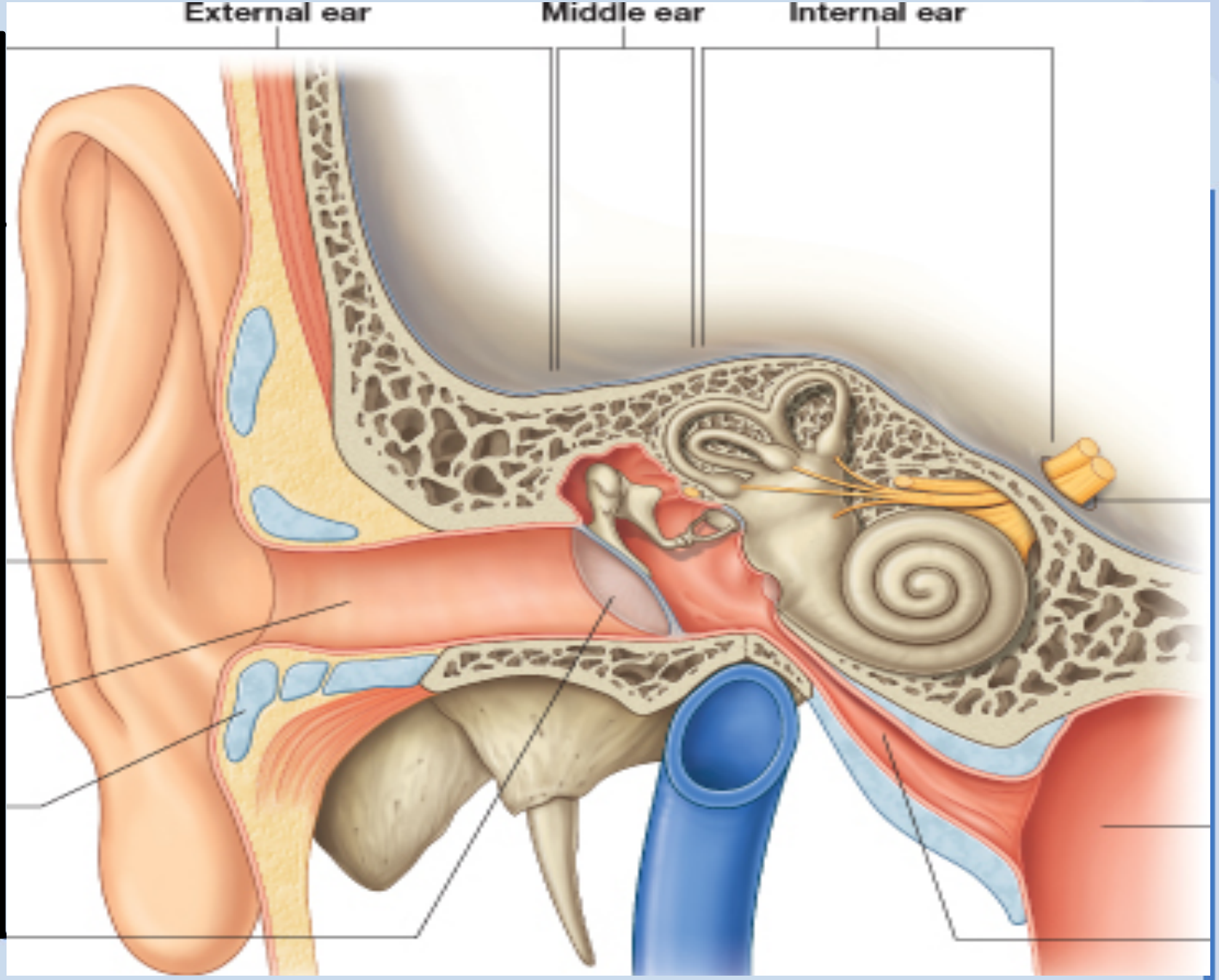
THE EAR



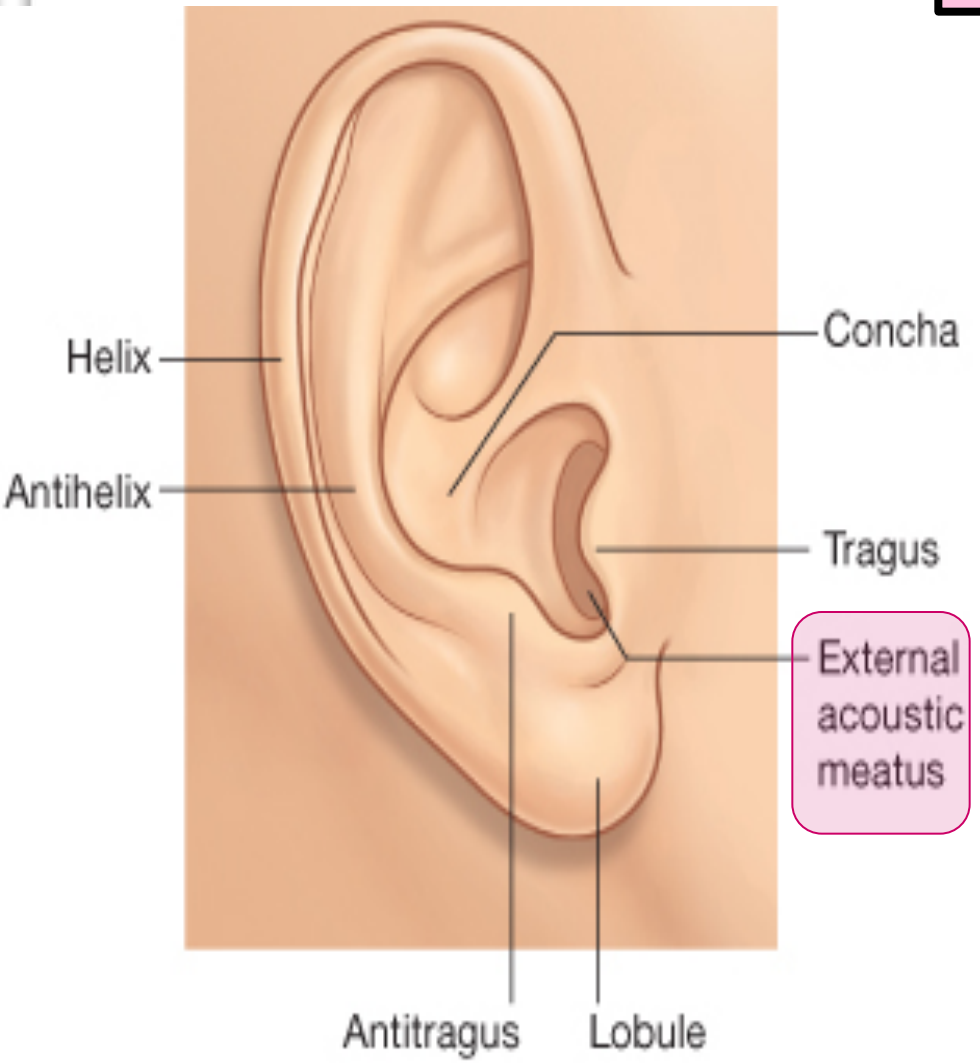
Objectives

- **By the end of the lecture the student should be able to:**
- **List the parts of the ear: External, Middle (tympanic cavity) and Internal (labyrinth).**
- **Describe the parts of the external ear: auricle and external auditory meatus.**
- **Identify the boundaries of the middle ear : roof, floor and four walls (anterior, posterior, medial and lateral).**

Objectives

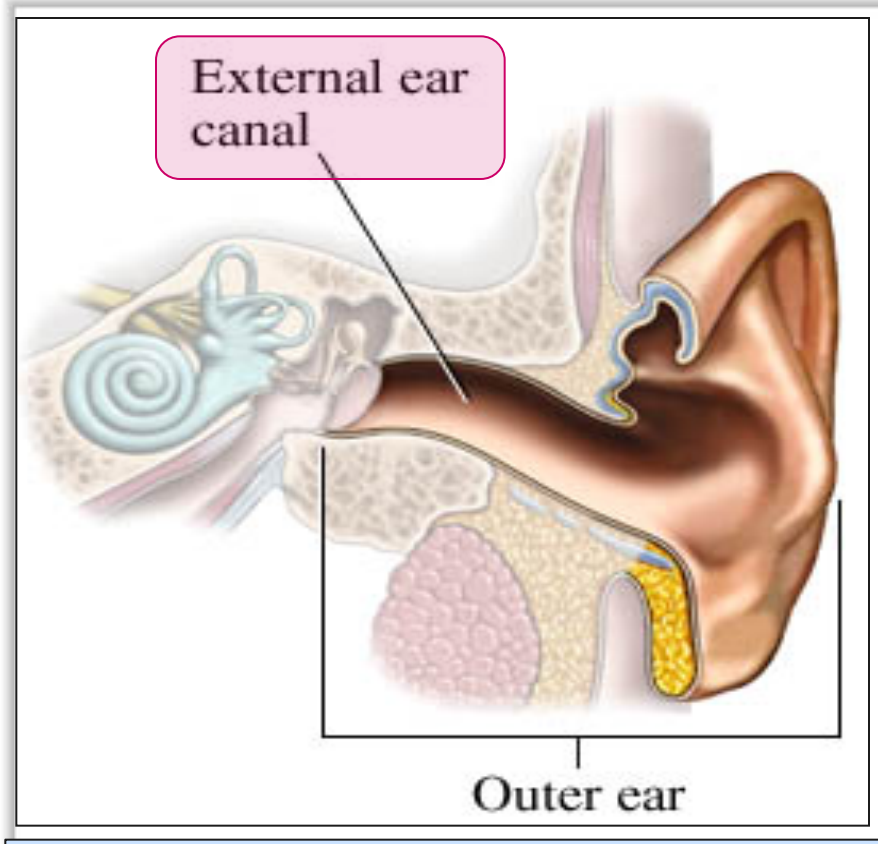
- **Define the contents of the tympanic cavity:**
- **I. Ear ossicles,:** *(malleus, incus and stapes)*
- **II. Muscles,** (tensor tympani and stapedius).
- **III. Nerves** (branches of facial and glossopharyngeal)**.**
- List the parts of the inner ear, ***bony part filled*** with perilymph (Cochlea, vestibule and semicircular canals), in which is suspended the membranous part that filled with endolymph).
- List the organs of hearing and equilibrium.

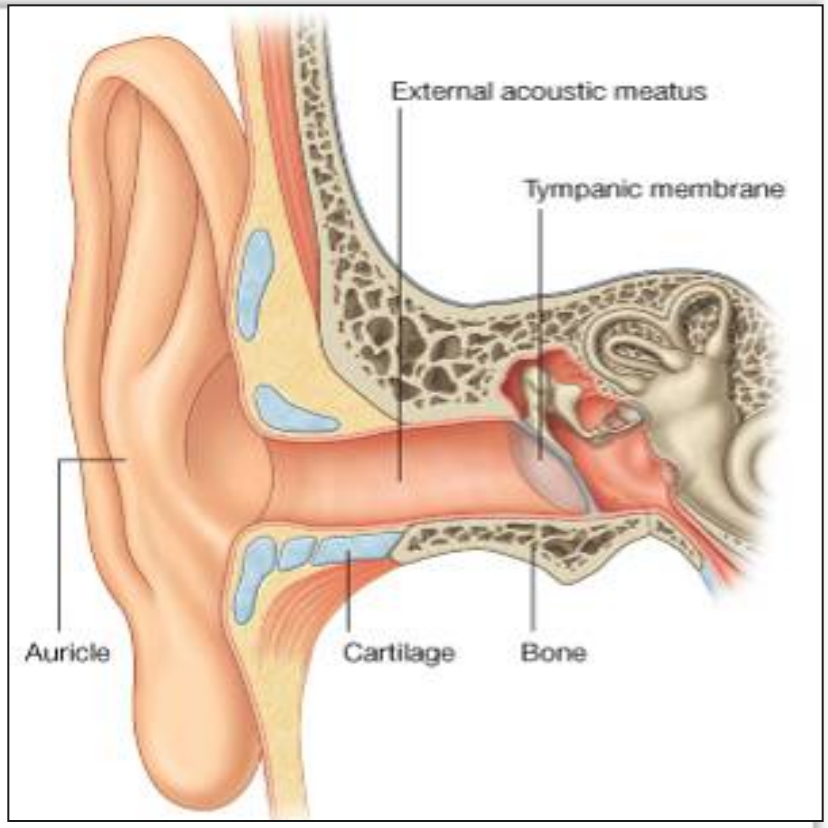
EXTERNAL EAR



It is formed of the **auricle,** & the **external auditory meatus.**

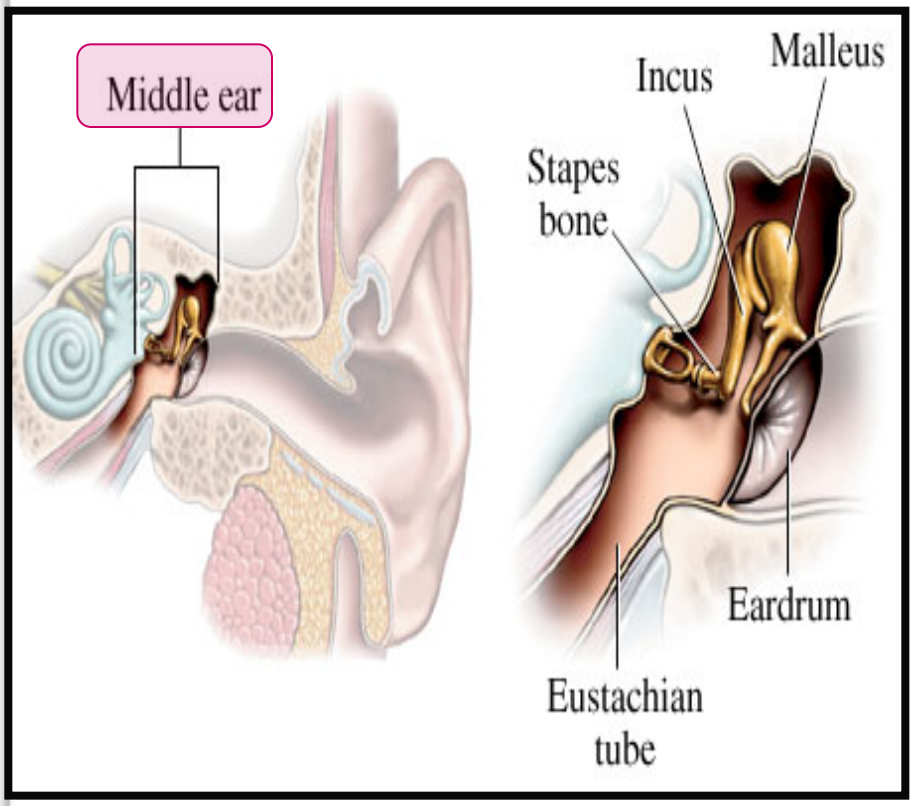
- The **Auricle** has a characteristic shape and collects air vibrations.
- It consists of a thin plate of *elastic cartilage* covered by a double layer of skin.
- It receives the insertion of extrinsic muscles, which are supplied by the **facial nerve. Sensation** is carried by **great auricular & auriculotemporal nerves.**

