABYRINTH)

- **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

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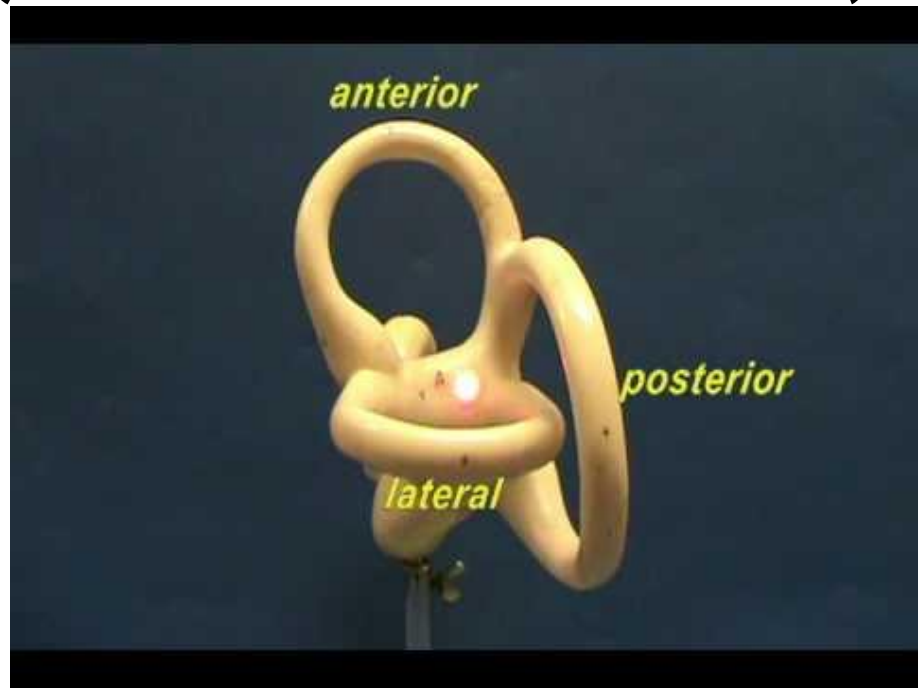
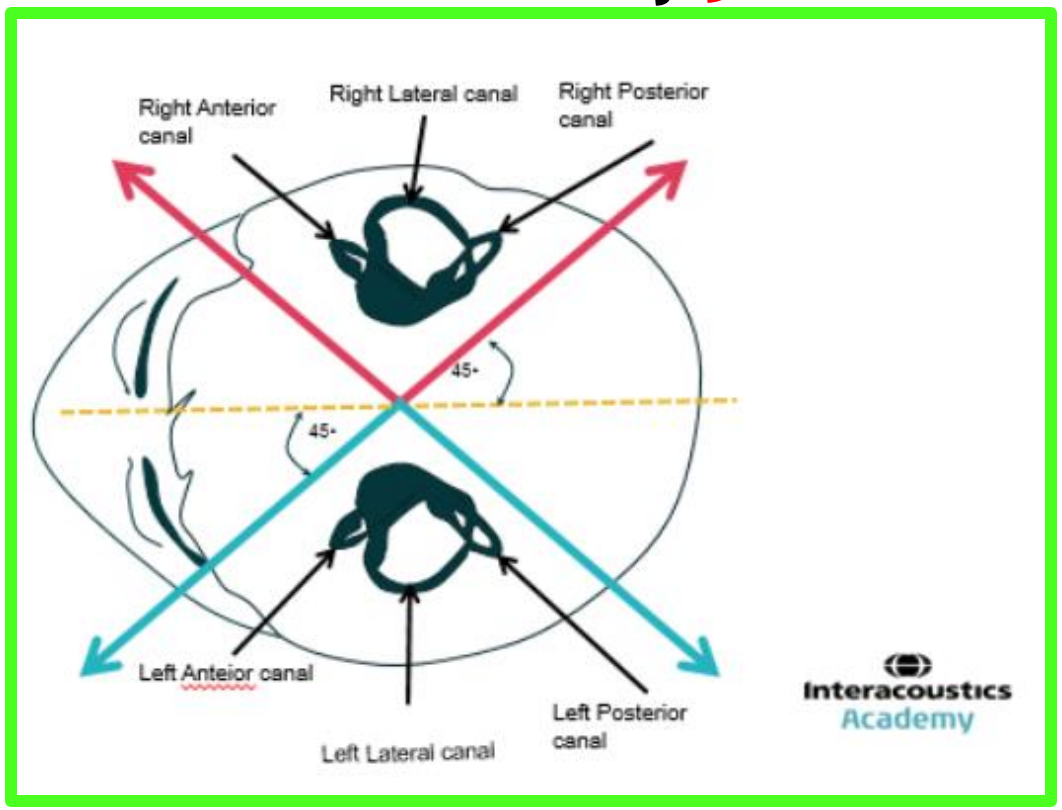
I- Semicircular canals: are 3 arched canals set at right angles to each other.

1) **Anterior 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).





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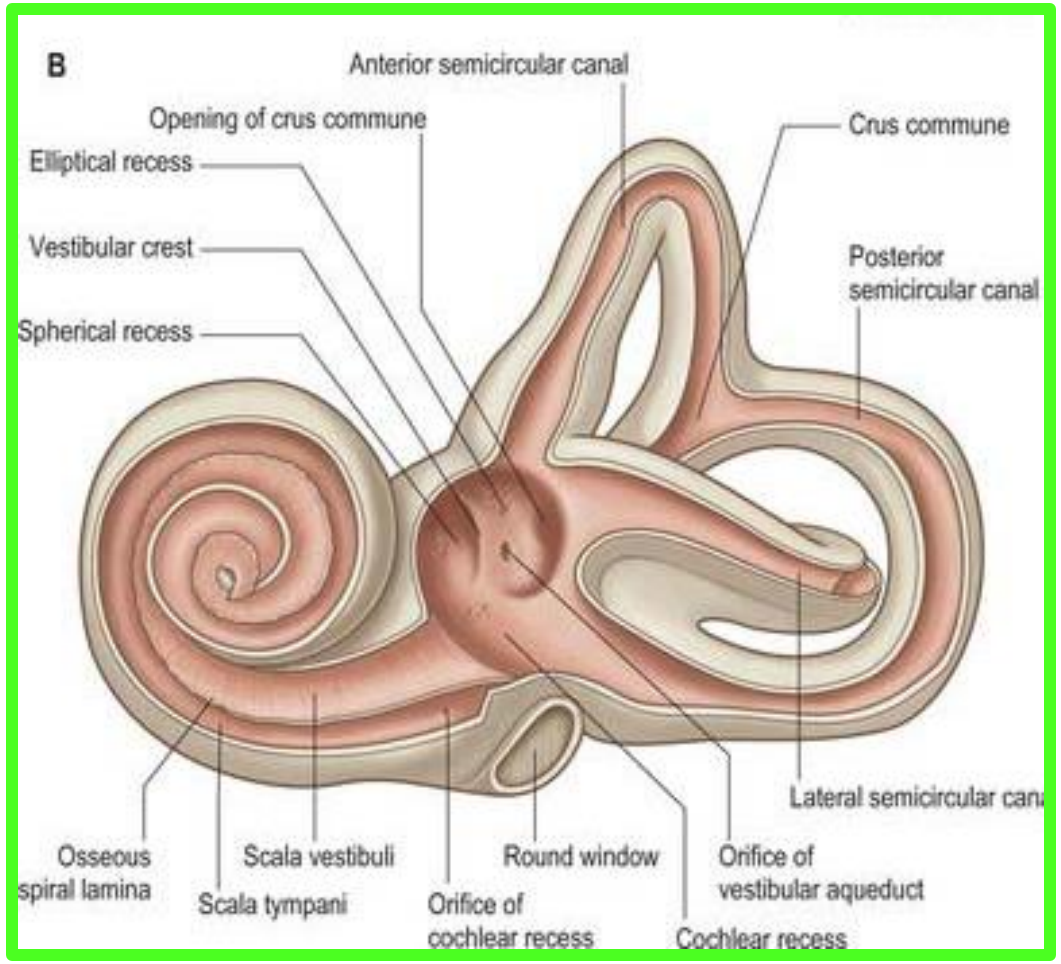
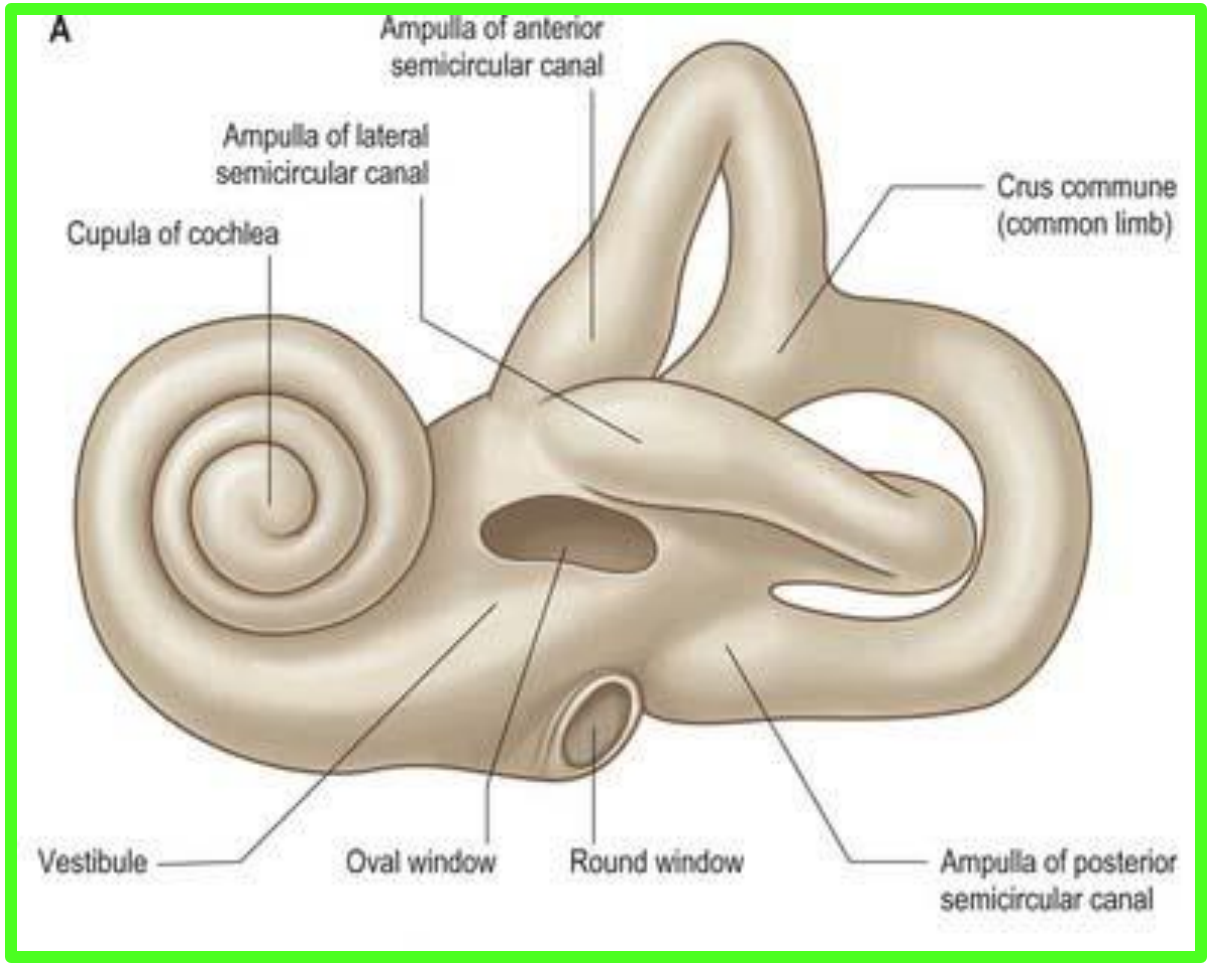
II- The vestibule: is the central part of bony labyrinth.

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.





