Anatomy Team
MED 439

Revised & Approved

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MED439
KING SAUD UNIVERSITY

Anatomy of the Ear

CNS Block

Don't forget to check the Editing File

Color index:

Content
Male slides
Female slides
Important
Doctors notes
Extra information, explanation

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Objectives

At the end of the lecture, students should be able to:

- List the parts of the ear: External , Middle (tympanic cavity) & Internal (Labyrinth).
- Describe the parts of the external ear: auricle & external auditory meatus.
- Identify the boundaries of the middle ear: roof, floor & four walls (anterior, posterior, medial & lateral).
- Define the contents of the tympanic cavity:

1. Ear ossicles (malleus, incus & stapes)
2. Muscle (tensor tympani & stapedius)
3. Nerves (branches of facial & glossopharyngeal)

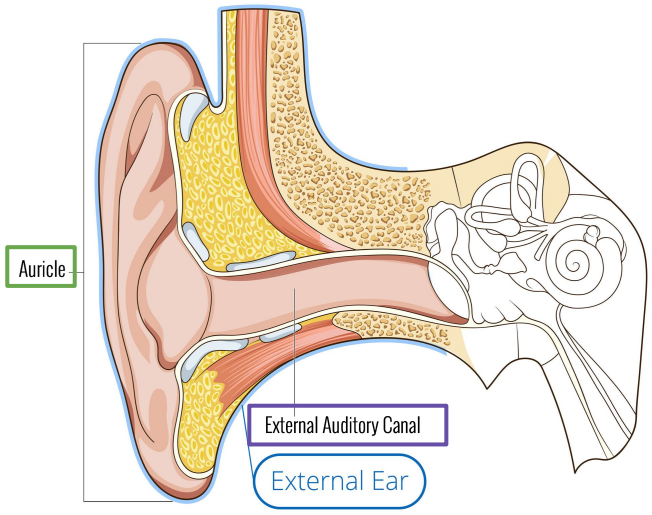
- List the parts of the inner ear, bony part filled with perilymph (cochlea, vestibule & semicircular canals) in which is suspended the membranous part that is filled with endolymph.
- List the organs of hearing & equilibrium.

The External Ear

Formed by

The Auricle (important)

- It has a characteristic shape and it 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 greater auricular & auriculotemporal nerves



The External Auditory Canal (important)

- 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 2/3rds are bony
- Its 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 ear wax)

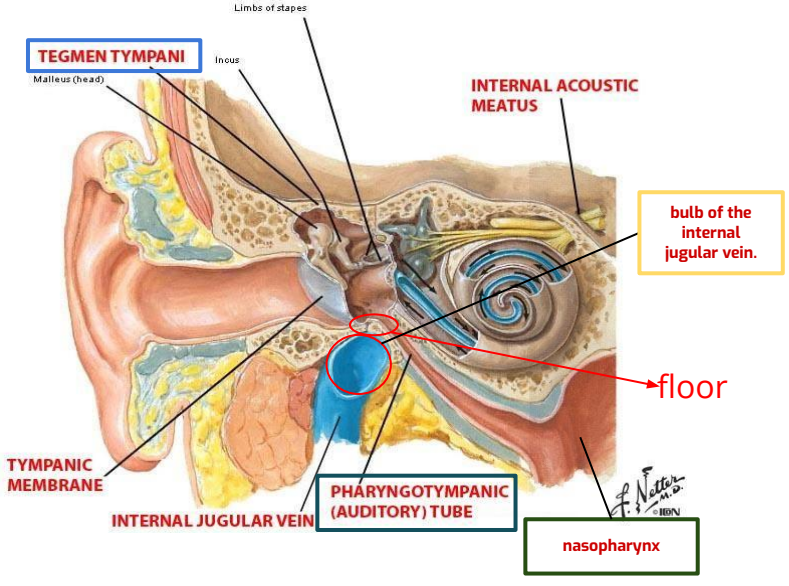
From #med438

* The auricle is also called pinna
* The external auditory canal is also called the external auditory (acoustic) meatus

Note:
The significance of the external auditory tube "unique" shape is to prevent powerful sound waves from reaching the tympanic membrane directly —> reducing the chances of the tympanic membrane to be damaged.