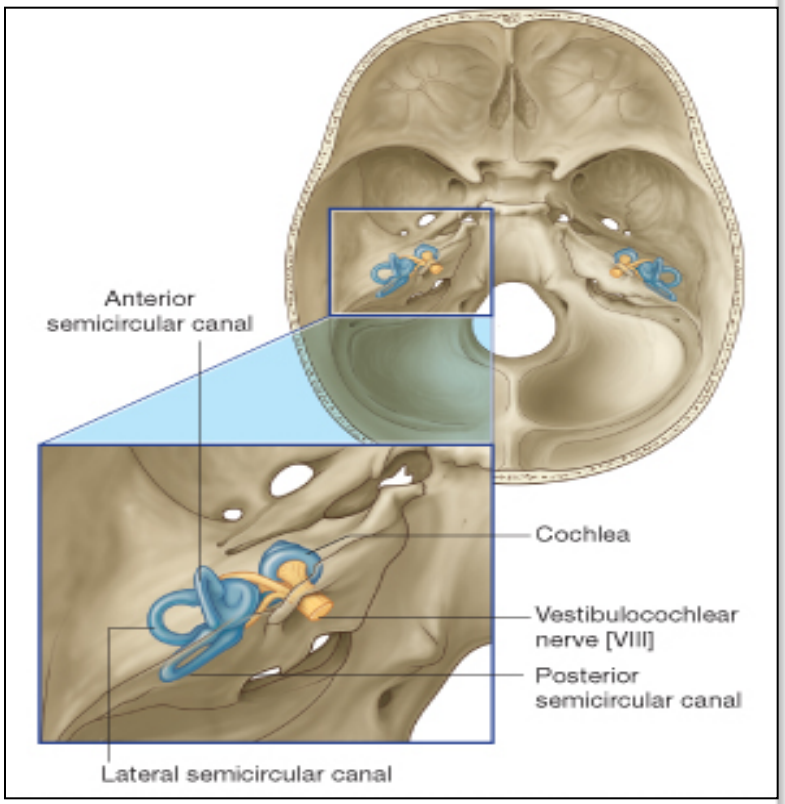




- **The external auditory canal** is a curved S-shaped tube about 2.5 cm, that conducts & collects sound waves from the auricle to the tympanic membrane. Its outer 1/3rd is **elastic cartilage**, while its inner 2/3^{rds} are **boney.**
- It is lined by skin, and its outer 1/3rd is provided with **hairs, sebaceous and Ceruminous Glands:** (modified sweat glands that secrete a yellowish brownish substance called the **ear wax).**

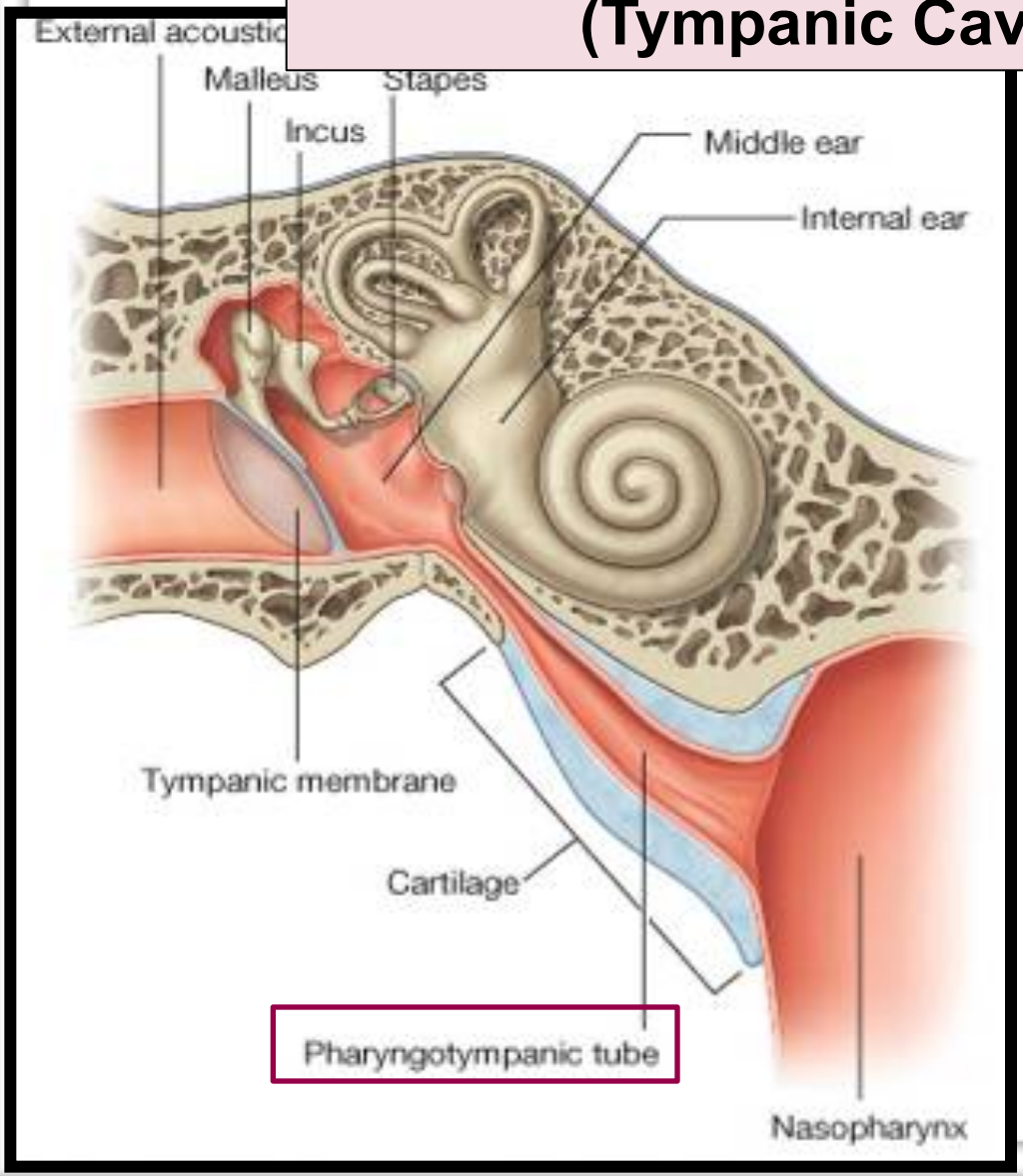
MIDDLE EAR (TYMPANIC CAVITY)





- **Middle ear** is a narrow, oblique, slit- like cavity (air-filled) in the petrous temporal bone & lined with mucous membrane.
- It contains the ***auditory ossicles***, which transmit the vibrations of the tympanic membrane (eardrum) to the internal ear.

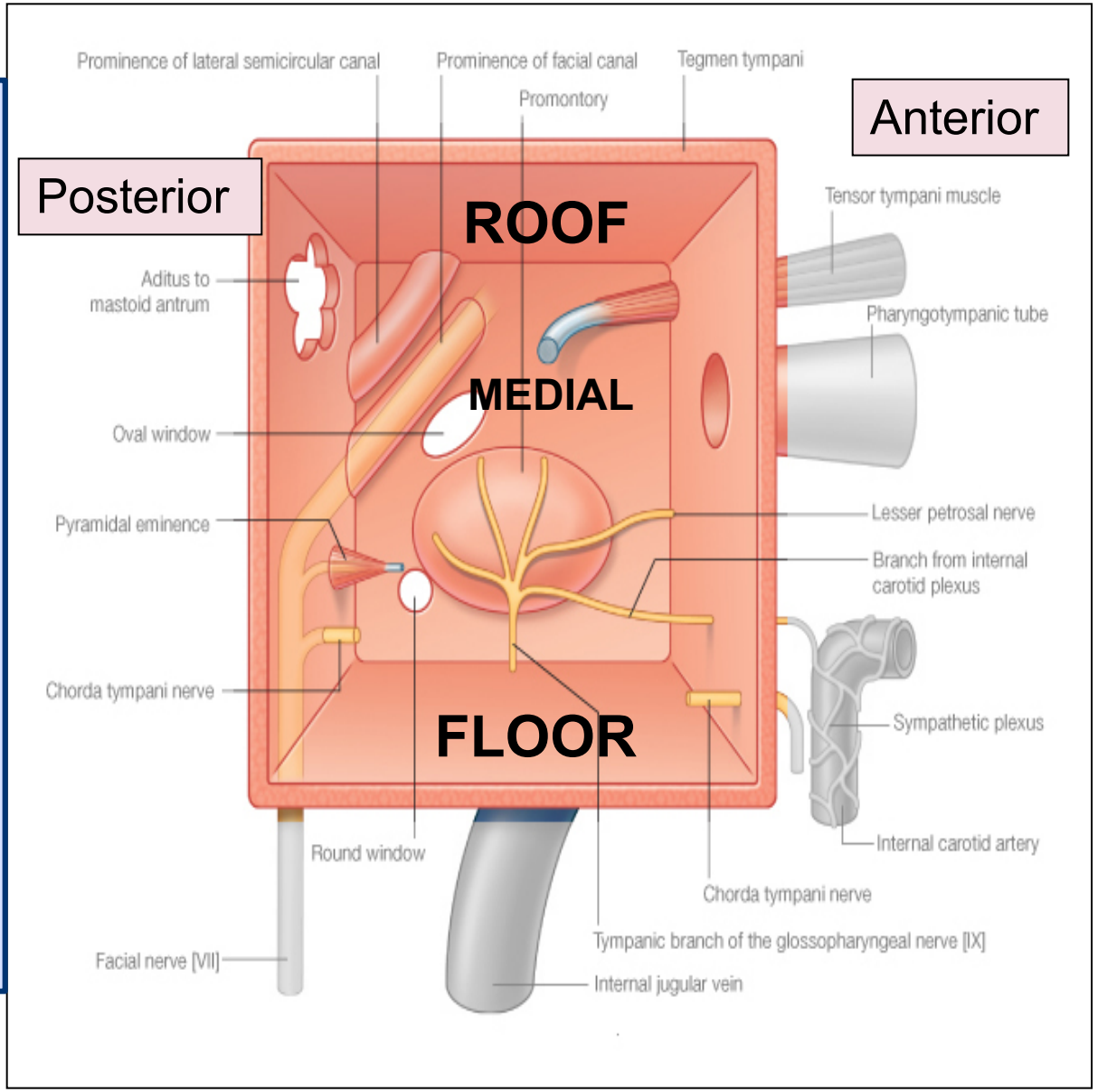
Communications of Middle Ear (Tympanic Cavity)



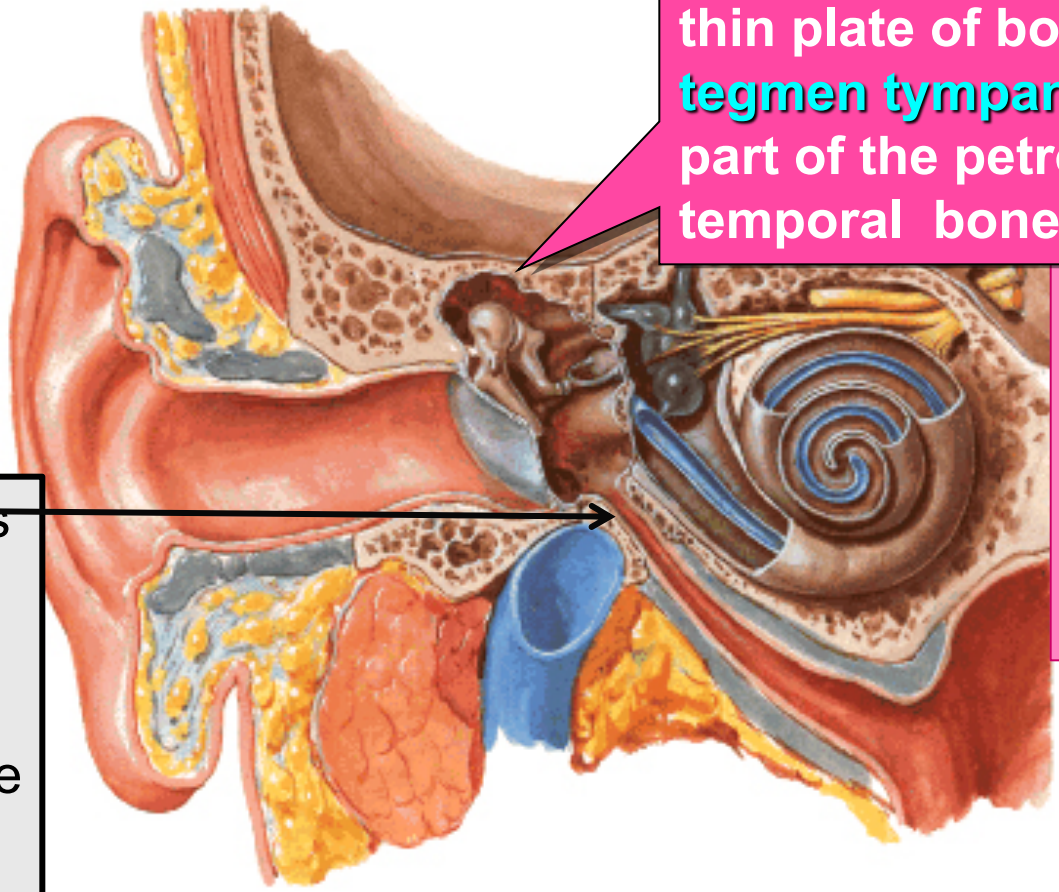
- ***Anteriorly:***
- with the **Nasopharynx** through the **Auditory Tube, which** extends from the anterior wall downward, forward, and medially to the nasopharynx).
- The posterior 1/3rd of the canal is bony, and its anterior 2/3rds are cartilaginous.
- Its function is to equalize the pressure on both sides of the ear drum.

