

وسهلا

أهلا



الأستاذ الدكتور يوسف حسين

أستاذ التشريح وعلم الأجنة - كلية الطب - جامعة الزقازيق - مصر

رئيس قسم التشريح و الأنسجة و الأجنة - كلية الطب - جامعة مؤتة - الأردن

دكتورة من جامعة كولونيا المانيا

Prof. Dr. Youssef Hussein Anatomy اليوتيوب

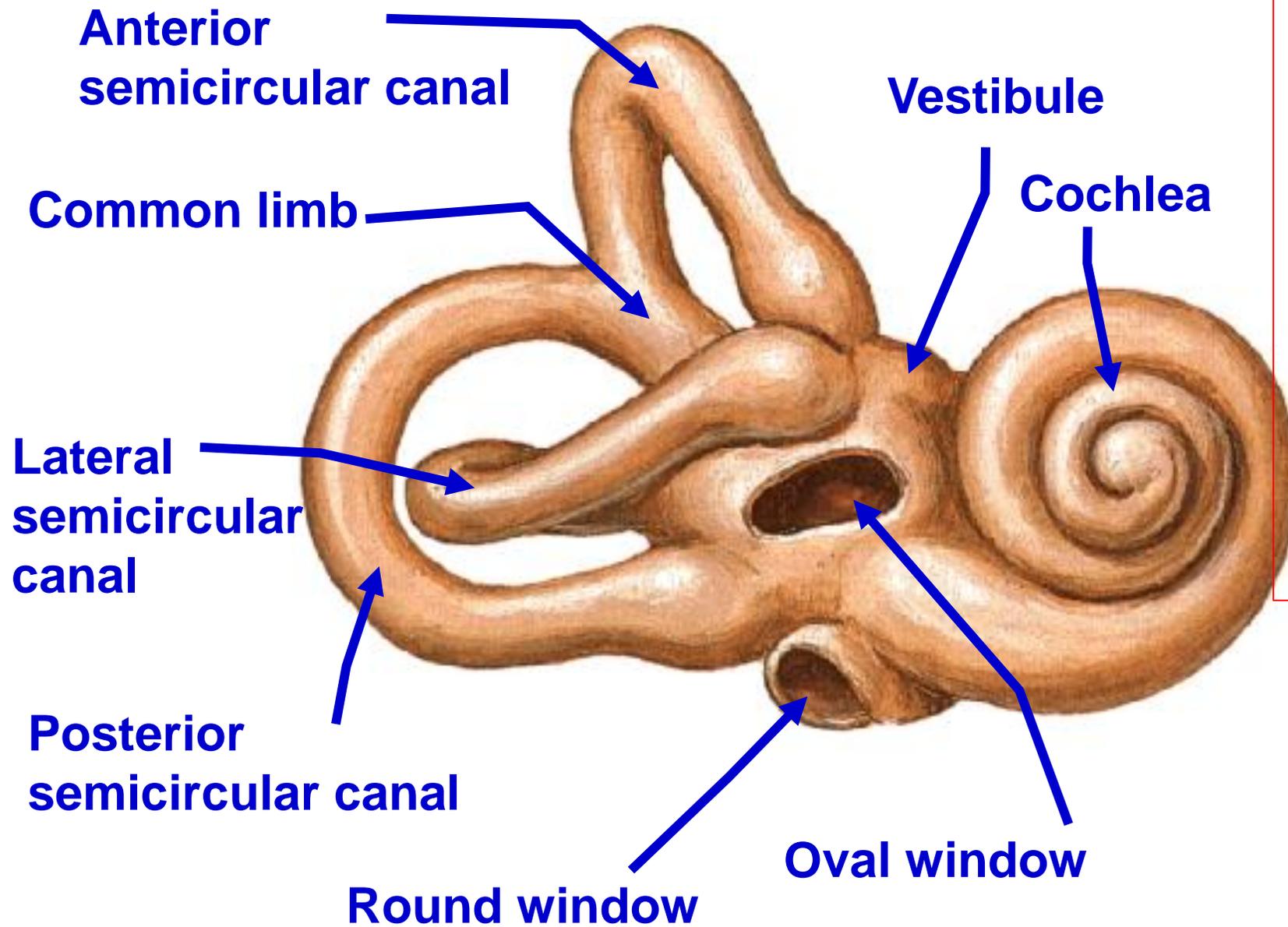
جروب الفيس د. يوسف حسين (استاذ التشريح)

Inner Ear

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

dr_youssefhussein@yahoo.com

Bony Labyrinth



- **3 arched Semicircular canals**

- 1) **Anterior** in vertical plane.

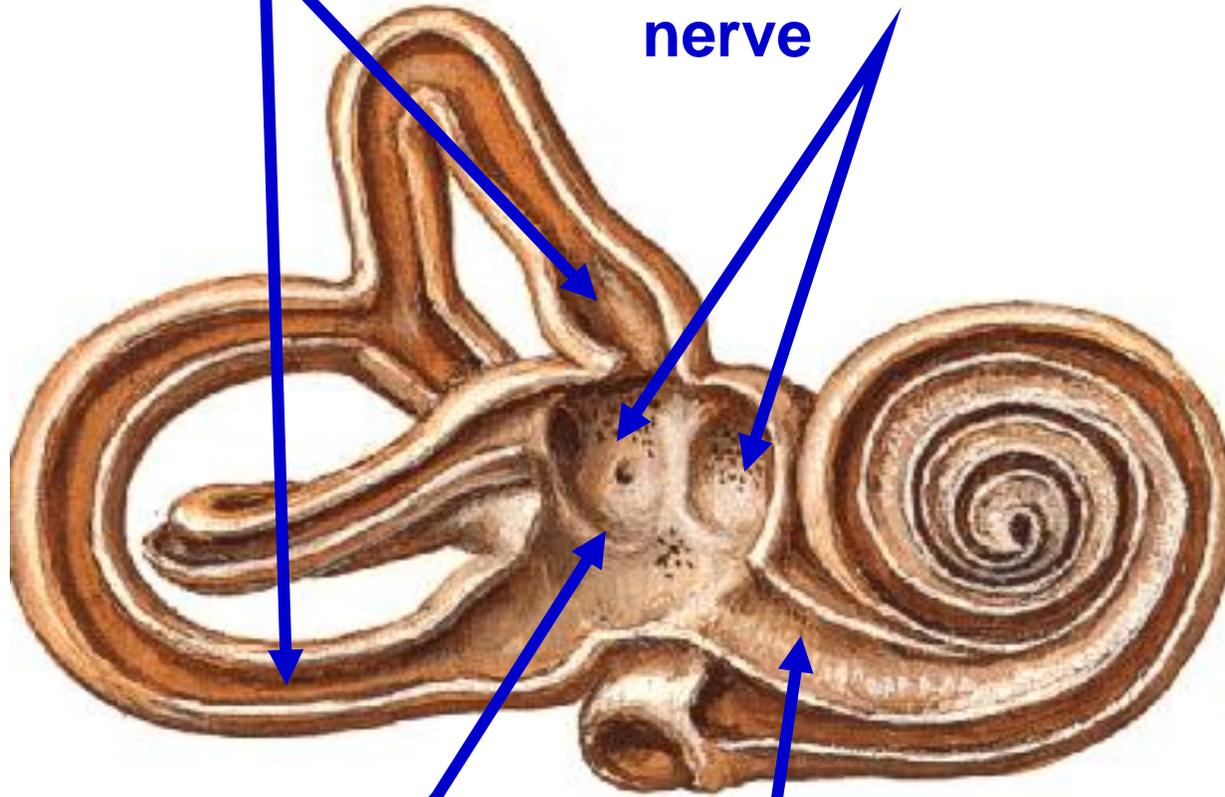
- 2) **Posterior** in vertical plane.