Middle Ear (Tympanic Cavity)

- The middle ear is a narrow, oblique slit-like cavity (air-filled) in the proteus temporal bone & lined with mucous membrane,
- It contains the auditory ossicles, which transmit vibrations of the tympanic membrane (eardrum) to the internal ear..
- The middle ear communicates 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 (The auditory tube) is bony and its anterior 2/3rds are cartilaginous.
- Its function is to equalize the pressure of both sides of the eardrum.



Note: the tympanic membrane connects both the anterior wall and the auditory tube. Why? to establish **equalization** of pressure on both sides of the tympanic membrane.

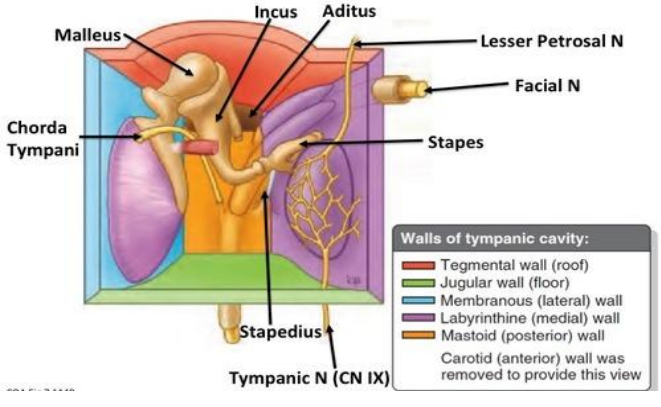
Ossicles= tiny little bones

It Has

- Anterior Wall
- Medial Wall
- Lateral Wall
- Posterior Wall

Roof

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**



Floor

Formed by a thin plate of bone which **separates the middle ear from the** bulb of the internal jugular vein.

Middle Ear (Tympanic Cavity)

Posterior Wall

- The posterior wall has in its upper part a large irregular opening, which is the **aditus to 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 (one of the two muscles in the middle ear) and its tendon
- The tendon emerges from the apex of the pyramid

Anterior Wall

At the upper part:
- There are 2 canals at the upper part of the anterior wall:

1. Upper smaller, which is the canal for the **tensor tympani muscle.** (one of the two muscles in the middle ear)
2. Lower larger, which is for the **auditory tube.**

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

Lateral Wall

- It is largely formed by the tympanic membrane.
- The membrane is obliquely placed, facing downward, forward, & laterally.
- It's extremely sensitive to pain.

Nerve supply of the eardrum:

Outer surface Or laterally:
- Auriculotemporal nerve
- Auricular branch of vagus nerve