The middle ear has:

- **Roof,**
- **Floor,**
- **<u>and 4 walls</u>:**
- **Anterior,**
- **Posterior,**
- **Lateral, and**
- **Medial.**



The Roof is formed by a **thin plate of bone**, called **tegmen tympani, which is part of the petrous temporal bone.**



It separates the tympanic cavity from the temporal lobe of the brain.

The Floor is formed by a thin plate of bone, which separates the middle ear from **the bulb of the internal jugular vein.**

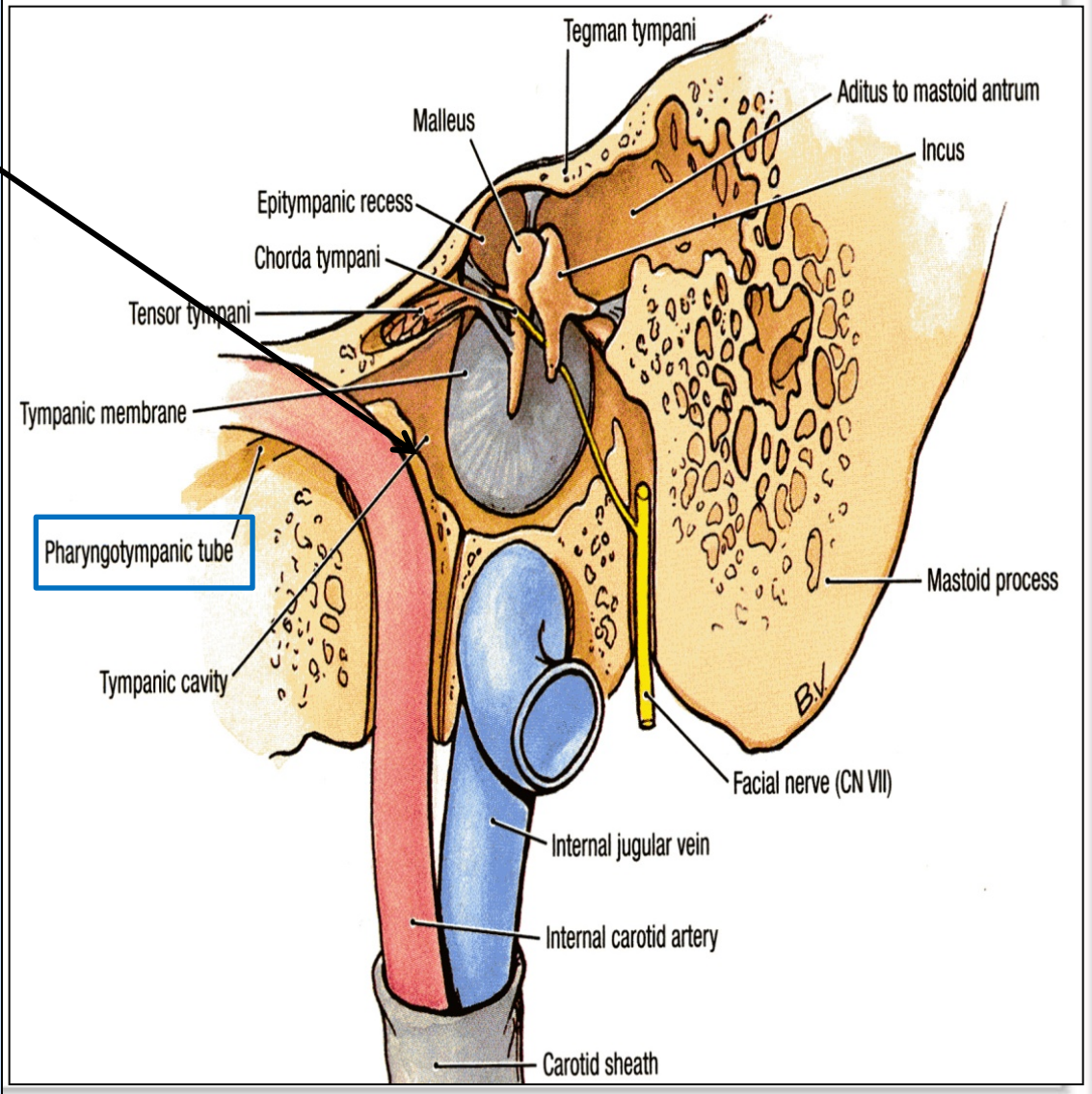
Anterior wall

The *anterior wall* is formed below by a thin plate of bone that separates tympanic cavity from the internal carotid artery.

There are 2 canals at the upper part of the anterior wall.

The upper smaller is the **canal for the tensor tympani muscle.**

The lower larger is for the **auditory tube.**

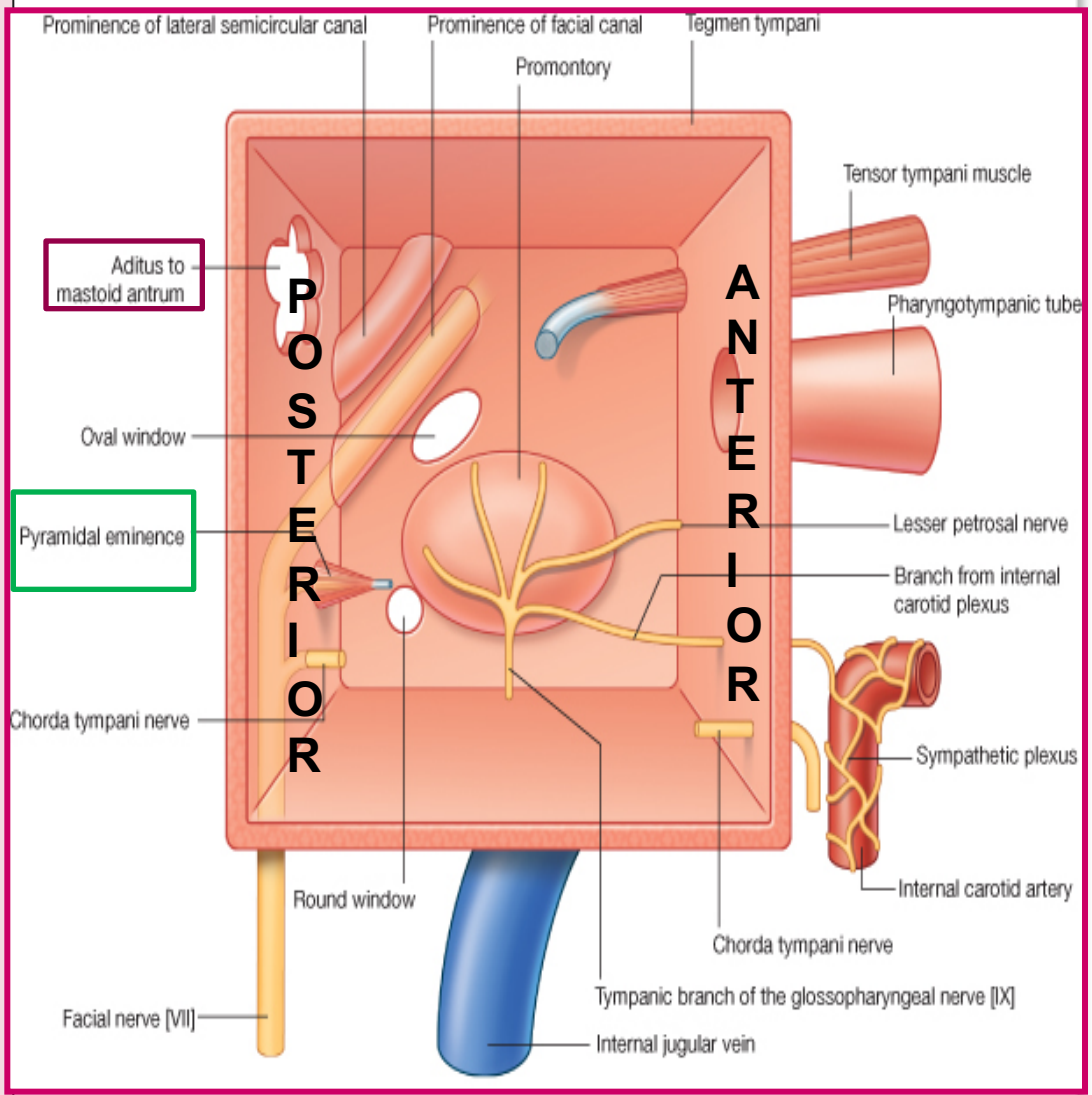


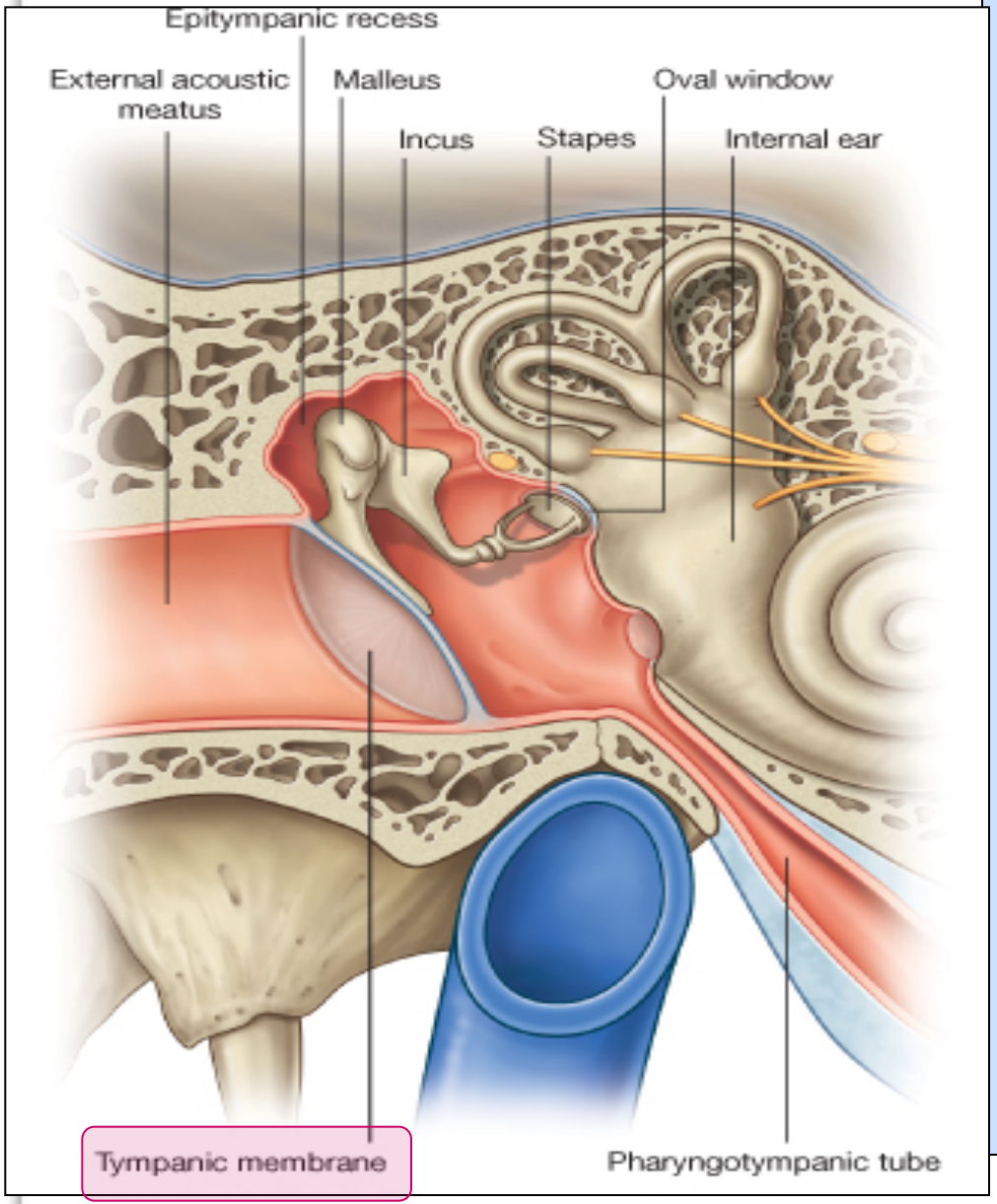
Posterior wall

The posterior wall has in its **Upper** part a large, irregular opening, the **aditus to the mastoid antrum (a cavity behind the middle ear, within mastoid process, it contains air cells)**

