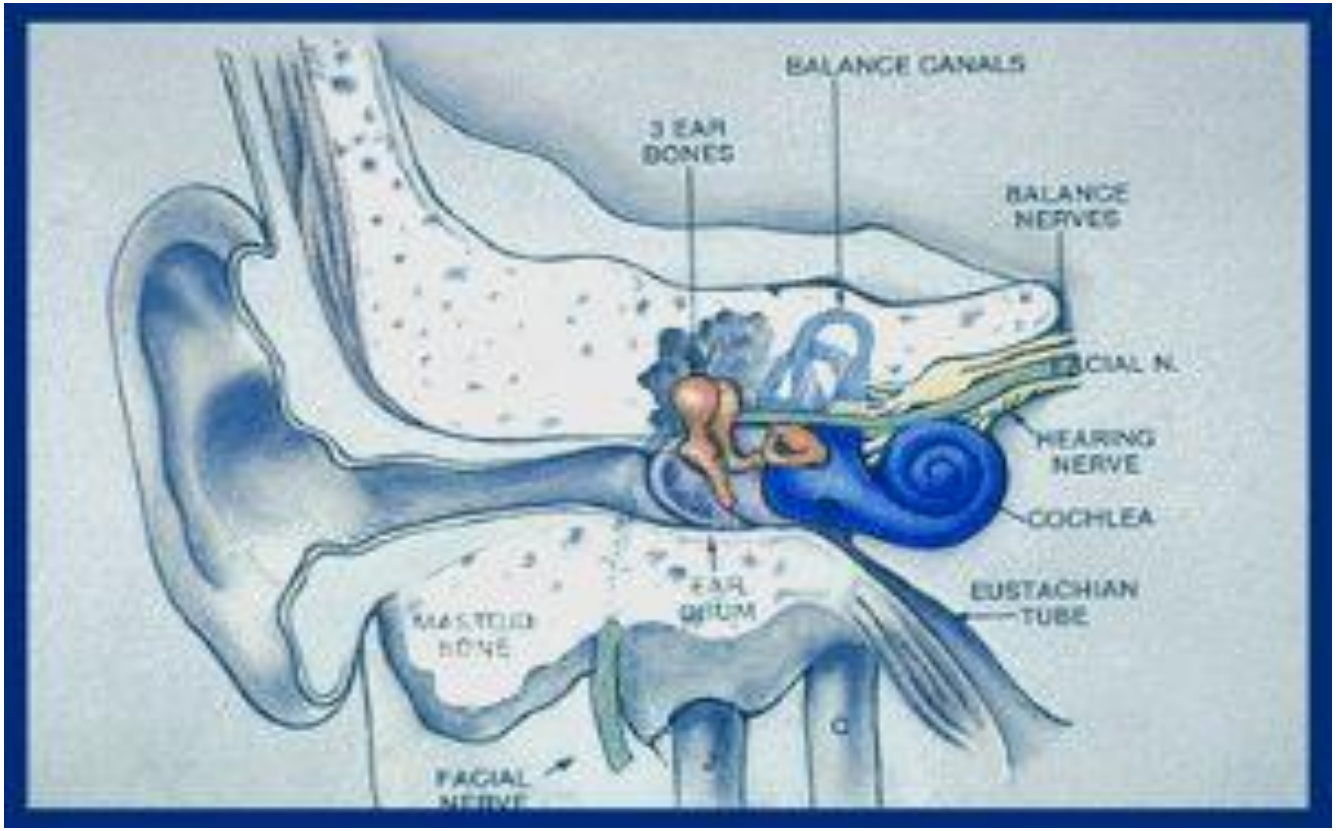
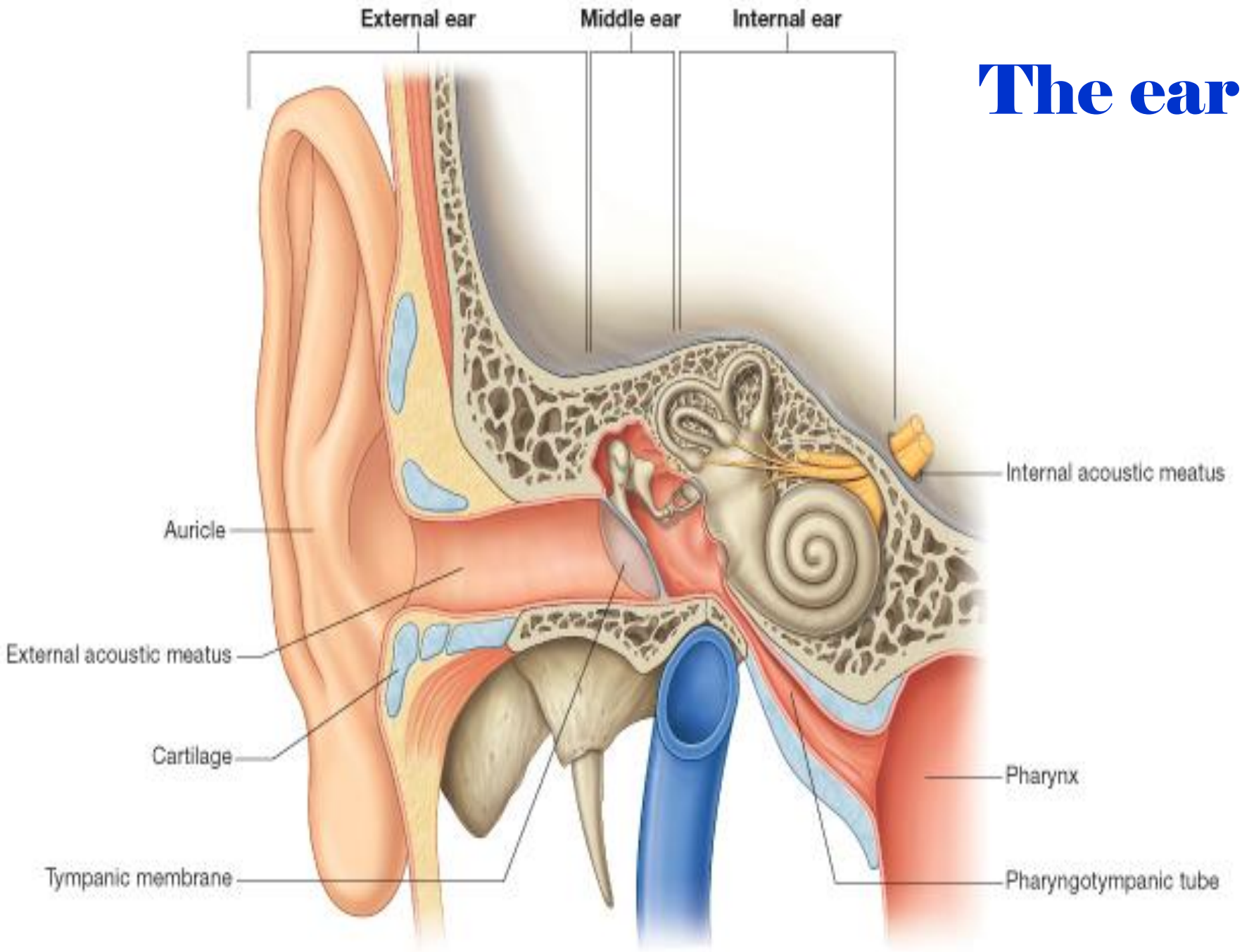
The ear


BALANCE CANALS
3 EAR BONES
BALANCE NERVES
FACIAL N.
HEARING NERVE
COCHLEA
EUSTACHIAN TUBE
FACIAL NERVE

The ear


External ear
Middle ear
Internal ear
Internal acoustic meatus
Auricle
External acoustic meatus
Cartilage
Pharynx
Tympanic membrane
Pharyngotympanic tube

- ***EAR***

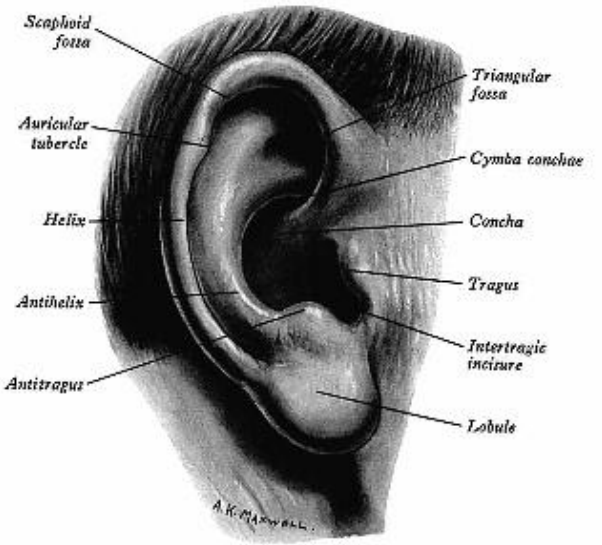
- ***The ear is the organ of hearing and balance.***
- ***It has three parts ;***
- ***the first part is the external ear consisting of the part attached to the lateral aspect of the head and the canal leading inward;***

- the second part is the **middle ear**-a cavity in the petrous part of the temporal bone bounded laterally, and separated from the external canal, by a membrane and connected internally to the pharynx by a narrow tube;

- the third part is the **internal ear** consisting of a series of cavities within the petrous part of the temporal bone between the middle ear laterally and the internal acoustic meatus medially.

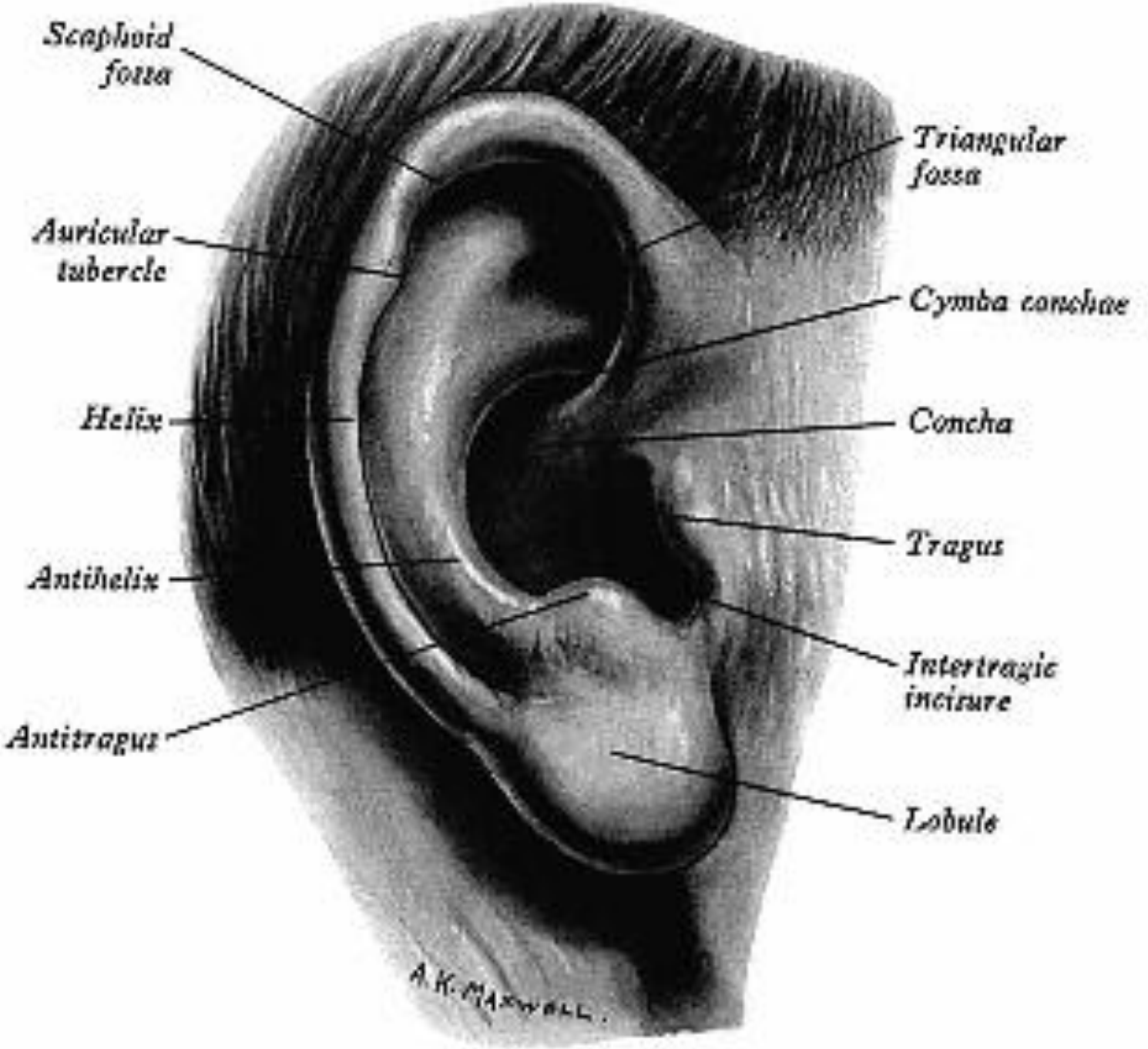
The internal ear converts the mechanical signals received from the middle ear, which start as sound captured by the external ear, into electrical signals to transfer information to the brain. The internal ear also contains receptors that detect motion and position.

- The external ear consists of two parts.
- The part projecting from the side of the head is the **auricle** (**pinna**)
- and the canal leading inward is the **external acoustic meatus**.