- 3) **Lateral** in horizontal plane.

- These 3 canals open in the posterior aspect of the **vestibule** by **5 orifices** (common limb from anterior and posterior canals).

Semicircular
canals

Perforation of
vestibulocochlear
nerve



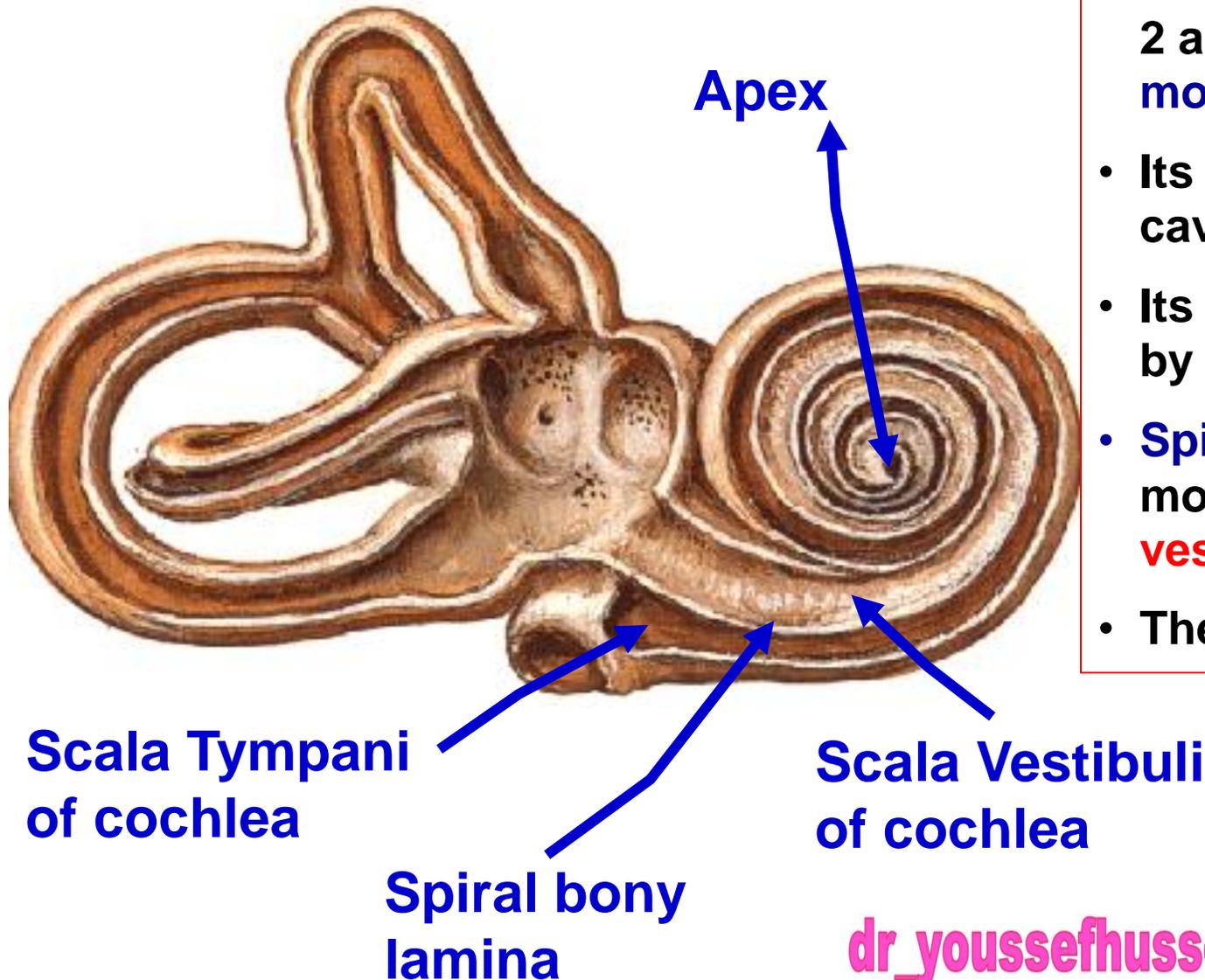
Vestibule

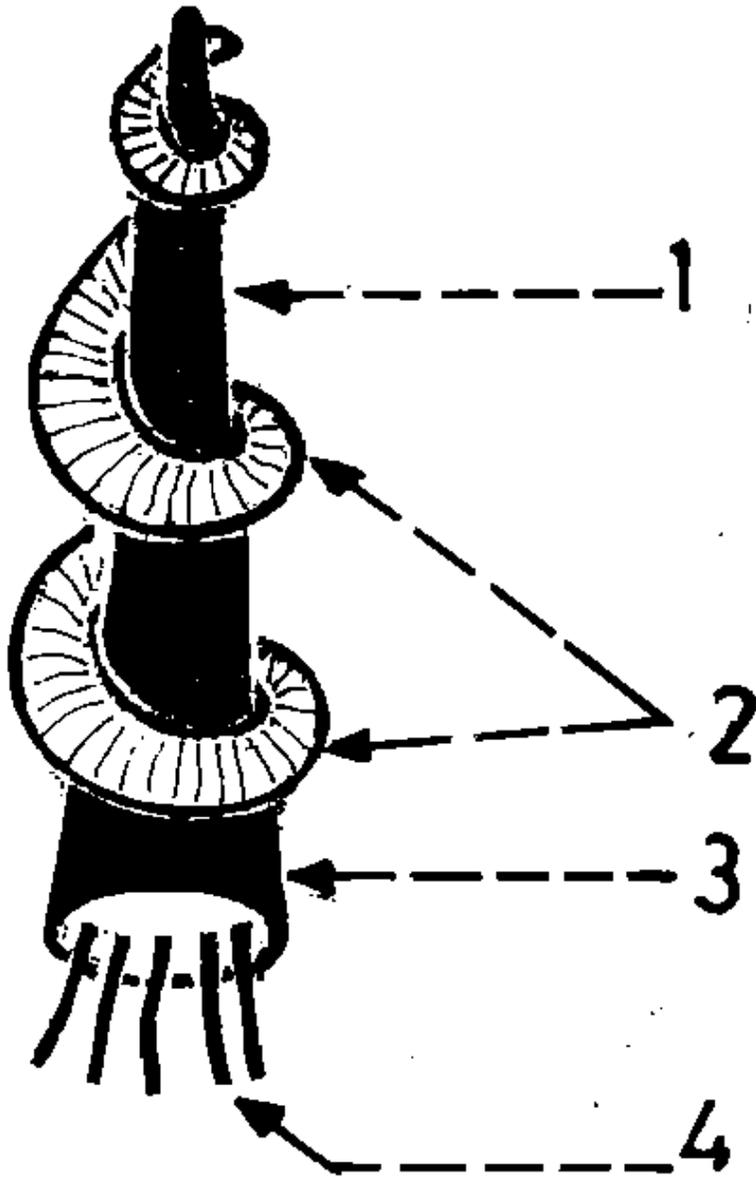
Scala Vestibuli of
cochlea

- **Vestibule:** central part of bony labyrinth.
 - Its **posterior wall** receives the 5 openings of the 3 semicircular canals.
 - Its **anterior wall** shows the opening of the scala vestibuli of the cochlea.
 - Its **lateral wall** is related to the middle ear and shows **fenestra vestibuli** (oval window) which is closed by the foot of stapes.
 - Its **medial wall** forms the bottom of the internal auditory meatus and is perforated by the 8th cranial nerve.

