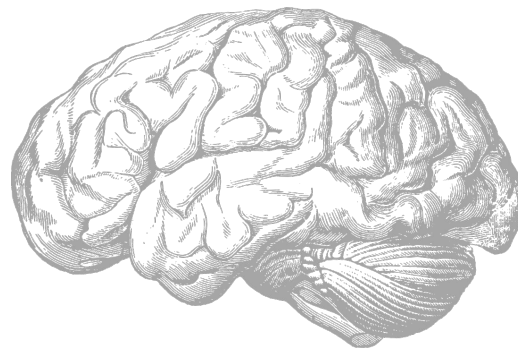




Anatomy of the Ear

CNS Block



Color Index

- ◆ Main Text
- ◆ Female Slides
- ◆ Male Slides
- ◆ Drs' Notes
- ◆ Important
- ◆ Extra info

[The Editing File](#)



Objectives



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).



You can find Atlas by [Clicking HERE!](#)

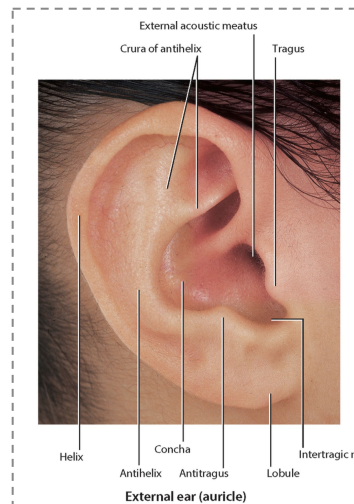
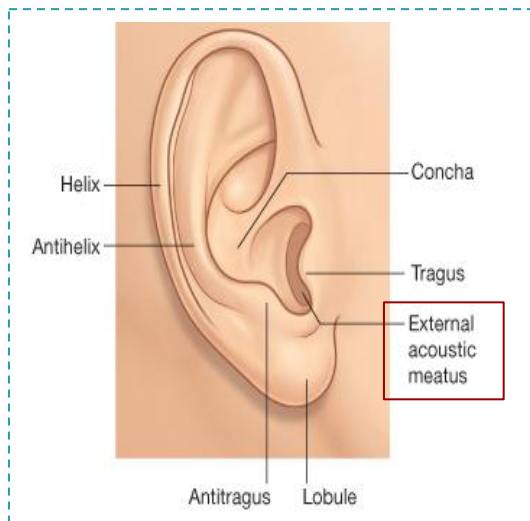
External Ear

External Ear is formed of:

1. **Auricle**
2. **External Auditory Meatus** (External Acoustic Meatus)

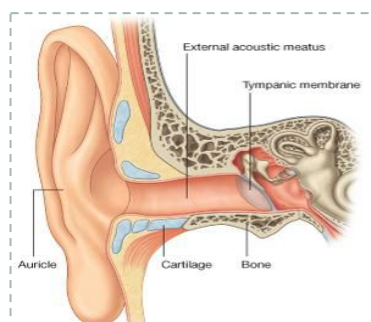
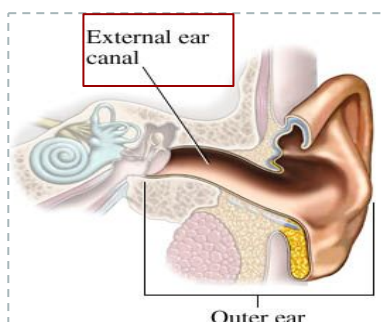
1. Auricle

- It 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**.



2. External Auditory Meatus

- **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)

Definition

Middle ear is a narrow, oblique, slit-like cavity (air-filled) in the petrous temporal bone & lined with mucous membrane.