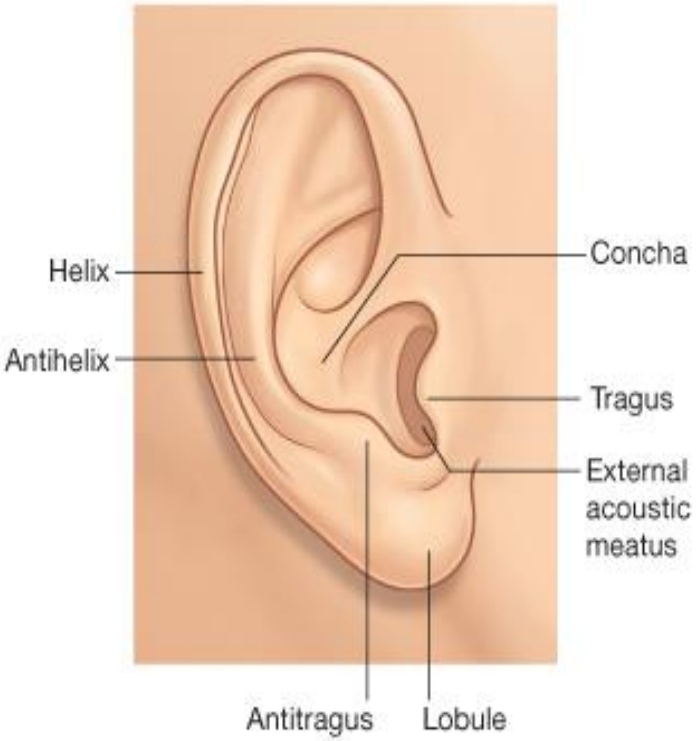


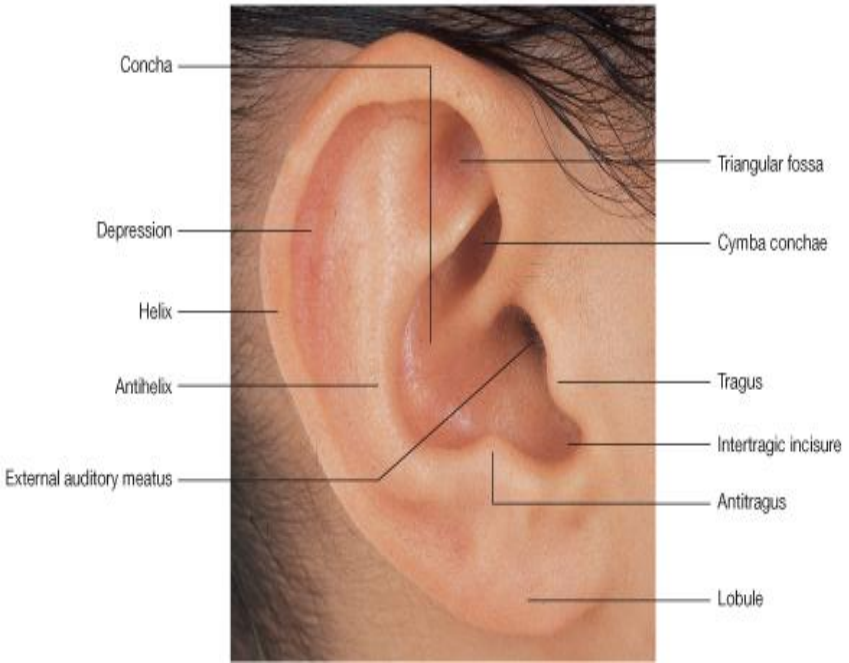
- The auricle is on the side of the head and assists in capturing sound.

- It consists of cartilage covered with skin and arranged in a pattern of various elevations and depressions


Scaphoid fossa
Triangular fossa
Auricular tubercle
Cymba conchae
Helix
Concha
Tragus
Antihelix
Intertragic incisure
Antitragus
Lobule
A. K. MAXWELL.

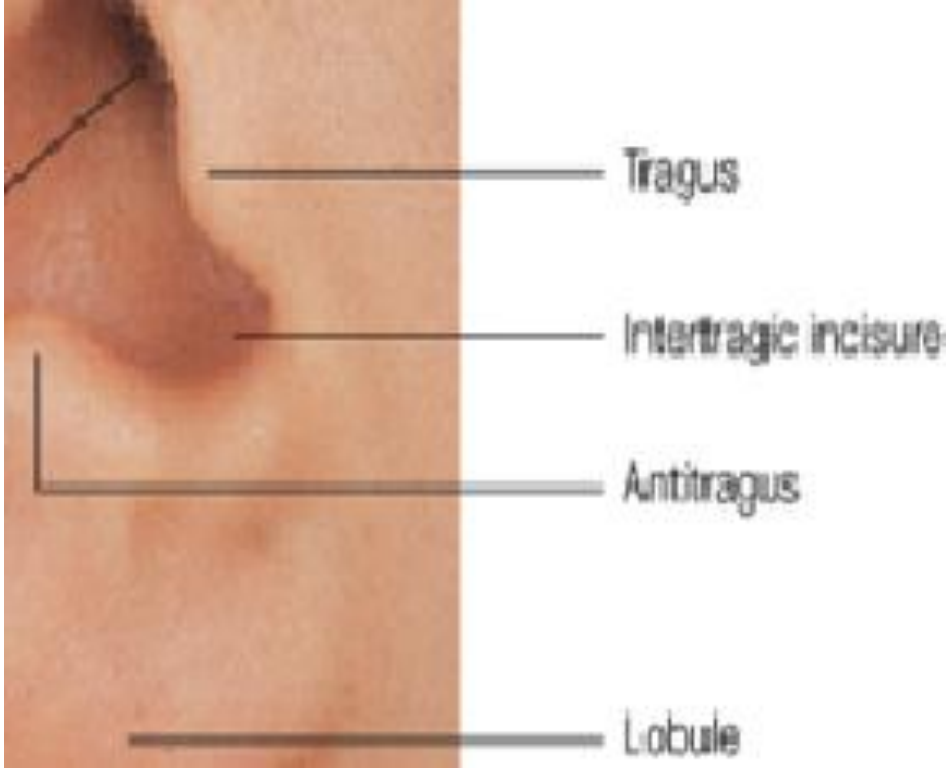
- The large outside rim of the auricle is the **helix**.
- It ends inferiorly at the fleshy **lobul**e, the only part of the auricle not supported by cartilage.





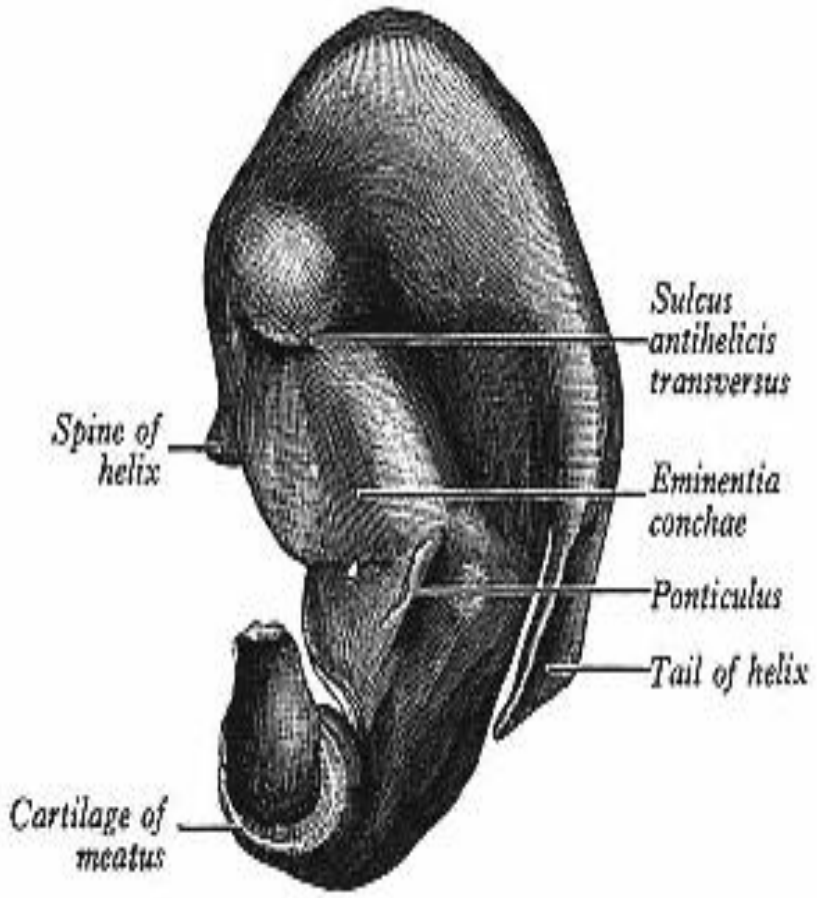
- The hollow center of the auricle is the ***concha*** **of auricle**.
- The ***external acoustic meatus*** leaves from the depths of this area.

- Just anterior to the opening of the external acoustic meatus, in front of the concha, is an elevation (the **tragus**).
- Opposite the tragus, and above the fleshy lobule, is another elevation (the **antitragus**).
- .



- A smaller curved rim, parallel and anterior to the helix is the **antihelix**.
- The **helix** usually bears posterosuperiorly a small auricular tubercle (of Darwin), a structure which is quite pronounced around the sixth month of intrauterine life

- Auricular Cartilage
- This is a single piece of elastic fibrocartilage, its surface moulded by eminences and depressions ; it is absent from the lobule and between the tragus and the crus of the helix, the gap being filled by dense fibrous tissue.



- Anteriorly, where the helix curves upwards, is a small cartilaginous projection, the spine of the helix,
- its other extremity being prolonged inferiorly as the tail of the helix
- and separated from the antihelix by the fissura antitragohelicina.

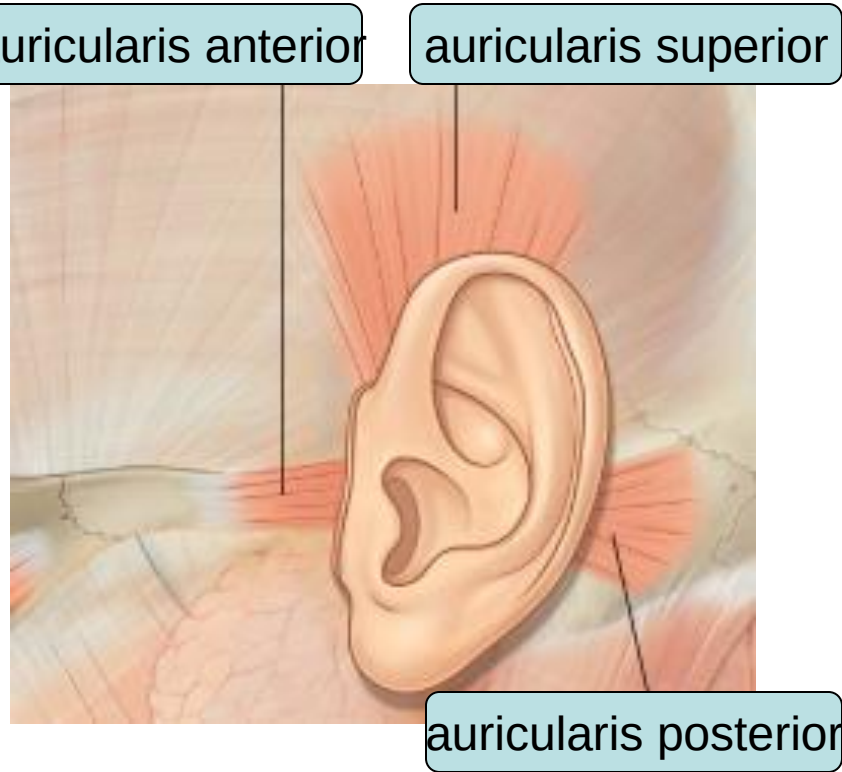
- Ligaments of the Auricle
- These consist of two sets:
- • extrinsic, connecting it to the temporal bone
- • intrinsic, interconnecting various parts of its cartilage.

- **Muscles**
- **.Numerous intrinsic and extrinsic muscles are associated with the auricle:**
- **the intrinsic muscles**

  pass between the cartilaginous parts of the auricle and may change the shape of the auricle;

- **the extrinsic muscles,** ***the anterior, superior, and posterior auricular muscles,*** **pass from the scalp or skull to the auricle and may also play a role in positioning of the auricle.**
- **Both groups of muscles are innervated by the facial nerve [VII].**

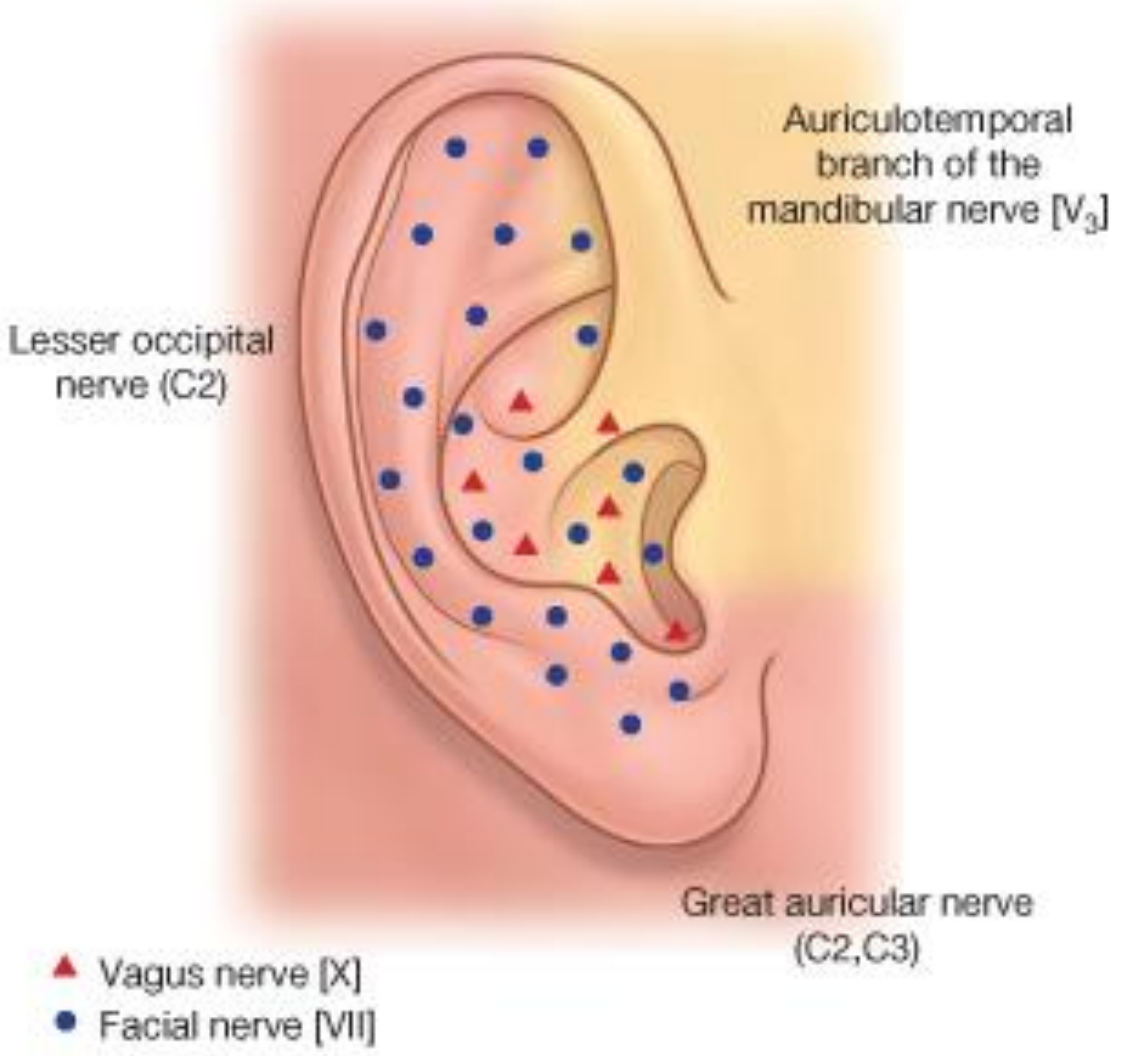
- Extrinsic Muscles
- These are the auriculares anterior, superior and posterior.
- Nerve Supply
- The auriculares anterior and superior are supplied **by temporal branches** of the facial nerve
- and the auricularis posterior by the **posterior auricular branch** of the same nerve.