• Cochlea القوقعة

- Anterior part of boney labyrinth
- It resembles **shell of a common snail** forming 2 and 1/2 turns around its axis called **modiolus**.
- Its **apex** is directed laterally towards tympanic cavity.
- Its **base** is directed medially and is perforated by **cochlear nerve**.
- **Spiral bony lamina** projects from the modiolus dividing cochlear canal into **Scala vestibuli** above and **Scala tympani** below.
- The cochlear canal lodges **cochlear duct**.





- **Modiolus**

- It is the central pillar of the **cochlea**
- It is conical in shape and its base directed to the bottom of the internal auditory (acoustic) meatus

1- Modiolus

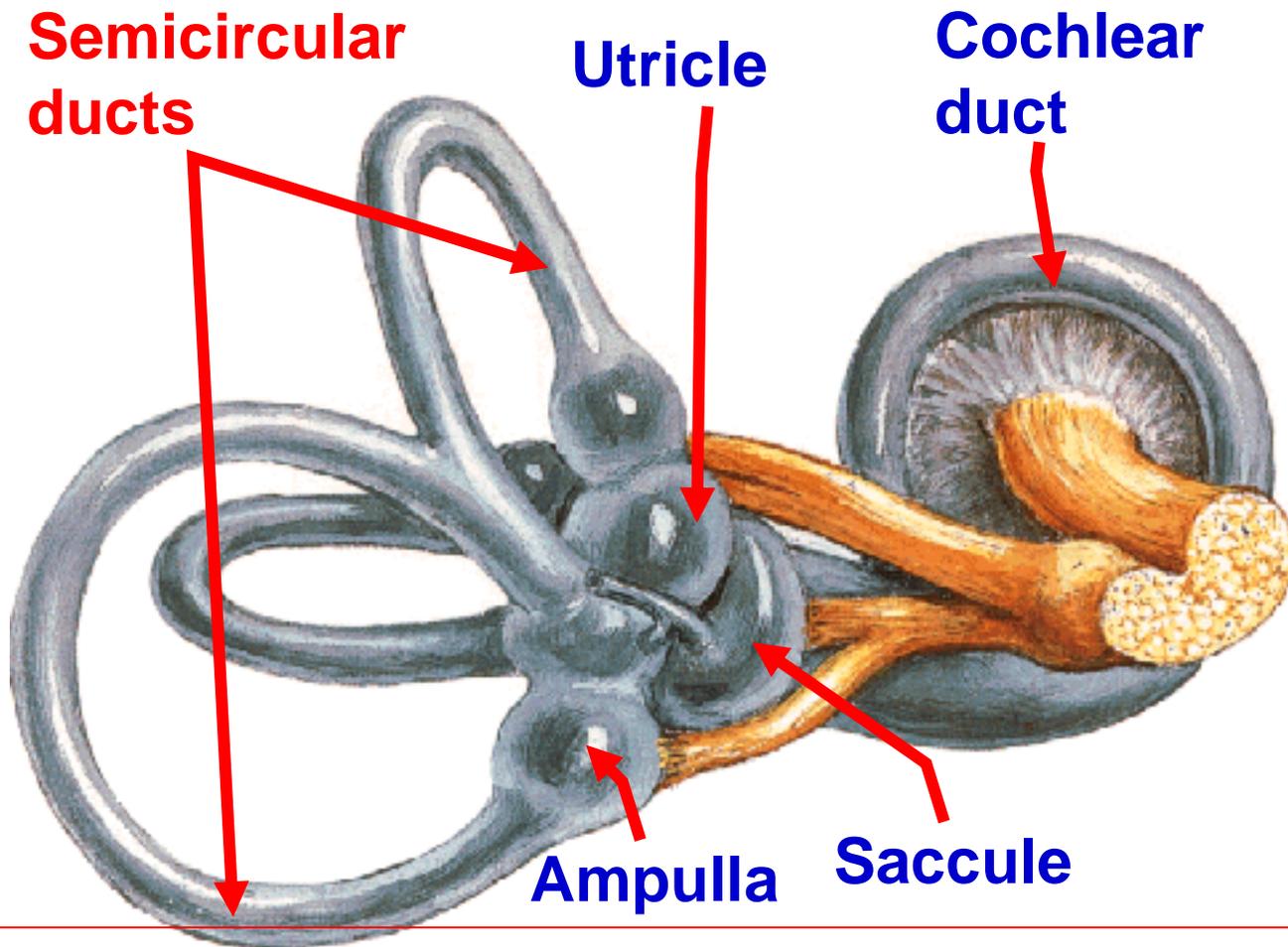
2- Spiral bony lamina project from modiolus dividing cochlear canal into **Scala vestibuli** above and **Scala tympani** below