Inner surface or Medially:
- Tympanic branch of the glossopharyngeal nerve

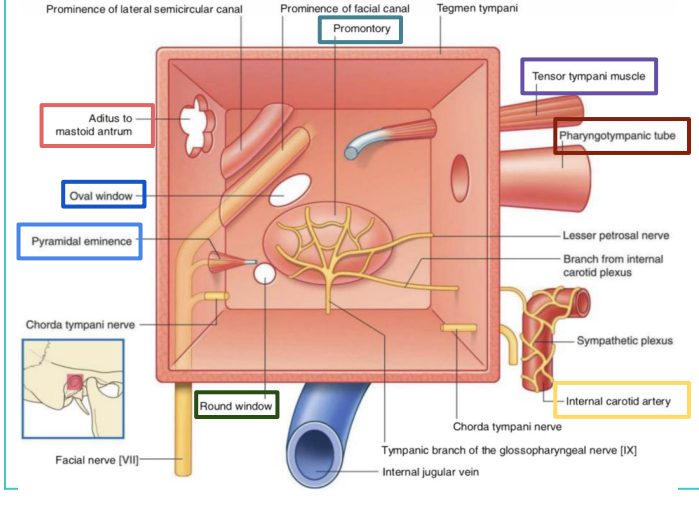
Medial Wall

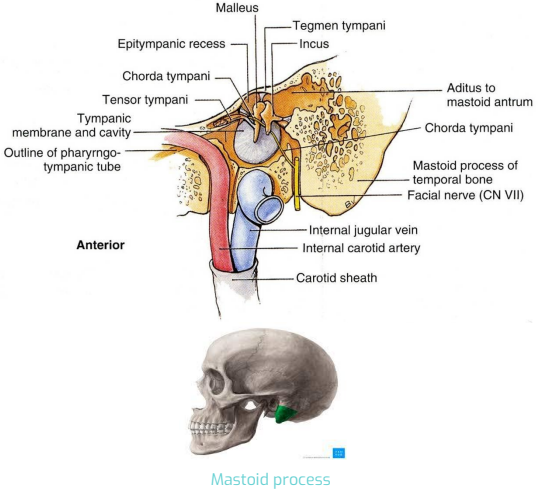
- The medial wall is formed by the lateral wall of the inner ear.
- The greater part of the medial wall shows a rounded projection called the **promontory**, that results from the underlying 1st turn of cochlea.
- Above & behind the promontory lies the **oval window (Fenestra Vestibuli)**, which is closed by the base of the stapes.
- Below & behind the promontory lies the **round window (Fenestra Cochleae)**, which is closed by the secondary tympanic membrane.

Fenestra is latine for Window

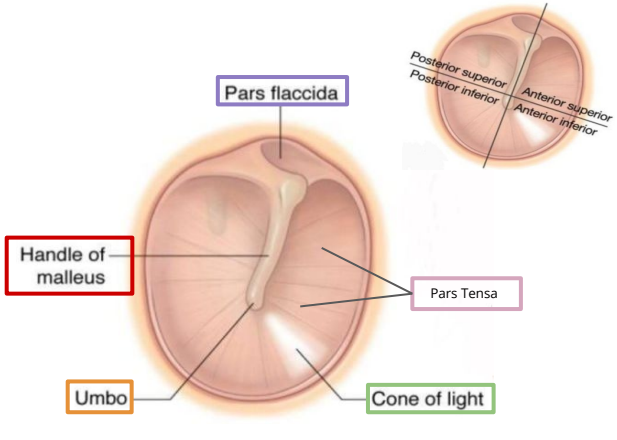
Tympanic Membrane

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





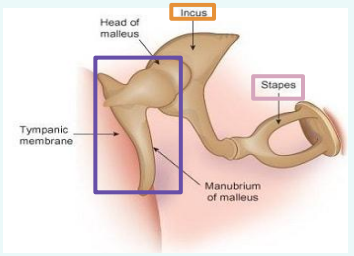
Mastoid process



Middle Ear (Tympanic Cavity)

The Auditory Ossicles

- They transmit sound waves from the tympanic membrane to the perilymph of the internal ear.
- They are covered by mucous membrane & are articulated by synovial joints.



Malleus (Hammer)

Incus (Anvil)

Stapes (Stirrup)

Muscles Of the Ossicles

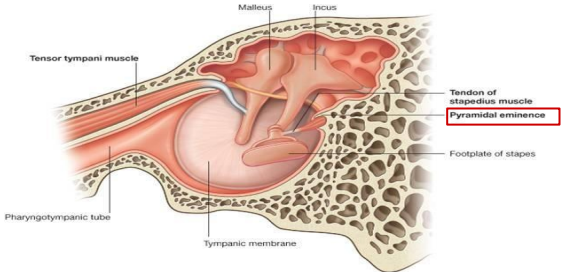
Tensor Tympani

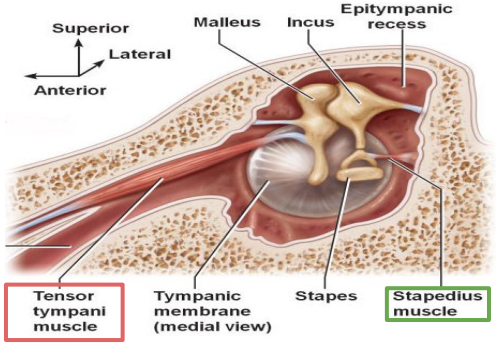
Origin:
- Cartilage of the auditory tube & the bony walls of its own canal.