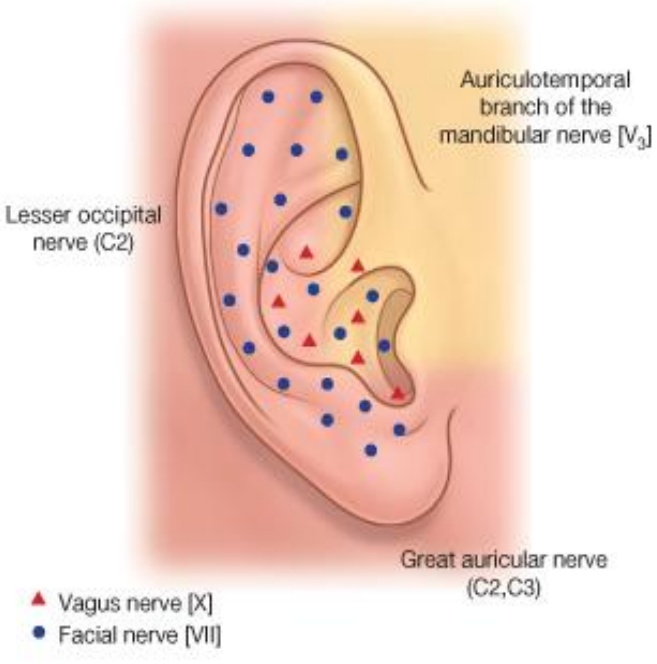
- ***Actions***
- ***In man these muscles have very little obvious effect:***
- ***auricularis anterior draws the auricle forwards and upwards;***
- ***auricularis superior elevates it slightly;***
- ***auricularis posterior draws it back.***

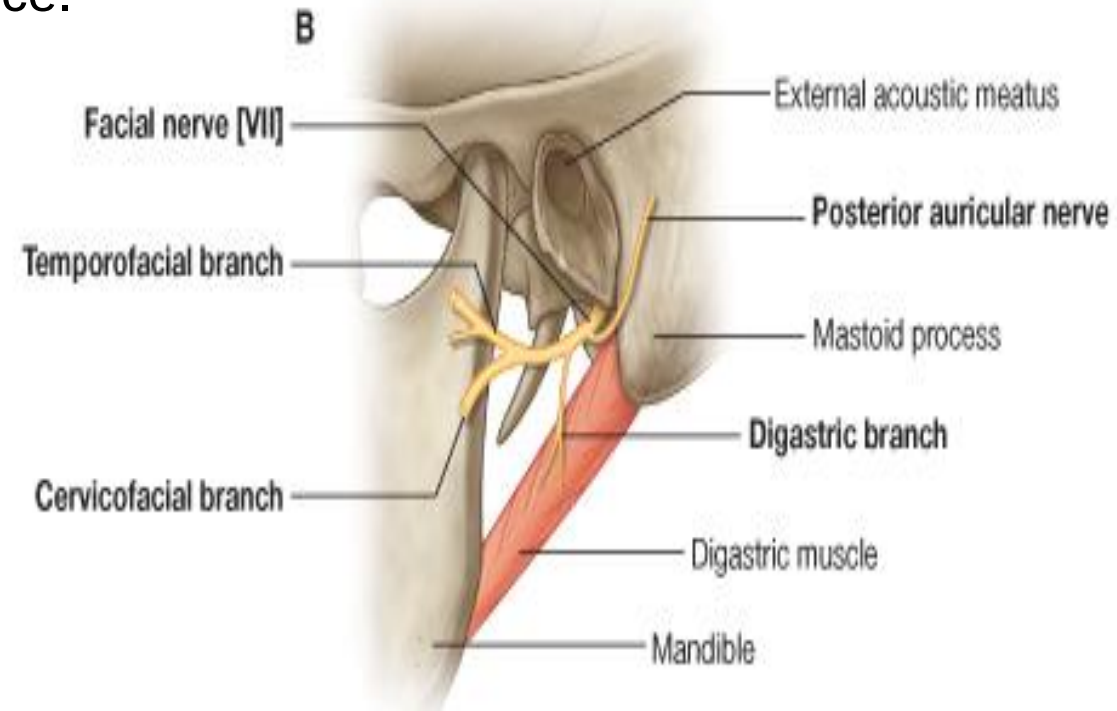
- Intrinsic Muscles
- They are: helicis major and minor, tragicus, antitragicus, transversus auriculae and obliquus auriculae.
- Nerve Supply
- On the lateral aspect this is from the temporal branches of the facial and to those on the cranial aspect from the facial's posterior auricular branch.

- Sensory innervation of the auricle is from many sources,
- outer more superficial surfaces of the auricle are supplied by the great auricular and lesser occipital nerves from the cervical plexus and the auriculotemporal branch of the mandibular nerve [V3].
- deeper parts of the auricle are supplied by branches from the ***facial nerve [VII]*** and the vagus nerve [X].



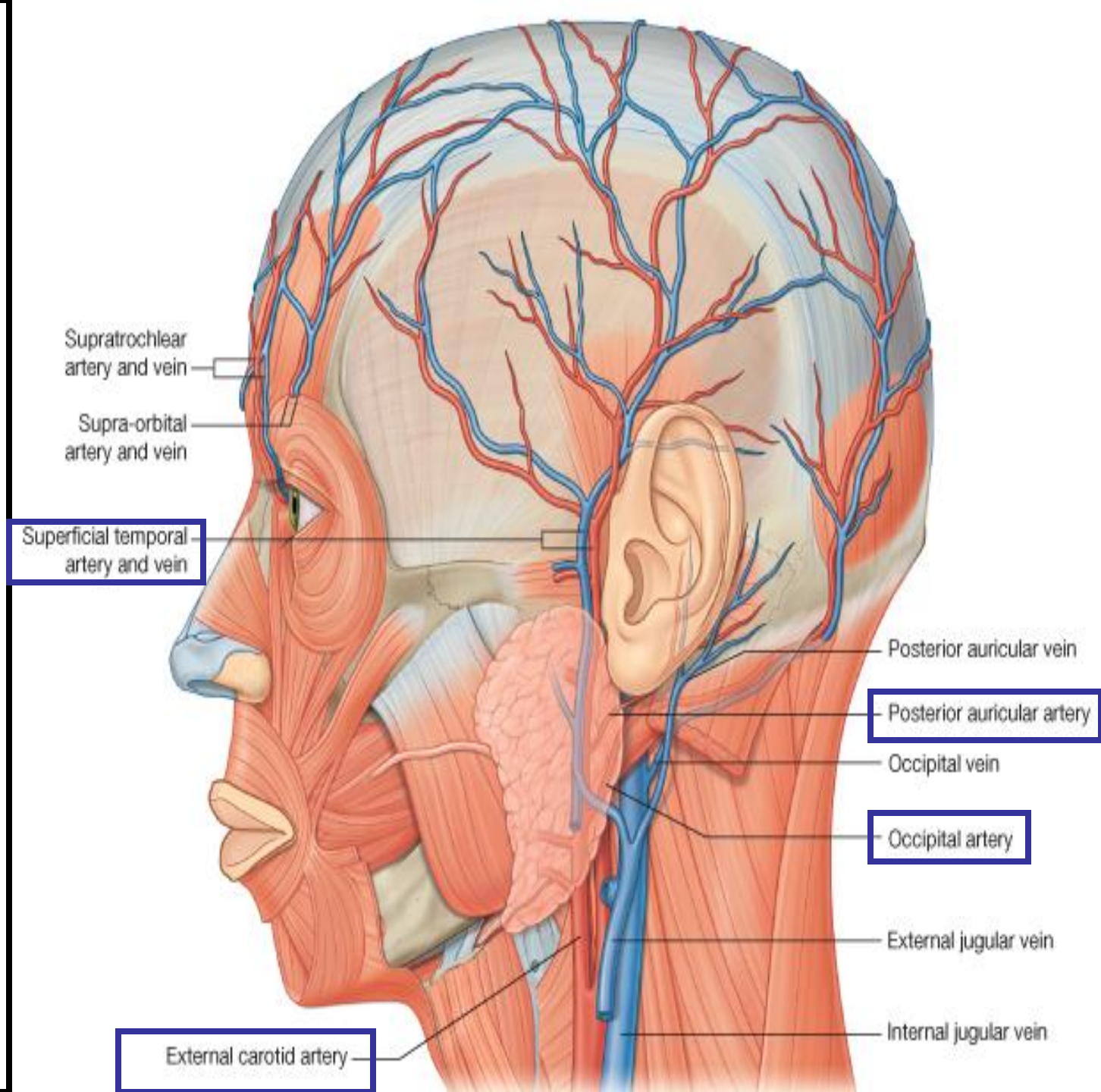
- **Sensory Nerves**
- These are:
- • **the great auricular nerve**, supplying most of the cranial surface and the posterior part of the lateral surface (helix, antihelix, lobule)
- • **the lesser occipital nerve,** supplying the upper part of the cranial surface.
- • **the auricular branch of the vagus,** supplying the concavity of the concha and posterior part of the eminentia.
- • **the auriculotemporal nerve**, supplying the tragus, crus of the helix and the adjacent part of the helix
- • **the facial nerve**, which with the auricular branch of the vagus probably supplies small areas on both aspects of the auricle in the depression of the concha and over its eminence.



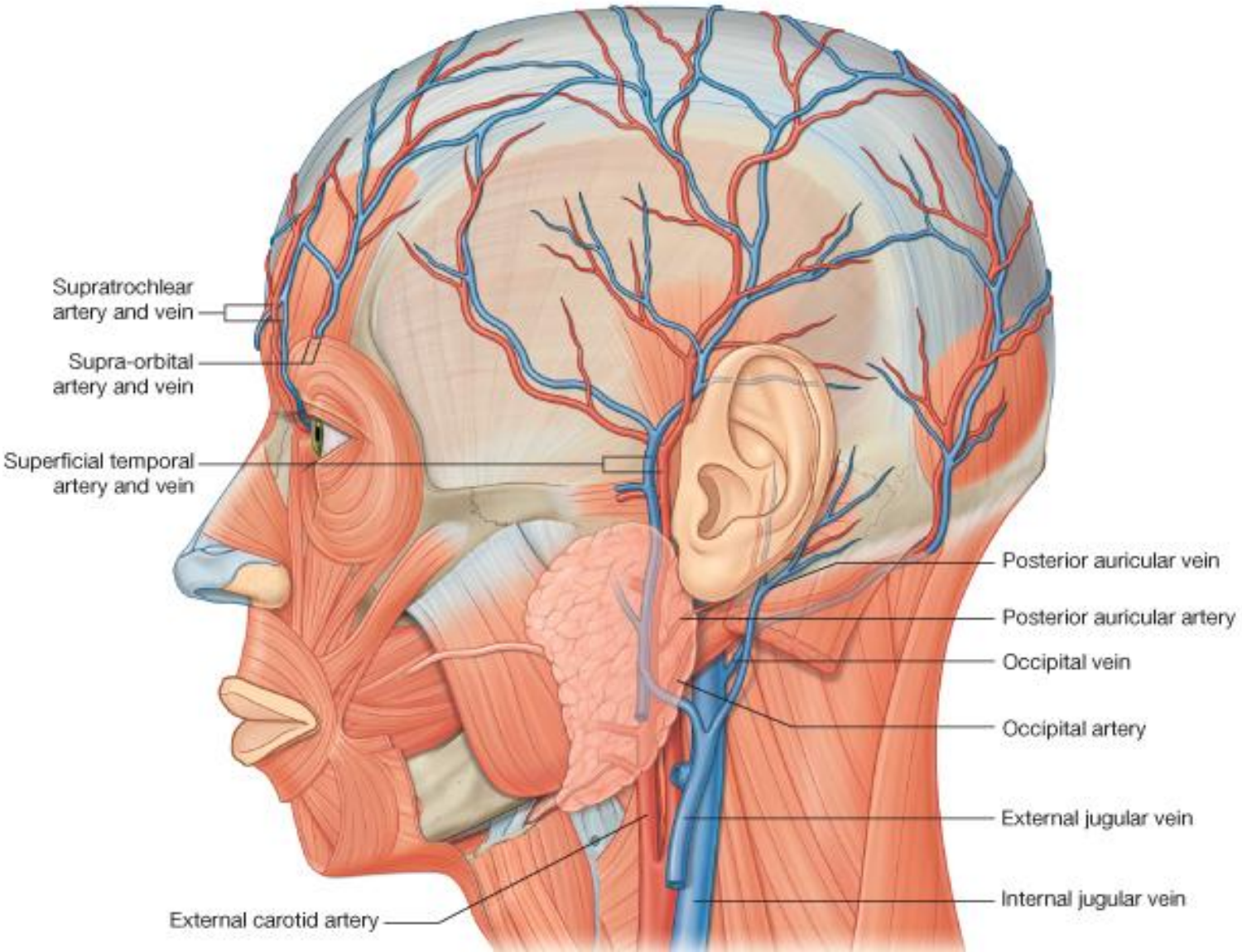


- **Vessels**
- Arteries
- These are:
- • the ***posterior auricular*** branch of the external carotid, supplying three or four branches to its cranial surface; twigs from these reach the lateral surface, some through fissures in the cartilage, others round the margin of the helix
- • the anterior auricular branches of the ***superficial temporal artery***, distributed to the lateral surface
- • a branch from the occipital artery.

- the posterior auricular branch of the external carotid
- the anterior auricular branches of the superficial temporal artery
- a branch from the occipital artery.