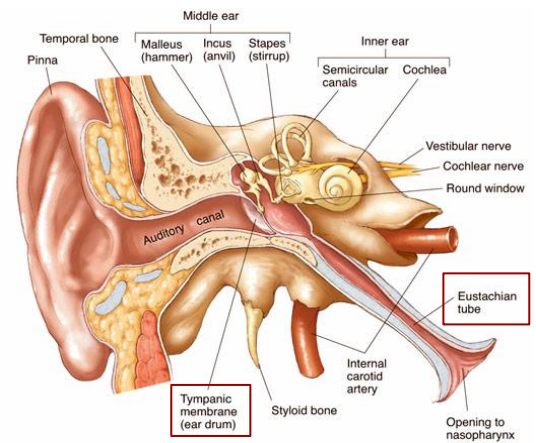
◆ It contains the auditory ossicles (small bones), which transmit the vibrations of the tympanic membrane (eardrum) to the internal ear.

Auditory tube:

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 is **bony** and its anterior 2/3rds are **cartilaginous**.

Function: is to equalize the pressure of both sides of the eardrum.



Auditory tube, Eustachian tube or pharyngotympanic tube

Boundaries of the Middle ear

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**.

Four walls

Anterior

Posterior

Medial

Lateral

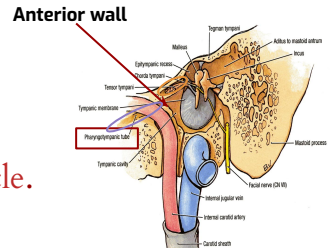
Middle Ear: The four walls

Anterior Wall

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:

1. The **upper smaller** is the canal for the **tensor tympani muscle**.
2. The **lower larger** is for the **auditory tube**.

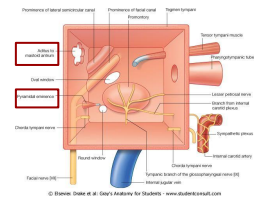


Posterior Wall

Upper Part: a large, irregular opening, the aditus to the mastoid antrum.

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.

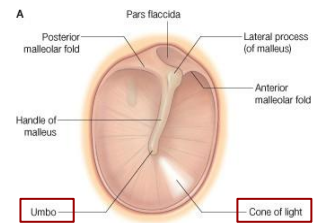


Lateral Wall

Is largely formed by the **tympanic membrane**.

The membrane obliquely placed, facing downward, forward, & laterally.

- It is extremely sensitive to pain.
- **Nerve supply of ear drum:**
 - **Outer surface:**
 - **Auriculotemporal nerve of mandibular (5th)**.
 - **Auricular branch of vagus (10th)**.
 - **Inner surface:**
 - **Tympanic branch (sensory) of the glossopharyngeal nerve (9th)**.

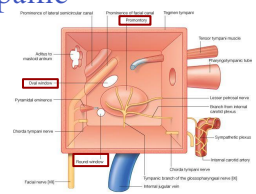


Tympanic Membrane:

- 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 (إضاءة) 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 (Tensed or at high tension)**.
- A small triangular area on its upper part is slack and called the **Pars Flaccida (More elasticity or less tension)**.

Medial Wall

- It separates the middle ear from the lateral wall of the inner ear.
- Greater part of the medial wall shows a rounded projection, (**Promontory**) that results from the underlying 1st turn of the cochlea.
 - Above and behind the promontory lies the **Oval window** which is closed by foot of stapes (**Fenestra Vestibuli**).
 - Below and behind the promontory lies the **Round window (Fenestra Cochleae)** which is closed by the secondary tympanic membrane.
- It is formed by the lateral wall of the inner ear.



Middle Ear: Auditory ossicles

Auditory ossicles

Malleus (hammer)

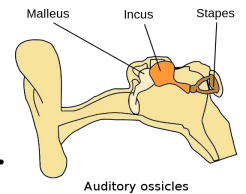
Incus (anvil)

Stapes (stirrup)

Function

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 of the Ossicles

Tensor tympani

Stapedius

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

Insertion: into the **handle of the malleus**.

Nerve supply: Mandibular nerve (branch of trigeminal N.).

Action: Contracts reflexly in response to loud sounds to limit the excursion of the tympanic membrane.