.Below : a small, hollow, conical projection, the **pyramid, which houses the stapedius muscle and its tendon.**

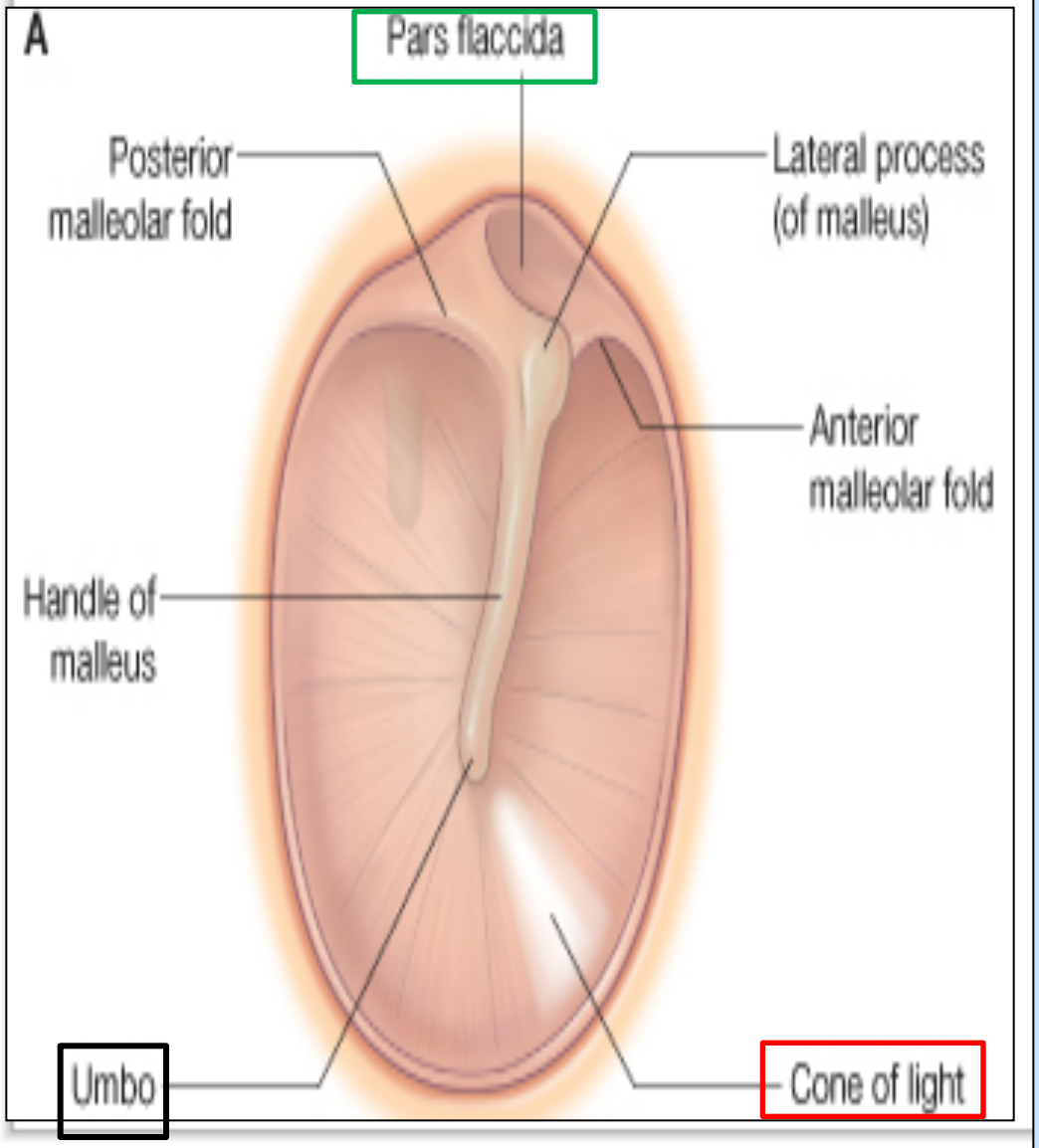
The tendon emerges from the apex of the pyramid.





- ***The lateral wall*** **:**
- **Is largely formed by the tympanic membrane.**
- **The membrane is obliquely placed, facing downward, forward, & laterally.**
- It is **extremely sensitive to pain.**
- **Nerve supply of ear drum:**
- **Outer surface:**
- 1- **Auriculotemporal nerve.**
- **2- Auricular branch of vagus.**
- **Inner surface:**
- ***Tympanic branch*** **of the glossopharyngeal nerve.**

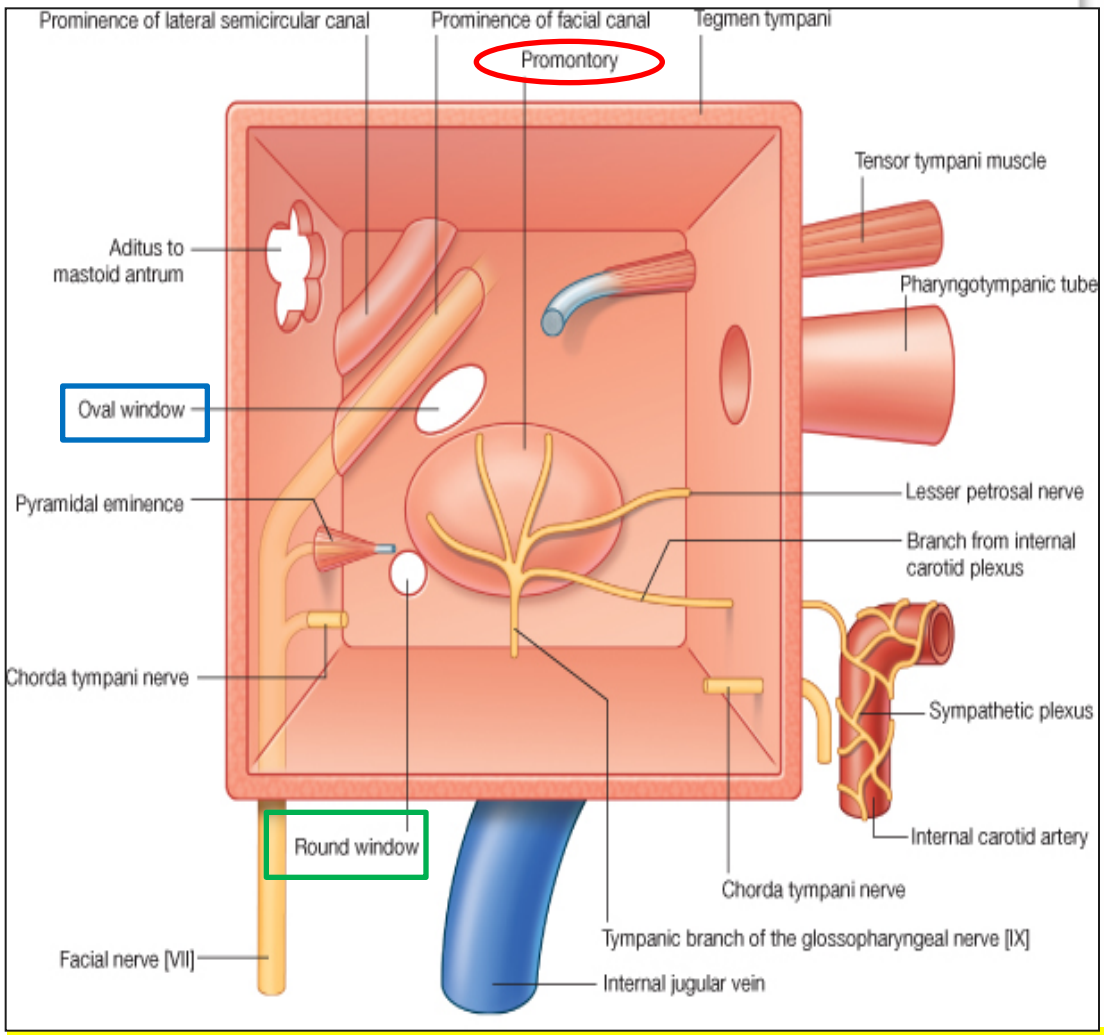
TYMPANIC MEBRANE



- Normally, It is **concave**, and directed downwards, forwards and laterally. At the depth of its concavity there is a small depression, " the **Umbo"** produced by the tip of the handle of the malleus.
- When the membrane is illuminated through an otoscope, the concavity produces a **"Cone of Light,"** which radiates anteriorly and inferiorly from the umbo.
- Most of the of the membrane is tense and is called the **Pars Tensa.**
- A small triangular area on its upper part is slack and called the **Pars Flaccida**

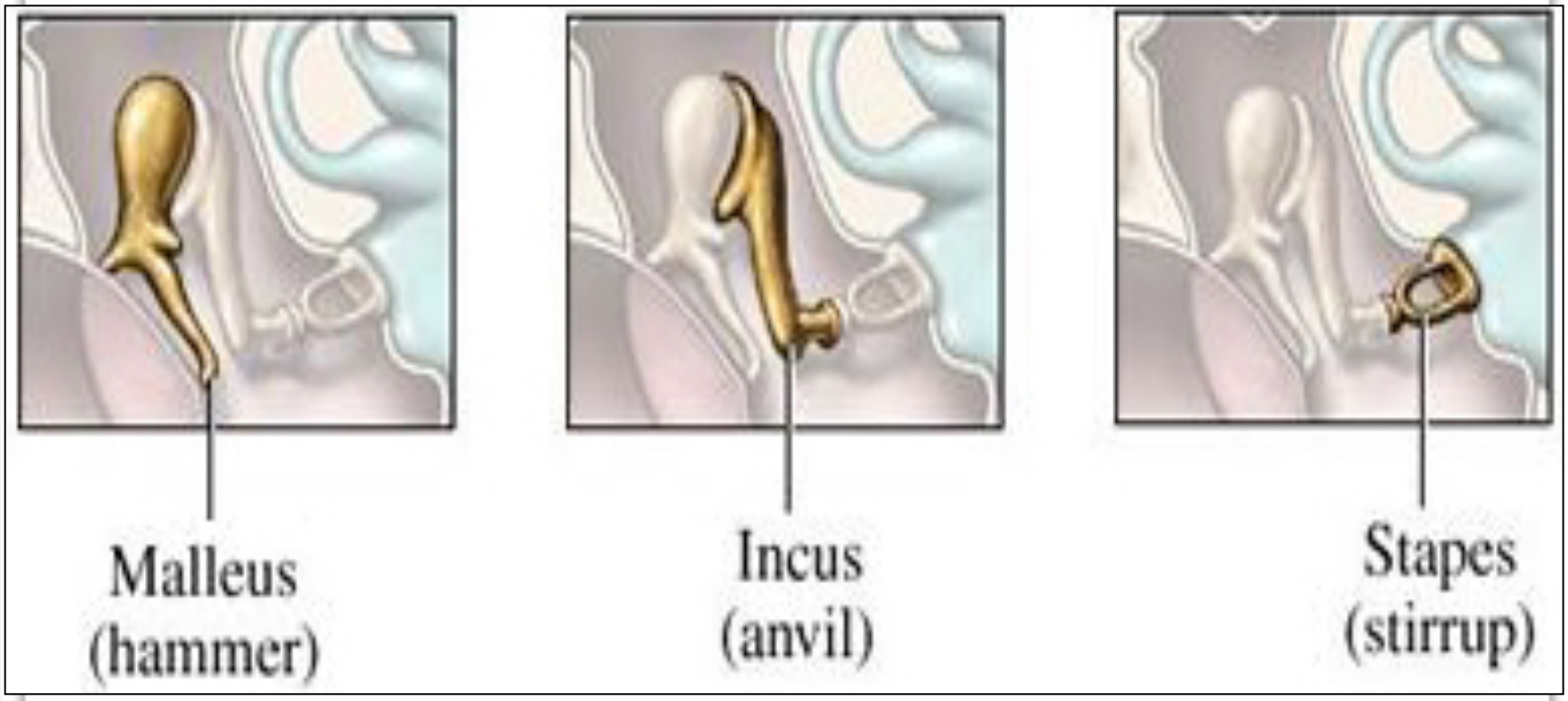
Medial wall

- Greater part of the **medial** wall shows a rounded projection, (**Promontory**)
- Above and behind the promontory lies the Oval window (**Fenestra Vestibuli**), Below and behind the promontory lies the Round window (**Fenestra Cochleae**),



It is formed by the lateral wall of the inner ear.