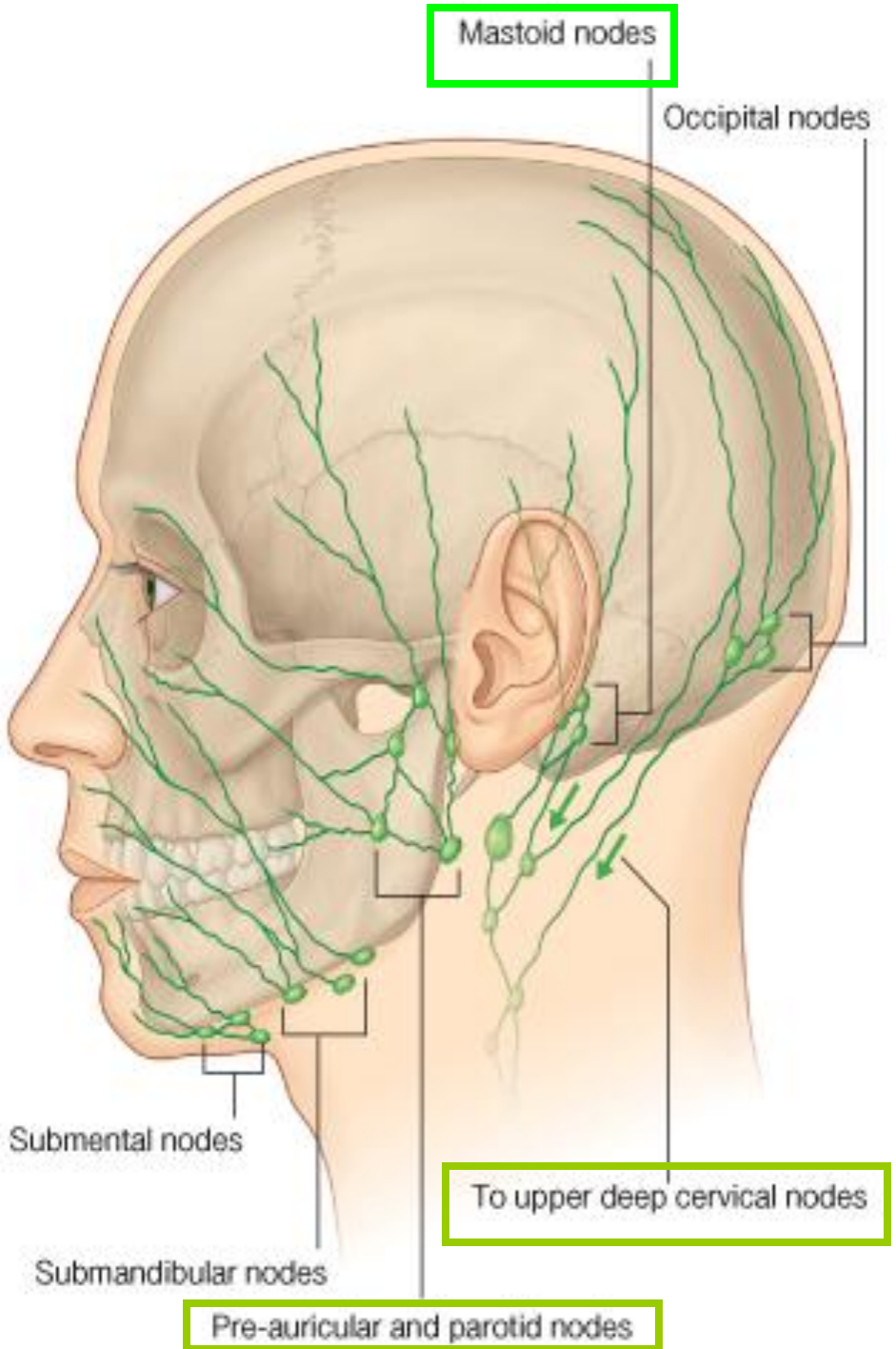
- Veins
- These correspond to the arteries of the auricle.
- Arteriovenous anastomoses are numerous in the skin of the auricle.



Lymphatic

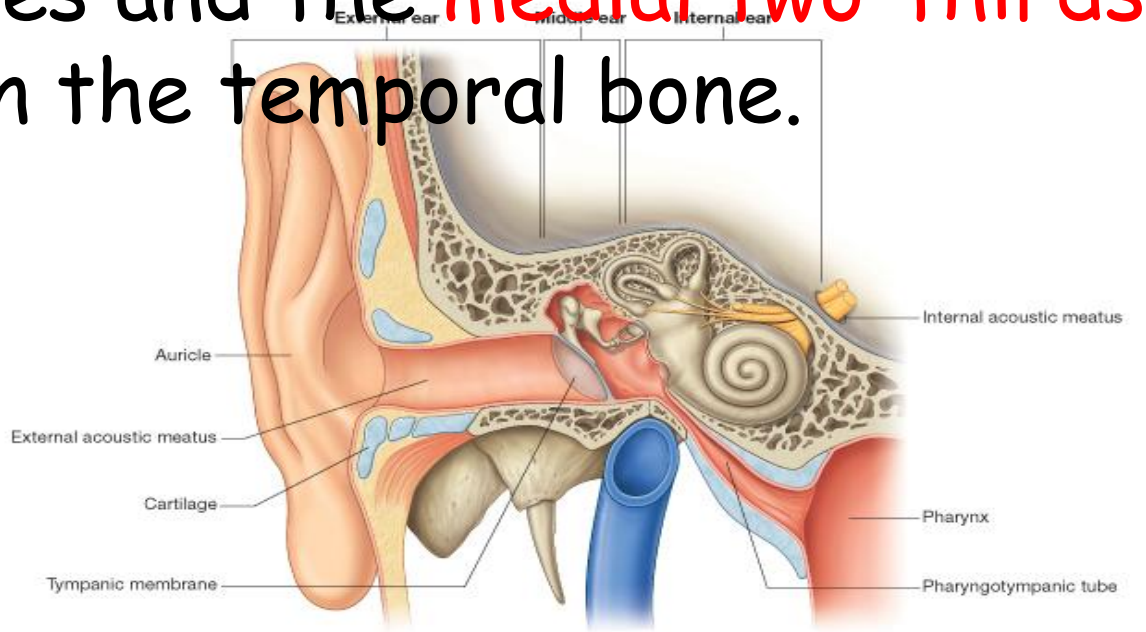
These drain into:

- the **parotid** lymph nodes, especially the node in front of the tragus
- the upper deep cervical lymph nodes
- the mastoid lymph nodes.



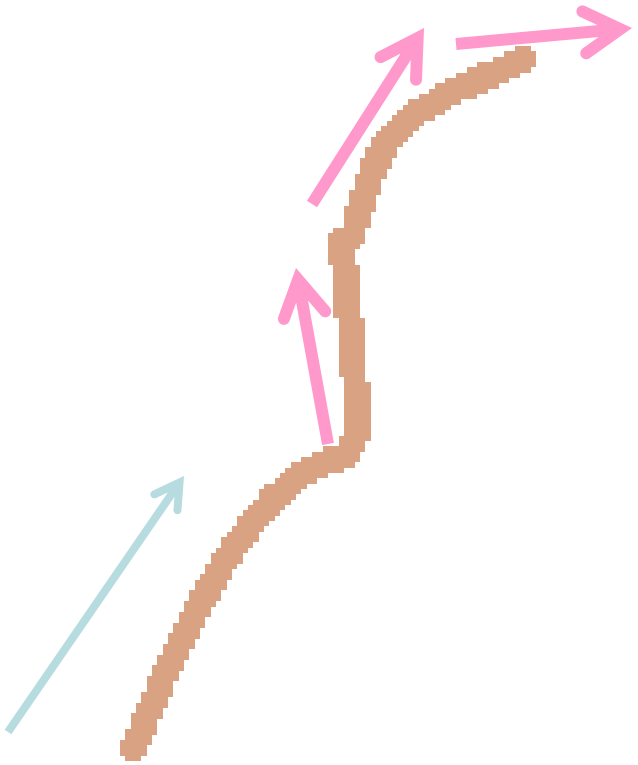
External acoustic meatus

- extends from the deepest part of the concha to the **tympanic membrane** (eardrum), a distance of approximately 1 inch (2.5 cm) .
- Its walls consist of cartilage and bone.
- The lateral one-third is formed from cartilaginous extensions from some of the auricular cartilages and the medial two-thirds is a bony tunnel in the temporal bone.

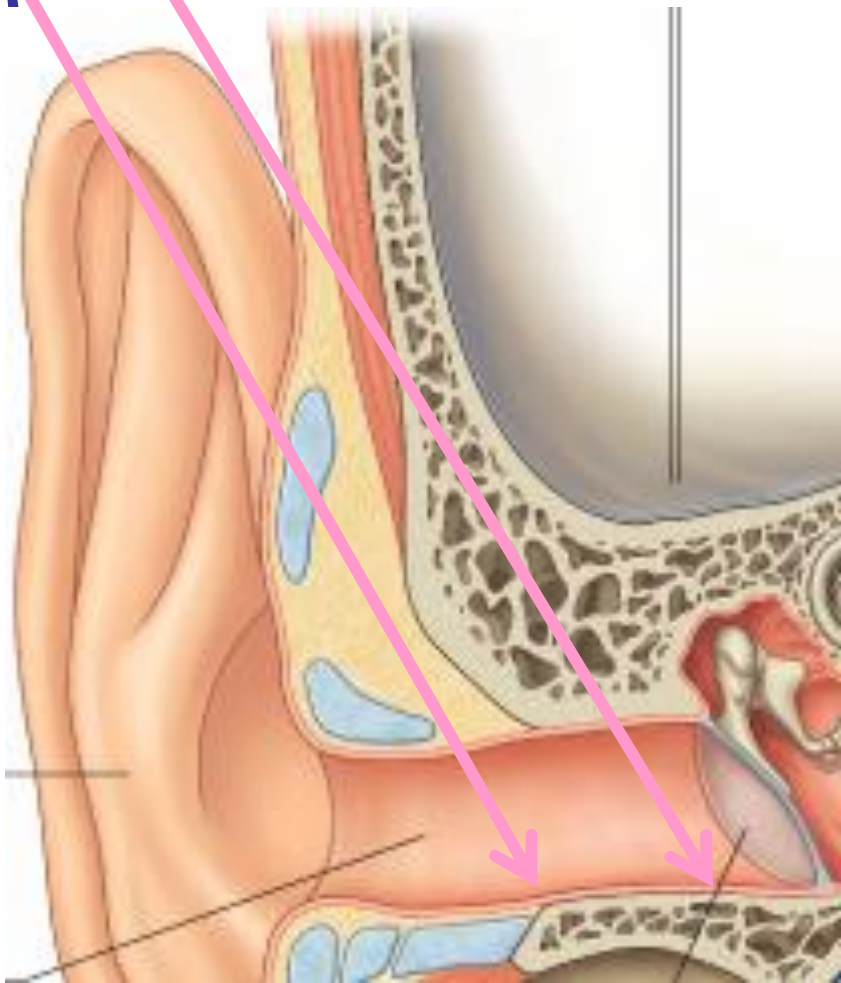


- Throughout its length the external acoustic meatus is covered with skin, some of which contains hair and modified sweat glands producing **cerumen** (earwax).
- Its diameter varies, being wider laterally and narrow medially.
- The external acoustic meatus does not follow a straight course, It forms an **S-shaped curve** .

- From the external opening it passes upwards in an anterior direction, then turns slightly posteriorly still passing in an upwards direction, and finally, turns again in an anterior direction with a slight descent.

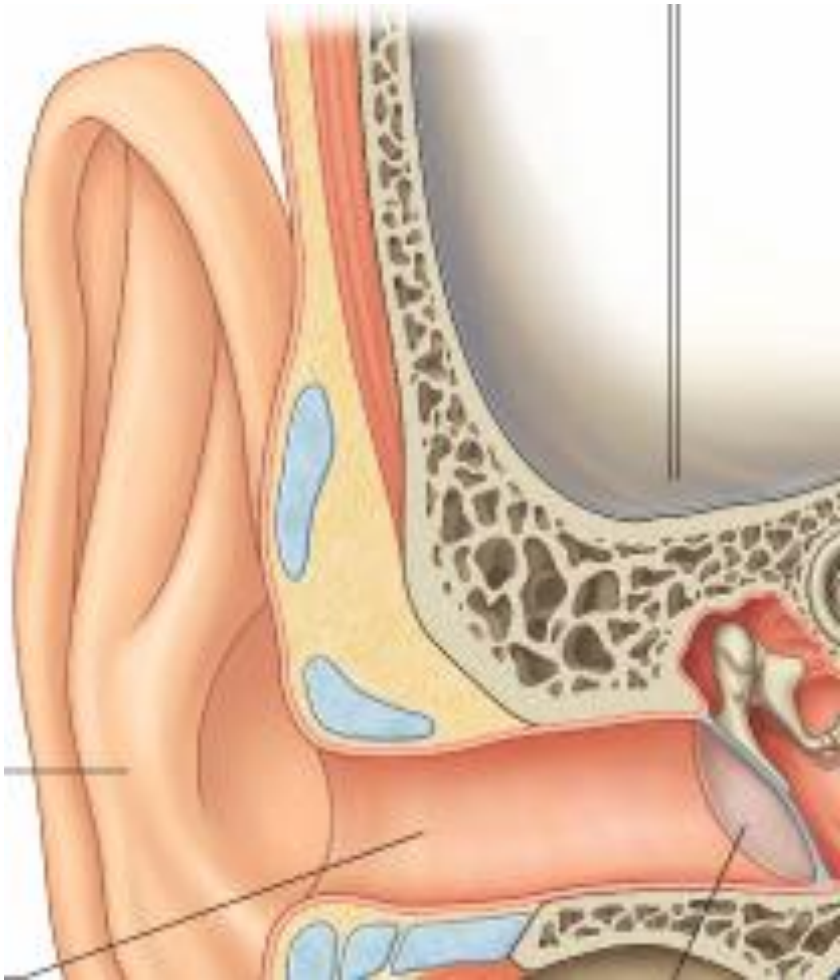


- There are two constrictions,
- one near the **medial end of the cartilaginous part**,
- the other, the isthmus, in the osseous part **about 2 cm** from the bottom of the concha.
- The tympanic membrane, which closes its medial end, is obliquely set and *so **the floor and the anterior wall** of the meatus are longer than its roof and posterior wall.*



- The lateral, **cartilaginous part** is about 8 mm long: it is continuous with the auricular cartilage and attached by fibrous tissue to the circumference of the osseous part. This meatal cartilage is deficient posterosuperiorly, the gap being occupied by a sheet of collagen

- The **osseous part** is about 16 mm long, and is narrower than the cartilaginous part.
- It is directed anteromedially and slightly downwards, with a slight posterosuperior convexity.
- a narrow tympanic sulcus, to which the tympanic membrane is attached.
- Its lateral end is dilated and mostly rough for the attachment of the meatal cartilage.



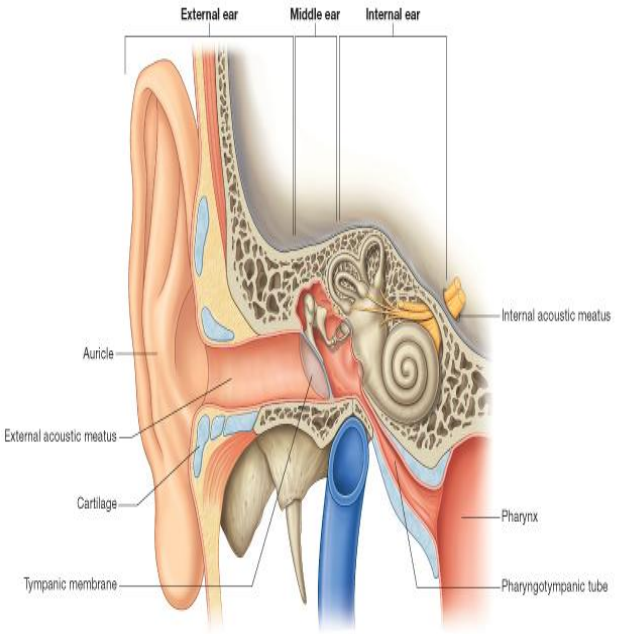
- The anterior, inferior and most of the posterior parts of the osseous meatus are formed by the tympanic element of the temporal bone, which in the fetus is only a tympanic ring .
- the posterosuperior region is formed by the temporal squamous bone.