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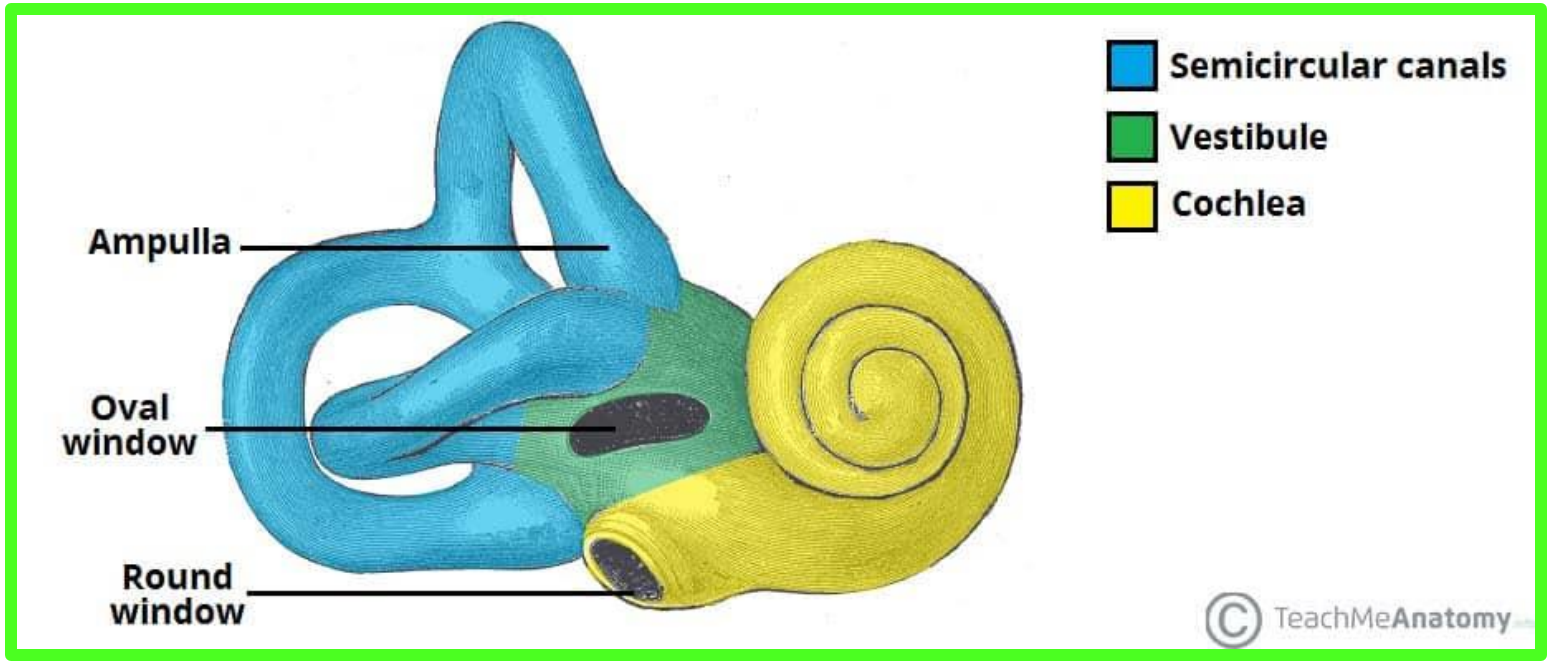
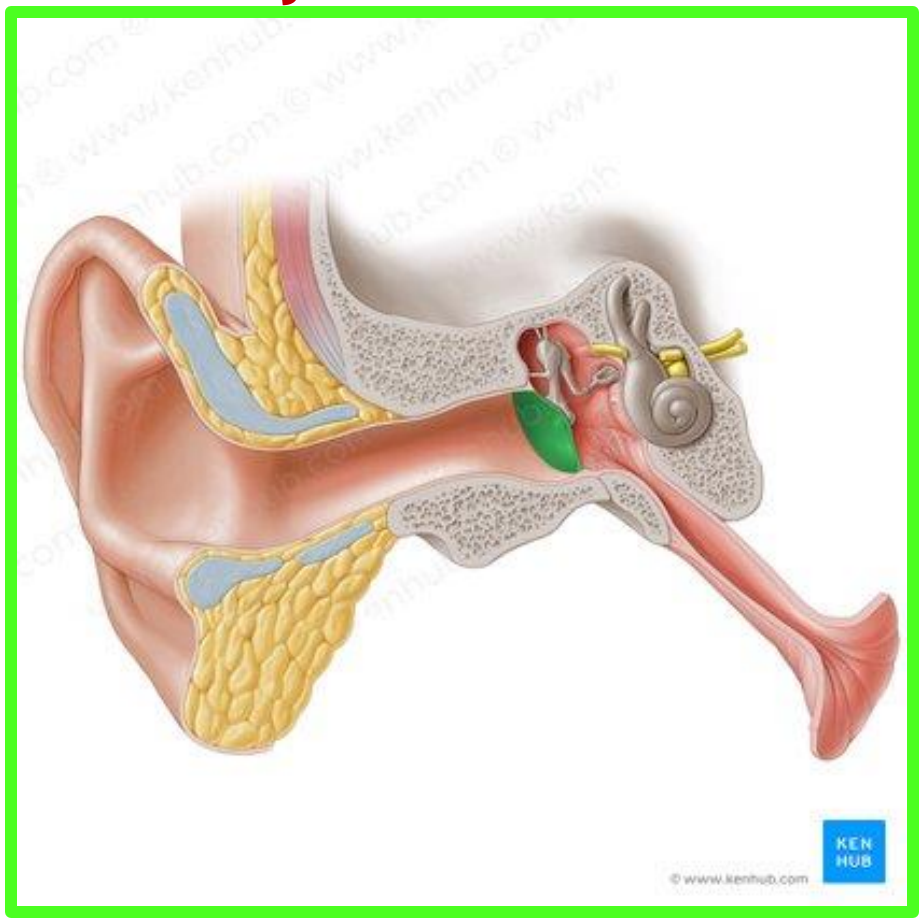
II- The vestibule:

c- Its lateral wall is related to the middle ear and shows fenstera 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

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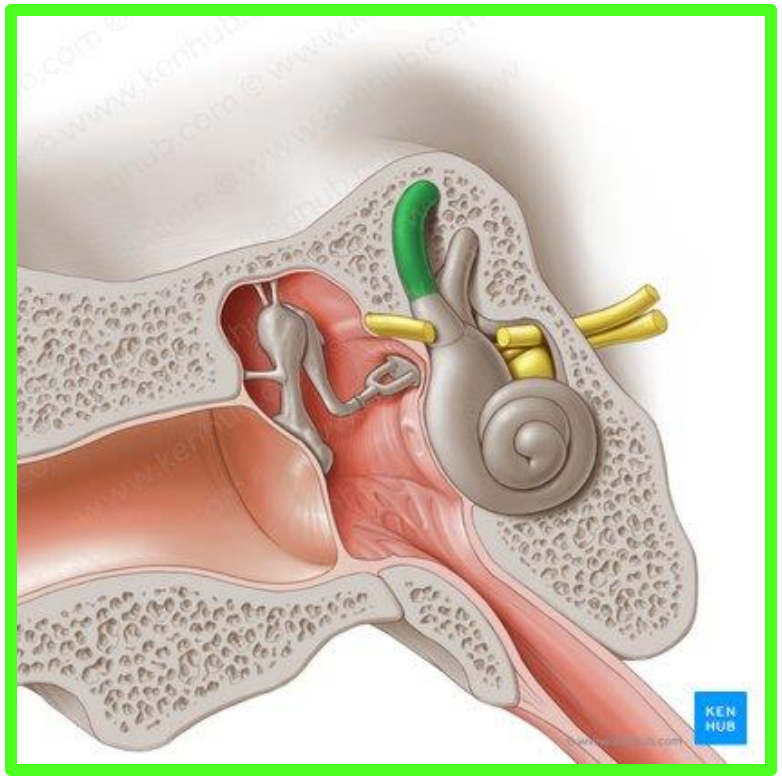
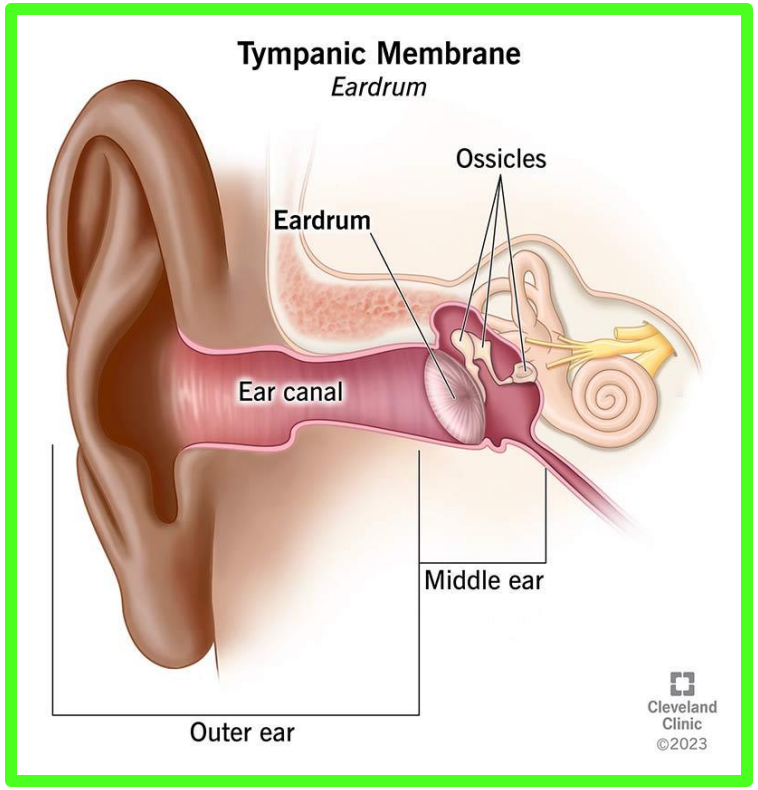
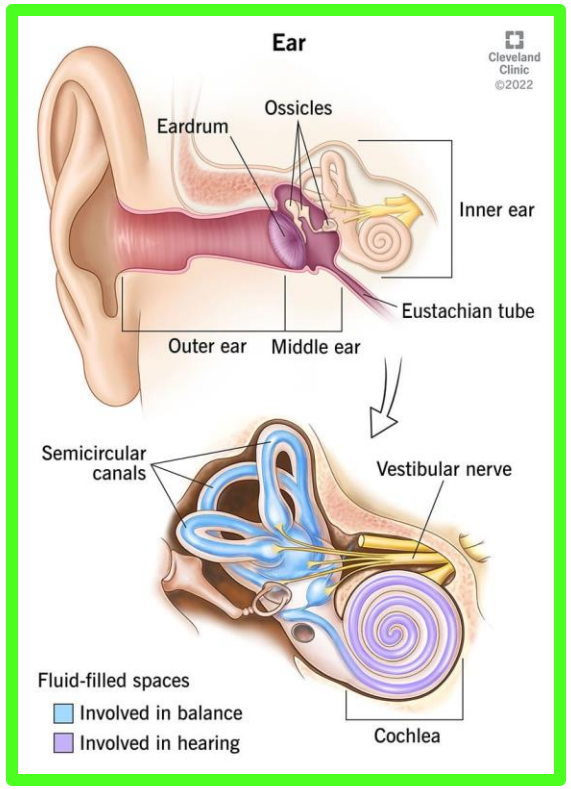
III- The cochlea: is the **anterior part of the boney labyrinth:**

- 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 fibers of the **cochlear nerve.**



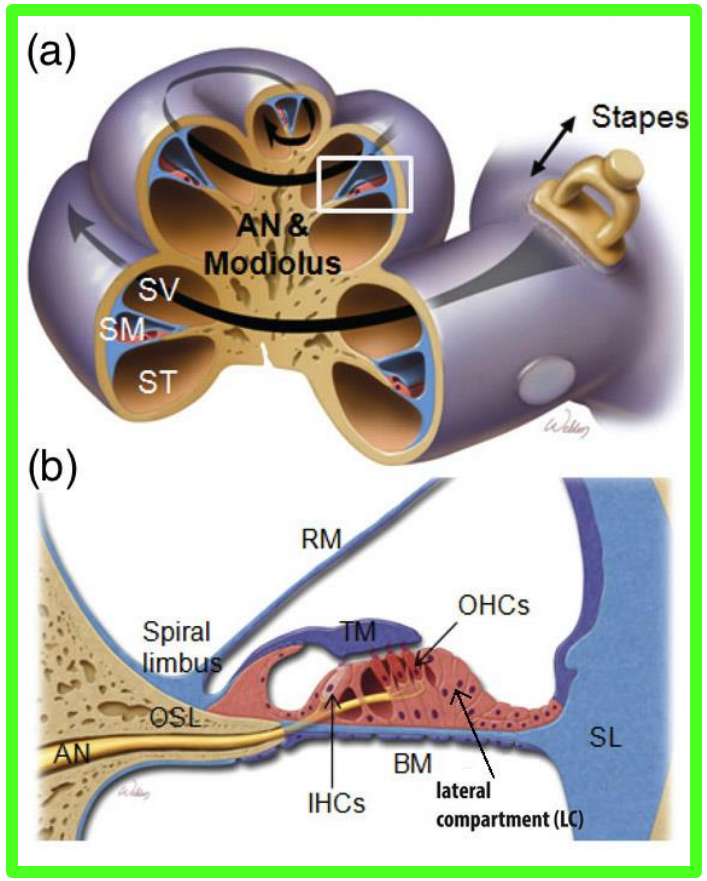


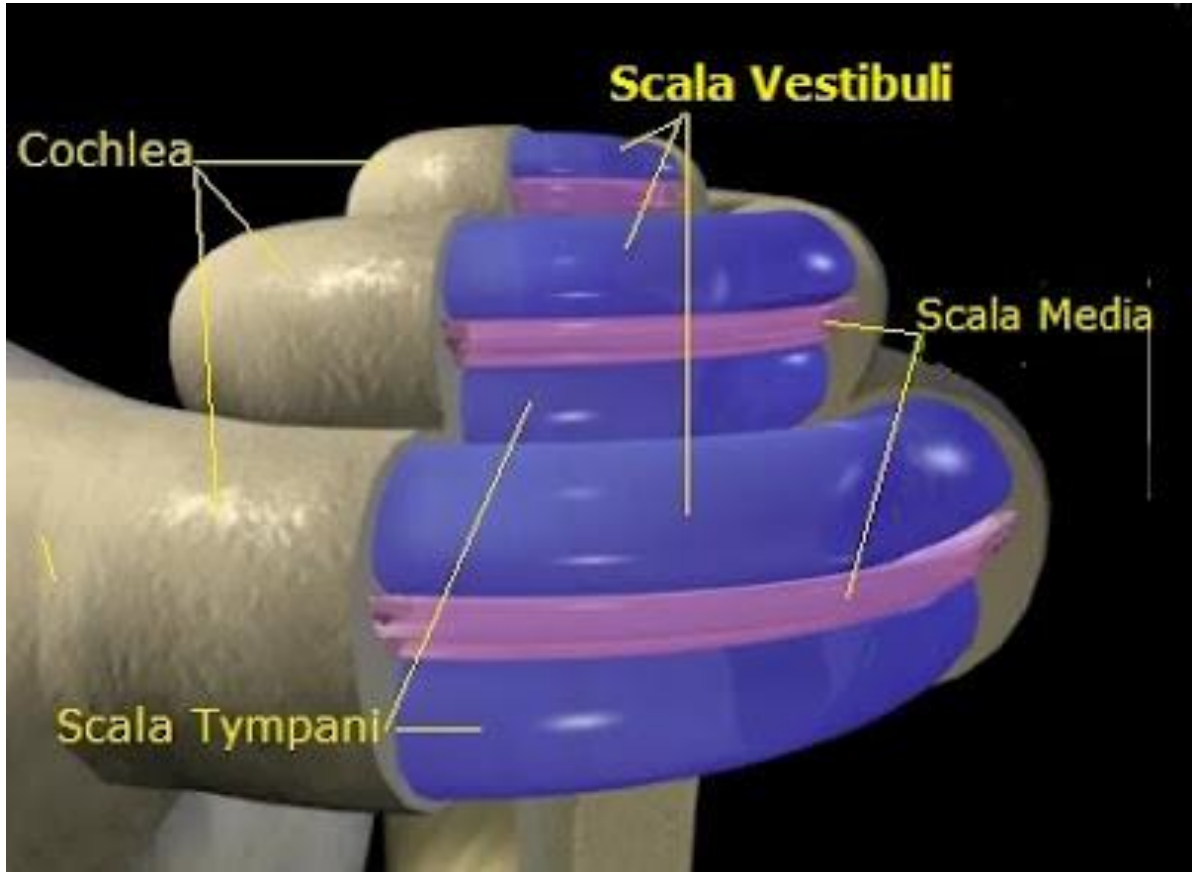


BONY LABYRINTH

❑ 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 modulus dividing the cochlear canal into scala vestibuli above and scala tympani below.