Auditory Ossicles

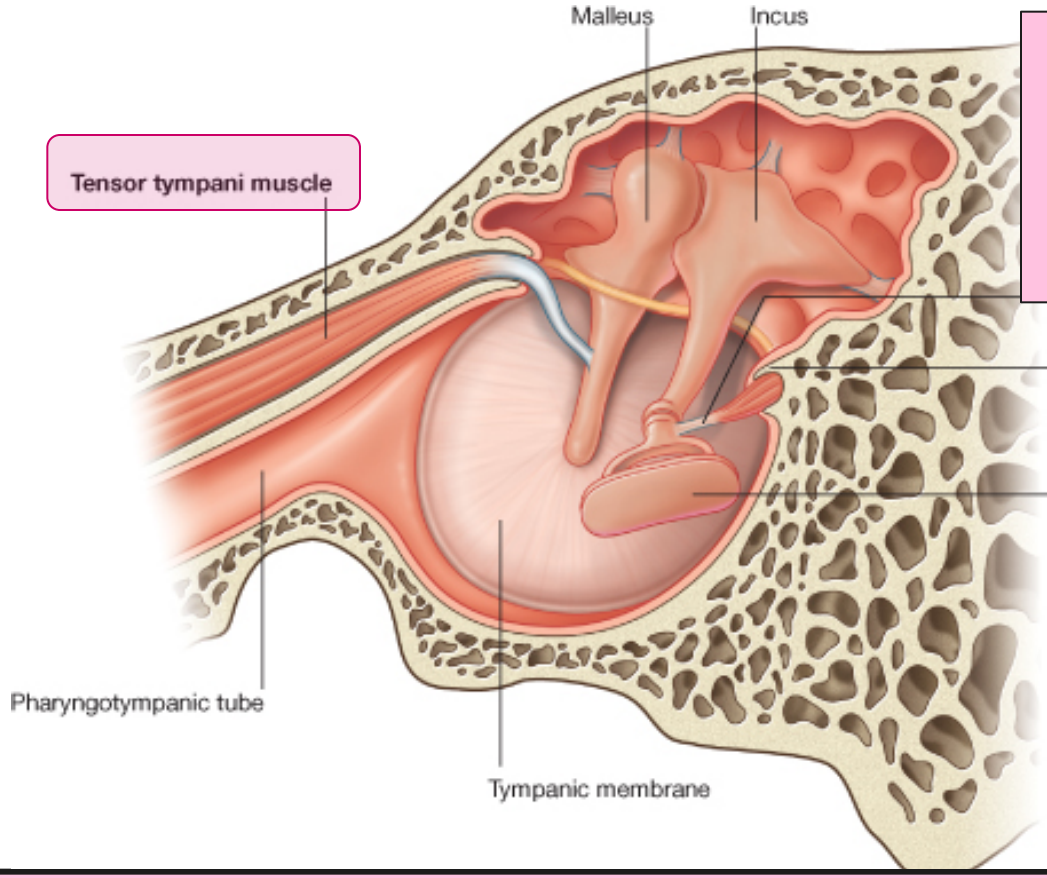


The auditory ossicles are (**3**) malleus, incus, and stapes.

They transmit sound waves from tympanic membrane to the perilymph of the internal ear.

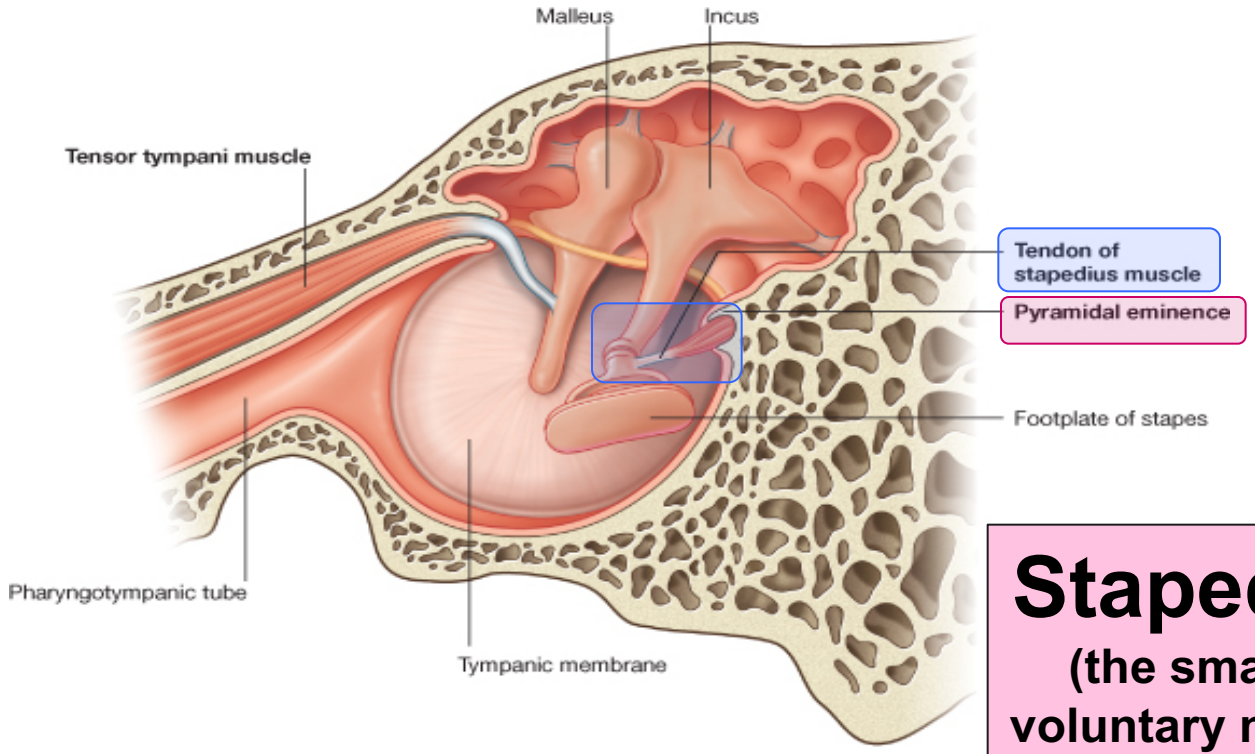
They are covered by mucous membrane & articulate by synovial joints.

Muscles within the tympanic cavity



TENSOR TYMPANI

- **Origin:** **C**artilage of the auditory tube and the bony walls of its own canal.
- **Insertion**: ***into the handle of the malleus.***
- ***Nerve supply:*** **Mandibular nerve.**
- **Action:** **Contracts reflexly in response to loud sounds to limit the excursion of the tympanic membrane.**

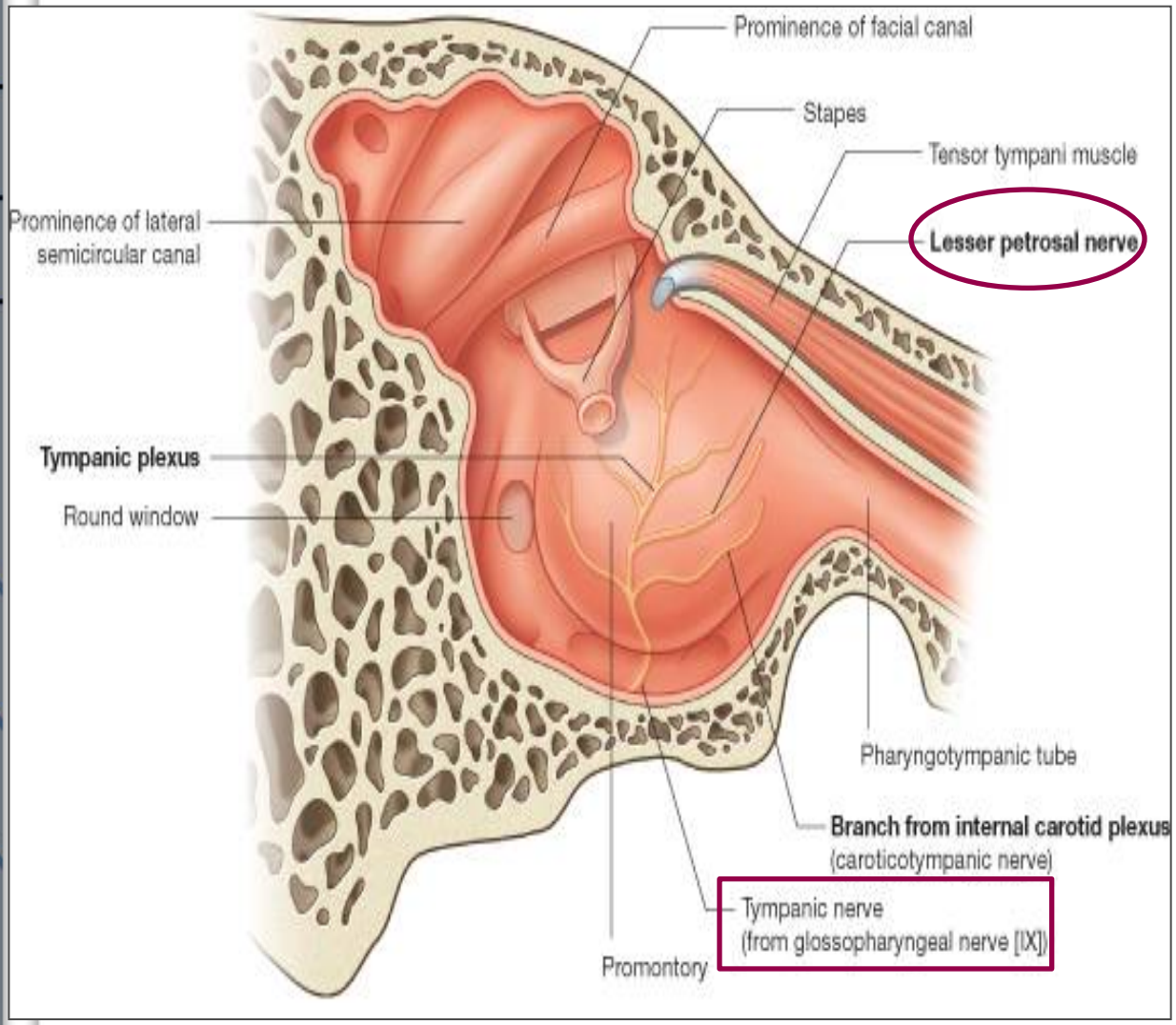


Stapedius

(the smallest voluntary muscle)

- **Origin:** Internal walls of the hollow pyramid.
- **Insertion:** The tendon emerges from the apex of the pyramid and *is* ***inserted into the neck of the stapes.***
- **Nerve supply:** **Facial nerve.**
- **Action:** **Reflexly damps down** the vibrations of the stapes by pulling on the neck of that bone.

NERVES WITHIN MIDDLE EAR



- ***Tympanic nerve***
- a branch of the **glossopharyngeal nerve.**
- **It gives:**
- **Tympanic plexus** on the promontory
- The tympanic plexus gives the,
- **Lesser petrosal** nerve which relays in the otic ganglion.
- It gives secretomotor supply to the **parotid gland**

FACIAL NERVE

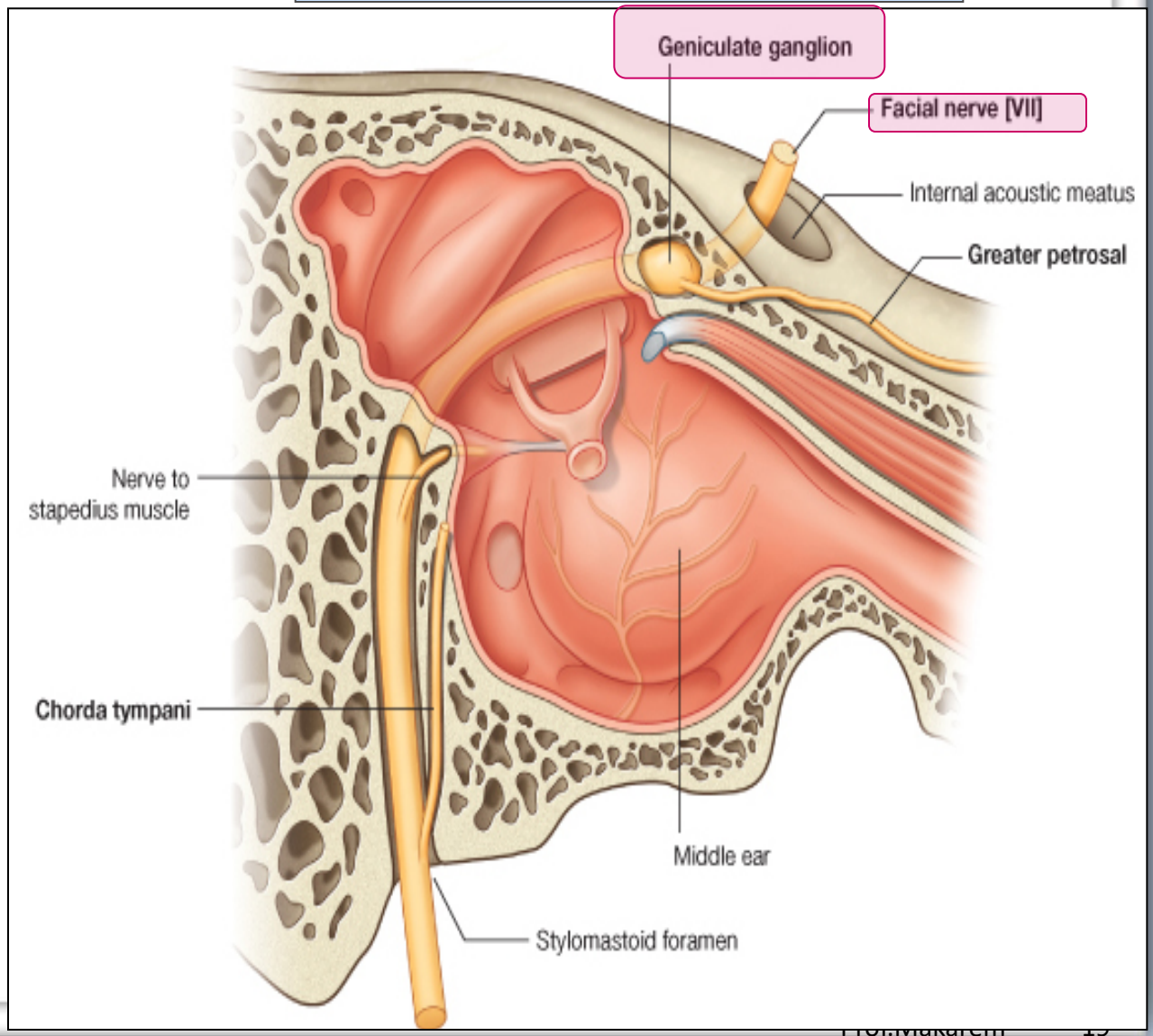
Enters through the

Internal acoustic meatus with the 8th nerve.