- ***The skin of the auricle continues into the external acoustic meatus and covers the tympanic membrane's external surface.***

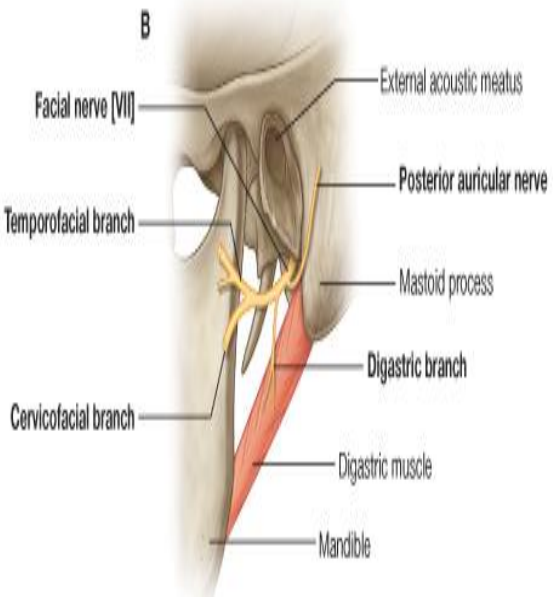
- ***It is thin, with no dermal papillae, and is closely adherent to the cartilaginous and osseous parts of the tube; inflammation is very painful owing to increased tension in these tissues.***

- ***Ceruminous glands and hair follicles are largely limited to the cartilaginous meatus***

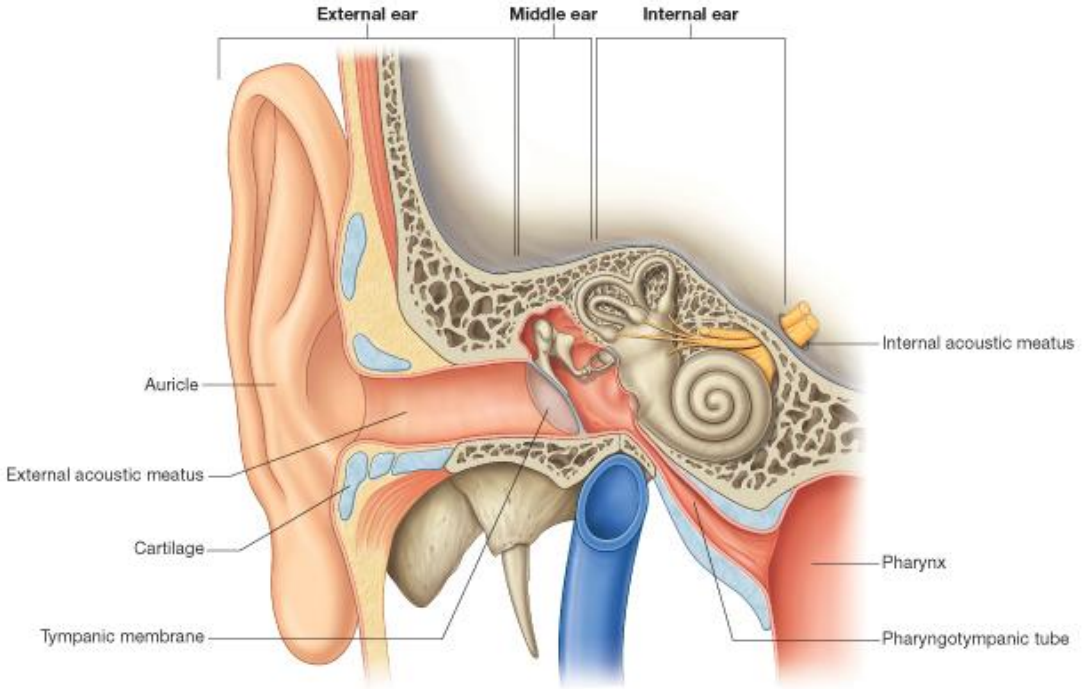
- **Relations of the Meatus**
- anterior :The **mandible's condyloid process** lies anterior to the meatus and partially separated from its cartilaginous part by a small portion of the parotid gland.



- ***A blow on the chin may cause the condyle to break into the meatus.***
- Mandibular movements affect the size of the cartilaginous lumen.



Relations of the Meatus



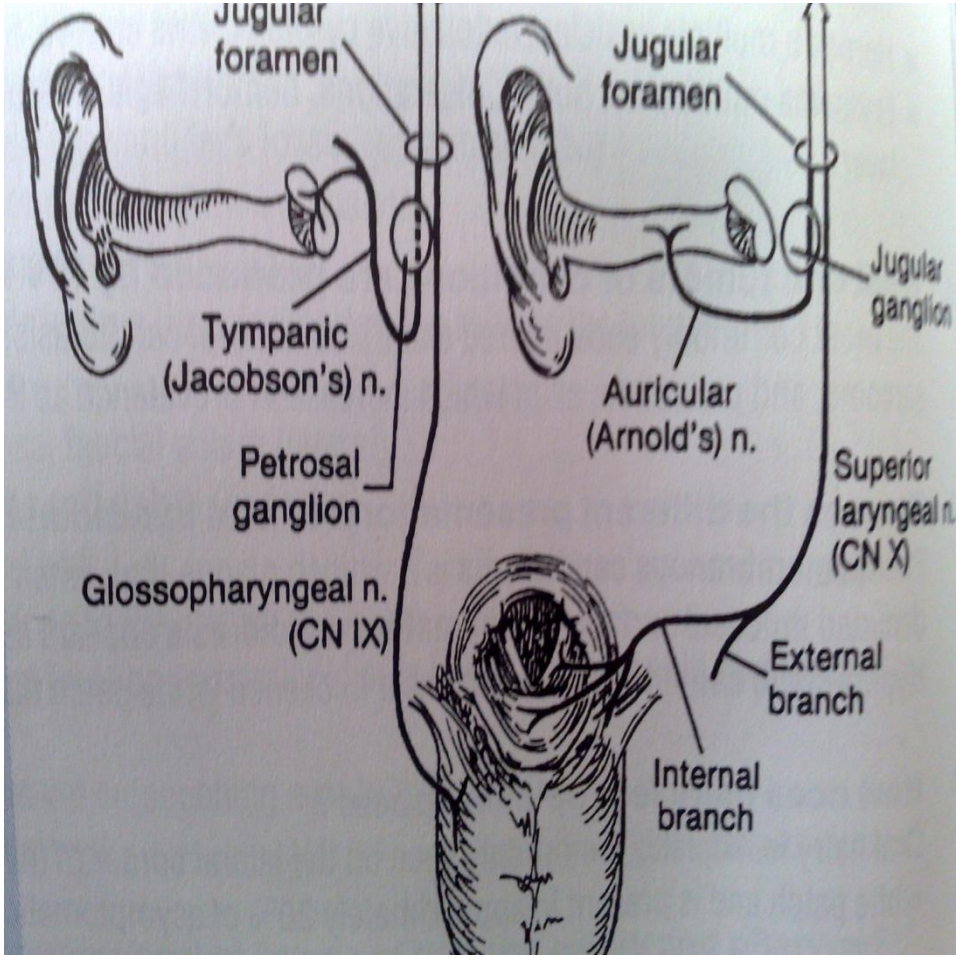
Superior :The **middle cranial fossa** lies above the osseous meatus.

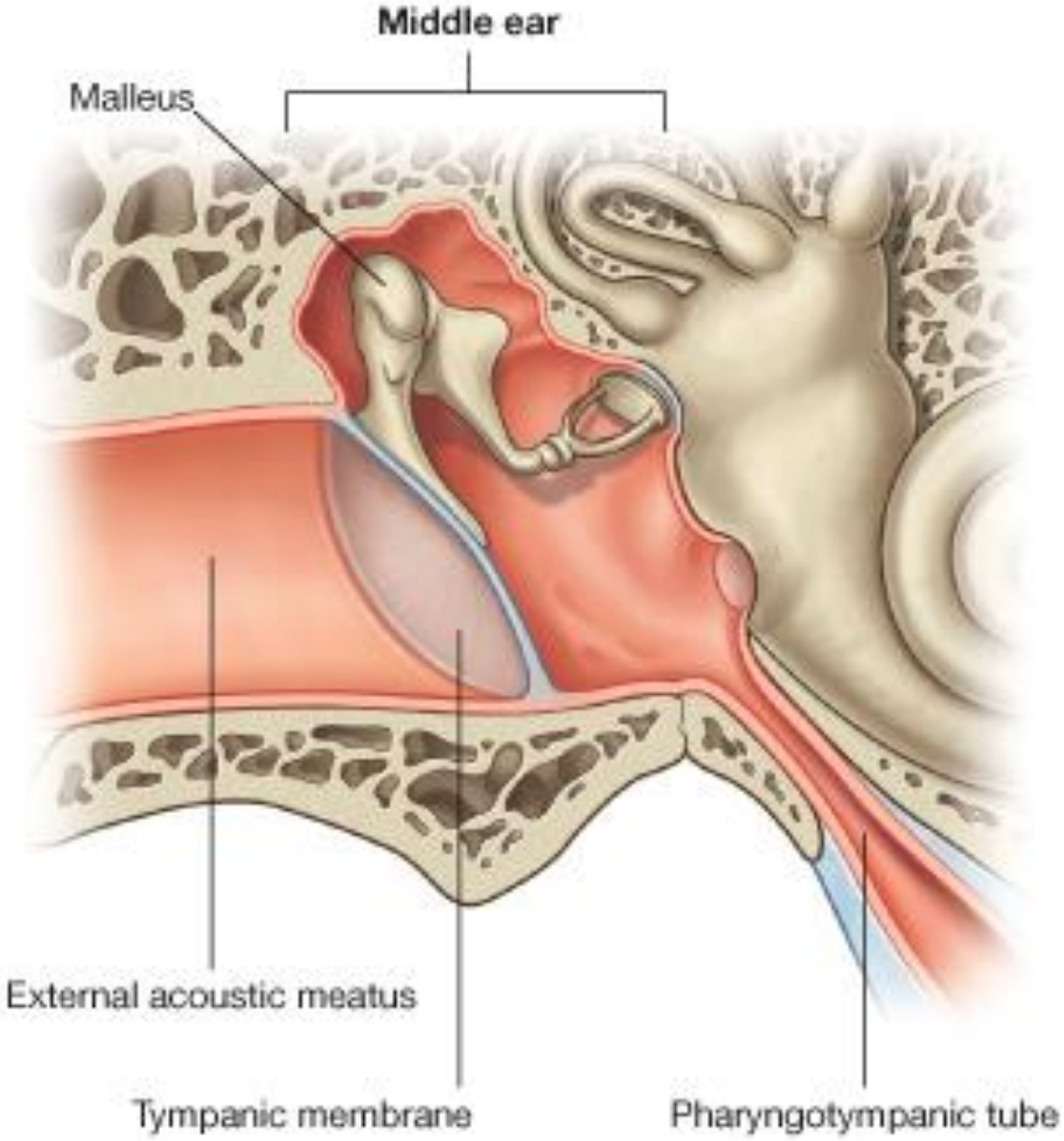
Posterior:-the **mastoid air cells** are posterior to it, separated from the meatus by a thin layer of bone.

Its deepest part is situated below the **epitympanic recess** and antero-inferior to the mastoid antrum, the lamina of bone separating it from the antrum being only 1–2 mm thick and providing the 'transmeatal approach' of aural surgery.

- **Arteries**
- These are: the posterior auricular branch of the external carotid, the deep auricular branch of the maxillary and the auricular branches of the superficial temporal.
- Veins
- They drain into: the external jugular and maxillary veins and the ***pterygoid plexus*** .
- **Lymphatics**
- These drain with those of the auricle.
- **Nerves**
- These are derived from the auriculotemporal branch of the mandibular, which supplies the anterior and superior walls of the meatus, and the auricular branch of ***the vagus,*** innervating the posterior and inferior walls.