MEMBRANOUS LABYRINTH

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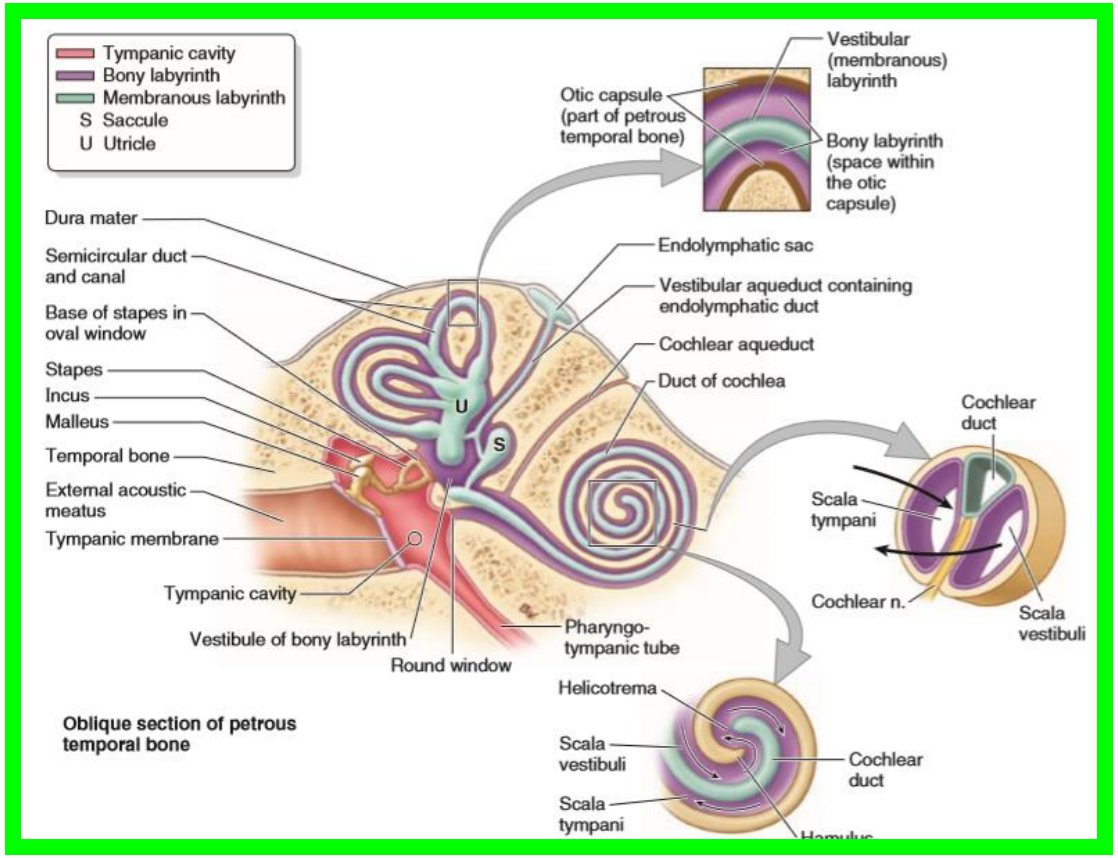
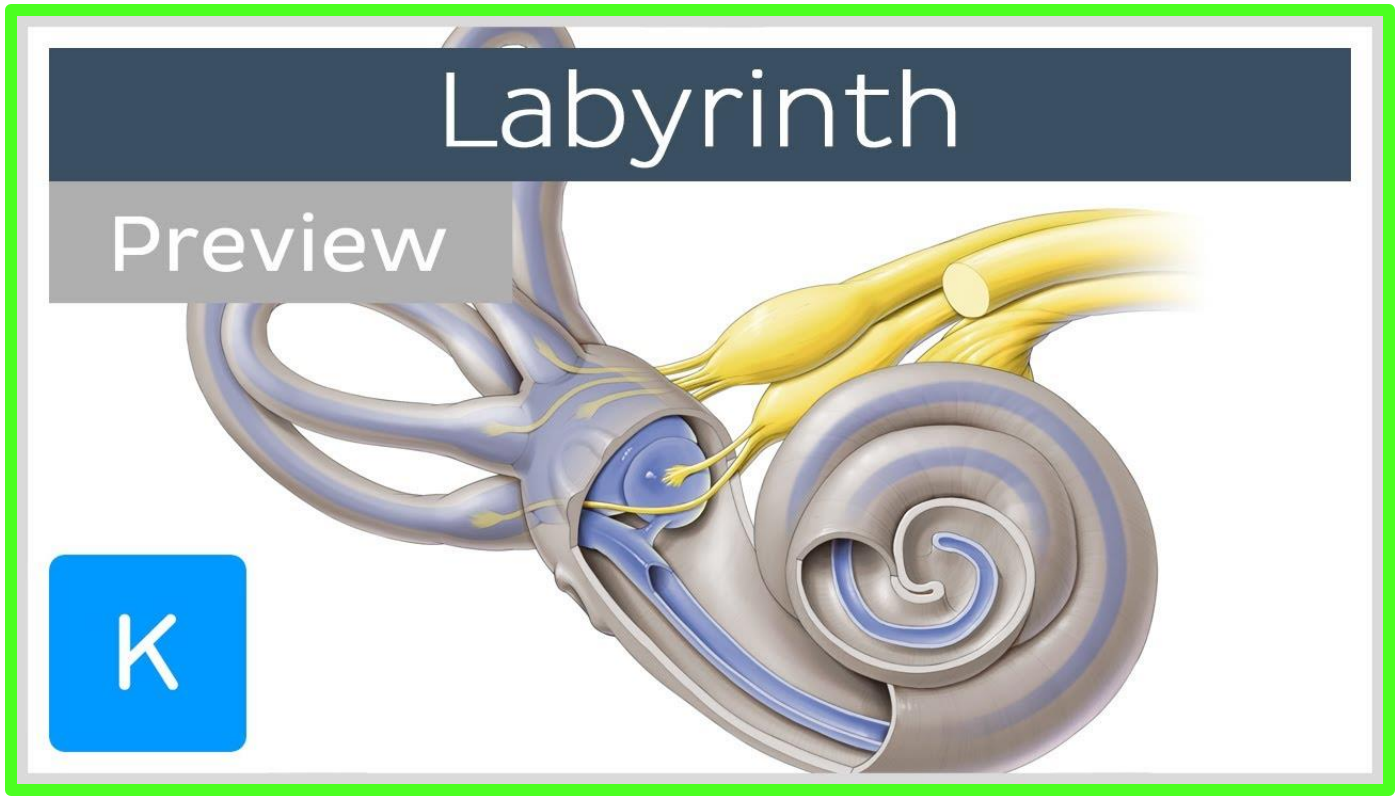
* **Structure:** it consists of number of **membranous cavities** inside the bony labyrinth.

- These cavities are filled with fluid called **endolymph.**
- They are separated from the bony labyrinth by fluid called **perilymph.**



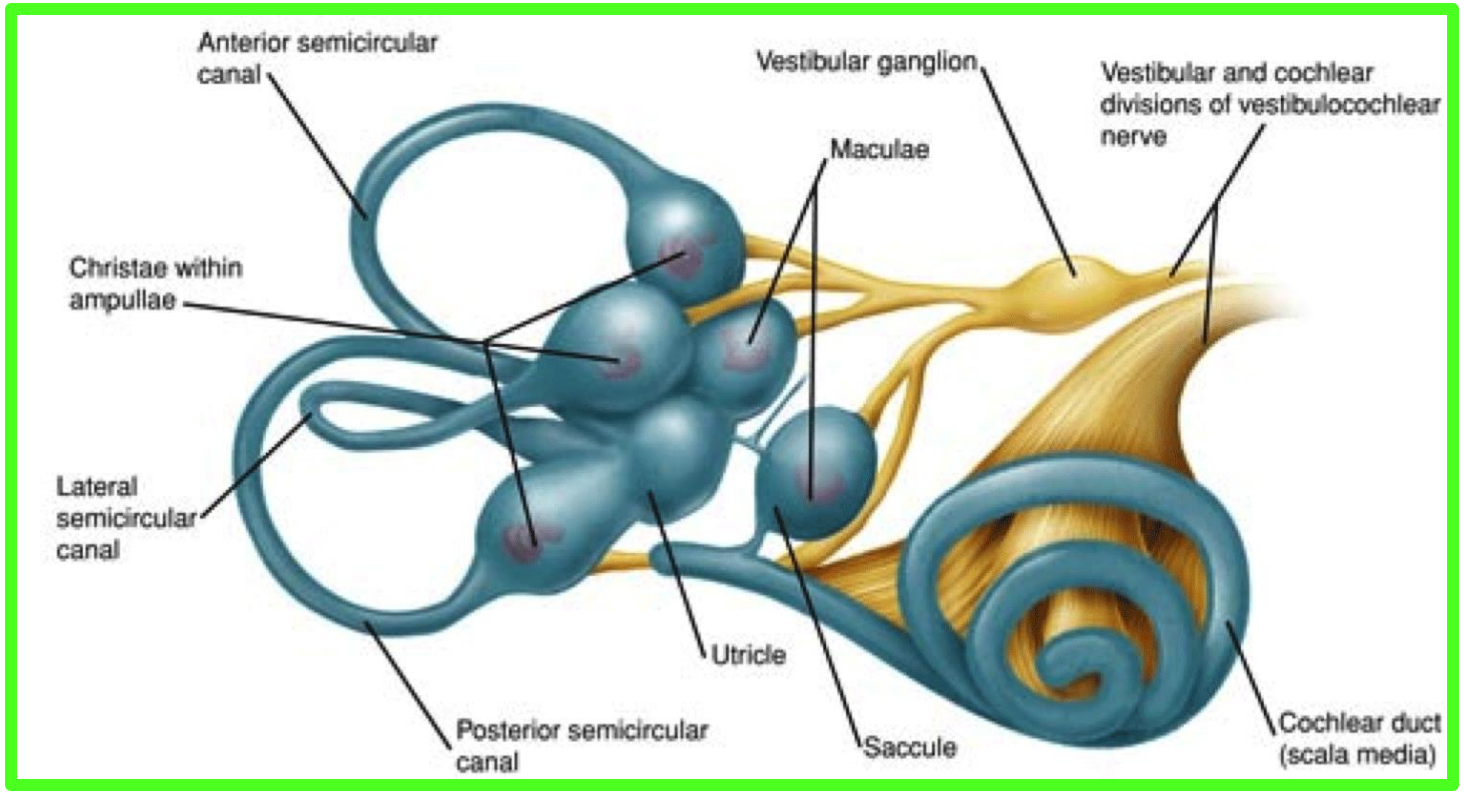


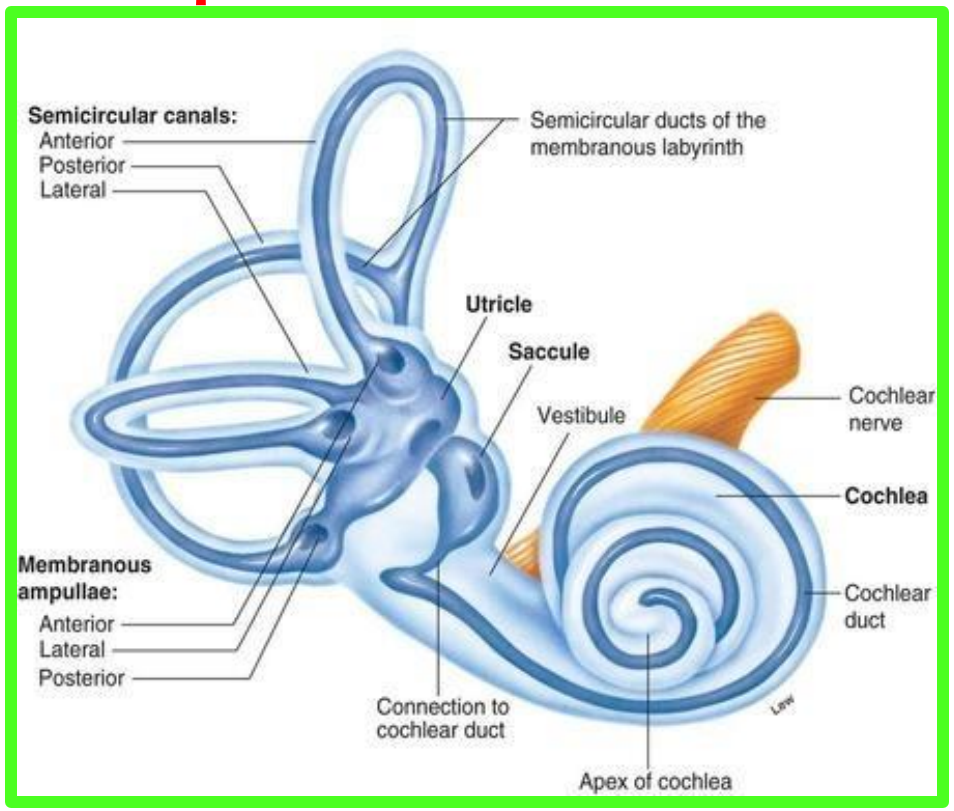
MEMBRANOUS LABYRINTH

- **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.