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 hollow pyramid.

Insertion:
- The tendon emerges from the apex of the pyramid and is inserted into the neck of the stapes. Stapedius= Neck of Stapes

Nerve Supply:
- Facial Nerve.

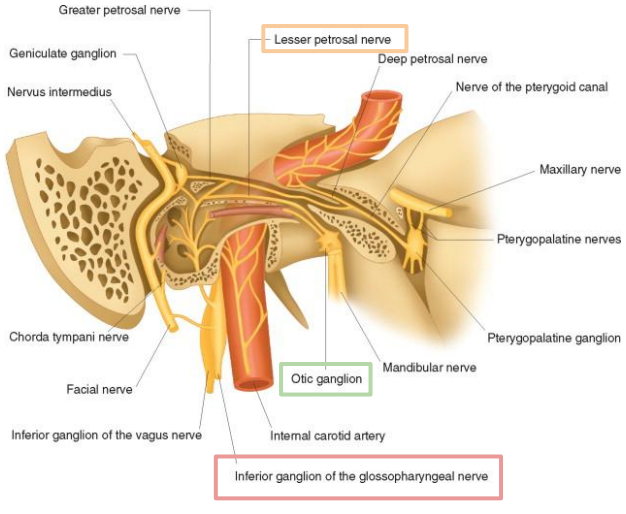
Action:
- Reflexly damps downs the vibrations of the stapes by pulling on the neck of that bone.

Nerves in Middle Ear

Tympanic Nerve

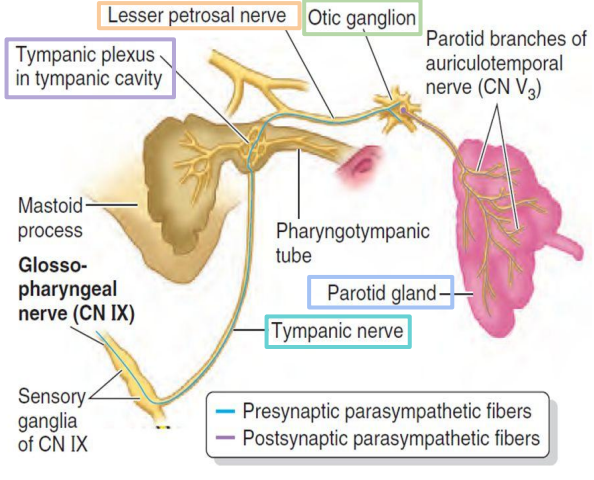
1

The tympanic nerve is a branch of the glossopharyngeal nerve



2

It gives the tympanic plexus on the promontory



3

The tympanic plexus gives the lesser petrosal nerve which relays in the otic ganglion