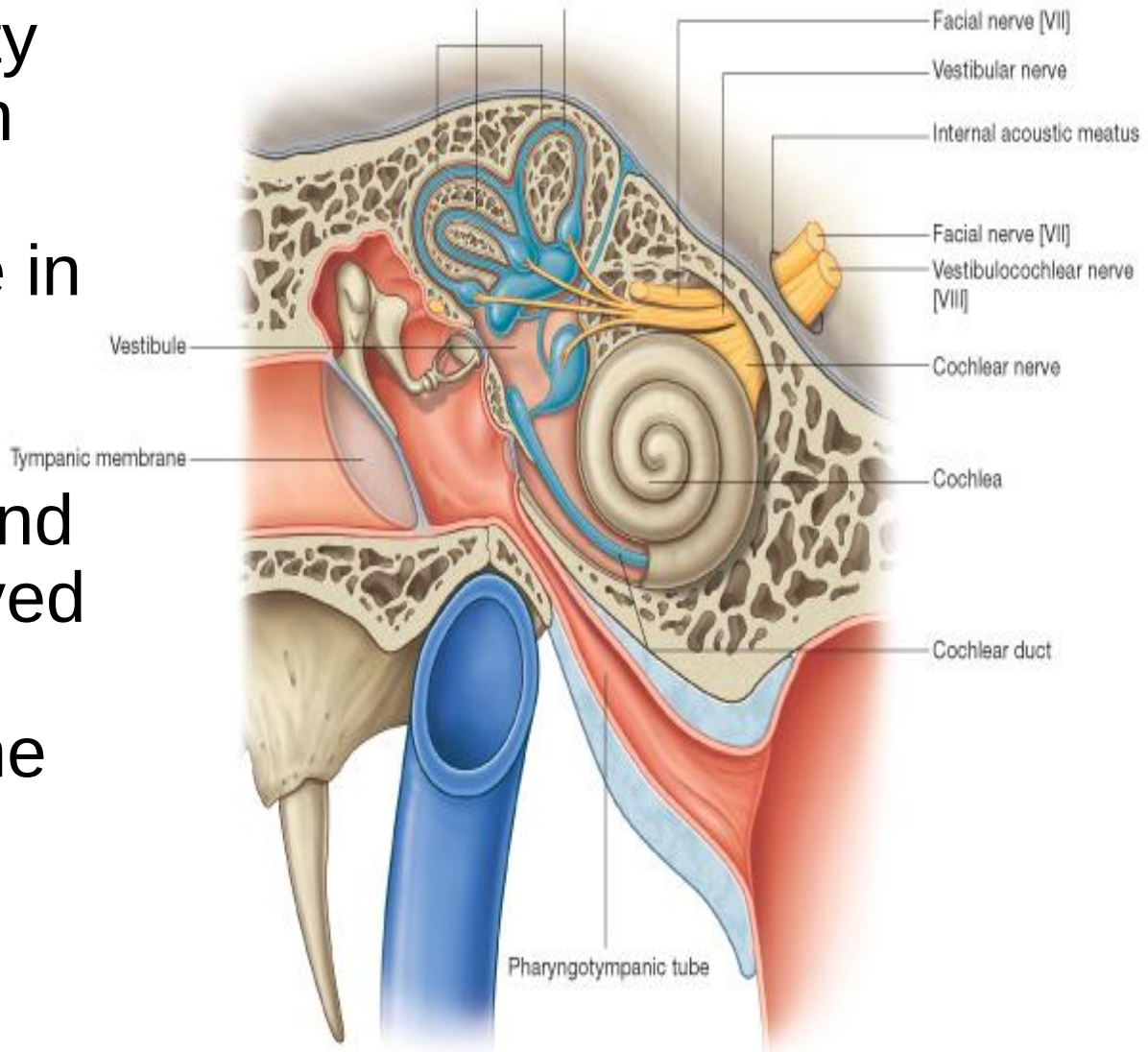
Referred otalgia



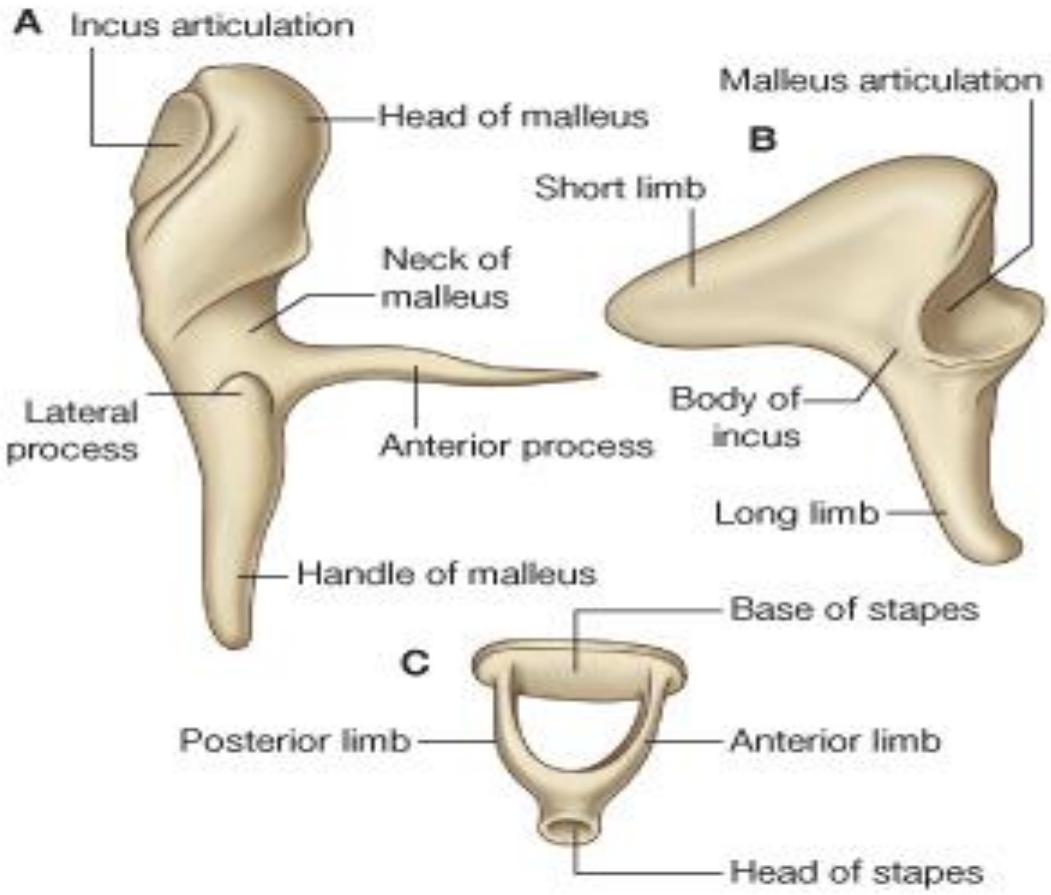

Middle ear
Malleus
External acoustic meatus
Tympanic membrane
Pharyngotympanic tube

•TYMPANIC CAVITY (TYMPANUM)

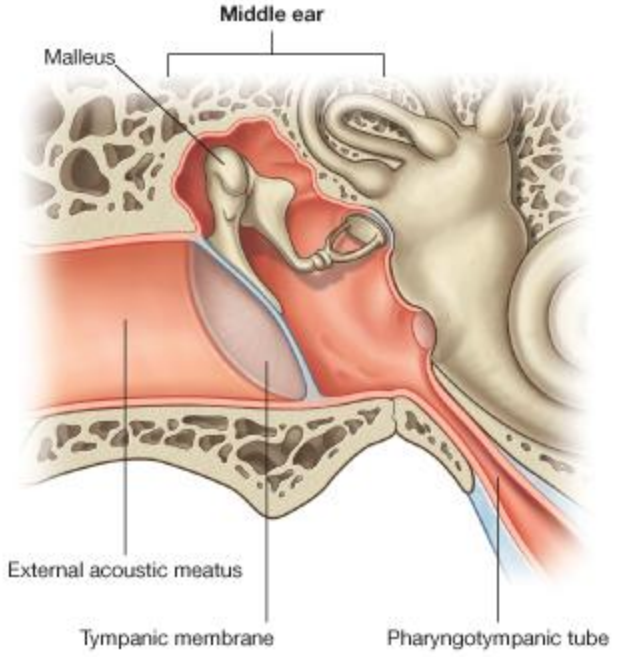
- The tympanic cavity or middle ear is an irregular, laterally compressed space in the temporal bone,
- lined by mucoperiosteum and containing air derived from the nasopharynx via the pharyngotympanic tube.



- It contains a train of three movable ossicles, which connect the lateral to the medial wall to transmit vibrations of the tympanic membrane across the cavity of the middle ear to the cochlea

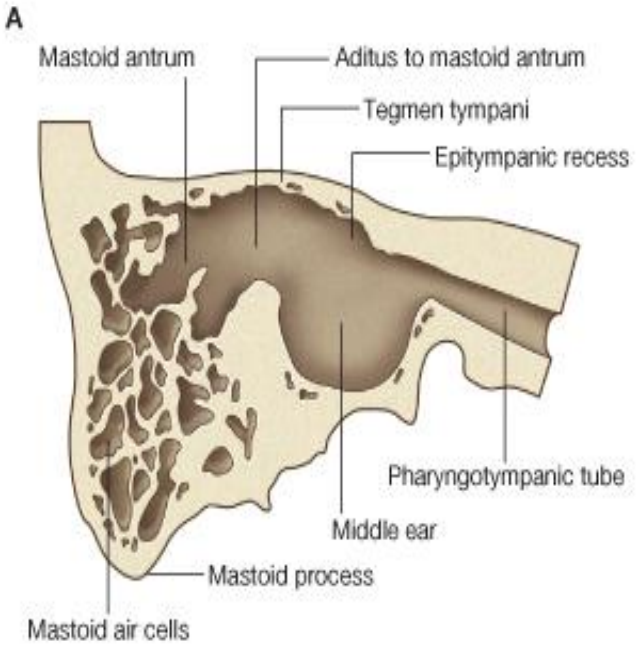


- The cavity has two parts: the tympanic cavity proper, opposite the membrane,
- and an epitympanic recess, above its level.
- The latter contains the upper half of the malleus and most of the incus.
- Including the recess, the vertical and anteroposterior diameters of the cavity are each about 15 mm;
- the transverse is about 6 mm above
- and 4 mm below but
- opposite the umbo it is only 2 mm.

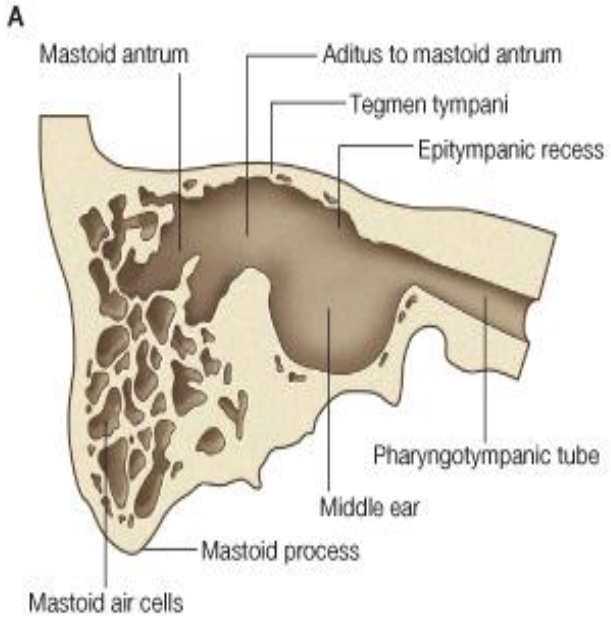


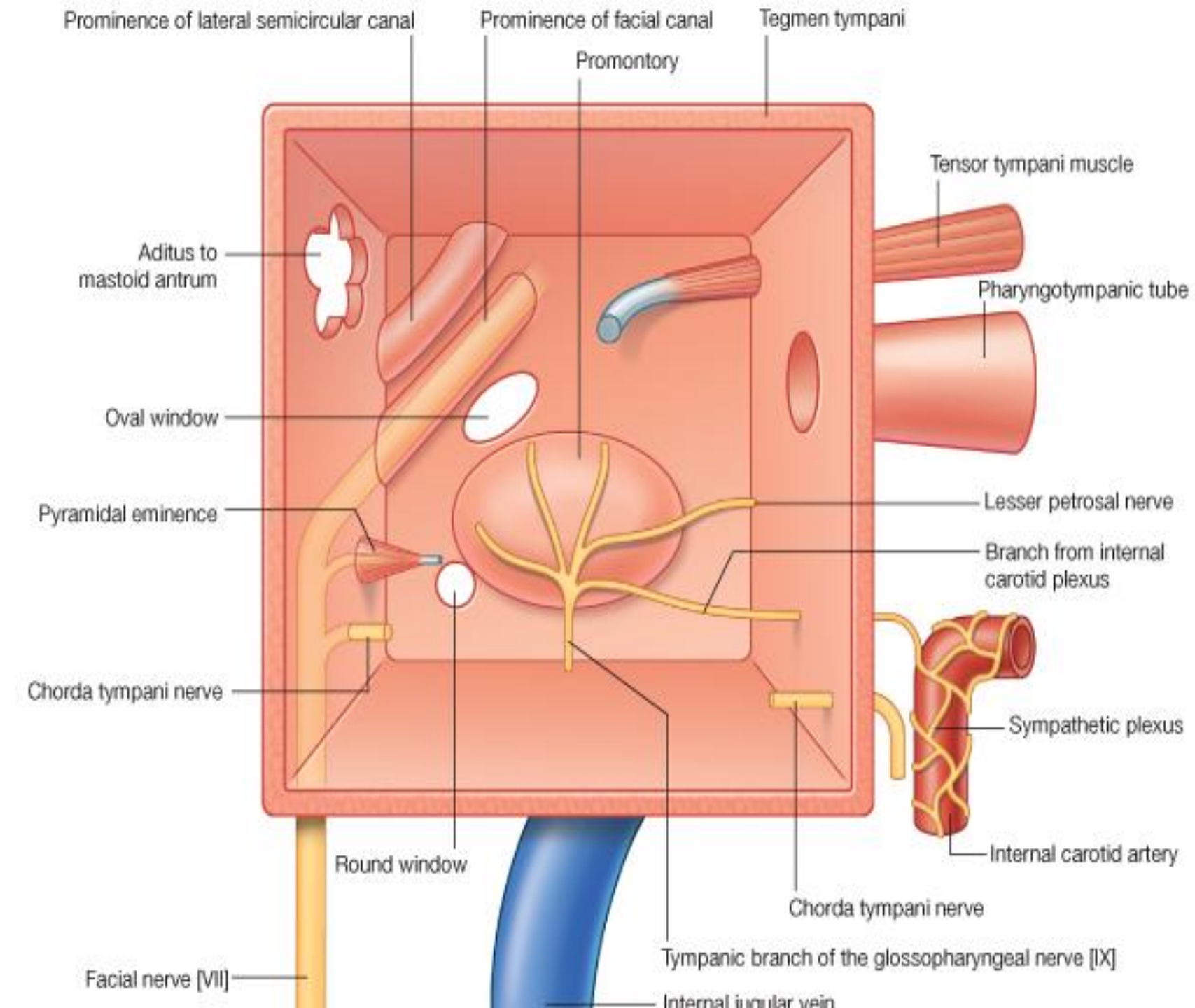
- Boundaries of the Tympanic Cavity

- The cavity is bounded
- laterally by the tympanic membrane and
- medially by the lateral wall of the internal ear.
- posteriorly with the mastoid antrum and via this with the mastoid air cells;
- anteriorly it communicates with the pharyngotympanic tube .



- **The Roof of the Tympanic Cavity**
- A thin plate of compact bone, the tegmen tympani, separates the cranial and tympanic cavities, forming much of the anterior surface of the petrous temporal bone.
- The tegmen tympani is prolonged posteriorly to roof the mastoid antrum and anteriorly to cover the canal for the tensor tympani.
- In youth, the unossified petrosquamosal suture may allow the spread of infection from the tympanic cavity to the meninges.
- In adults, veins from the tympanic cavity traverse this suture to the **superior petrosal or petrosquamous sinus** and may also transmit infection to these structures .




Prominence of lateral semicircular canal
Prominence of facial canal
Tegmen tympani
Promontory
Tensor tympani muscle
Aditus to mastoid antrum
Pharyngotympanic tube
Oval window
Pyramidal eminence
Lesser petrosal nerve
Branch from internal carotid plexus
Chorda tympani nerve
Sympathetic plexus
Internal carotid artery
Round window
Chorda tympani nerve
Tympanic branch of the glossopharyngeal nerve [IX]
Facial nerve [VII]
Internal jugular vein

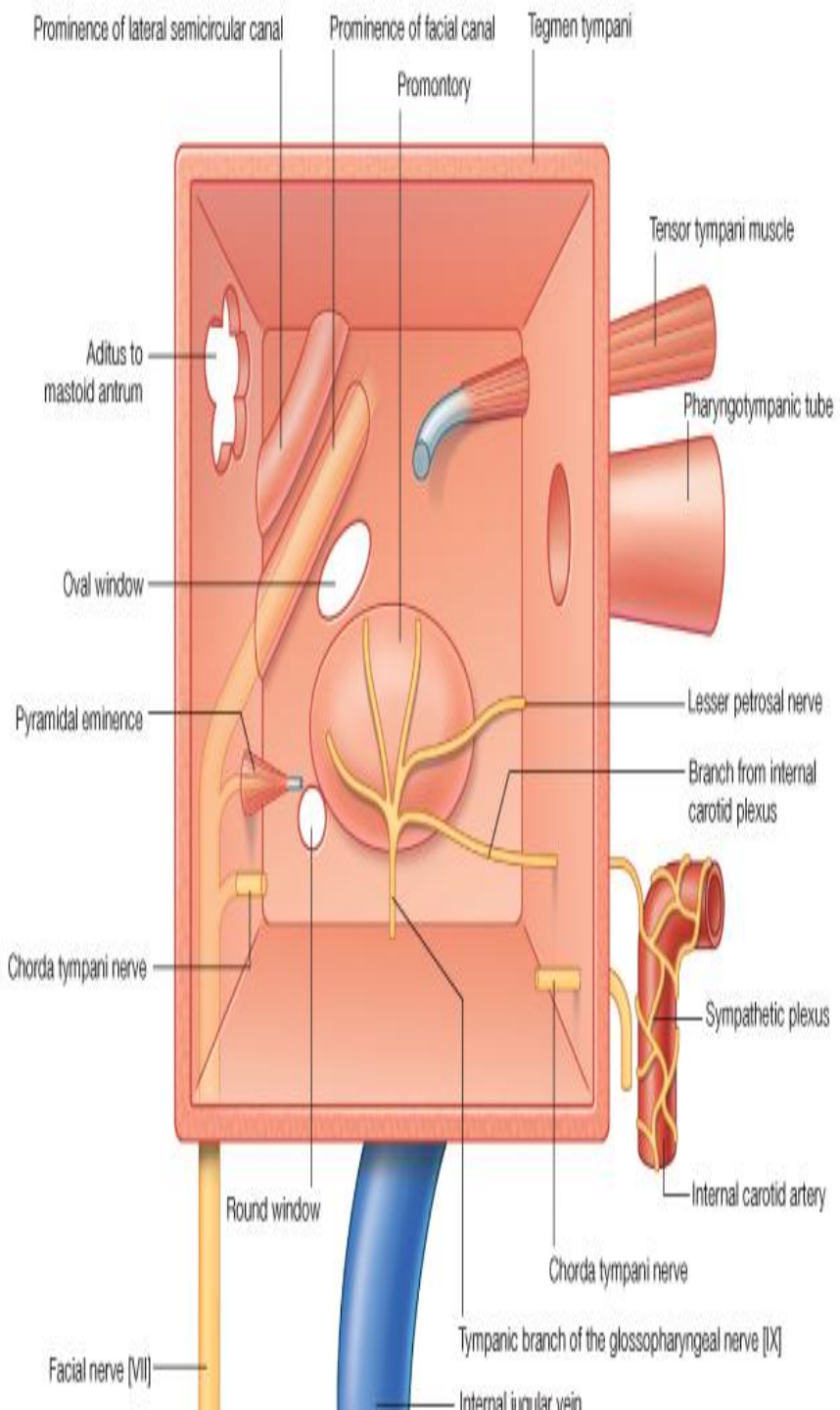
- **The Floor of the Tympanic Cavity**
- The floor is a narrow, thin, convex plate of bone separating the cavity from the superior bulb of the internal jugular vein; bone may be patchily deficient here and the tympanic cavity and the vein are then separated only by mucous membrane and fibrous tissue.