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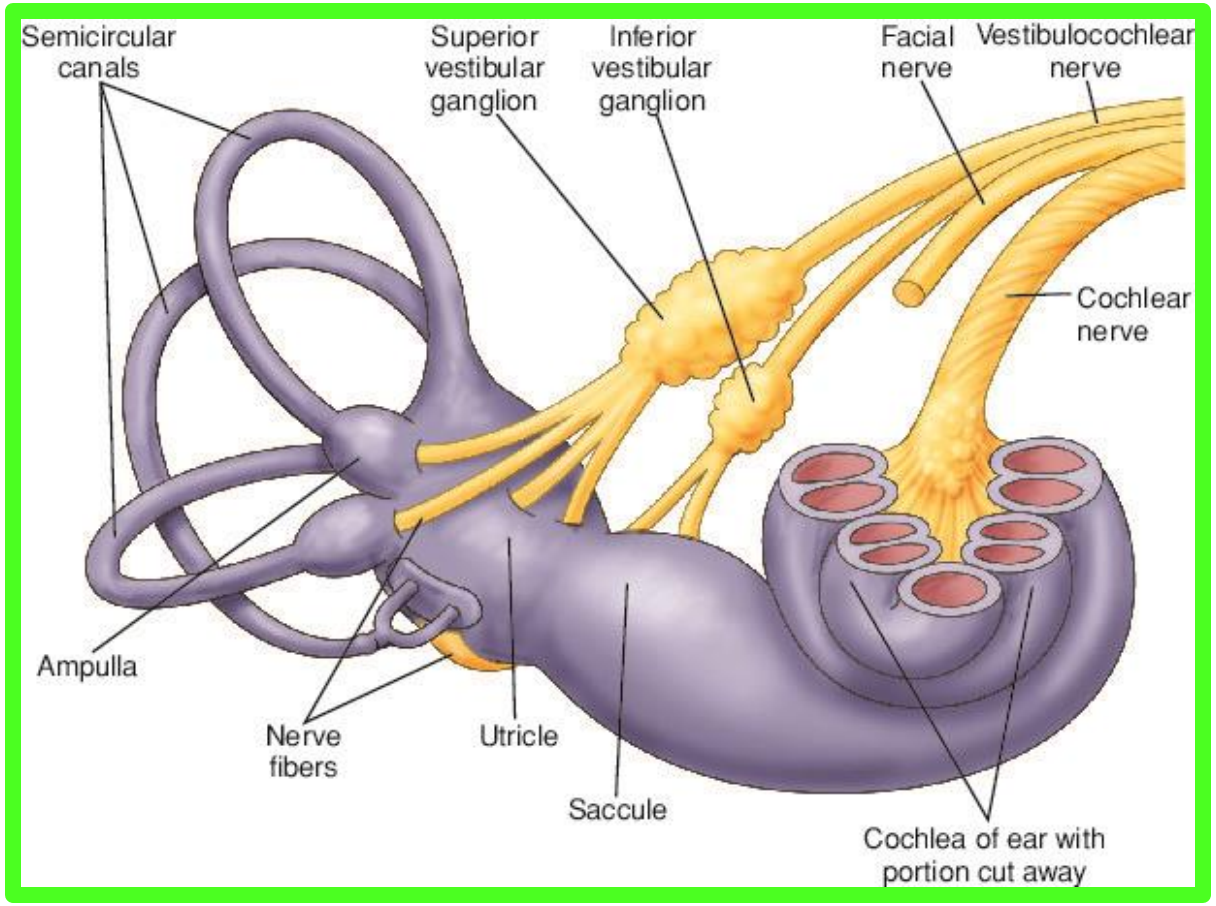
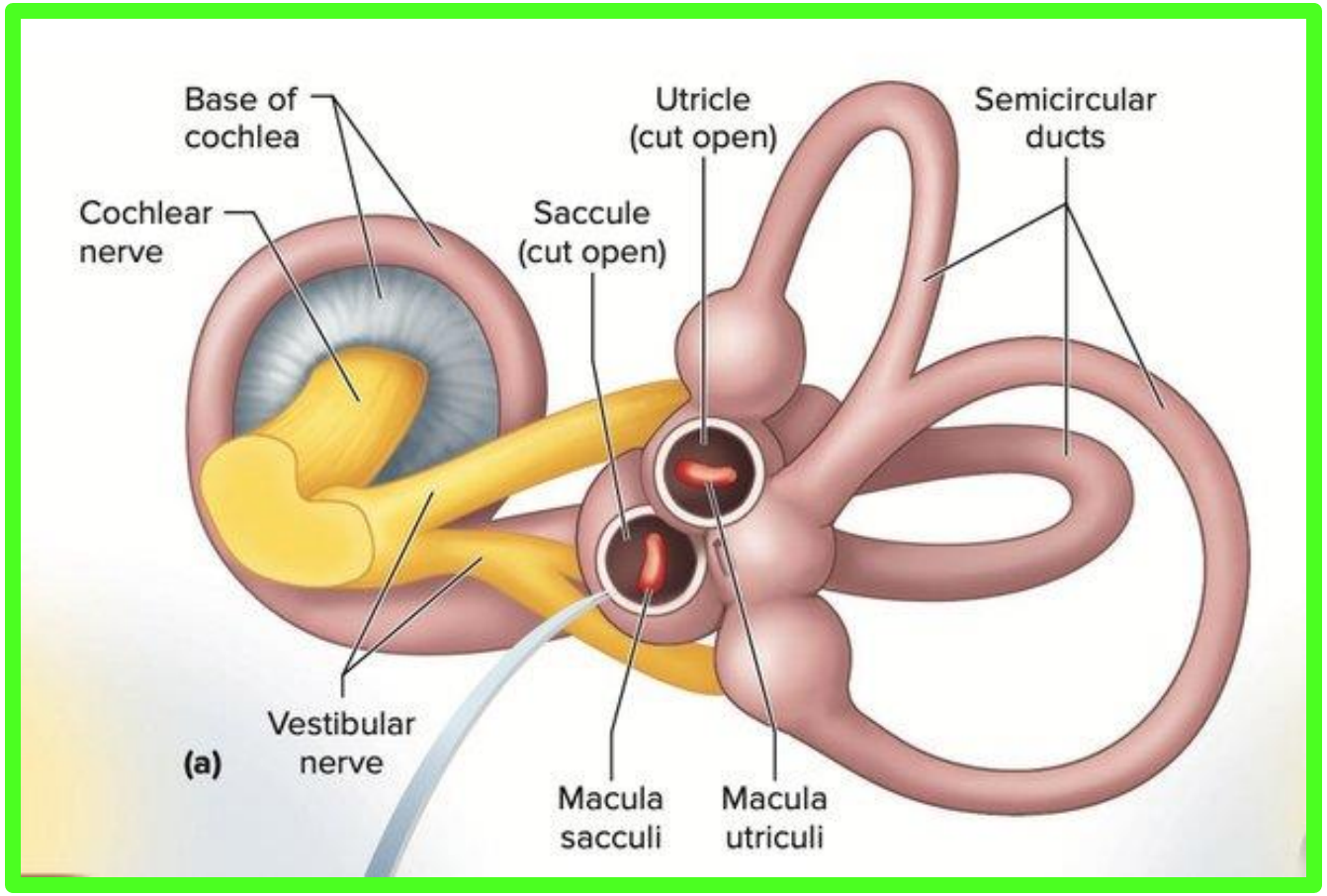
(2) The utricle and saccule: they are 2 small sacs which lie **in the vestibule**.

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

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

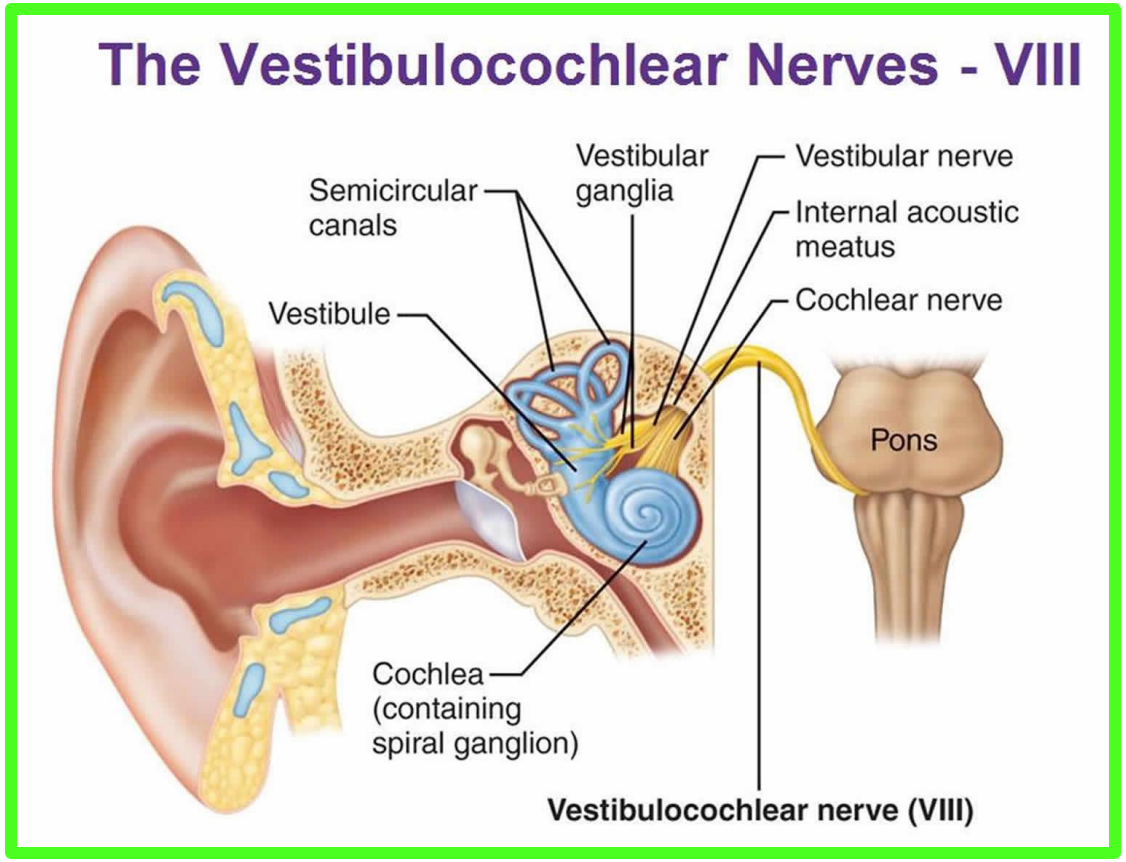


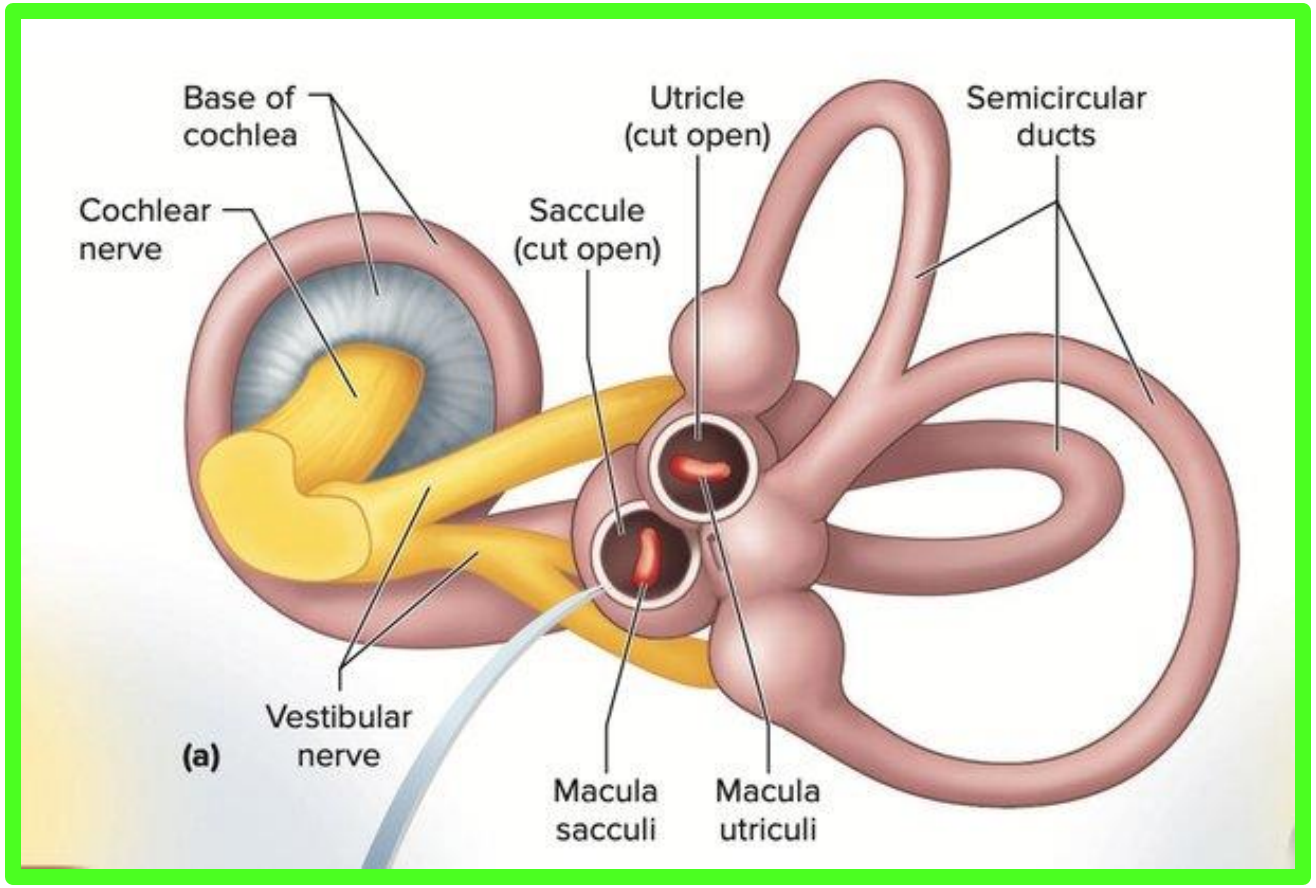


MEMBRANOUS LABYRINTH

B. Saccule: lies close to the base of the cochlea.

- It is connected to the basal turn of cochlea by **ductus reunines**.
- Its anterior wall in thickened to **form a macula.**
- The macula receives **the fibers of the vestibular nerve.**





MEMBRANOUS LABYRINTH

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(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.