4

The lesser petrosal nerve gives secretomotor supply to the parotid gland

Nerves in Middle Ear

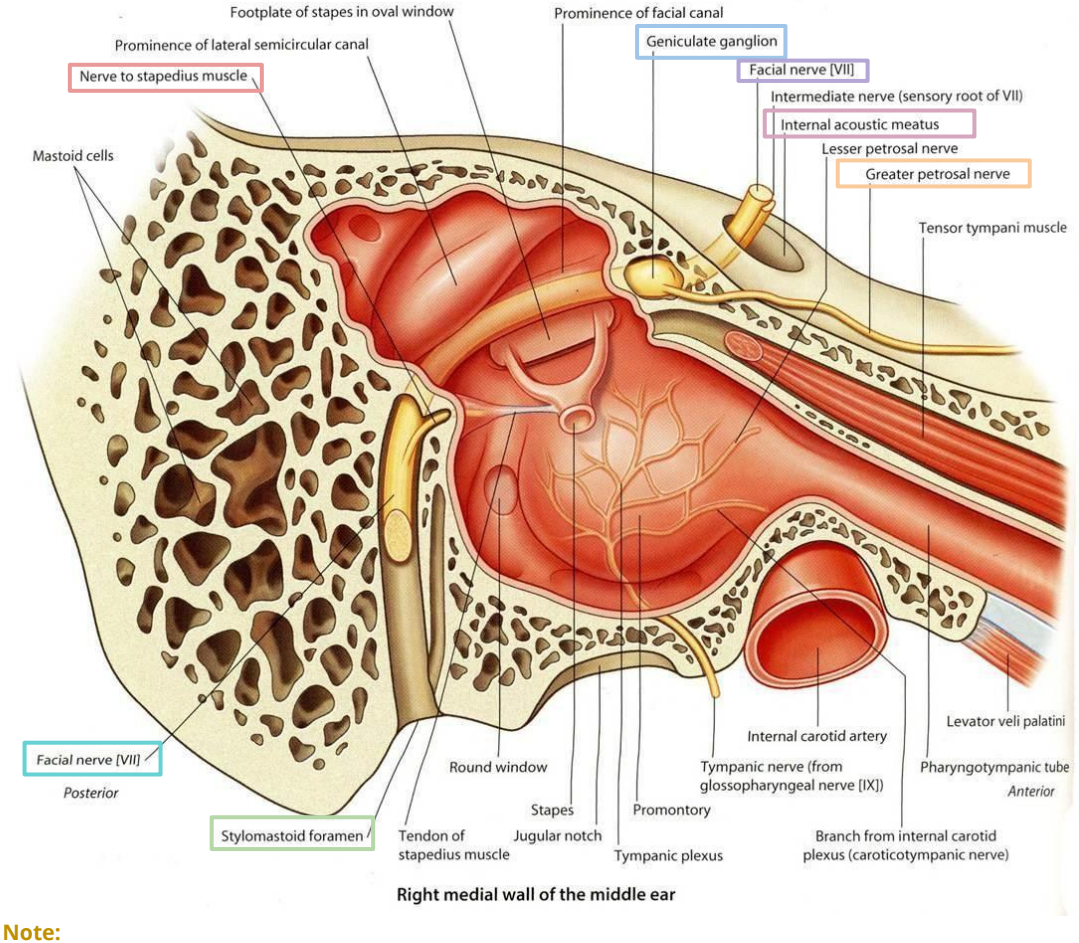
Facial Nerve

1. The facial nerve enters through the internal acoustic meatus with the 8th nerve.

2. It expands to form the geniculate ganglion

3. It passes vertically behind the pyramid leaves the middle ear through the stylomastoid foramen

4. Branches:
   - Greater petrosal nerve: arises from the geniculate ganglion & carries preganglionic parasympathetic to supply Lacrimal, nasal, & palatine glands.
   - Nerve to stapedius
   - Chorda tympani: arises just before the facial nerve exits



Right medial wall of the middle ear

Note:

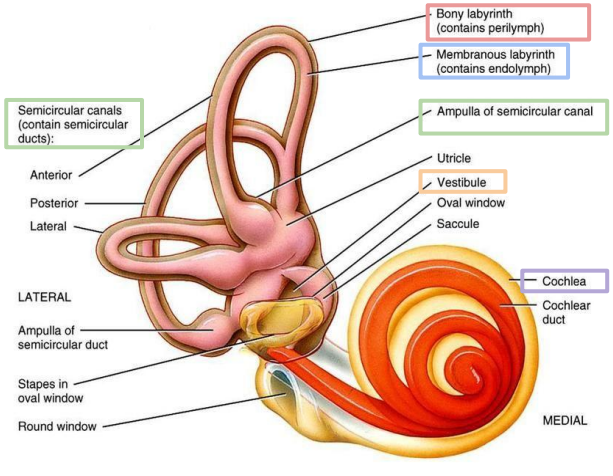
Damage to chorda tympani will lead to loss of taste sensation