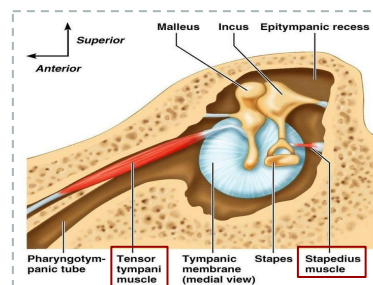
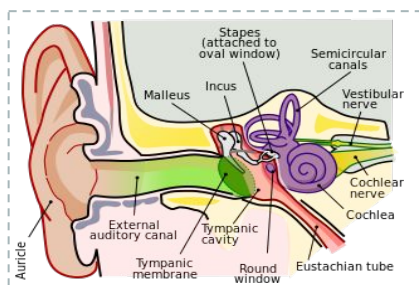
Origin: Internal walls of the hollow pyramid.

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.

★ Both muscles lead to the same action: reduce loud noise, but in different ways.



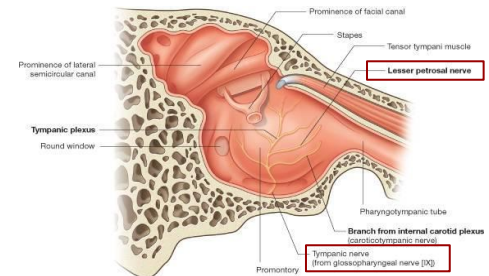
Nerves within the Middle Ear

Tympanic nerve:

1 It is a branch of the **glossopharyngeal nerve**.

2 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**.

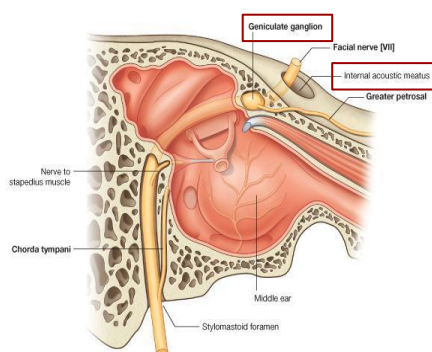


Facial nerve:

Course

Enters Through:

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 (it courses through the facial canal of temporal bone before leaving through the stylomastoid foramen, which is formed by two bones, 1. styloid process, 2. mastoid process, and are both of temporal bone)**.



Branches

1. Greater Petrosal Nerve:

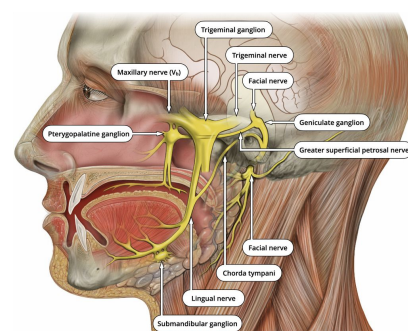
Arises from **Geniculate Ganglion**.

Carries preganglionic parasympathetic to supply: Lacrimal, Nasal & Palatine glands.

2. Nerve to Stapedius.

3. Chorda Tympani:

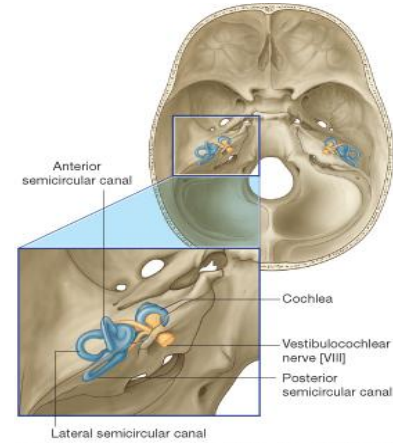
Arises just before the facial nerve exits.