3- Base of modiolus is perforated by of cochlear nerve

4- Cochlear nerve

dr_youssefhussein@yahoo.com

Membranous Labyrinth

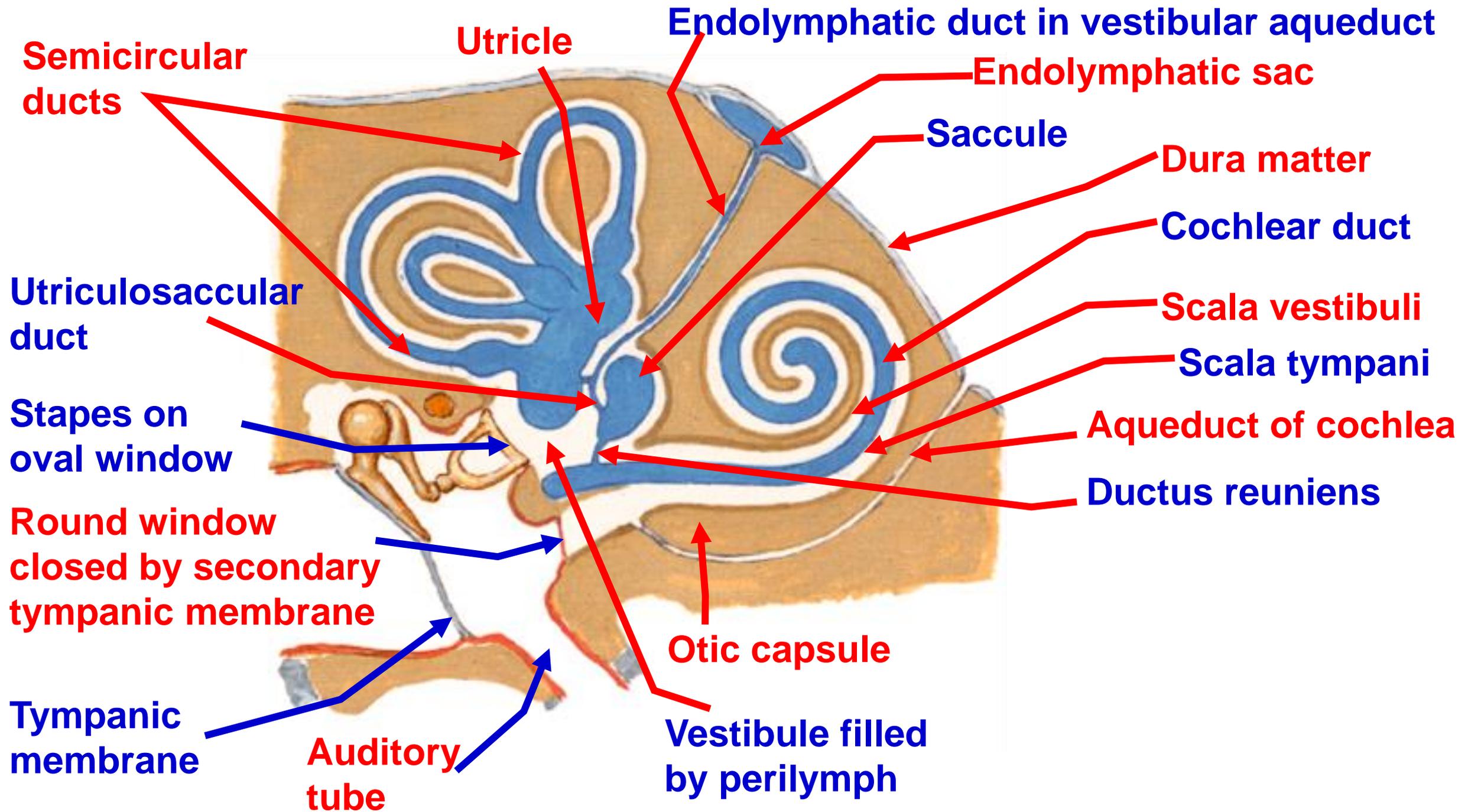


❖ MEMBRANOUS LABYRINTH

- * 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** that **communicate with subarachnoid space** through **aqueduct of cochlea**

❖ 3 semicircular ducts

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



❖ **Utricle and saccule**: small sacs filled by **endolymph** in **vestibule** filled by **perilymph**.

A- Utricle is larger than **saccule**, receives 3 semicircular ducts

- **The utricle** communicates with **saccule** via **Y-shaped utriculosaccular duct**.

- **This utriculosaccular duct** has a side branch to the endolymphatic duct which passes inside bony canal (called **vestibular aqueduct**) in **petrous part of temporal bone** to the **endolymphatic sac** that situated under the dura matter.

- **Endolymph** is resorbed into the **cerebrospinal fluid** from the endolymphatic sac (site for the drainage of endolymph)

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

B- Saccule, close to base of cochlea.

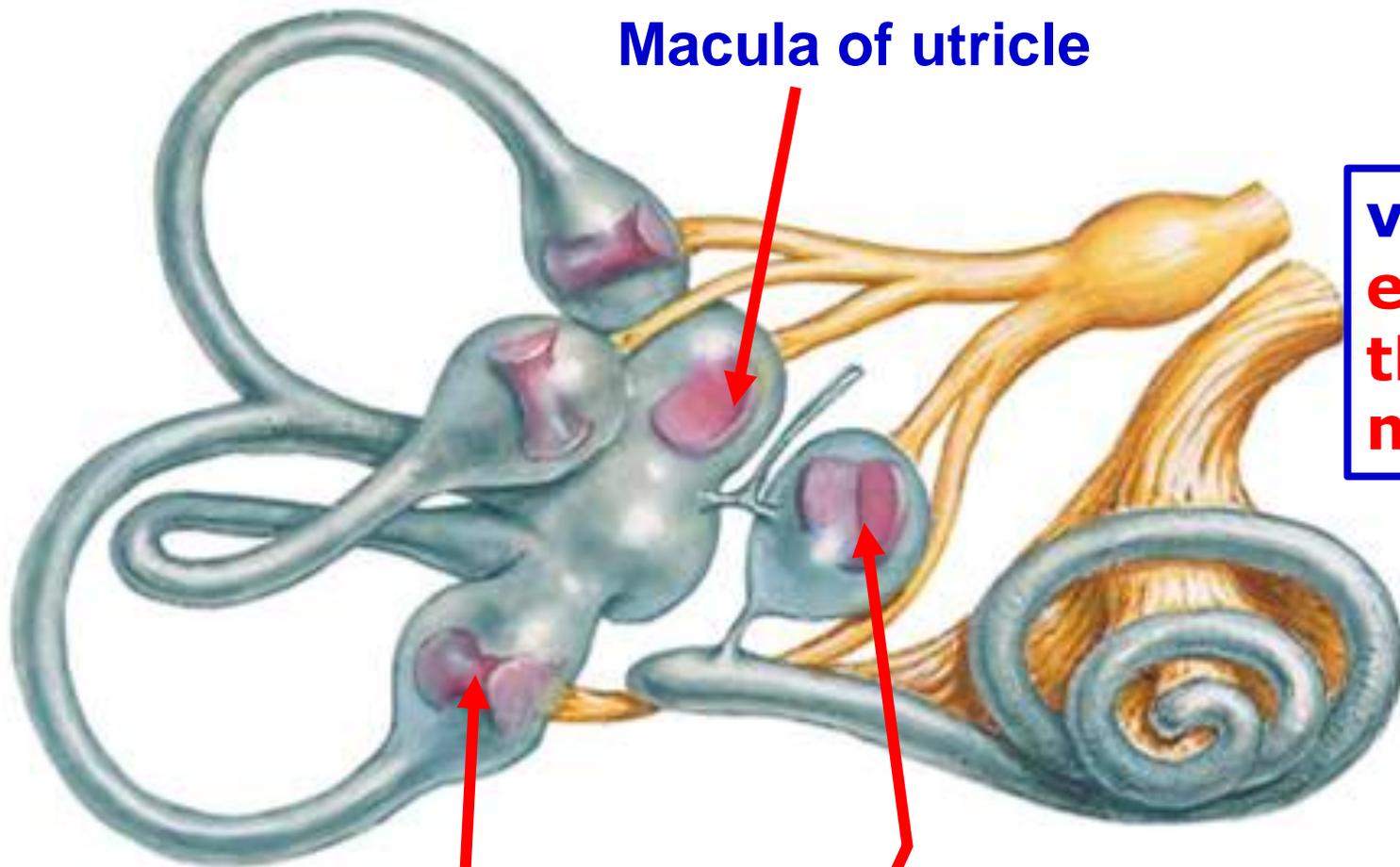
- It is connected to cochlear duct by **ductus reuniens**.