It expands to form **Geniculate ganglion.**

passes vertical behind the pyramid.

leaves the middle ear through the **stylomastoid foramen.**



BRANCHES OF FACIAL NERVE

1. **Greater Petrosal nerve.**

Arises from **Geniculate Ganglion.**

Carries preganglionic parasympathetic to :

Lacrimal,

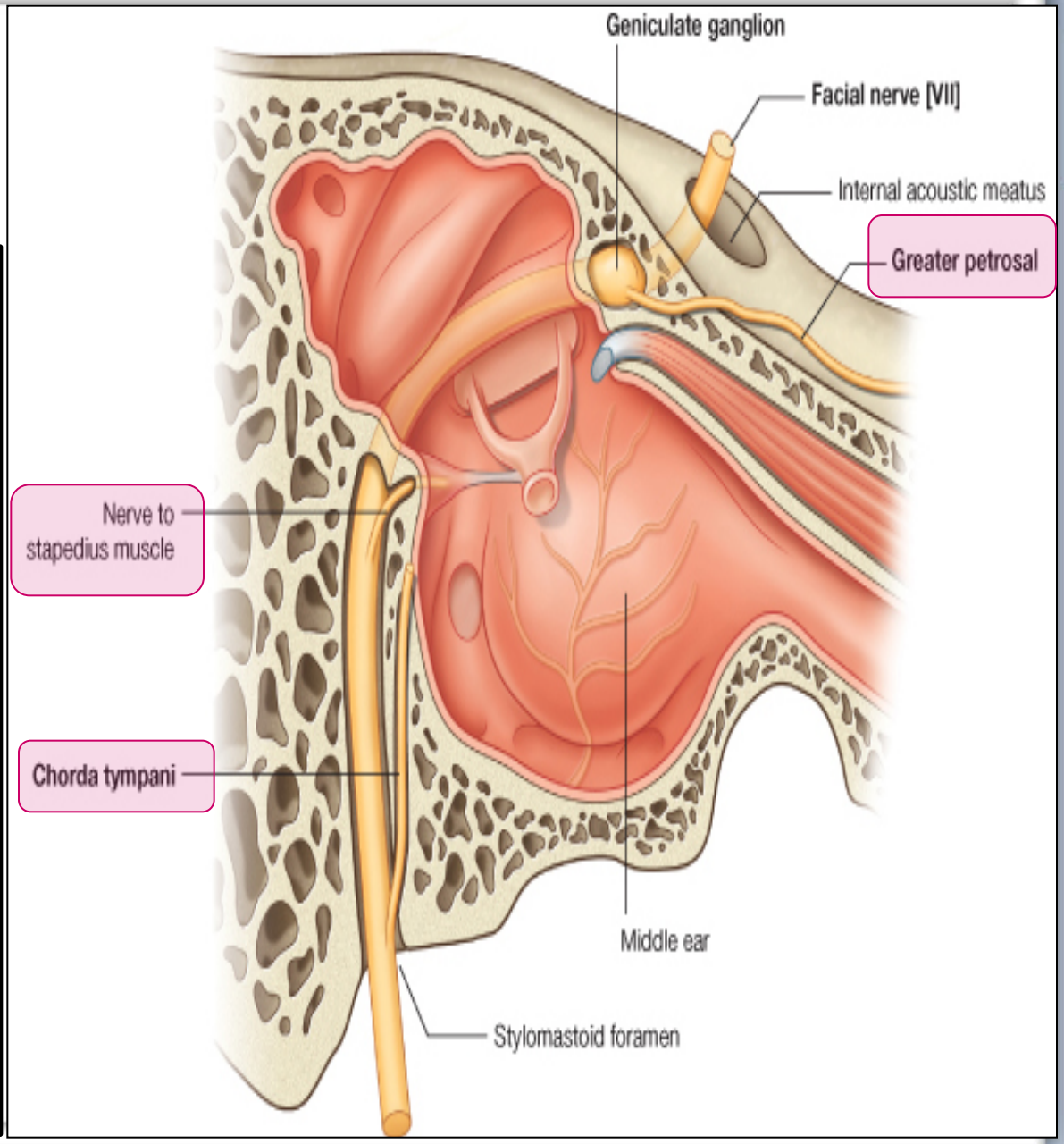
Nasal &

Palatine glands.

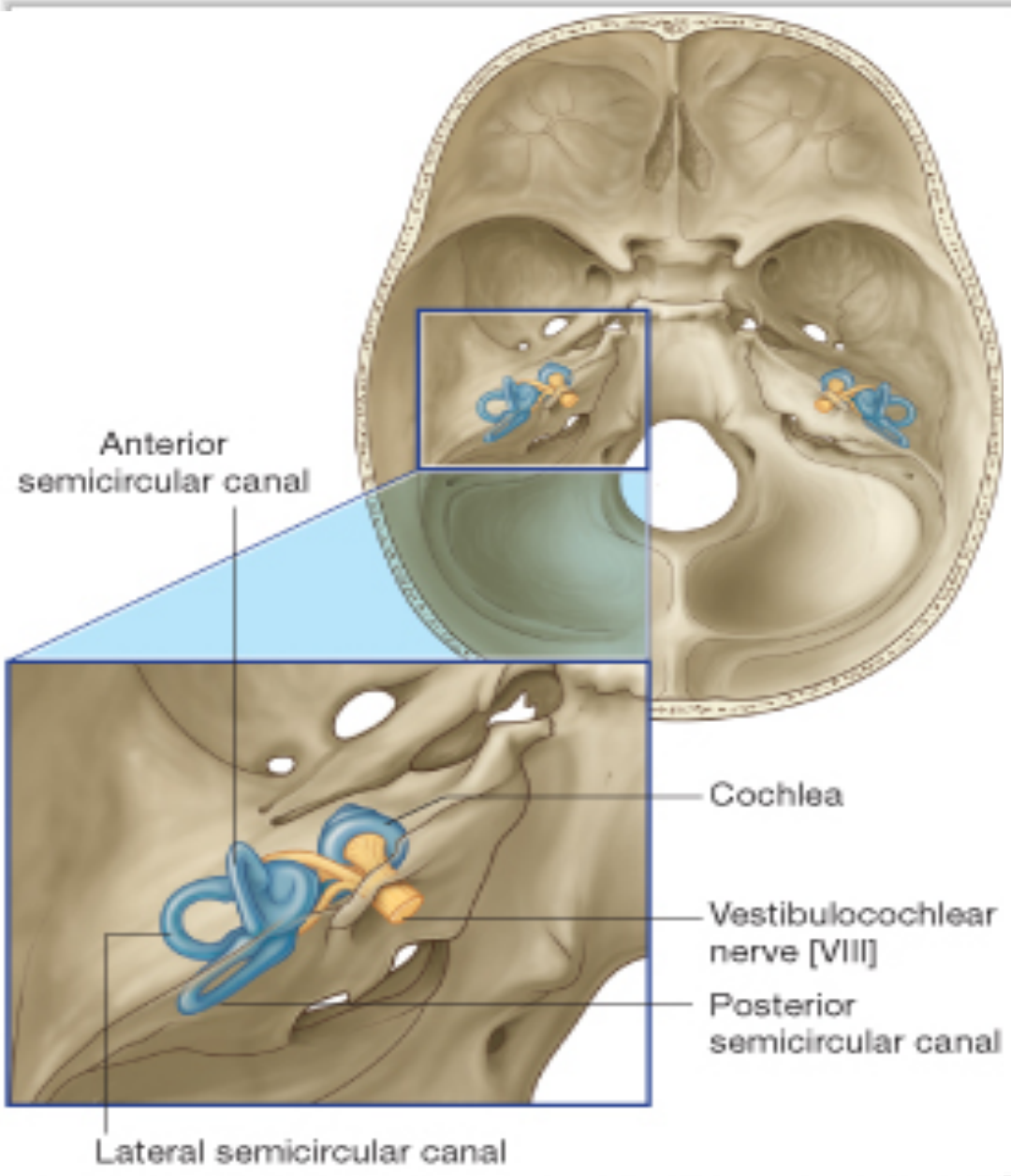
2. **Nerve to Stapedius.**

3. **Chorda Tympani:**

Arises just before the facial nerve exits.



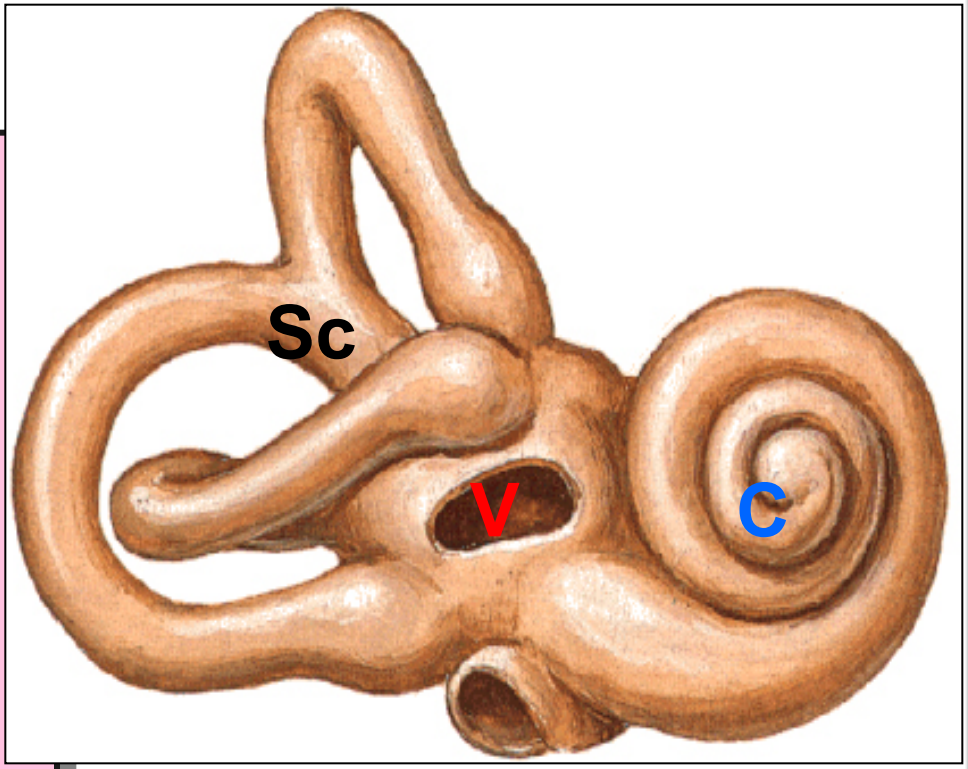
INTERNAL EAR, (LABYRINTH)



Labyrinth is situated in the petrous part of the temporal bone, medial to the middle ear.

It consists of : **Bony** & **Membranous** labyrinth

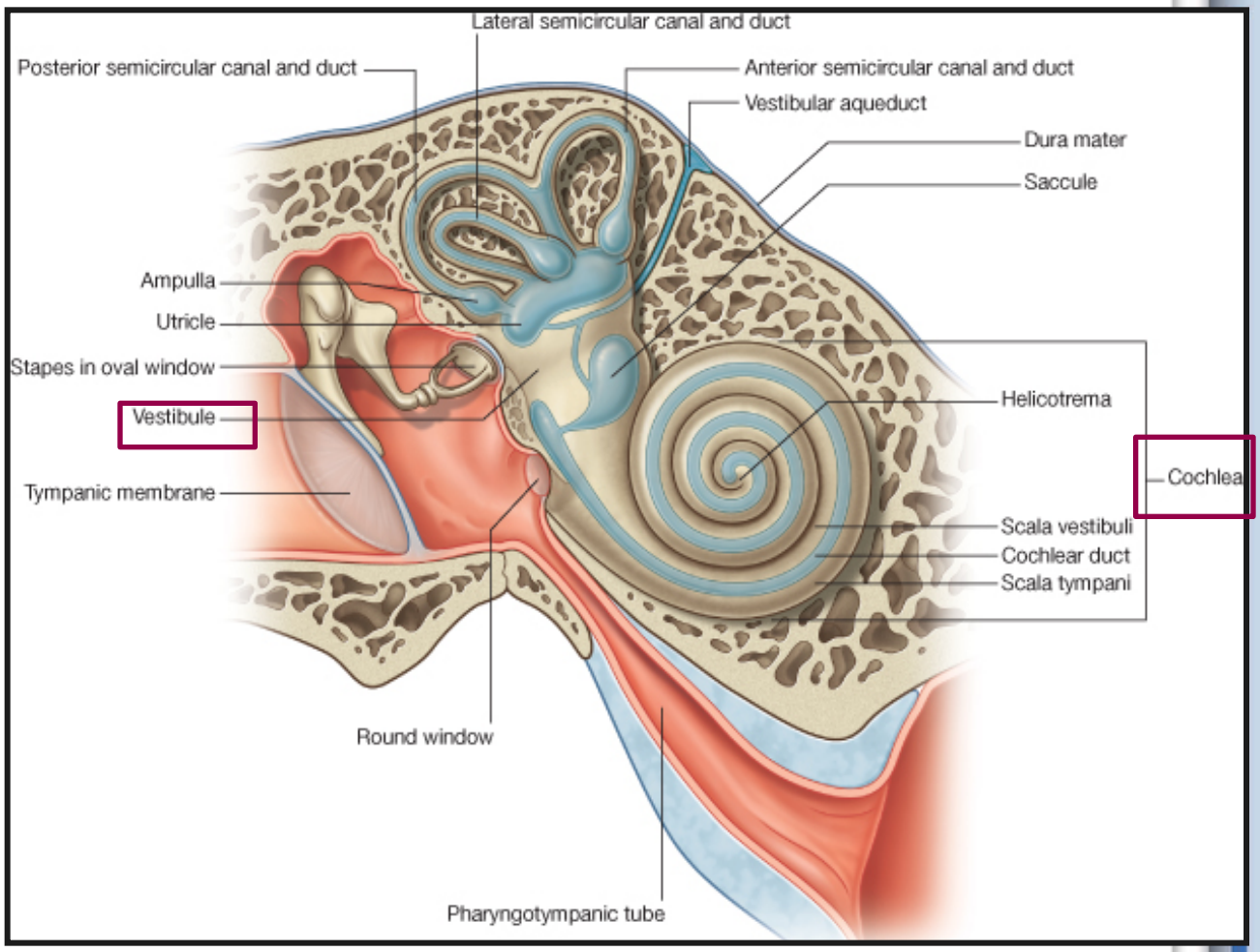
- It is a series of bony chambers lined by endosteum.
- They contain a clear fluid, the **perilymph**,
- It consists of:
- Cochlea
- Vestibule,
- **Semicircular canals,**