Internal Ear (Labyrinth)

The inner ear (**Labyrinth**) is situated in the petrous part of the Temporal Bone, medial to the middle ear cavity, and it consists of:

- a. **Bony Labyrinth.**
- b. **Membranous Labyrinth.**



Bony Labyrinth

- It is a series of bony chambers lined by endosteum (bone cells).
- They contain a clear fluid, the **perilymph**, in which suspended the **membranous labyrinth**.
- The bony labyrinth consists of: **i. Cochlea, ii. Vestibule, iii. Semicircular Canals.**



Bony Labyrinth



Sectioned Bony labyrinth

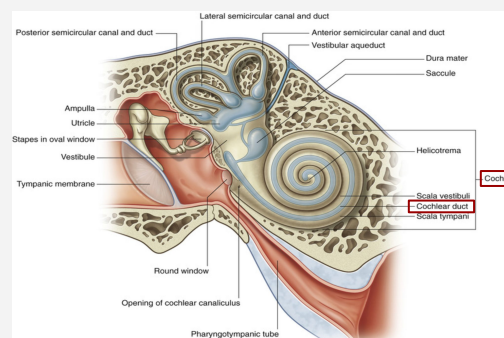
Bony Labyrinth

Cochlea

Vestibule

Semicircular canals

- Its first turn produces the **promontory** on the medial wall of the tympanic cavity.
- It contains the **cochlear duct** (part of the **membranous labyrinth**).



Internal Ear (Labyrinth) Cont.

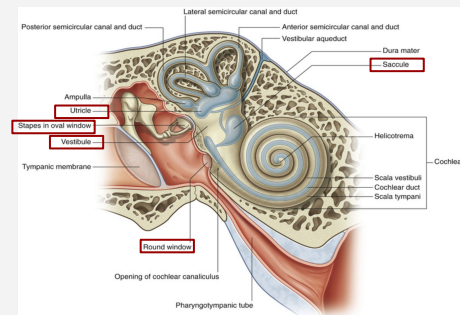
Bony Labyrinth

Cochlea

Vestibule

Semicircular canals

- It is the central part of the bony labyrinth.
- Contains the **utricle** & **sacculle** (part of membranous labyrinth).
- 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.



Bony Labyrinth

Cochlea

Vestibule

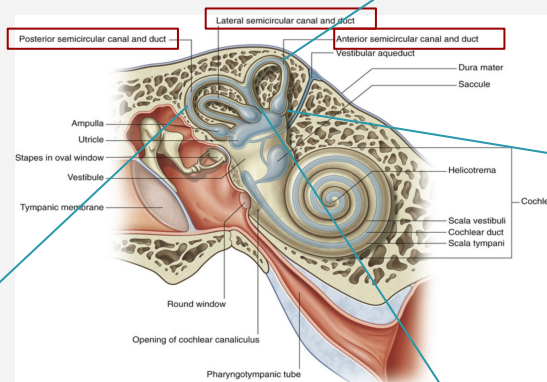
Semicircular canals

Semicircular canals: superior (anterior), posterior & lateral

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

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

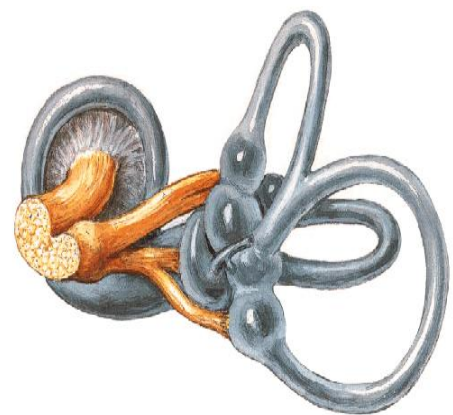
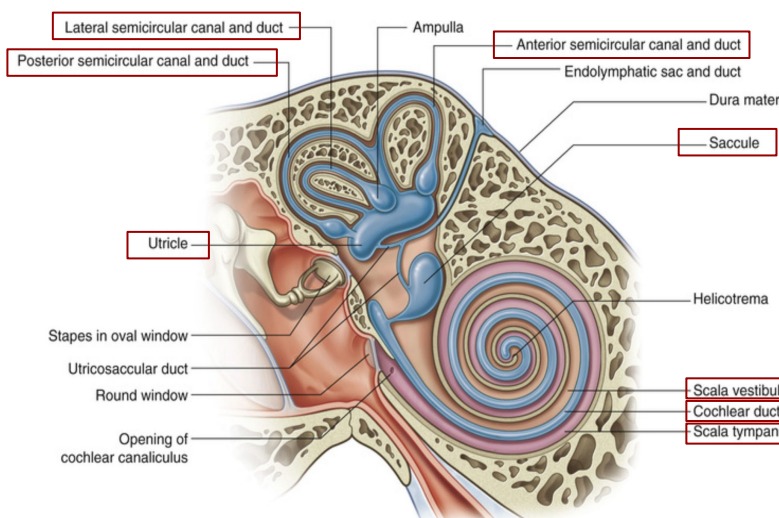
The canals open into the vestibule by five orifices, one of which is common to two of the canals.