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

- **The macula receives the fibres of the vestibular nerve.**

• Macula of the **utricle** detect **horizontal** linear acceleration

• Macula of **saccule** detect **Vertical** linear acceleration



Macula of utricle

**vestibular sensory
epithelium is located in
the walls of the
membranous labyrinth**

**Crista in ampulla of
semicircular duct**

Macula of saccule

dr_youssefhusseini@yahoo.com

Cochlear duct

**Scala vestibuli
containing perilymph**

Vestibular membrane

**Cochlear duct
containing endolymph**

Organ of Corti

Basilar membrane

Bony cochlea

Hair cells

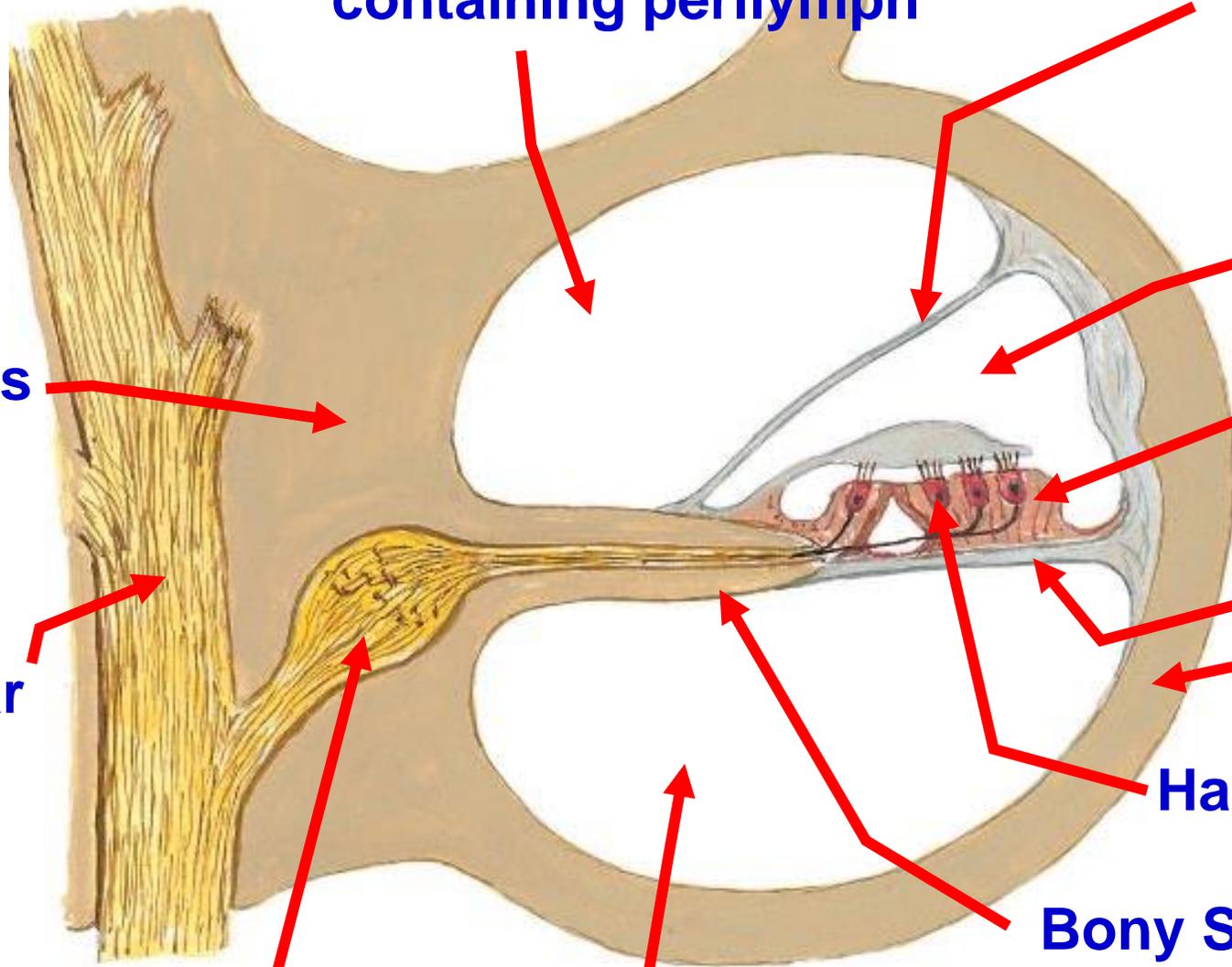
**Bony Spiral
lamina**

**Scala tympani
containing perilymph**

Spiral ganglia

Modiolus

**Cochlear
nerve**

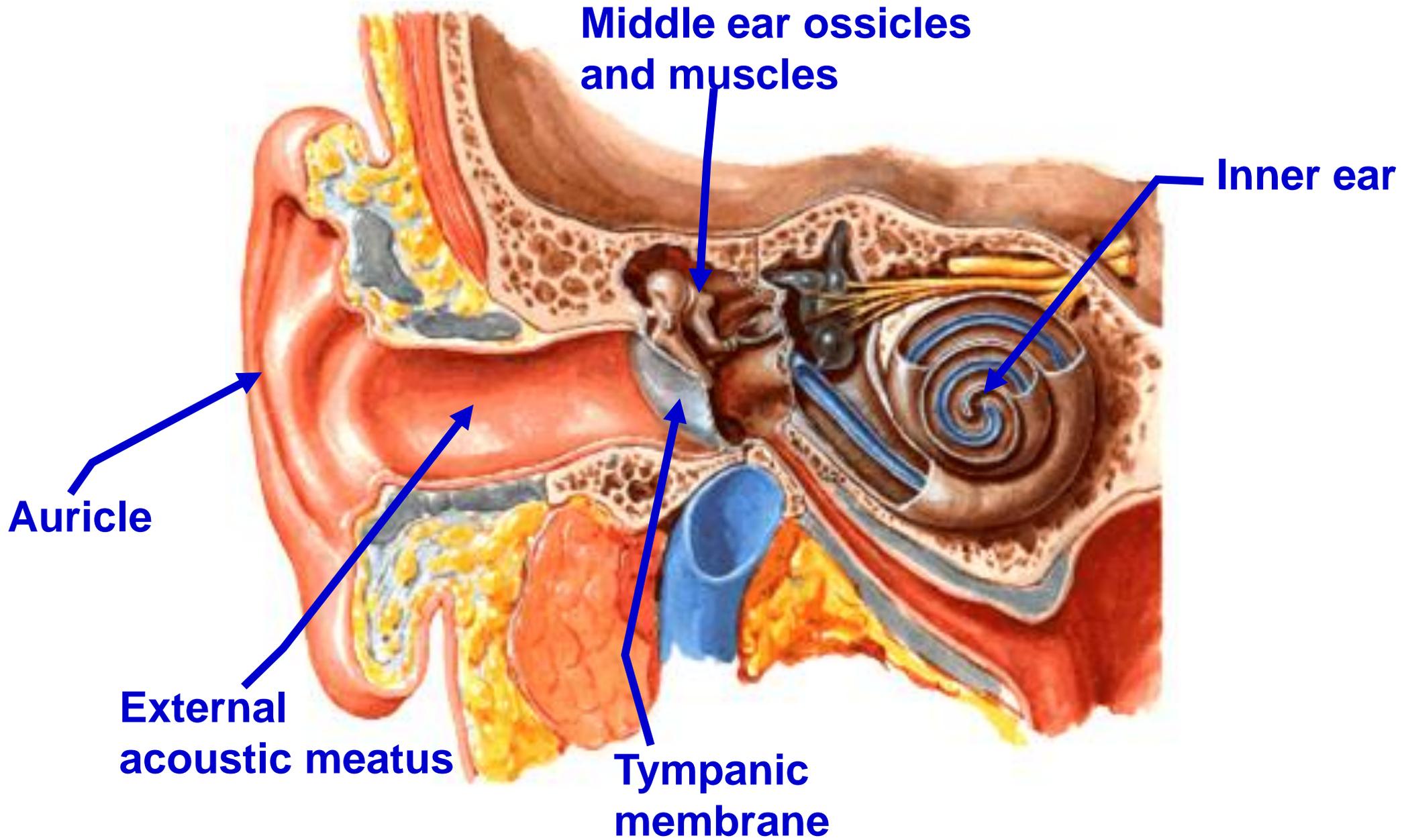


- **Cochlear duct** (inside the cochlear canal)

- It contains endolymph and **organ of corti** (**Ear receptors of sound**).
- It extends between **scala vestibuli** above and **scala tympani** below.
- It is separated from the scala vestibuli (above) by the **vestibular membrane**.
- It is separated from the scala tympani (below) by the **basilar membrane**.
- **Spiral ganglion**, The peripheral processes receive the sensation from the **hair cells receptors** located on the basilar membrane (three outer and one inner, sensory receptors of cochlear nerve in organ of Corti).
- Their central processes (axons) form **cochlear nerve**

- **Meniere's disease (endolymphatic or labyrinthine hydrops)**
- Hydrops of the endolymphatic duct or **edema of the labyrinth** (excessive amounts of endolymph that distort the membranous labyrinth)
- **Resulting from** blow to the head, infection, inflammation of the vestibular division of the vestibulocochlear nerve, allergies, dehydration, loss of electrolytes, inner ear disorders, diabetes or autoimmune disorders,
- **It** is characterized by
- **Tinnitus** (ringing or buzzing in the ears)
- **Loss of balance (vertigo)**
- **Progressive hearing loss**
- **Nausea and vomiting**