- Near the medial wall is a small aperture for the tympanic branch of the **glossopharyngeal nerve**.

The Lateral Wall of the Tympanic Cavity

- The lateral wall consists mainly of the **tympanic membrane** but is partly also composed of the **ring of bone** to which the membrane is attached.
- The ring is deficient or notched above and near this region are the openings of the anterior and posterior canaliculi for the chorda tympani and also the petrotympanic fissure.

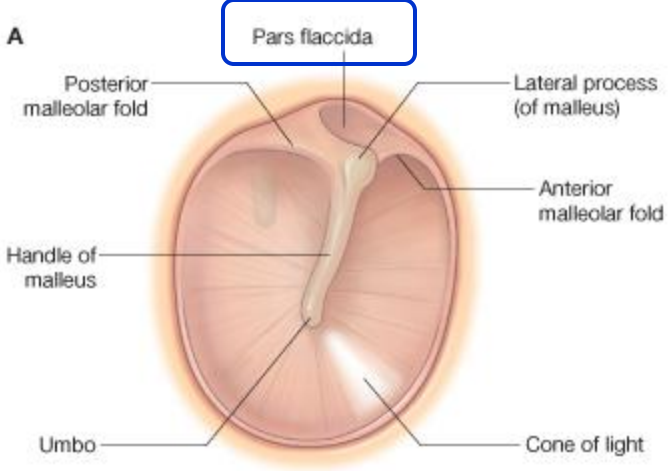
- The **posterior canaliculus** for the chorda tympani nerve is situated in the angle between the posterior and lateral walls of the tympanic cavity just behind the tympanic membrane and level with the upper end of the handle of the malleus; it leads into a minute canal which descends in front of the facial canal and ends in it about 6 mm above the stylomastoid foramen. Through it the chorda tympani nerve and a branch of the stylomastoid artery enter the tympanic cavity



- The **petrotympanic fissure** opens just above and in front of the ring of bone to which the tympanic membrane is attached.
- it is a mere slit about 2 mm in length, containing the anterior process and anterior ligament of the malleus .
- it transmits to the tympanic cavity the maxillary artery's anterior tympanic branch.

- The anterior canaliculus for the chorda tympani opens at the medial end of the petrotympanic fissure; through it the chorda tympani leaves the tympanic cavity.

The Tympanic Membrane

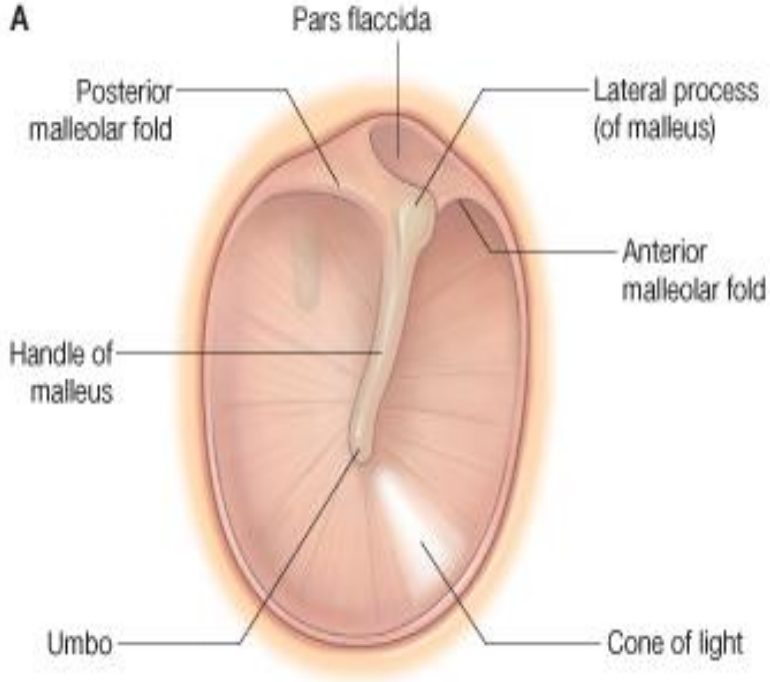


The tympanic membrane separates the tympanic cavity from the external meatus.

- It is thin and semi-transparent, almost oval, though somewhat broader above than below, and is placed at an angle of about 55° with the meatal floor.

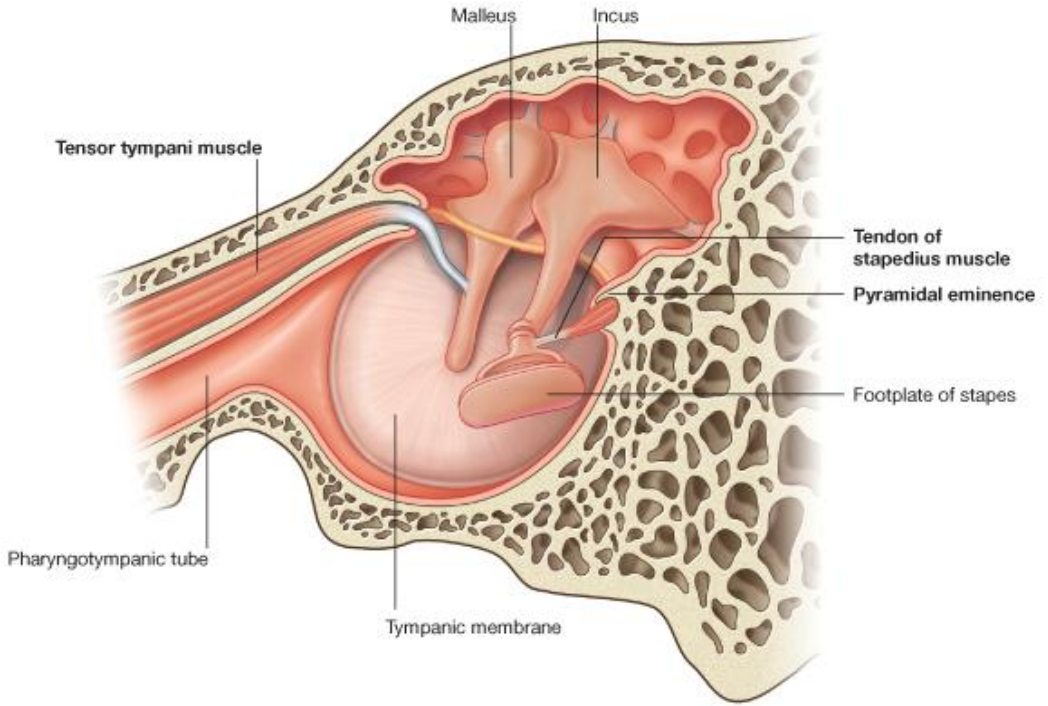
- Its longest, antero-inferior diameter is from 9–10 mm and its shortest is from 8–9 mm.
- Most of its circumference is a thickened fibrocartilaginous ring attached to the **tympanic sulcus** at the medial end of the meatus;
- this sulcus is deficient superiorly

- the anterior and posterior malleolar folds pass to the lateral process of the malleus,

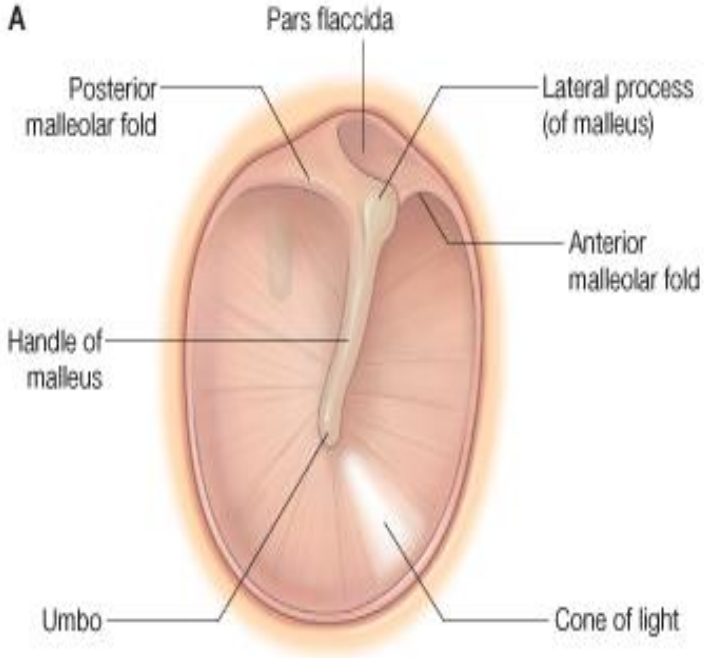


leaving between them the triangular **pars flaccida**, a thin, lax part of the membrane.

The membrane is elsewhere taut the **pars tensa.**



- The handle of the malleus is firmly attached to the membrane's internal surface as far as its centre, the umbo, which projects towards the tympanic cavity.



- Though this membrane as a whole is convex medially, its radiating fibres are curved with their concavities directed upwards.

Histologically

the tympanic membrane has three strata:

- an outer cuticular stratum

is continuous with the thin skin of the meatus and is keratinized, stratified squamous in type, devoid of dermal papillae and hairless.

- an intermediate fibrous
- an inner mucous.

The mucous stratum is a part of the mucosa of the tympanic cavity

Arteries of the Tympanic Membrane

- They arise from:
- the maxillary artery's deep auricular branch (to the outer, cuticular stratum).
- the stylomastoid branch of the occipital or
- the posterior auricular artery and
- the tympanic branch of the maxillary to the internal mucosa.

Veins of the Tympanic Membrane

- The superficial veins drain to the external jugular;
- those in the deep surface
- drain partly to the transverse sinus and dural veins
- and partly to the venous plexus of the pharyngotympanic tube.