Internal Ear (Labyrinth) Cont.

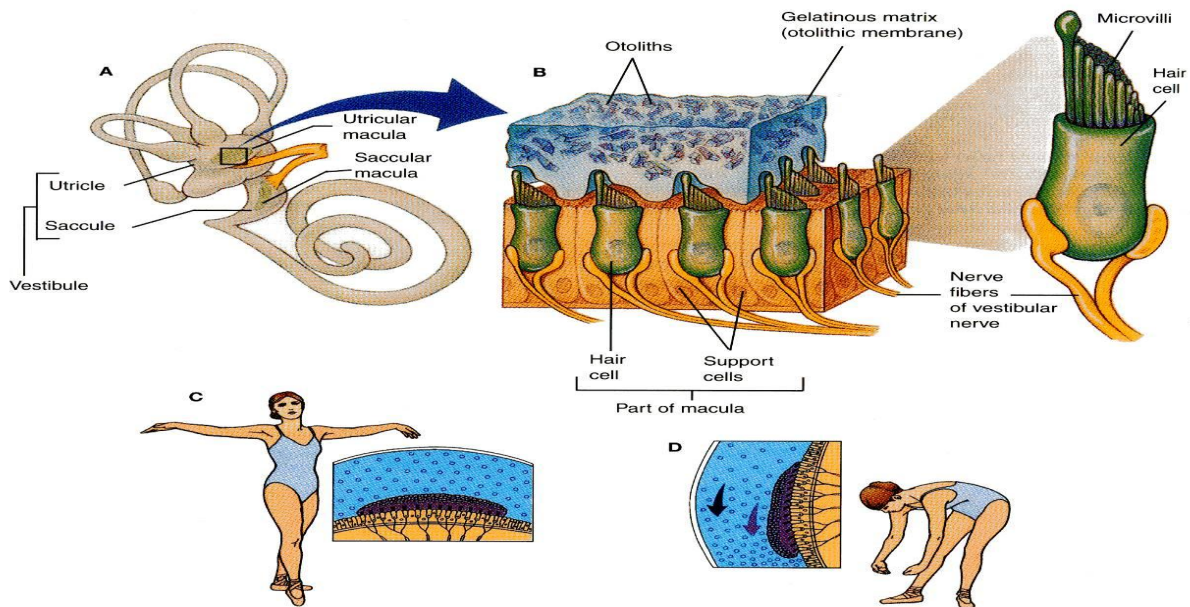
Membranous Labyrinth

- Consists of series of membranous **sacs** and **ducts** within the bony labyrinth.
- It is filled with **Endolymph**.
- Consists of (**Four ducts & Two sacs**) which are freely communicate with one another:
 - i. **Sacs: Utricle & Saccule** (within (lodged in) the bony vestibule).
 - ii. **Ducts:**
 - **Three semicircular Ducts**, (lie within the bony semicircular canals).
 - **Cochlear Duct**: (lies within the bony cochlea).
 - a. The cochlear duct divides the bony cavity into **Scala Vestibuli** and **Scala Tympani**.
 - b. The perilymph within the Scala Vestibuli is separated from the middle ear by the **base of the stapes** at the Fenestra Vestibuli. The perilymph in the **scala tympani** is separated from the middle ear by the secondary tympanic membrane at **Fenestra Cochleae**