Auditory Pathway



Receptors

**Scala vestibuli
containing perilymph**

Vestibular membrane

**Cochlear duct
containing endolymph**

Organ of Corti

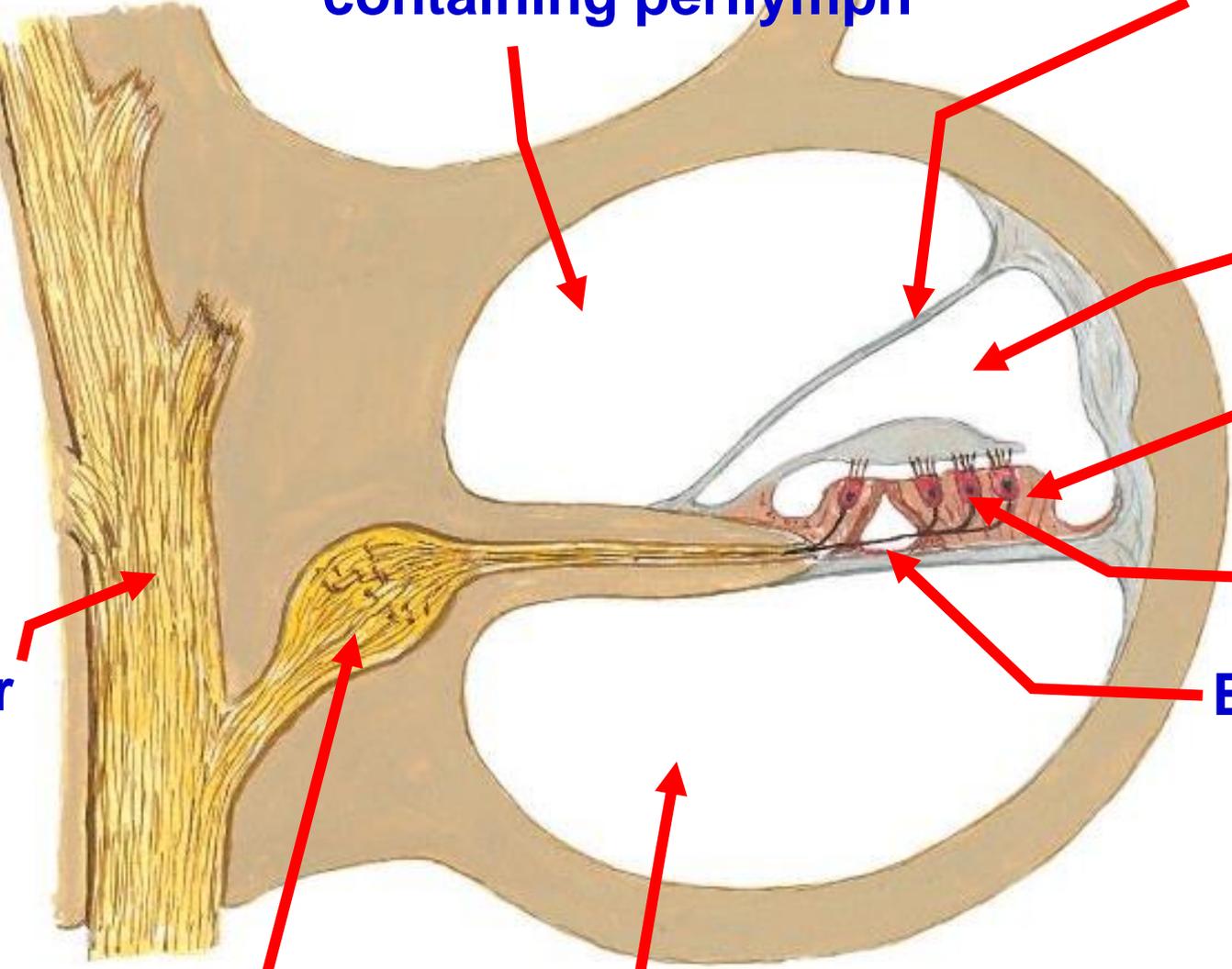
Hair cells

Basilar membrane

**Scala tympani
containing perilymph**

**Cochlear
nerve**

Spiral ganglia



AUDITORY (Hearing) PATHWAY

** Receptors

- Sound waves → External acoustic meatus ---- vibration of the tympanic membrane → sound waves and send vibrations to the auditory ossicles (malleus – incus and stapes) → send sound vibrations to cochlea → vibration of perilymph of the scala vestibule → vibration of vestibular membrane → vibration of perilymph of scala tympani → vibration of basilar membrane → Hair cells located on the basilar membrane (three outer and one inner, sensory receptors of cochlear nerve in organ of Corti), transform the sound vibration in the fluid of cochlea into electrical signals to the spiral ganglia of the cochlea

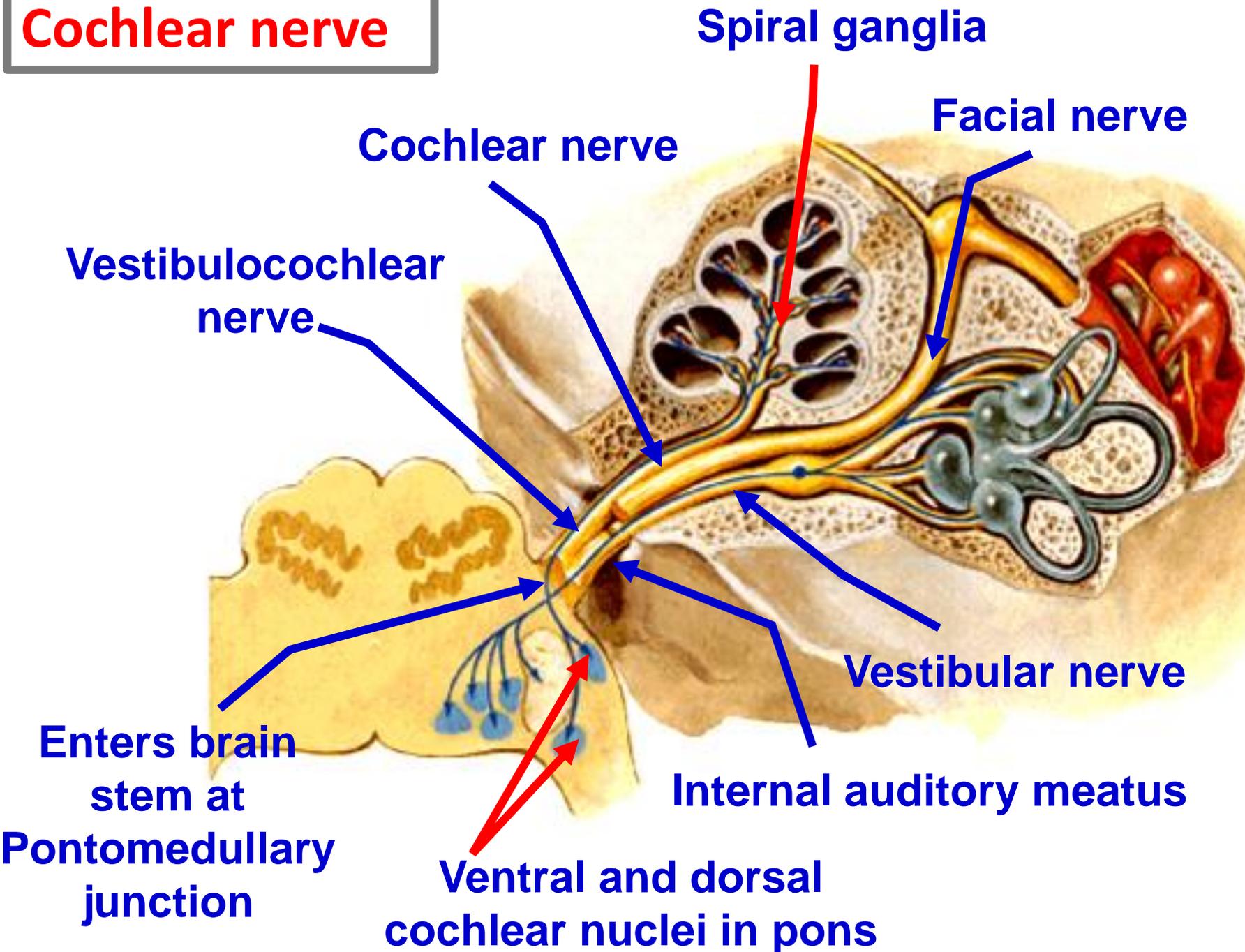
** At the base of cochlea (Thinner basilar membrane) encodes high pitched sounds