Internal Ear (Labyrinth): overview

The labyrinth is situated in the petrous part of the temporal bone, medial to the middle ear.
Consists of

Bony Labyrinth
Consists of :

- Vestibule
- Semicircular Canals
- Cochlea



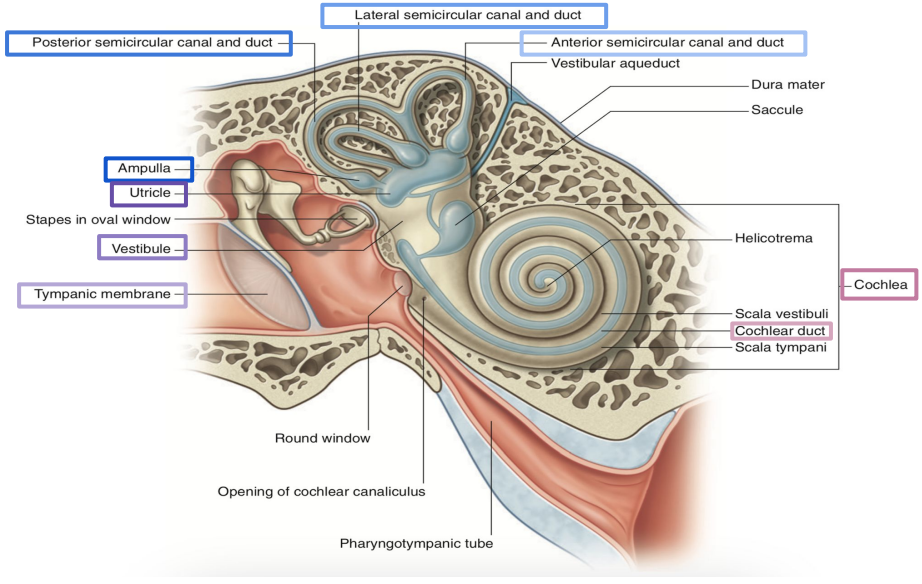
Membranous Labyrinth
Consists of :

- four ducts
- two sacs

Internal Ear (Labyrinth)

Bony Labyrinth

A series of bony chambers lined by endosteum. They contain a clear fluid, the perilymph, in which is suspended the membranous labyrinth