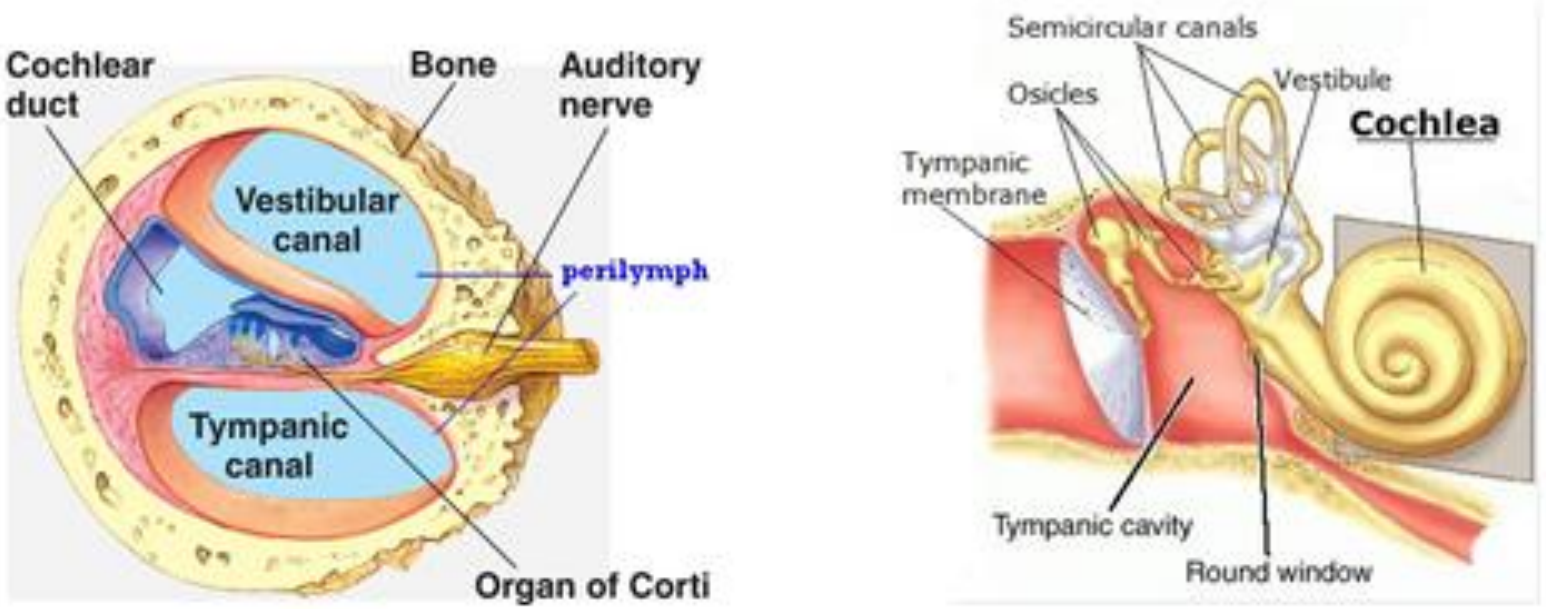
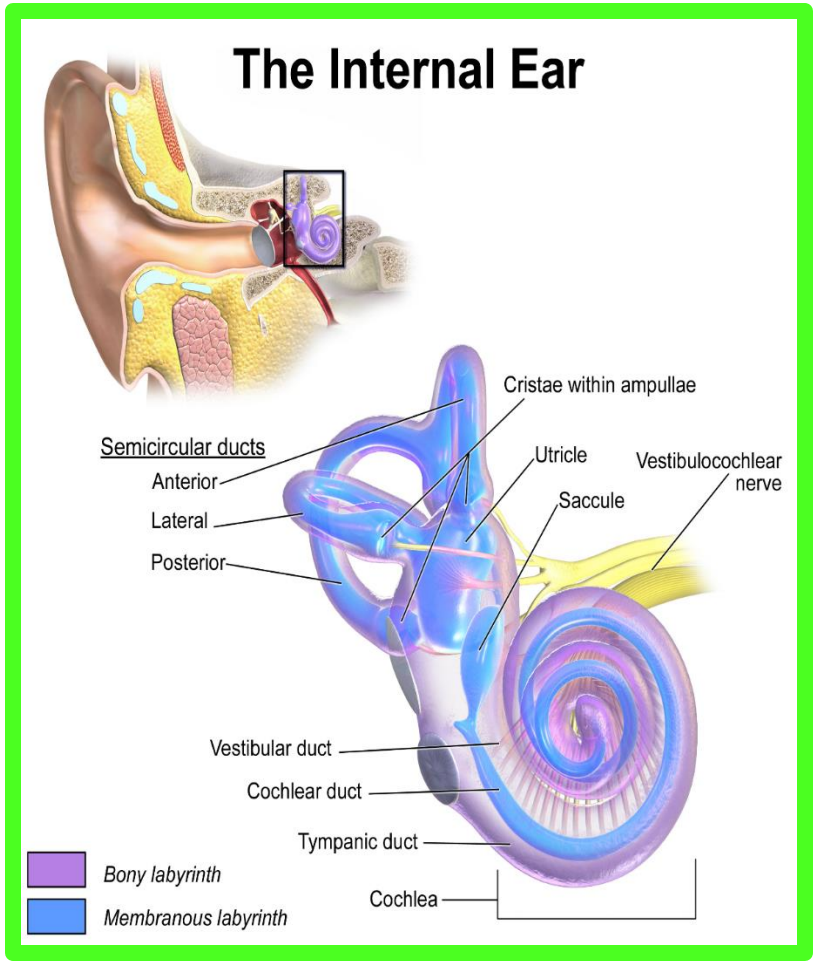
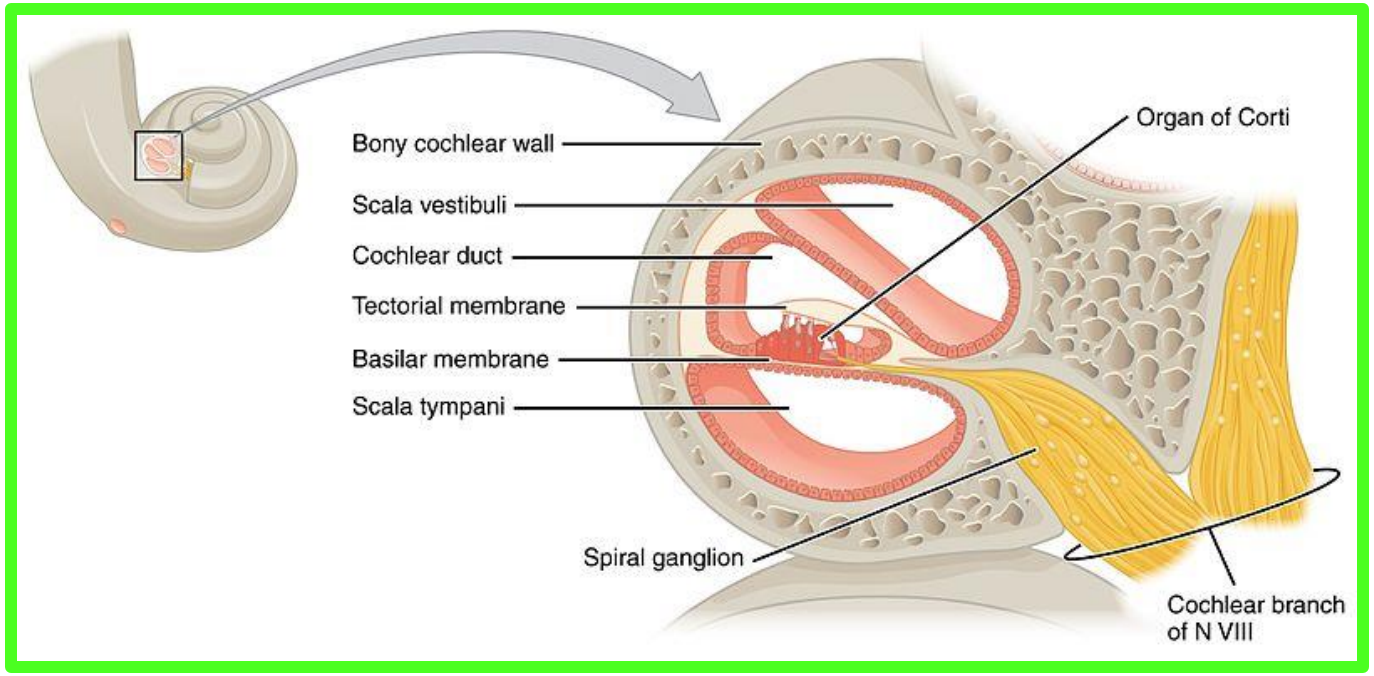


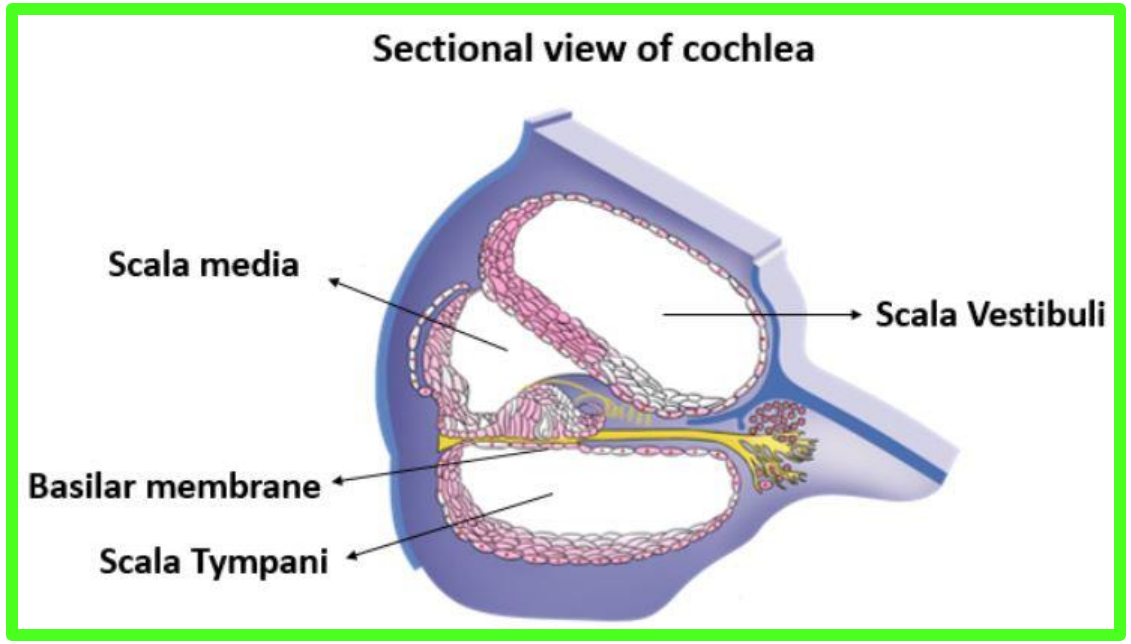
Fig. Structure of internal ear



MEMBRANOUS LABYRINTH

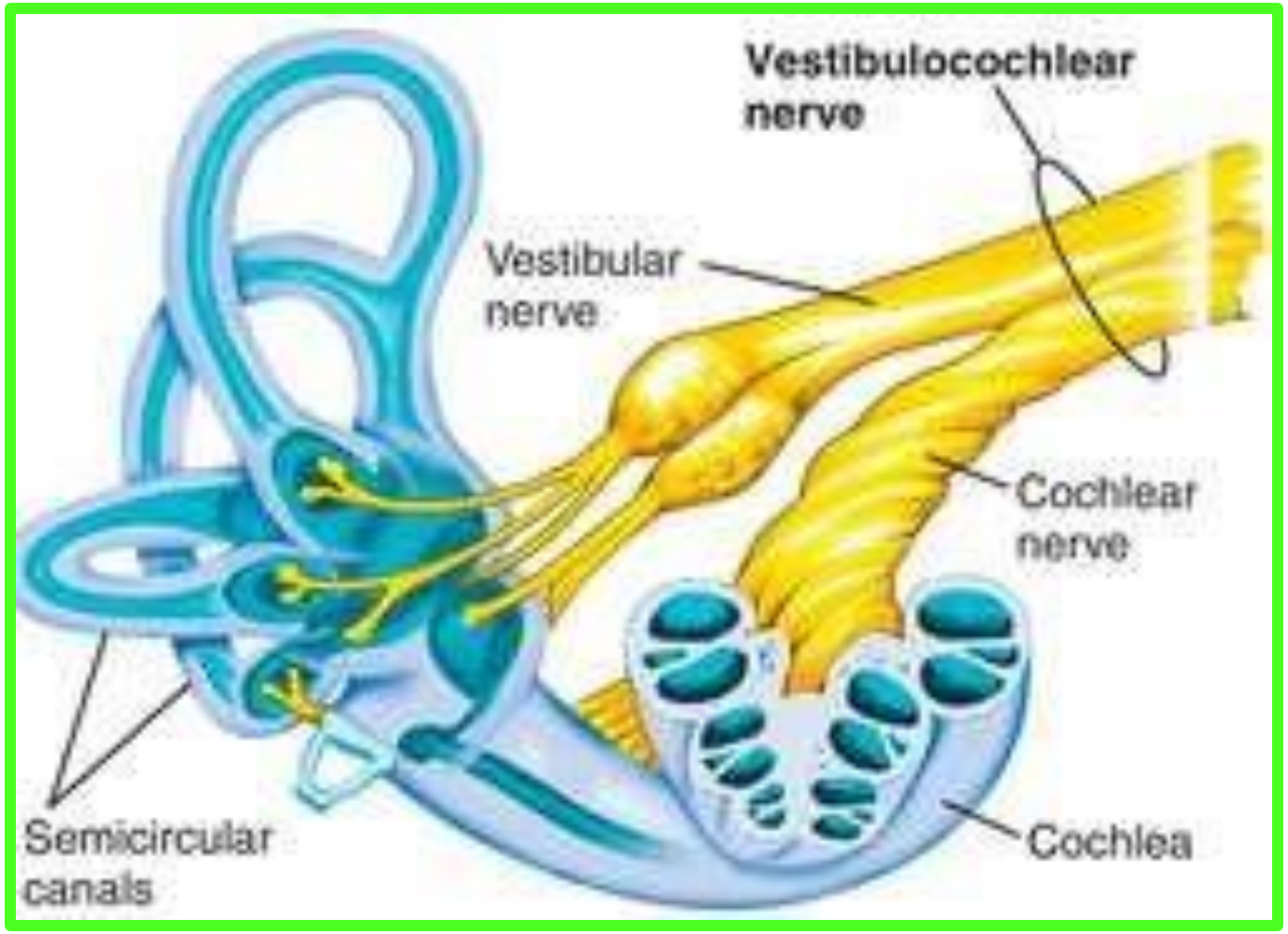
- It is separated from the scala vestbuli by the vestibular membrane.
- It is separated from the scala tympani by the basilar membrane.
- Spiral ganglion, the peripheral processes pass to the organ of corti and the central from the cochlear nerve.