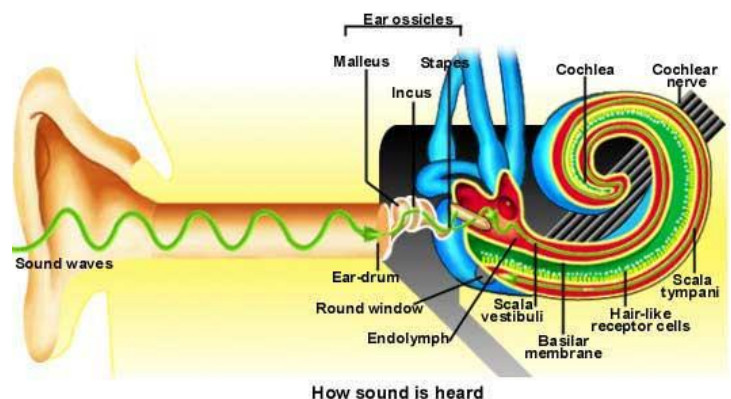
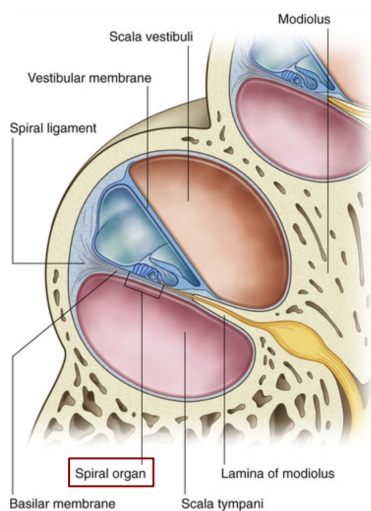
Equilibrium

- Located on the walls of the **Utricle** and **Saccul**e are specialized sensory receptors, which are **sensitive to the orientation of the head to gravity or other acceleration forces**.
- The **utricle, saccul**e and **semicircular ducts** are concerned with maintenance of **Equilibrium**.



Hearing

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



MCQs

Q1. Which of the following is a part of a membranous labyrinth?

- | | | | |
|------------|-----------------------|--------------|------------|
| A. Utricle | B. Semicircular Canal | C. Vestibule | D. Cochlea |
|------------|-----------------------|--------------|------------|

Q2. Which of the following nerves supplies the outer tympanic membrane?

- | | | | |
|--------------------------|--------------------------|--|------------------------------------|
| A. Great Auricular Nerve | B. Lesser Petrosal Nerve | C. Tympanic Branch of Glossopharyngeal Nerve | D. Auricular Branch of Vagus Nerve |
|--------------------------|--------------------------|--|------------------------------------|

Q3. Which of the following is responsible for closure of the oval window?

- | | | | |
|--------------------------------|----------------------|-----------------------|-------------------|
| A. Secondary Tympanic Membrane | B. Tympanic Membrane | C. Handles of Malleus | D. Base of Stapes |
|--------------------------------|----------------------|-----------------------|-------------------|

Q4. Which of the following is related to the anterior wall of the tympanic?

- | | | | |
|--------------------------|----------------------------|---------------|------------|
| A. Internal Jugular Vein | B. Internal Carotid Artery | C. Promontory | D. Pyramid |
|--------------------------|----------------------------|---------------|------------|

Q5. Which of the following branches of the glossopharyngeal nerve carries secretomotor fibers to the parotid gland?

- | | | | |
|------------|---------------|-------------|--------------|
| A. Lingual | B. Pharyngeal | C. Tympanic | D. Tonsillar |
|------------|---------------|-------------|--------------|

Q6. Which of the following nerves supplies the tensor tympani?

- | | | | |
|---------------|---------------------|--------------|-----------|
| A. Mandibular | B. Glossopharyngeal | C. Maxillary | D. Facial |
|---------------|---------------------|--------------|-----------|

A1. A A2. D A3. D A4. B A5. C A6. A

FOR ANKI FLASHCARDS





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