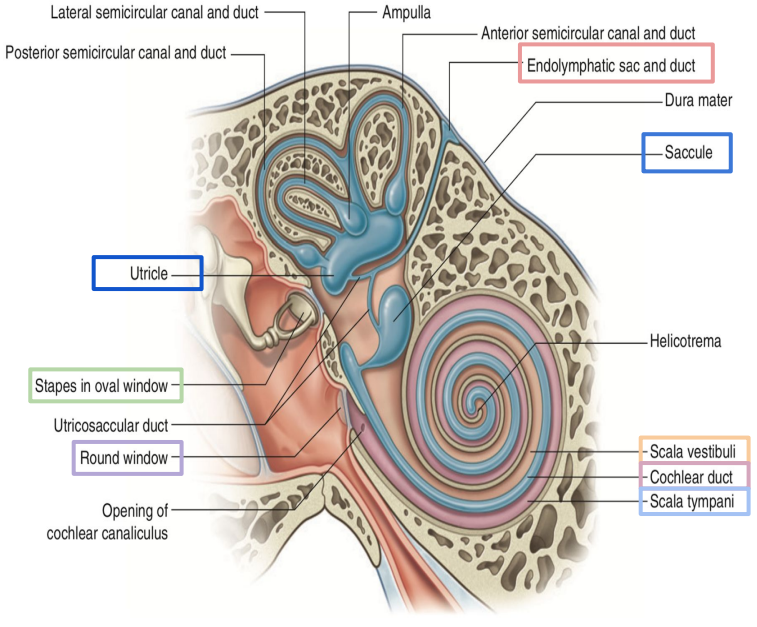


The Bony Labyrinth consists of		
Vestibule	Semicircular Canals	Cochlea
• The **vestibule** is the central part of the bony labyrinth. • It contains the **utricle** & saccule(parts of the membranous labyrinth) • In the lateral wall of of the the vestibule are the fenestra vestibuli, which is closed by the base of the stapes, and the fenestra cochleae, which is closed by the secondary tympanic membrane.	• There are 3 semicircular canals: Superior (anterior) canal, **Posterior canal** & **Lateral canal**. ما يهمنيش البوسيشن • 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 canals. • Lodged within the canals are the semicircular ducts.	• The first turn of the **cochlea** produces the promontory on the medial wall of the the tympanic cavity. • It contains the the **cochlear duct** (part of the membranous labyrinth).

Internal Ear (Labyrinth)

Membranous Labyrinth

- Consists of a series of membranous sacs & ducts within the bony labyrinth, the Membranous Labyrinth is filled with **endolymph**
- The perilymph in the **scala vestibuli** is separated from the middle ear by the base of stapes at the fenestra vestibuli (**oval window**)
- The perilymph in the **scala tympani** is separated from the middle ear by the secondary tympanic membrane at the fenestra cochleae (**round window**)

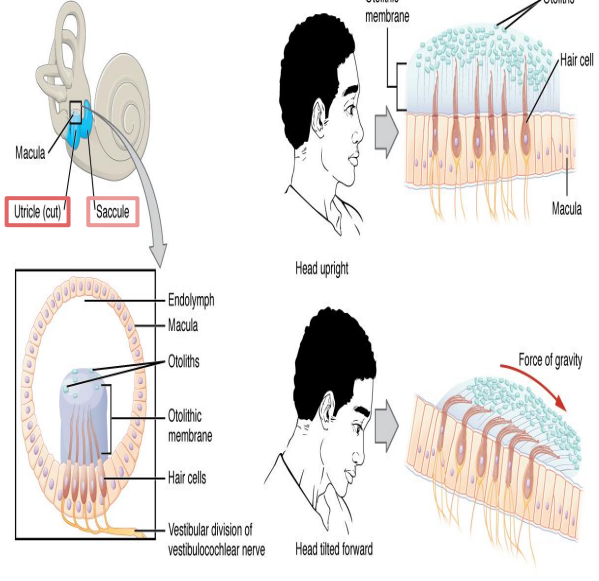


The membranous labyrinth consists of four ducts & two sacs, which freely communicate with one another.	
2 Sacs	4 Ducts
Utricle & **Saccule** (lodged in the bony vestibule)	3 semicircular ducts (lie within the bony semicircular canals)
	1 Cochlear duct (lies within the bony cochlea). The cochlear duct divides the bony cavity into Scala Vestibuli & Scala Tympani

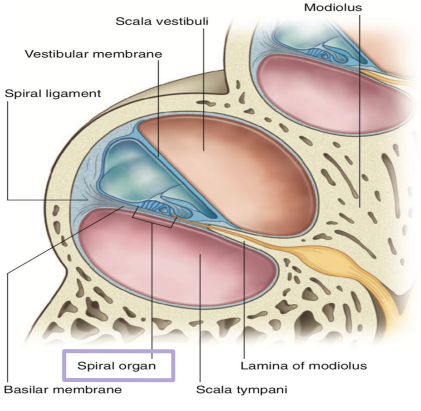
Internal Ear (Labyrinth)

Equilibrium & Hearing :