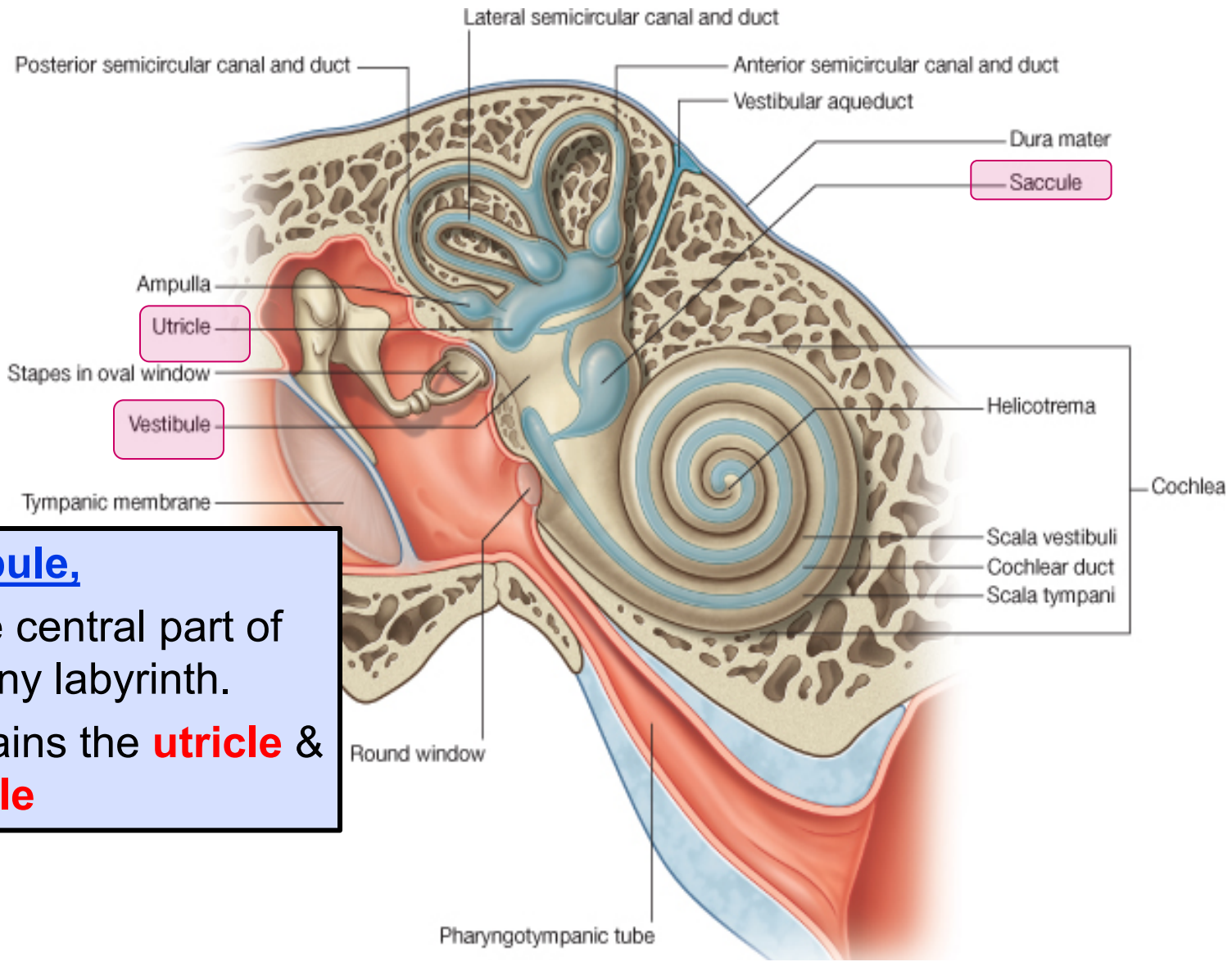


Bony Labyrinth

Cochlea

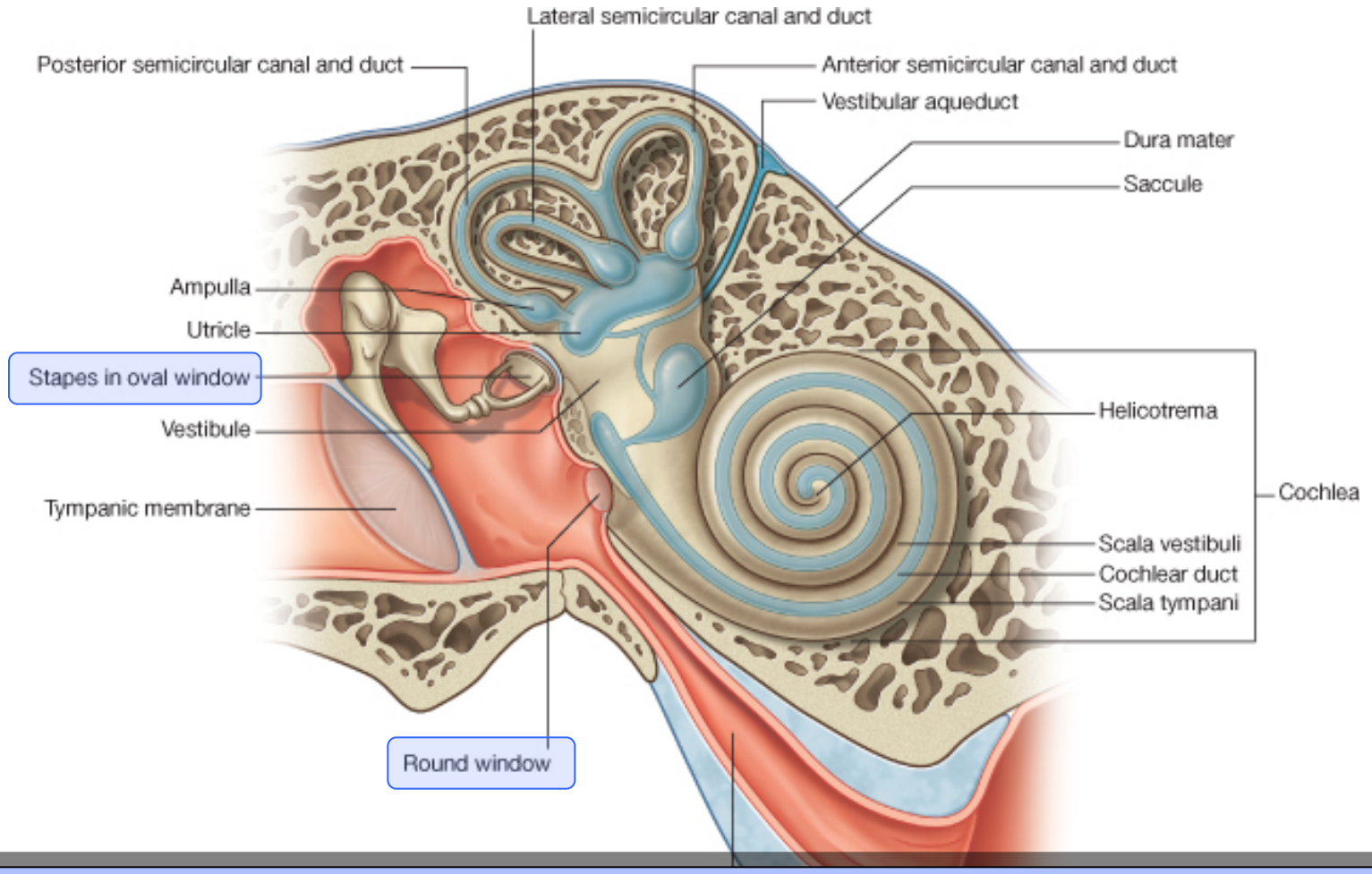
- Its first turn produces the **promontory** on the medial wall of the tympanic cavity.
- It contains the **cochlear duct**





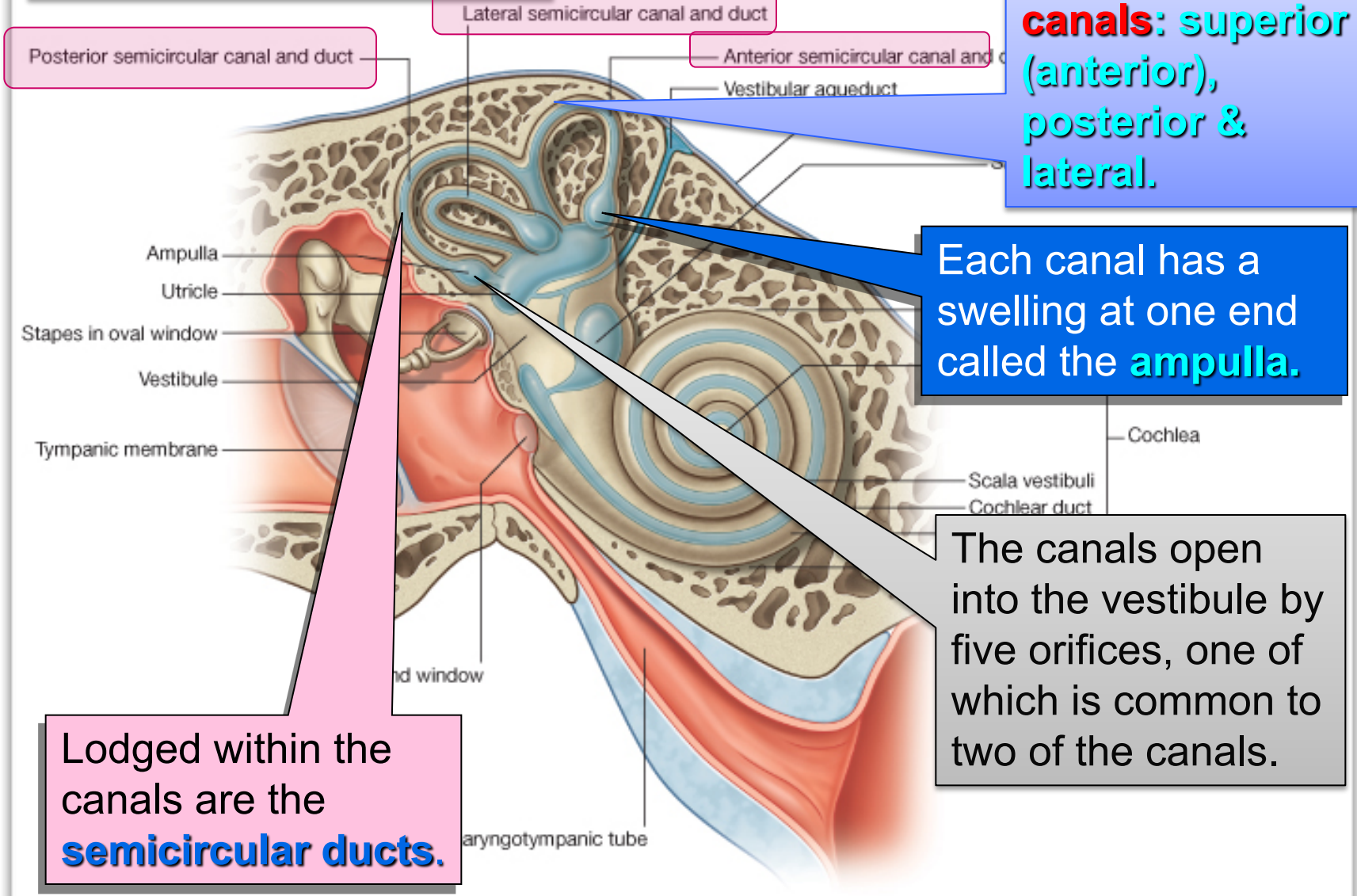
Vestibule,

- **Is** the central part of the bony labyrinth.
- Contains the **utricle** & **saccule**



In the lateral wall of the vestibule are the **fenestra vestibuli**, **which is closed by the base of the stapes**, and the **fenestra cochleae**, which is closed by the **secondary tympanic membrane.**