- **Nerve supply of the labyrinth**

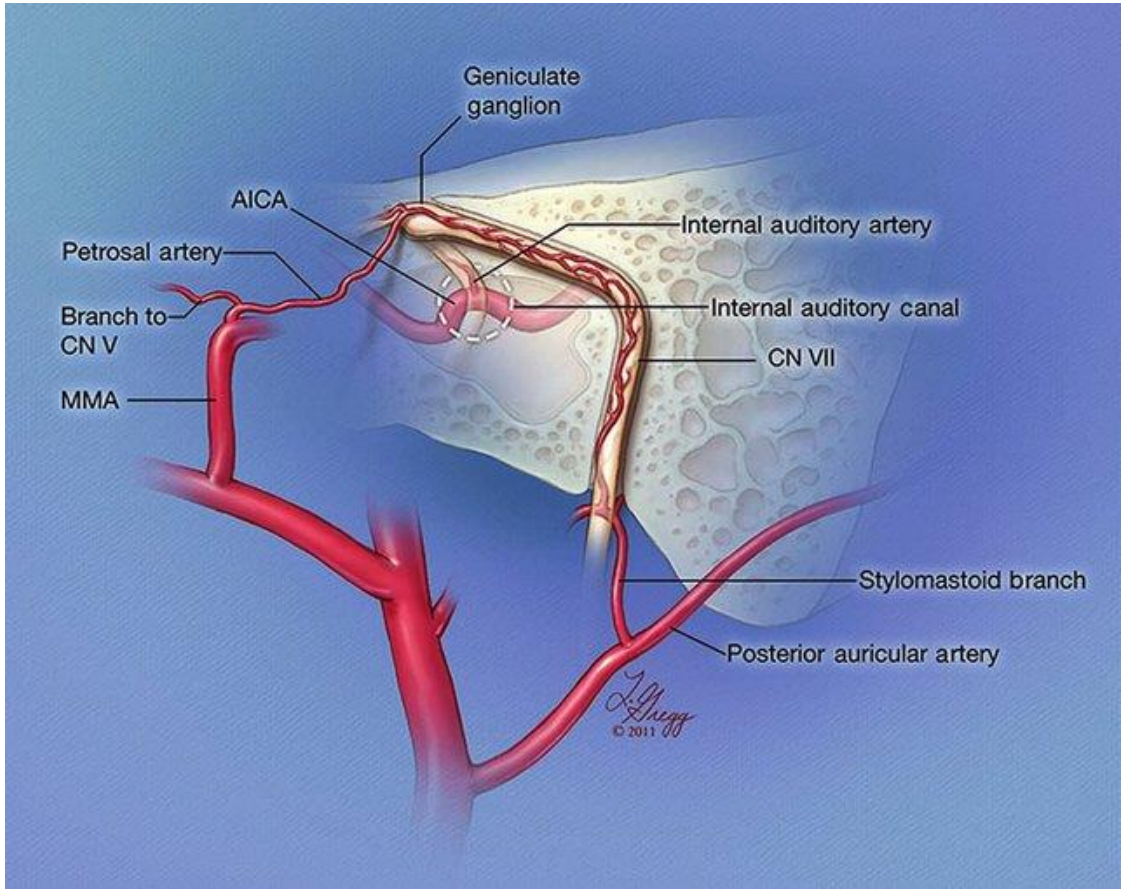
- It is supplied by the vestibule-cochlear nerve as following:
  - Its cochlear division for the hearing.
  - Its vestibular division for the equilibrium.

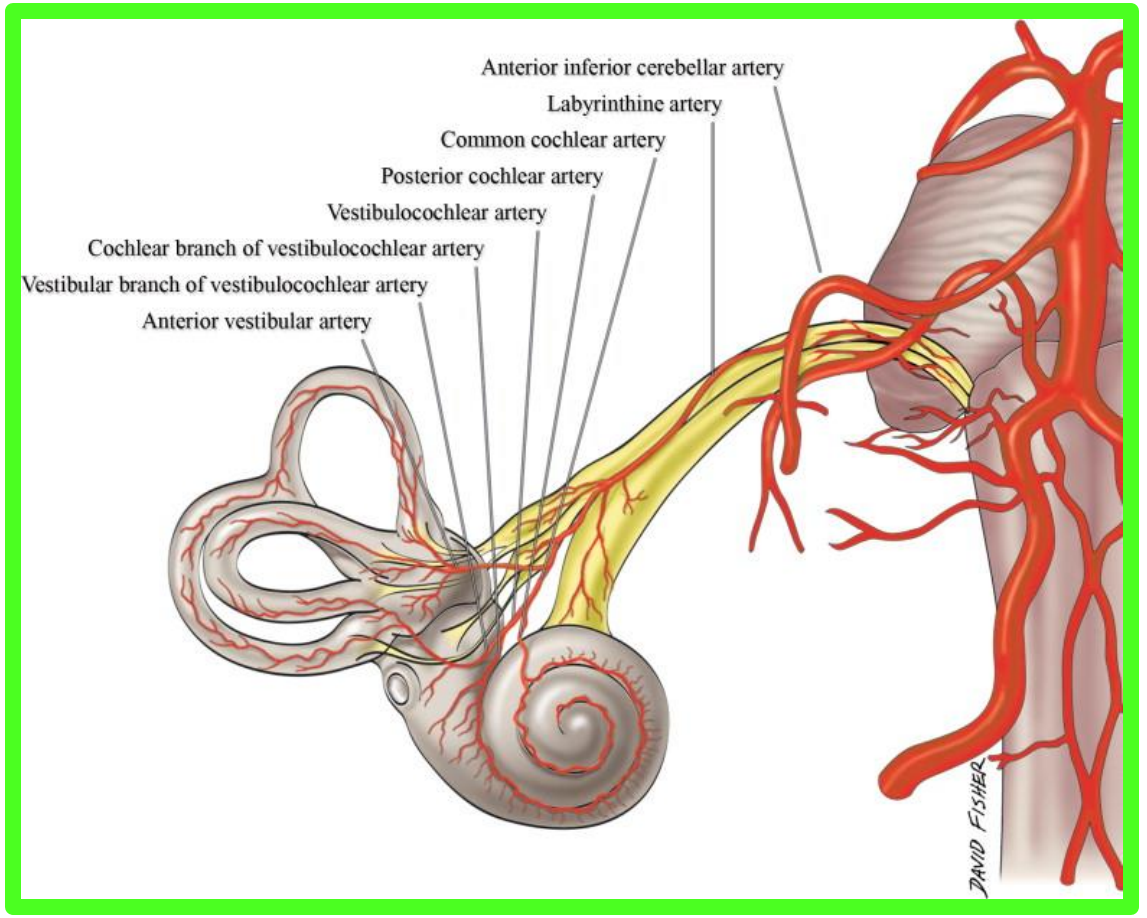


- **Blood supply of the labyrinth**

Arterial supply: (1) Labyrinthine branch of basilar artery.
(2) Stylomastoid branch of posterior auricular artery.

Venous drainage: into superior Petrosal sinus or transvers sinus.

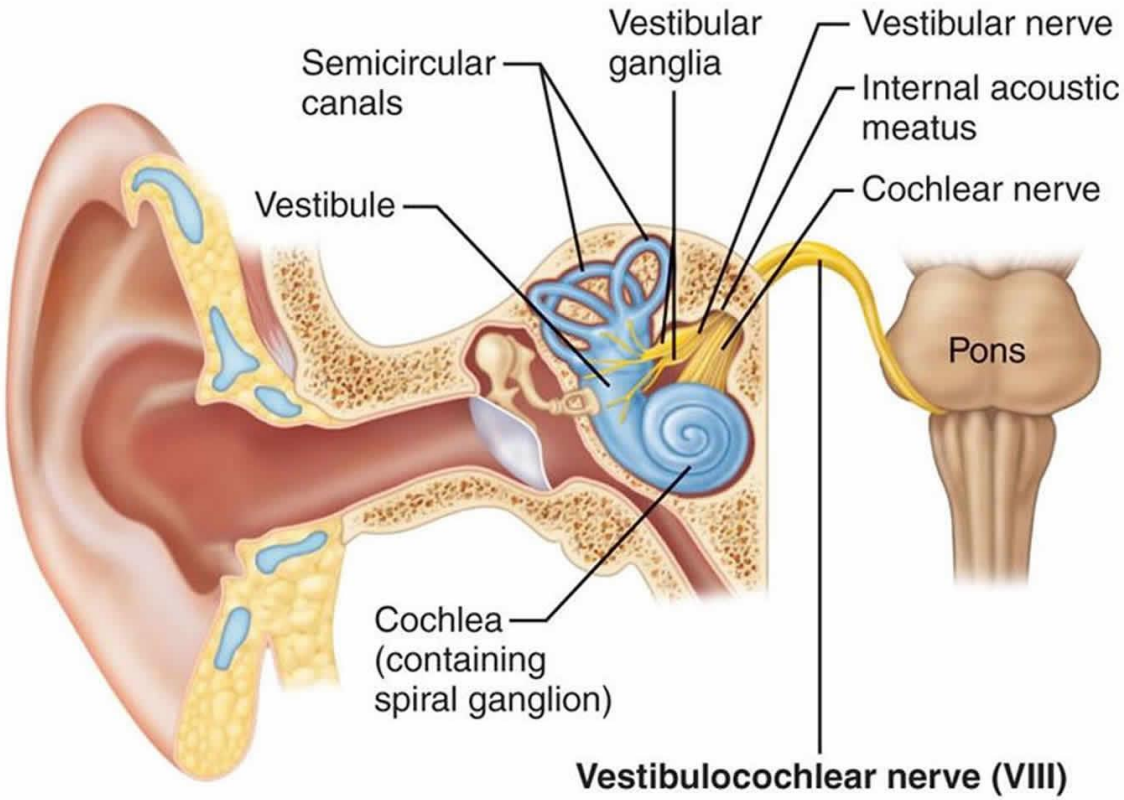




VESTIBULO – COCUHLEAR NERVE

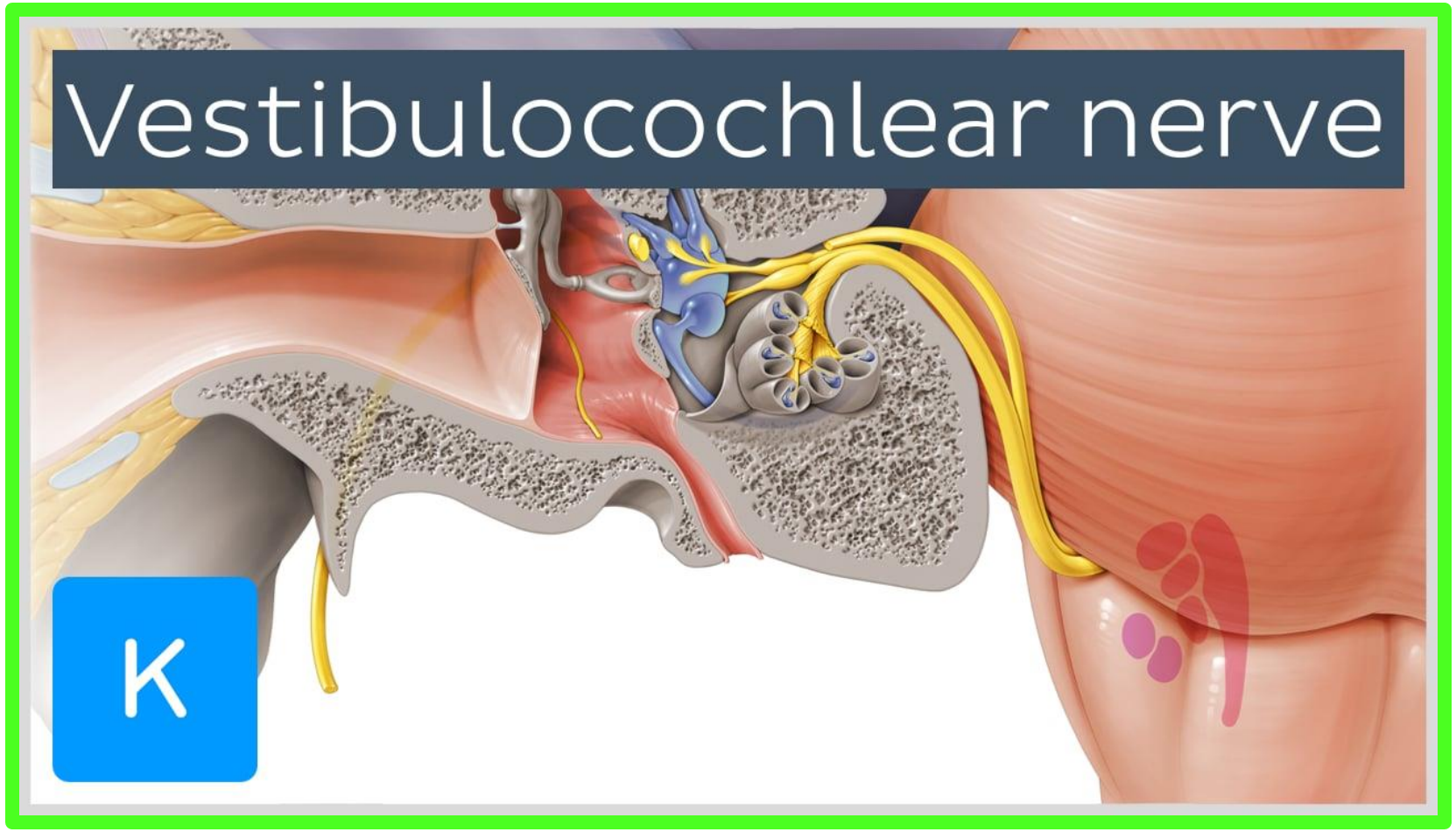
- **Type: special sensory nerve** (purely sensory) formed of 2 parts .
  - i. **Cochlear part:** carrying hearing impulses.
  - ii. **Vestibular part:** carrying equilibrium impulses .