** At the apex of cochlea (Thicker basilar membrane) encodes low pitched sounds

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

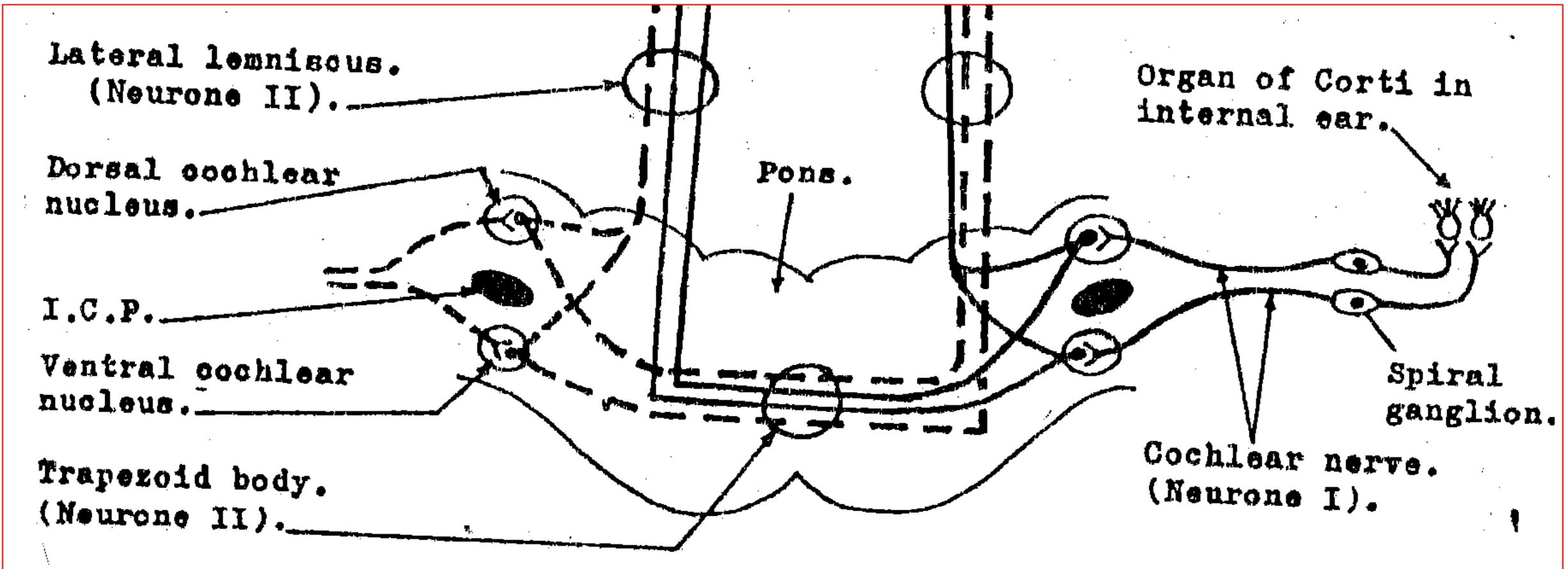
- Peripheral processes receive sensation from the hair cells
- Their axons form **cochlear nerve**

Cochlear nerve



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

- Peripheral processes receive the sensation from the receptors.
- Their axons form **cochlear nerve** which ends in ventral and dorsal cochlear nuclei in pons.



2- Second neuron: ventral and dorsal cochlear nuclei.

- **Most of the axons of these cells cross to the opposite side** → decussate with their fellows of the opposite side to form **trapezoid body** → ascend as a **lateral lemniscus** with **some fibres from the same side** → **medial geniculate body** of the thalamus.

Superior temporal gyrus

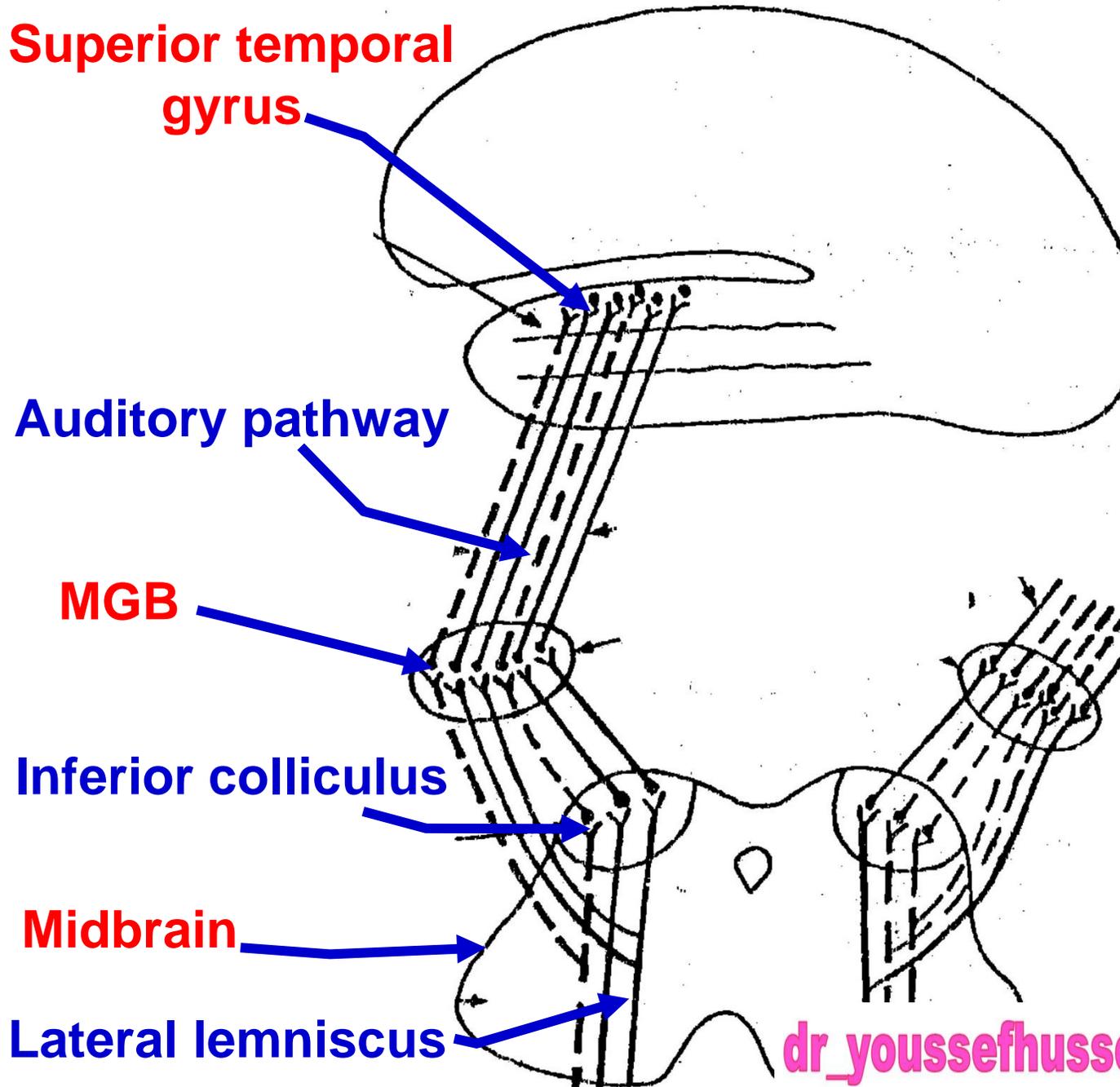
Auditory pathway

MGB

Inferior colliculus

Midbrain

Lateral lemniscus



3- Third order neuron (Medial geniculate body, MGB):

- Their axons form **auditory radiation** passes through **sublentiform of internal capsule** to **auditory area** of cerebral cortex (superior temporal gyrus, area 41 & 42).

* **On the midbrain** some of the fibers terminate in the **inferior colliculus** (center of auditory reflex, sound localization and tonal discrimination)

dr_youssefhussein@yahoo.com