Semicircular Canals

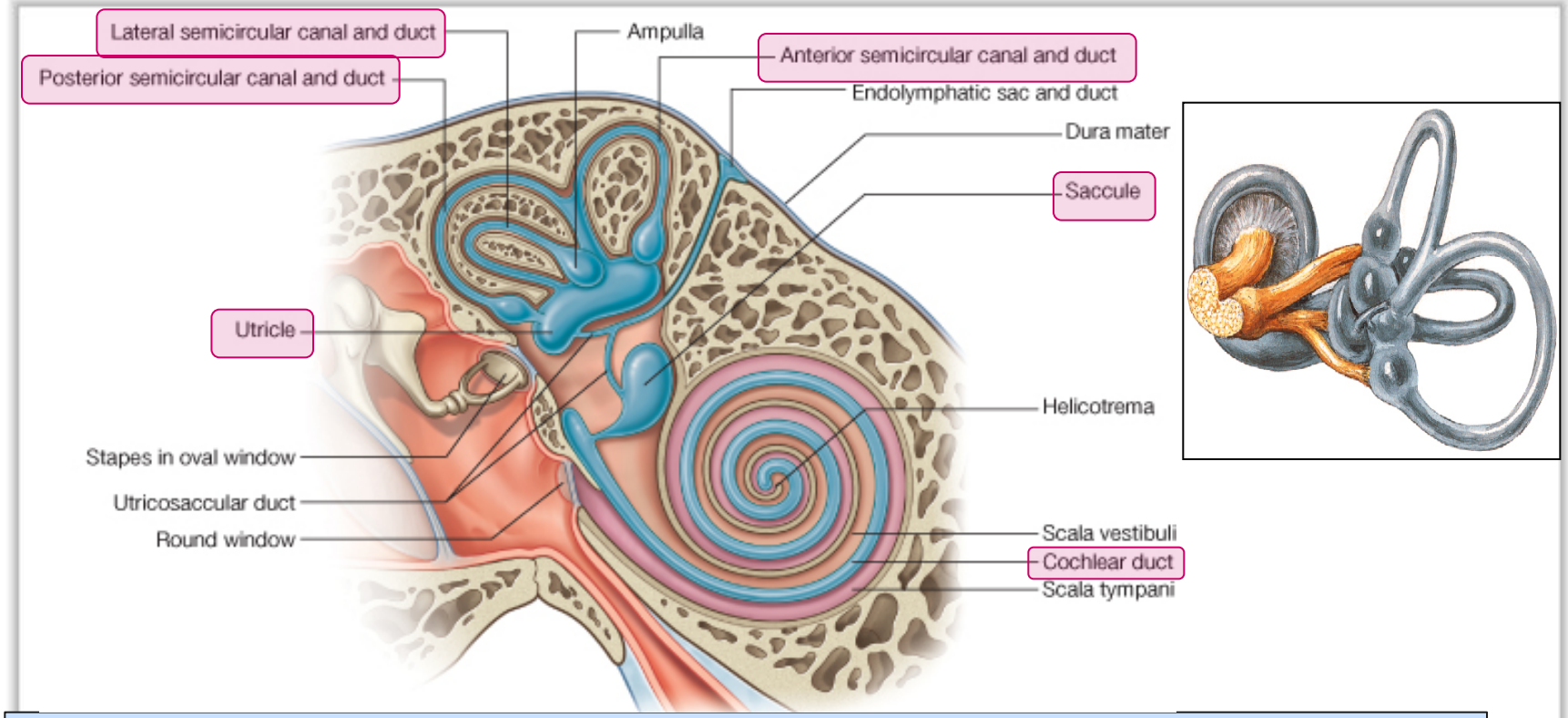


Semicircular canals: superior (anterior), posterior & lateral.

Each canal has a swelling at one end called the **ampulla.**

The canals open into the vestibule by five orifices, one of which is common to two of the canals.

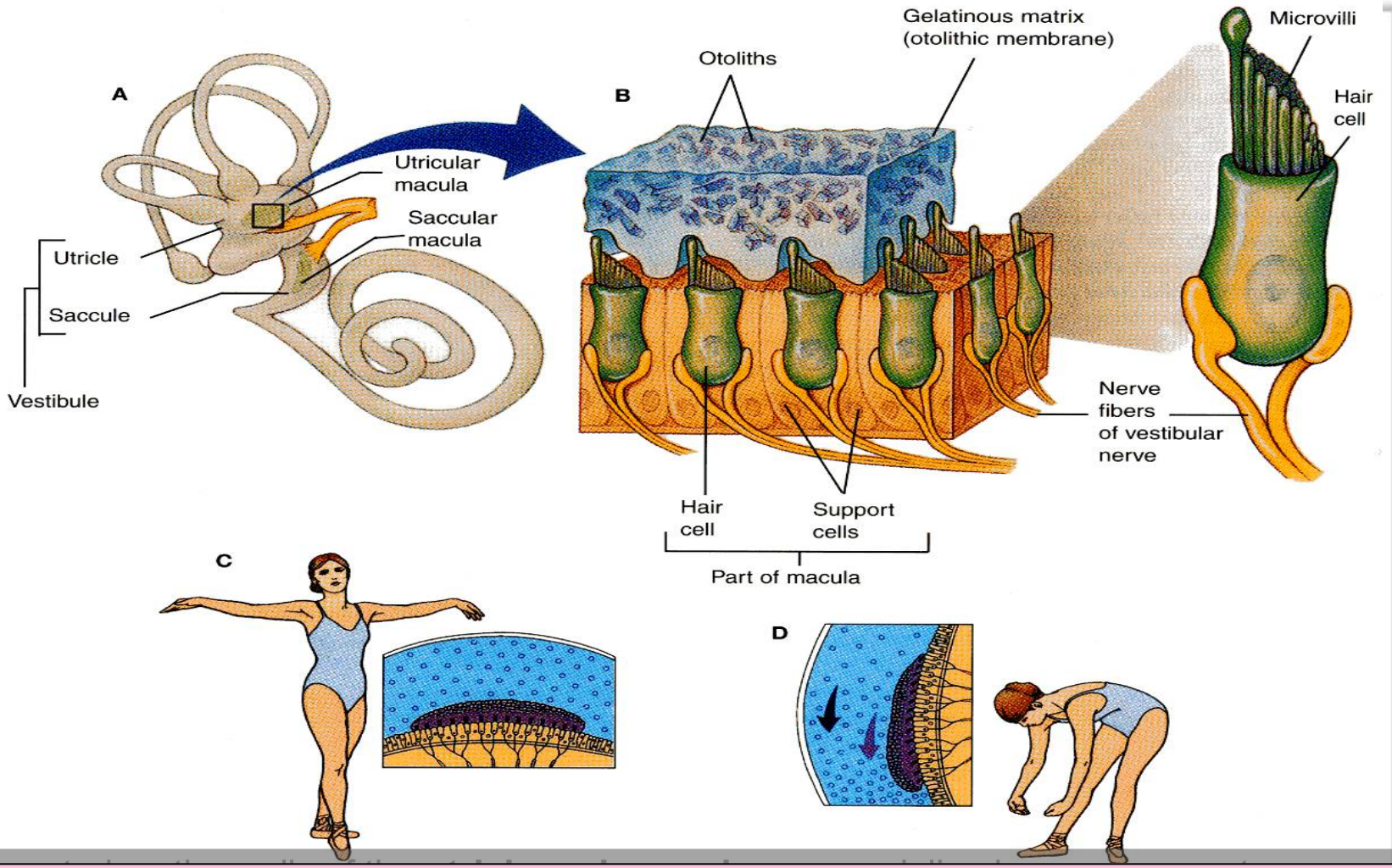
Lodged within the canals are the **semicircular ducts.**



The Membranous Labyrinth :consists of series of membranous sacs and ducts within the bony labyrinth, It is filled with ***Endolymph***.

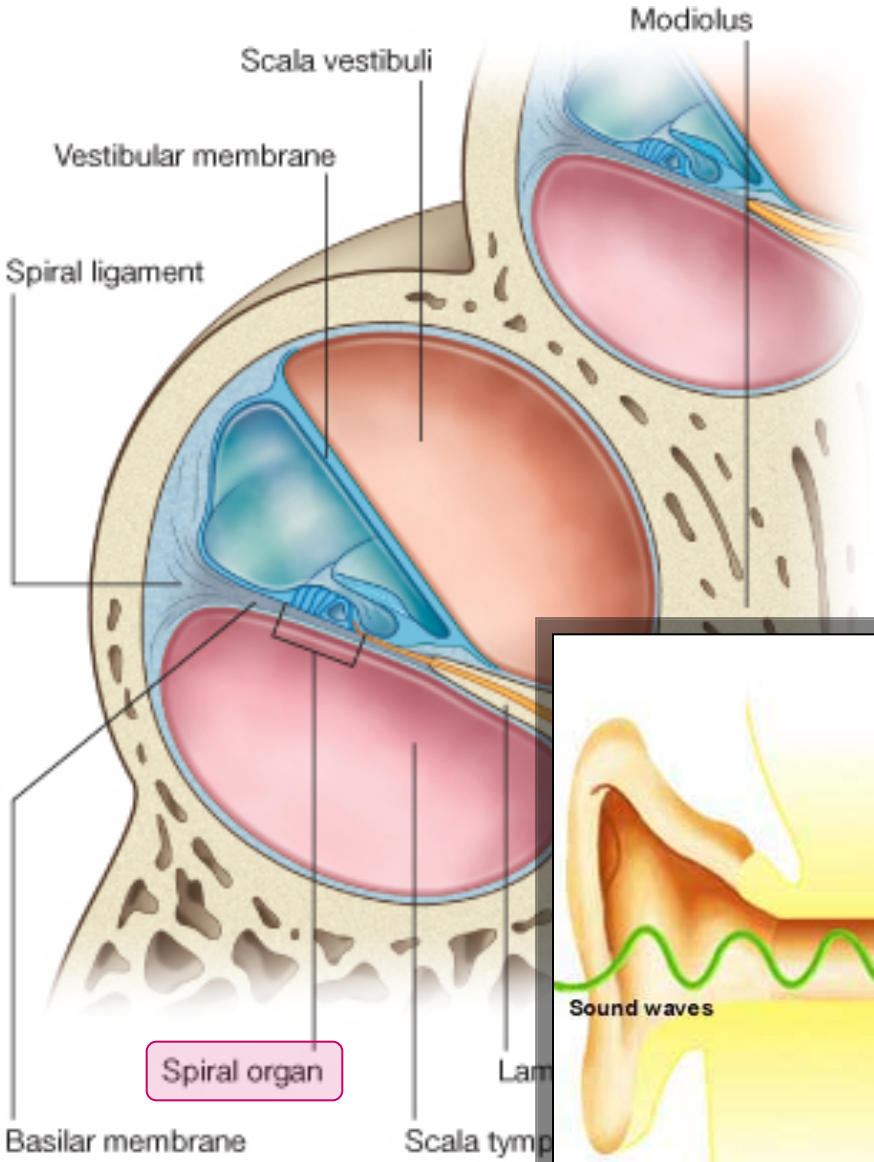
(**Four ducts & Two sacs**) Which are freely communicate with one another :

- **Sacs**: **Utricle & Saccule (**within the bony vestibule).
- **Ducts**: **Three semicircular Ducts ,**(within the bony semicircular canals),
- **Cochlear Duct: (**within the bony cochlea).

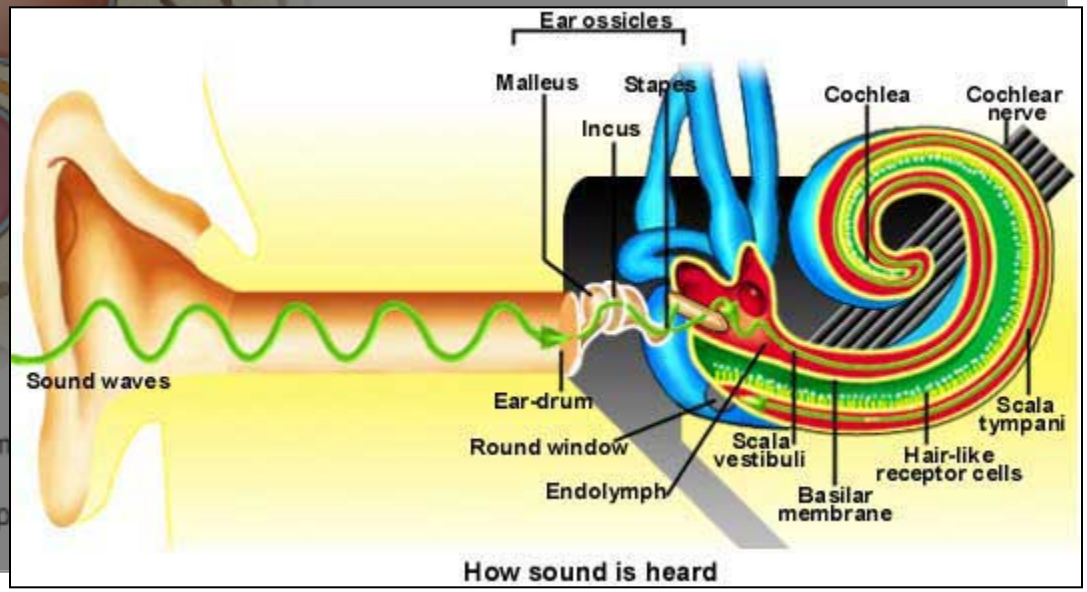


Located on the walls of the **utricle and saccule** are specialized sensory receptors, which are sensitive to the orientation of the head to gravity or other acceleration forces.

The utricle, saccule and semicircular ducts are concerned with maintenance of Equilibrium



- The highly specialized epithelium on the floor of cochlear duct forms **the Spiral organ of Corti** that
- **contains the sensory receptors for Hearing.**



THANK YOU