- **Exit from the brain stem:** from the **anterior aspect at the ponto-meduallary junction.**



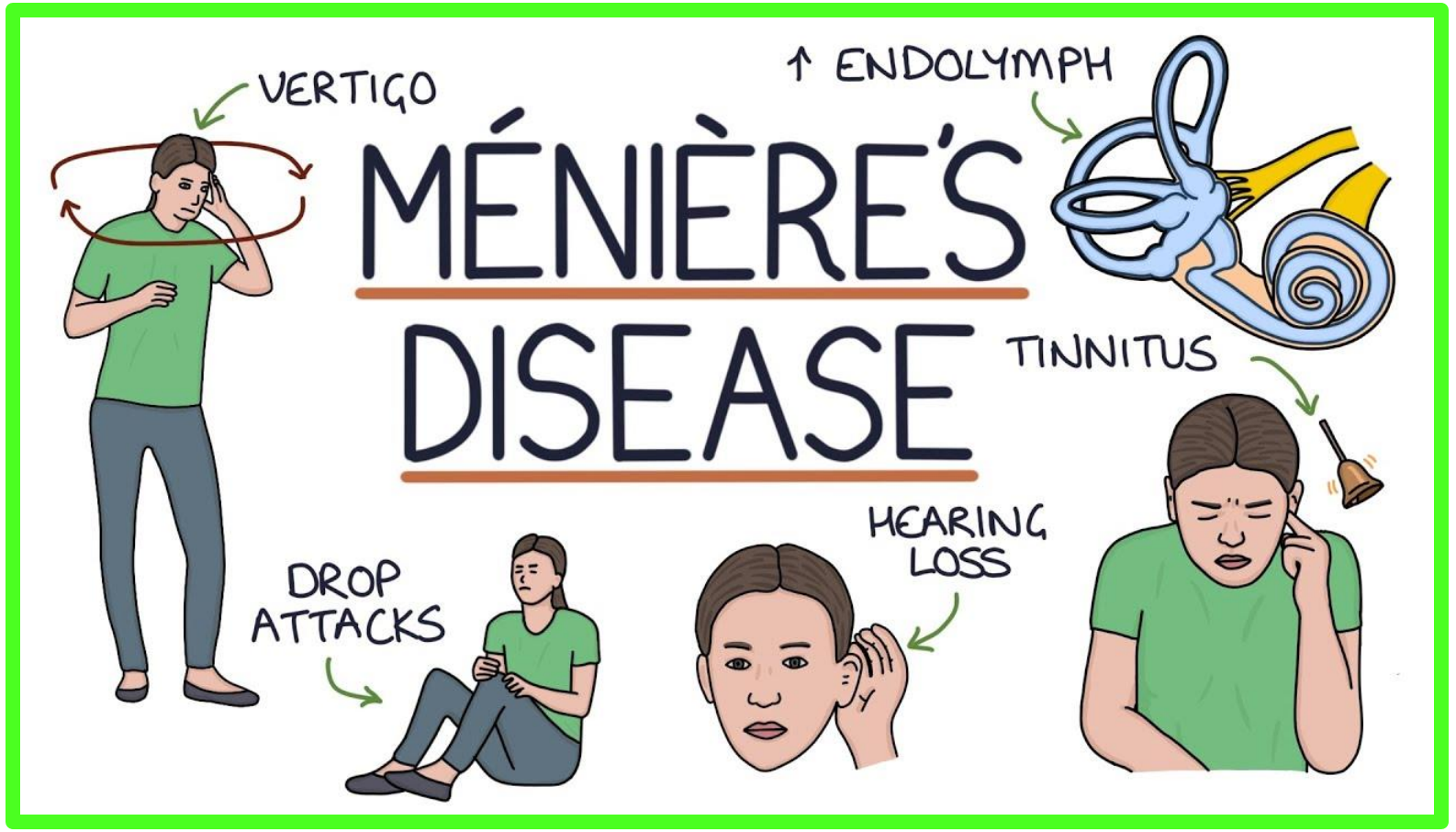
VESTIBULO – COCUHLEAR NERVE

- **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.



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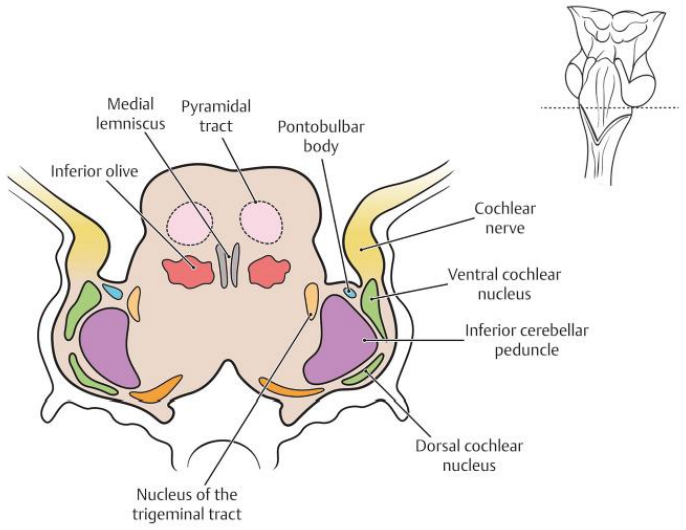
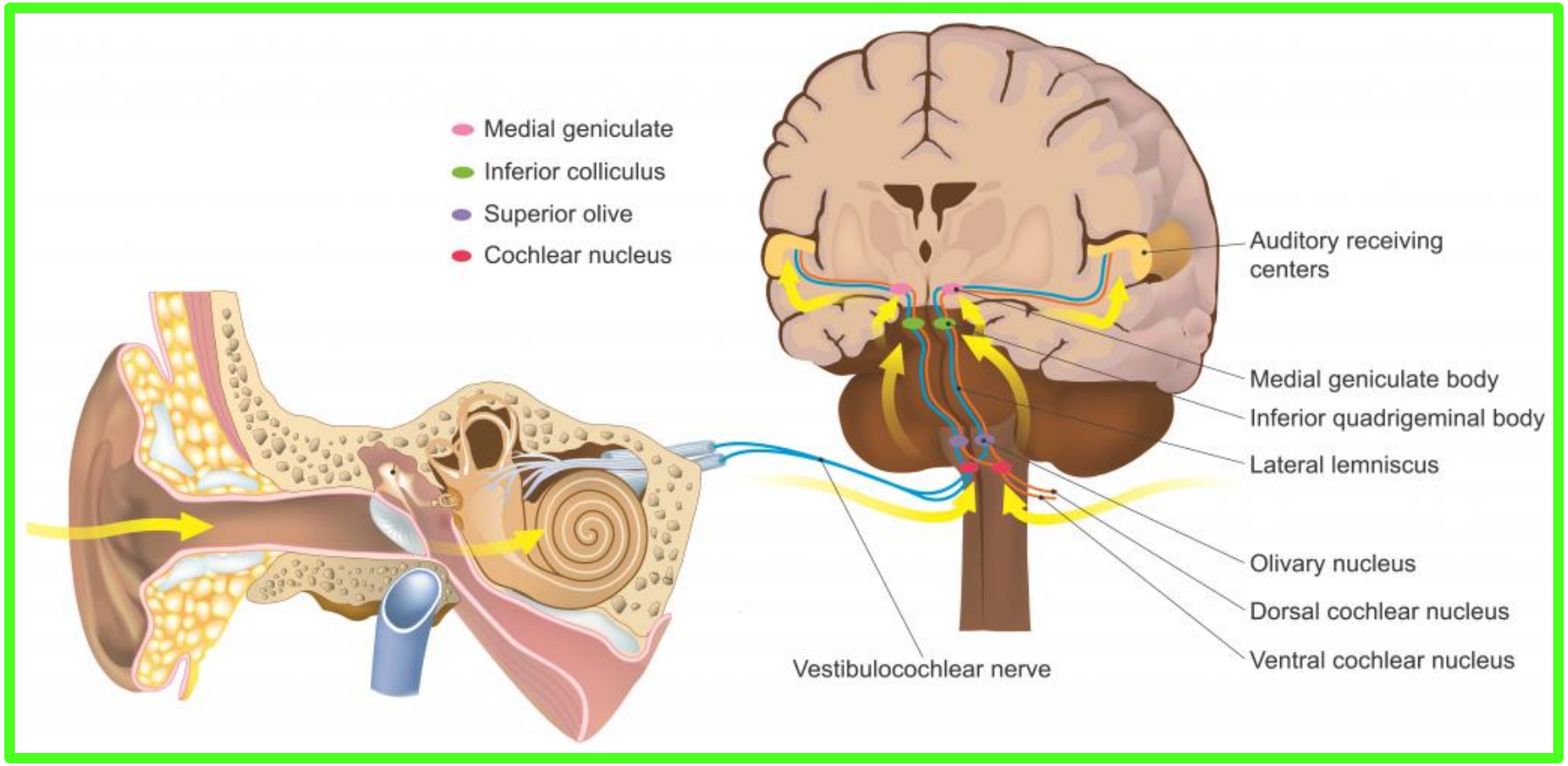
• AUDITORY (Hearing) PATHWAY

** **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.





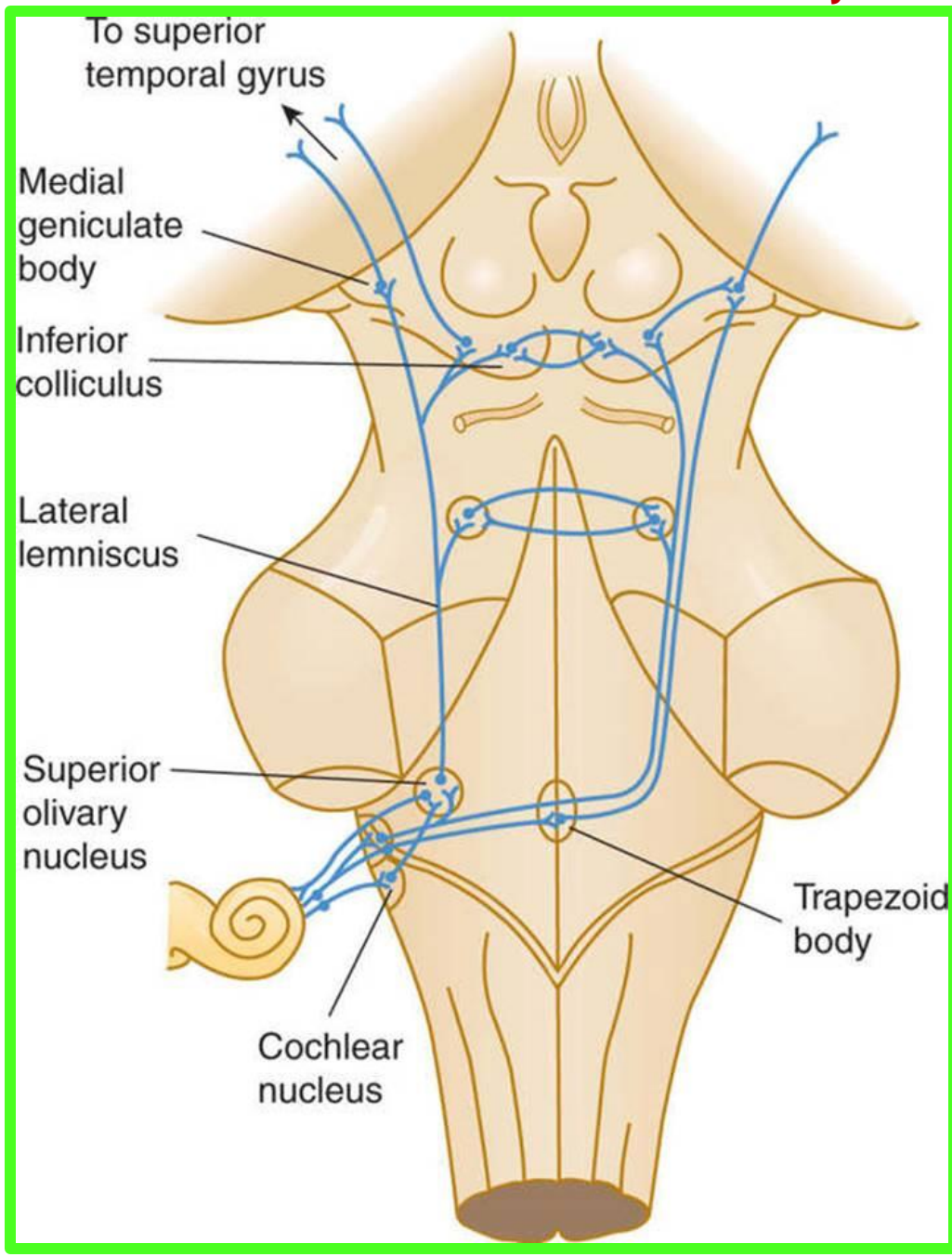
• AUDITORY (Hearing) PATHWAY

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 leminscus 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