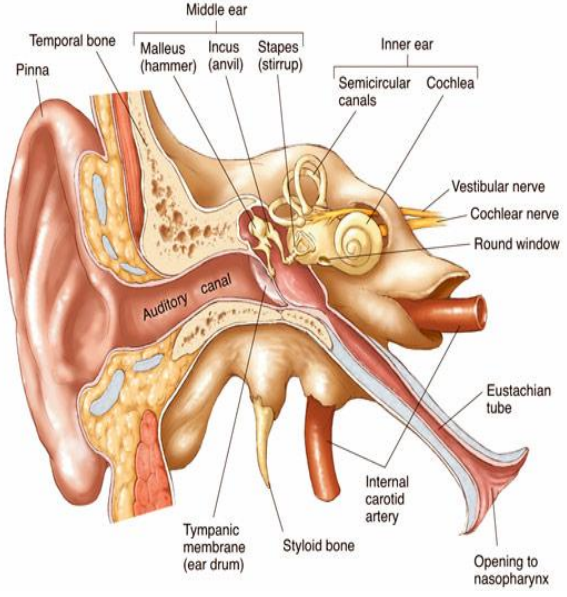
Located on the walls of the **utricle** & **saccule** are specialized sensory receptors, which are sensitive to the orientation of the head to gravity or other acceleration forces.



The **utricle**, **saccule**, & semicircular ducts are concerned with maintenance of equilibrium



The highly specialized epithelium on the floor of the cochlear duct forms the **spiral organ** of corti that contains sensory receptors for hearing.



MCQ

Q1: which of following is branch of the glossopharyngeal nerve			
A: Tympanic nerve	B: Vagus nerve	C: Hypoglossal nerve	D: accessory nerve

Q2: which of the following is forming the geniculate ganglion			
A: vagus nerve	B: facial nerve	C: optic nerve	D: hypoglossal nerve

Q3: which of following is consists of four ducts & two sacs, which freely communicate with one another.			
A: Bony Labyrinth	B: Tympanic cavity	C: Cartilage Labyrinth	D: Membranous Labyrinth

Q4: specialized sensory receptors, which are sensitive to the orientation of the head to gravity or other acceleration forces.			
A: utricle	B: saccule	C: Semicircular	D: A&B

Q5: Greater petrosal nerve branch of facial nerve supplies			
A: Lacrimal gland	B: nasal gland	C: palatine gland	D: A,B and C

Q6: Facial nerve leaves the middle ear through the			
A: jugular foramen	B: foramen magnum	C: stylomastoid foramen	D: foramen ovale

Answer key:
1 (A) , 2 (B) , 3 (D) , 4 (D) , 5 (D) , 6 (C)

MCQ

Q7:The tensor tympani muscle is inserted into?			
A: Neck of stapes	B: Handle of malleus	C: Neck of malleus	D: Handle of stapes

Q8: All of the nerves mentioned supply the Eardrum except?			
A: Auriculotemporal	B: Auricular branch of vagus	C: Tympanic branch of glossopharyngeal	D: Accessory nerve

Q9: The middle ear communicates anteriorly with the nasopharynx through the?			
A: Tympanic Membrane	B: Nasal Canal	C: Auditory tube	D: None of them

Q10: All of which is true about the auditory ossicles except?			
A: They articulate via synovial joints	B: transmit sound waves	C: Covered by mucous membrane	D: Are made of tendons only

Q11: Which wall of the of the tympanic cavity has the “aditus to mastoid antrum”?			
A: Anterior wall	B: Posterior wall	C: Medial wall	D: Lateral wall

Q12: Which of the following have a relation to the medial wall of the tympanic cavity			
A: Fenestra Vestibuli	B: The promontory	C: A&B	D: None of them

Answer key:
7(B) , 8(D) , 9(C) , 10(D) , 11(B) , 12(C)

SAQ

Q1: what are the branches of facial nerve and from where they originated

Q2: Define Bony Labyrinth

Q3: Define the Roof & Floor?

Q4: The External Ear is formed by? And talk briefly about them.

Answers

1 : slide 8

2 : A series of bony chambers lined by endosteum. They contain a clear fluid, the perilymph, in which is suspended the membranous labyrinth

3 : Slide 4

4: Slide 3

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