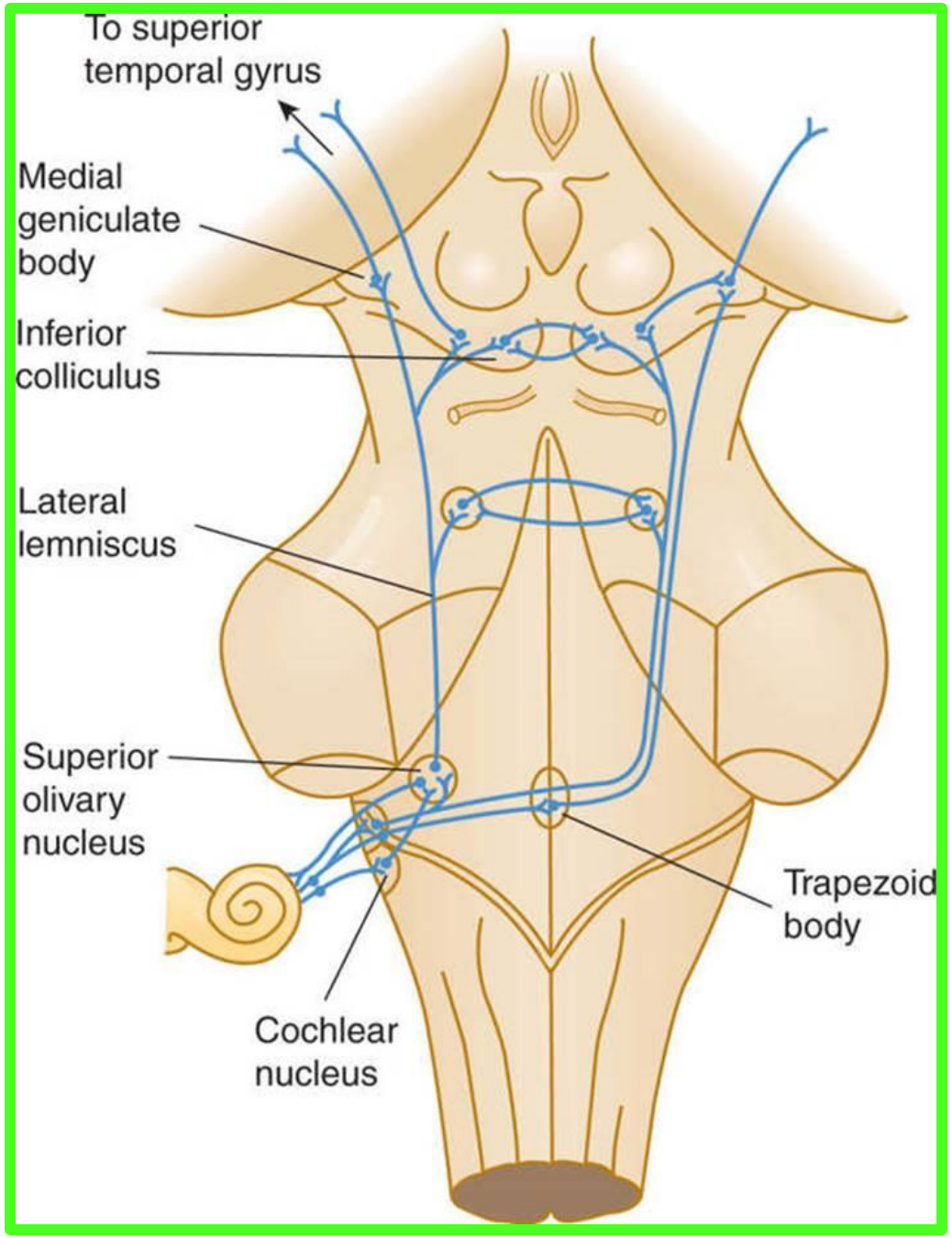
3- Third order neuron (superior olivary nucleus and nucleus of the trapezoid body)

- 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 fibers pass through the inferior brachium to end in the medial geniculate body.



• AUDITORY (Hearing) PATHWAY

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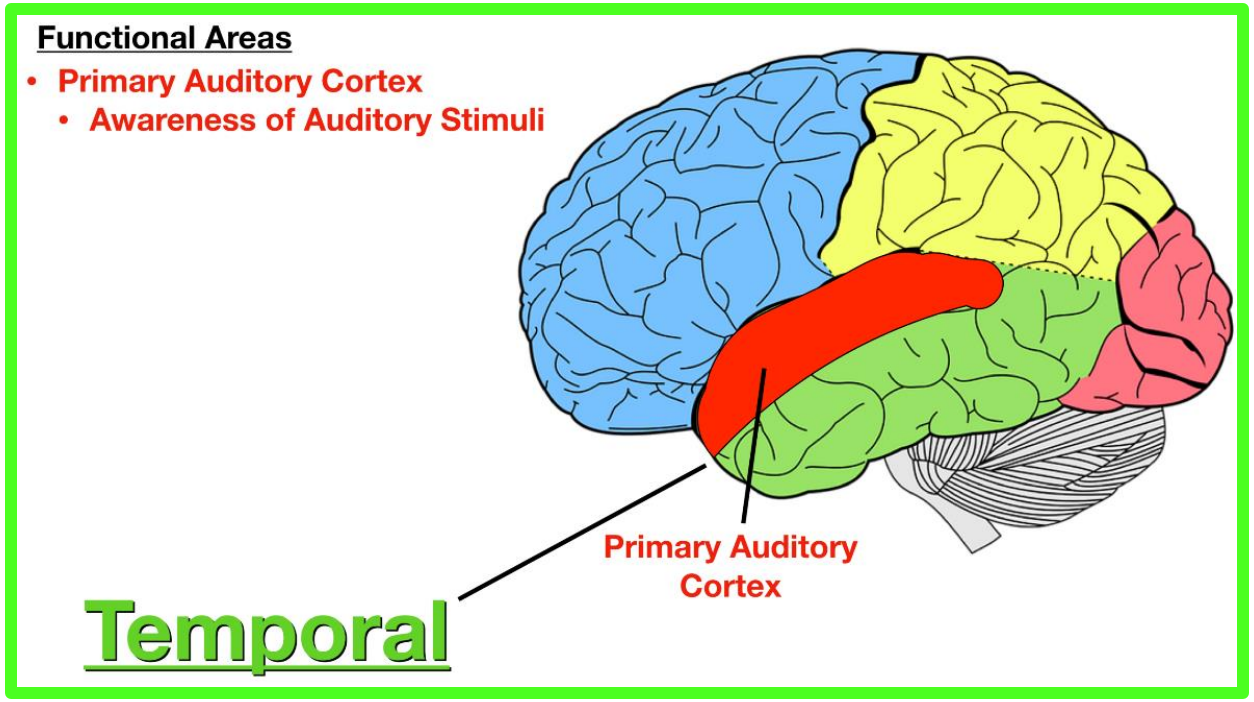
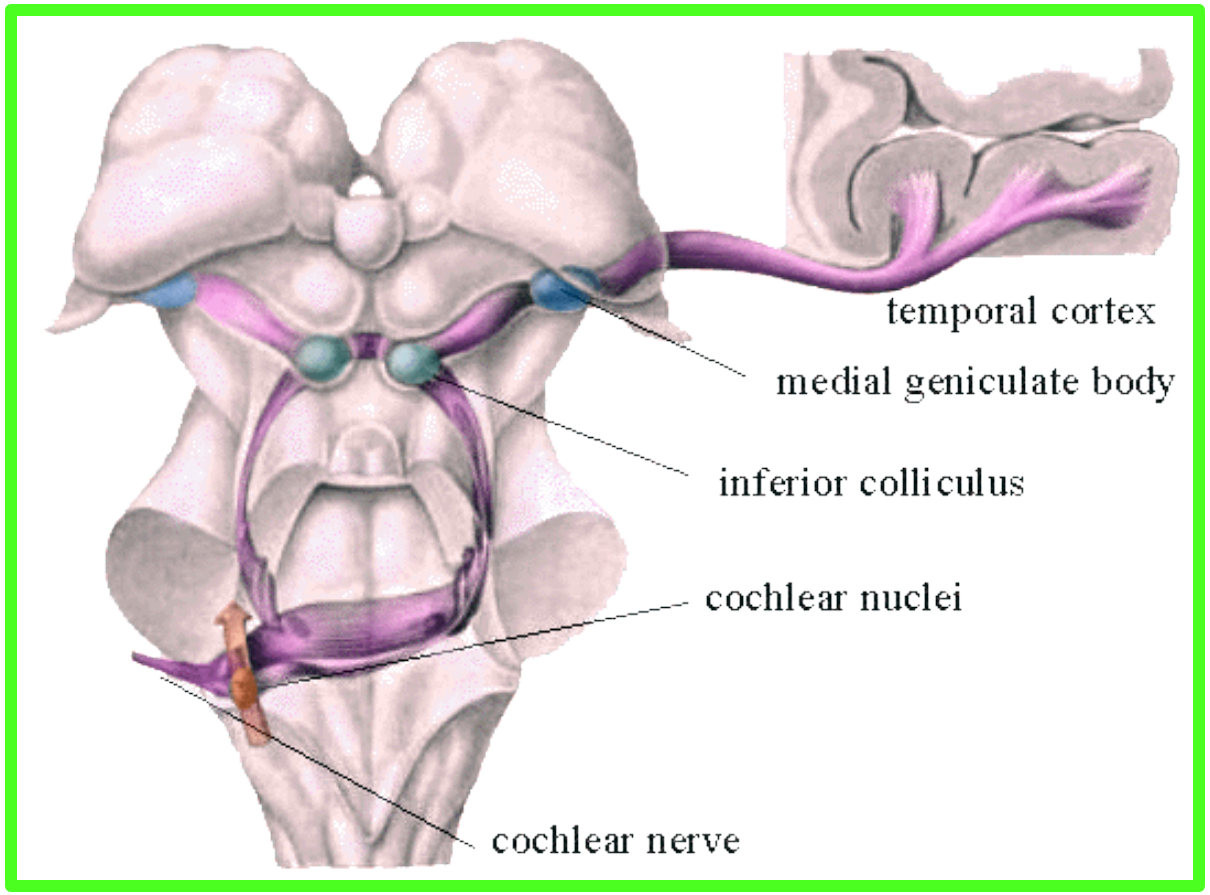
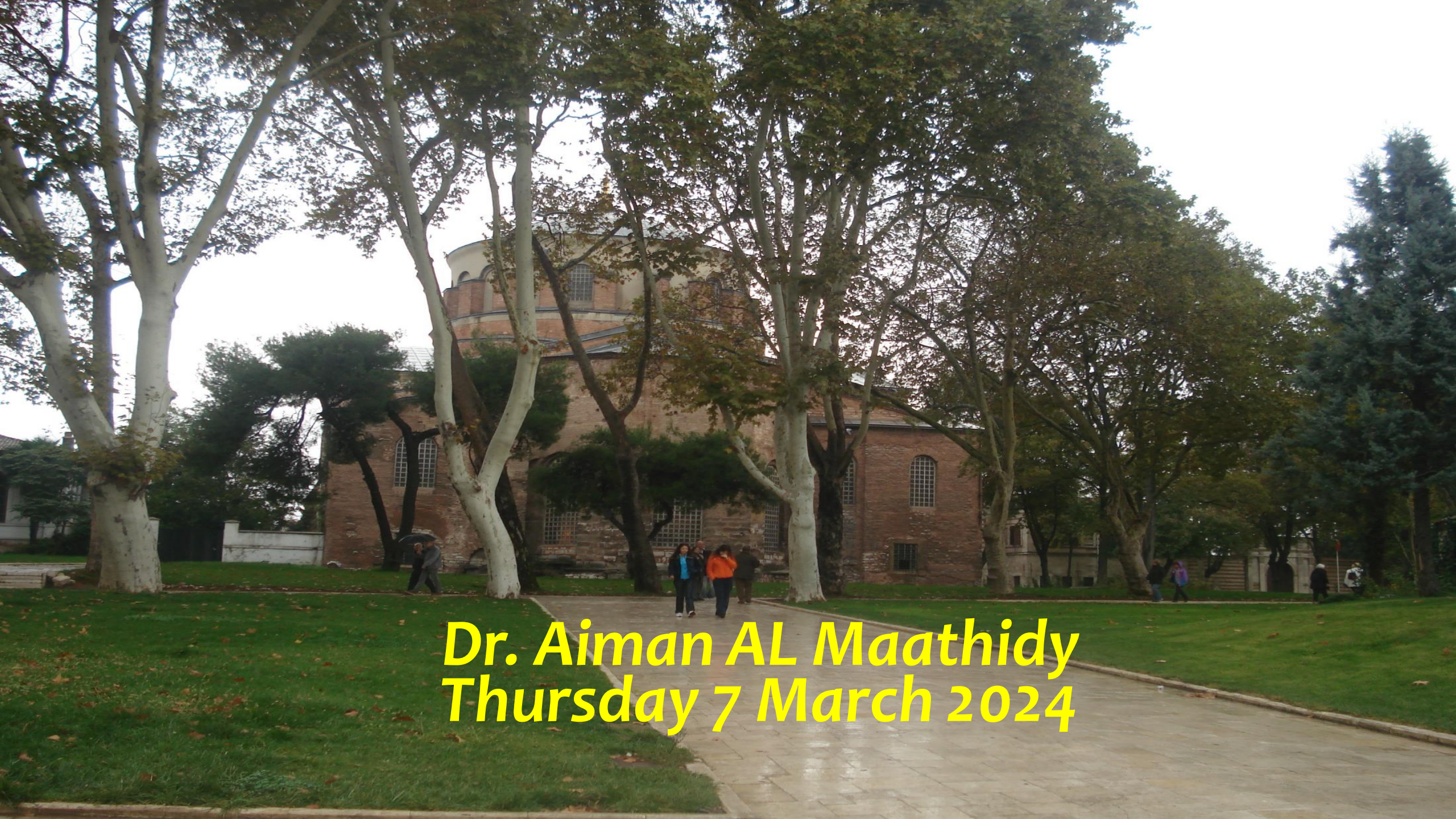
4- The 4th order neuron (Medial geniculate body):

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

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



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