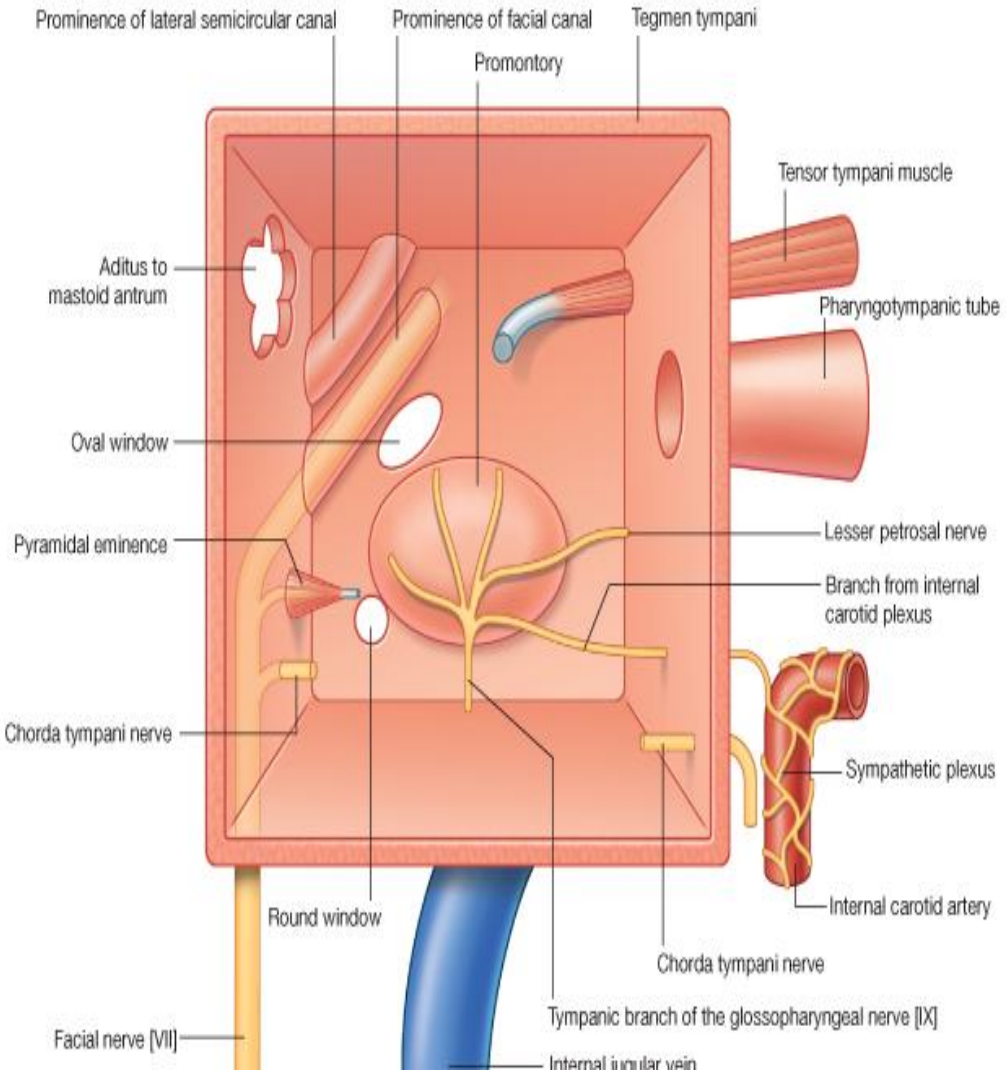
Nerve Supply of the Tympanic Membrane

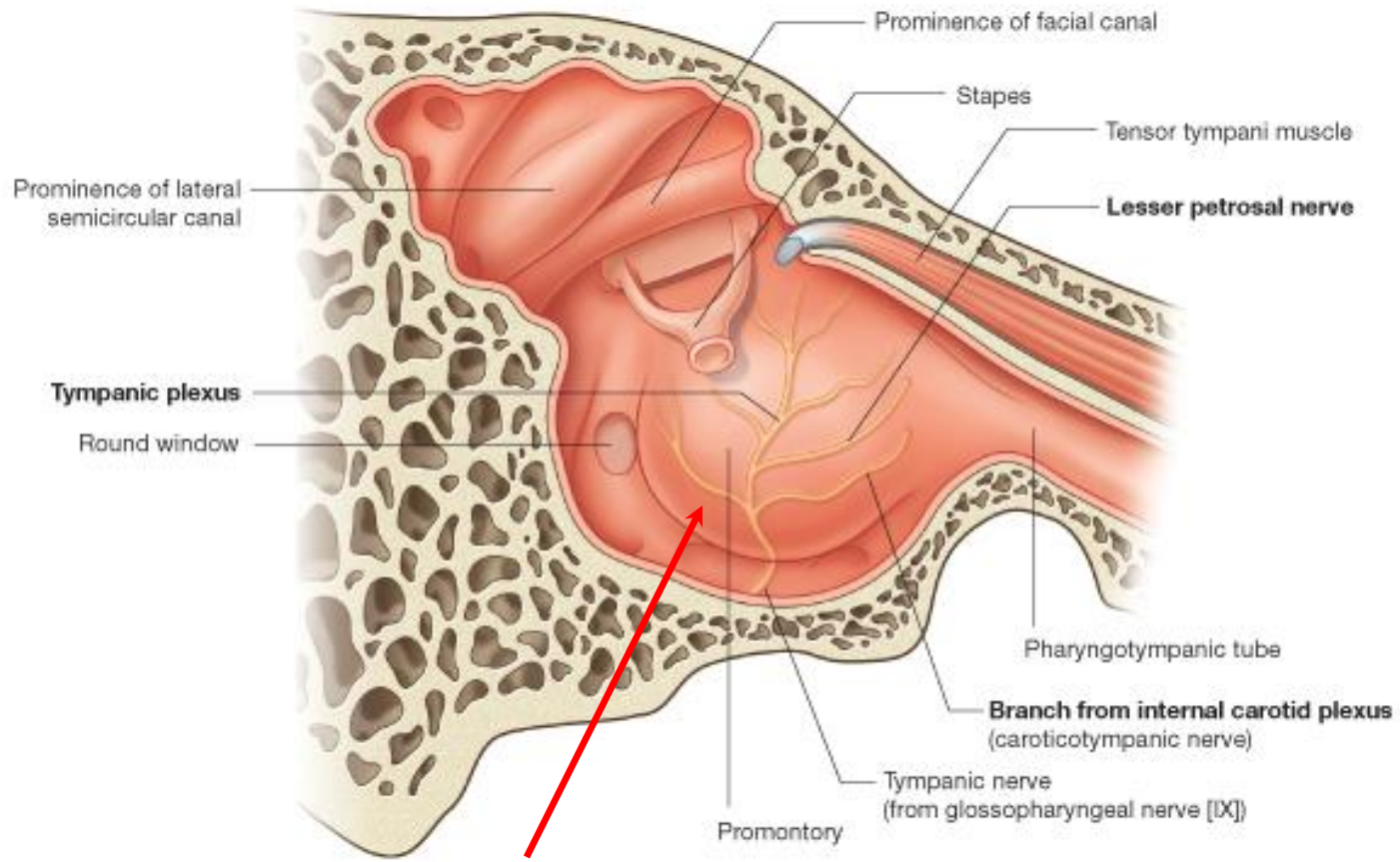
- This is from:
- the auriculotemporal branch of the mandibular nerve,
- the auricular branch of the vagus,
- the tympanic branch of the glossopharyngeal and possibly from the facial nerve.

The Medial Wall of the Tympanic Cavity

- The medial wall is also the lateral boundary of the internal ear.
- Its features are the:

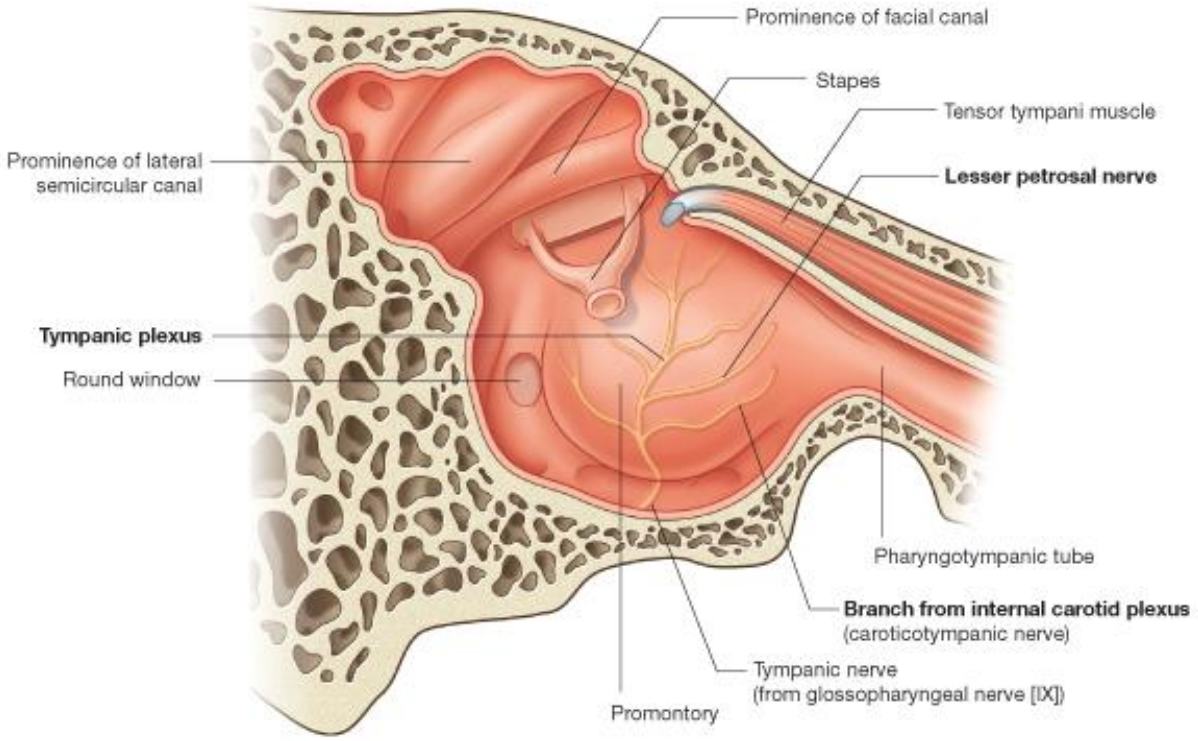
- promontory,
- fenestra vestibuli,
- fenestra cochleae
- facial prominence.





- The rounded promontory, minutely grooved by the nerves of the tympanic plexus, overlies the lateral projection of the basal turn of the cochlea.

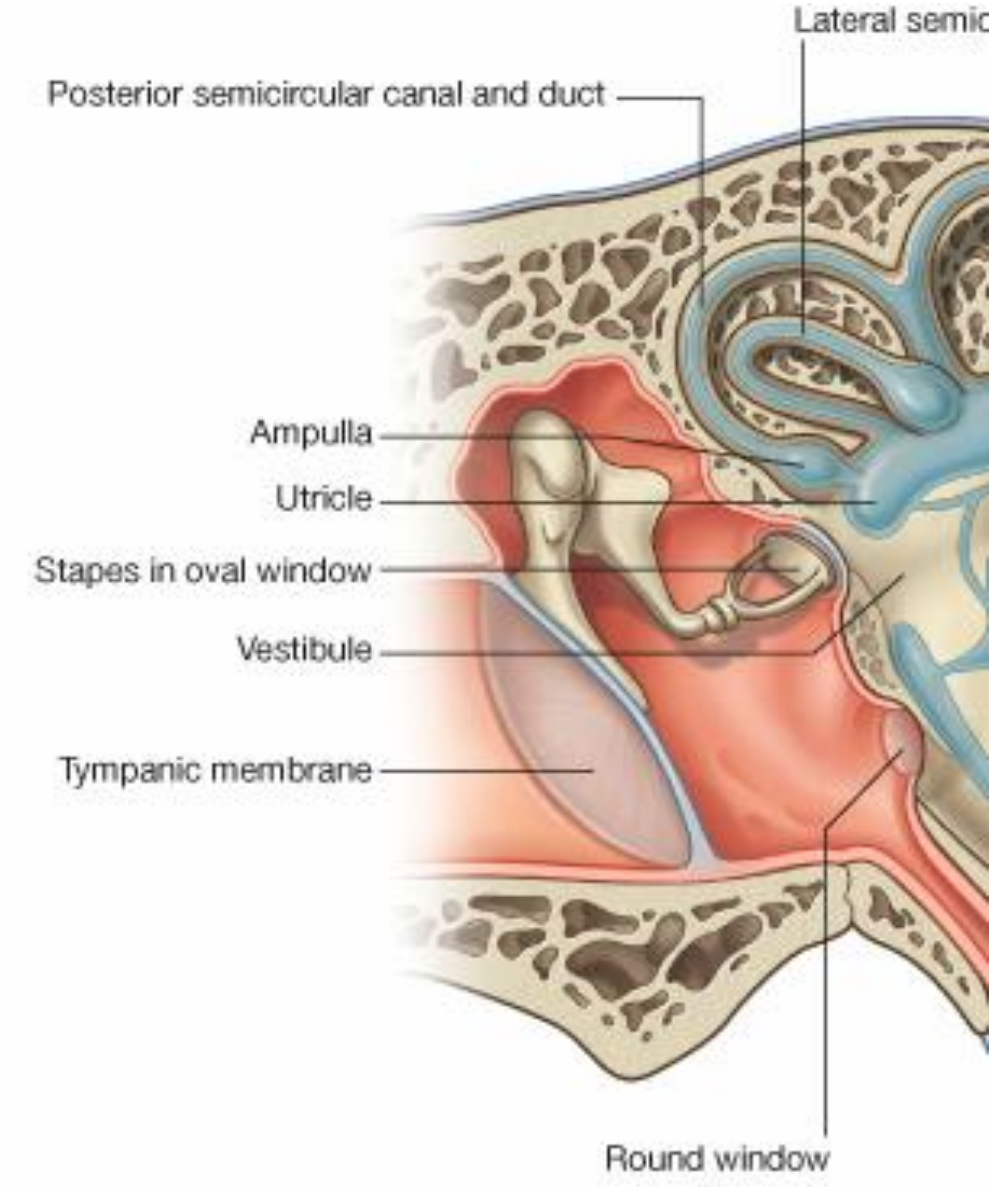
a minute spicule of bone frequently connects the promontory to the pyramidal eminence of the posterior wall



- Anterior to the promontory the apex of the cochlea lies near the medial wall of the tympanum.
- Behind the promontory the sinus tympani indicates the position of the ampulla of the posterior semicircular canal.

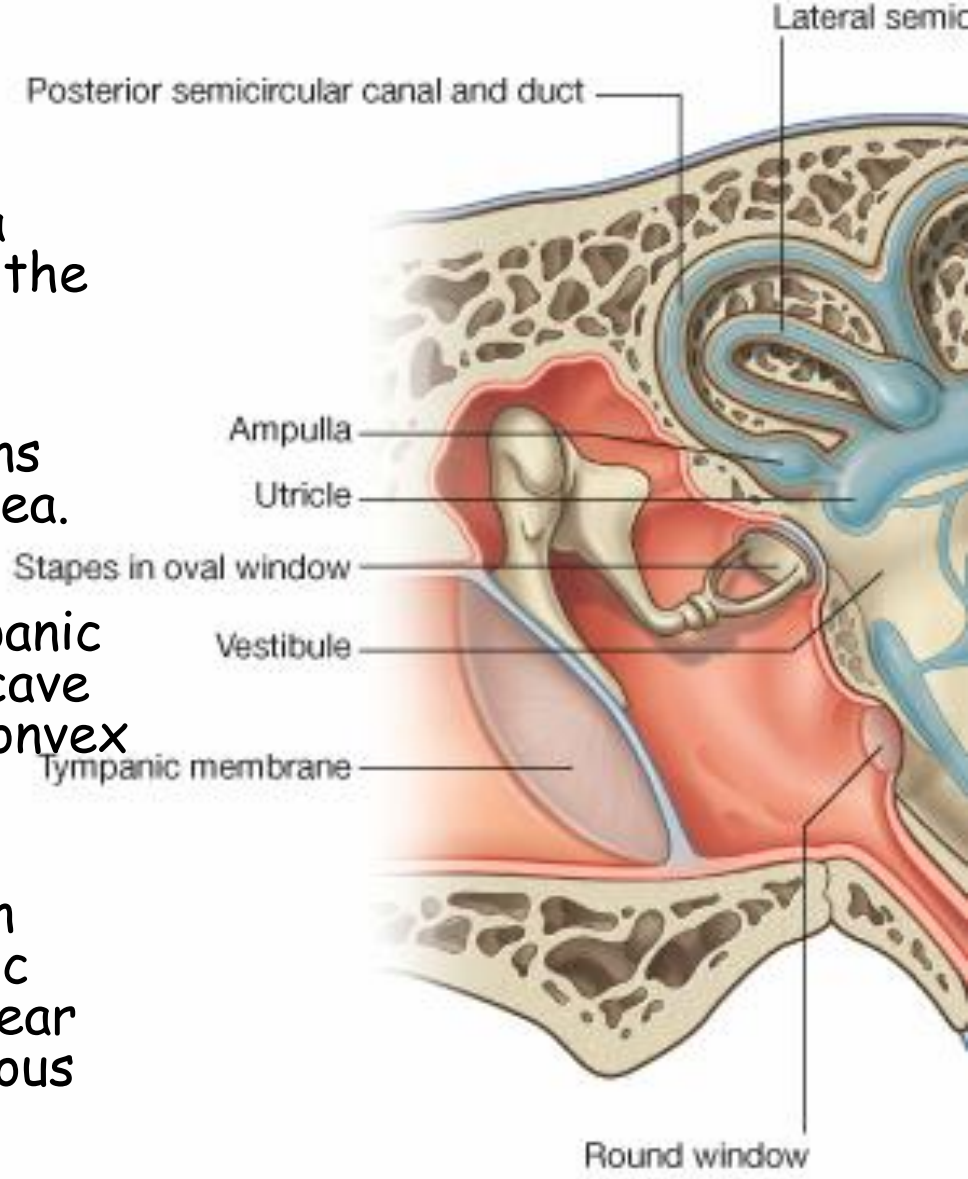
The fenestra vestibuli (f. ovalis)

- is a kidney-shaped opening posterosuperior to the promontory,
- connecting the tympanic cavity to the vestibule.
- It is occupied by the base of the stapes, the circumference of which is attached to the fenestral margin by an annular ligament.

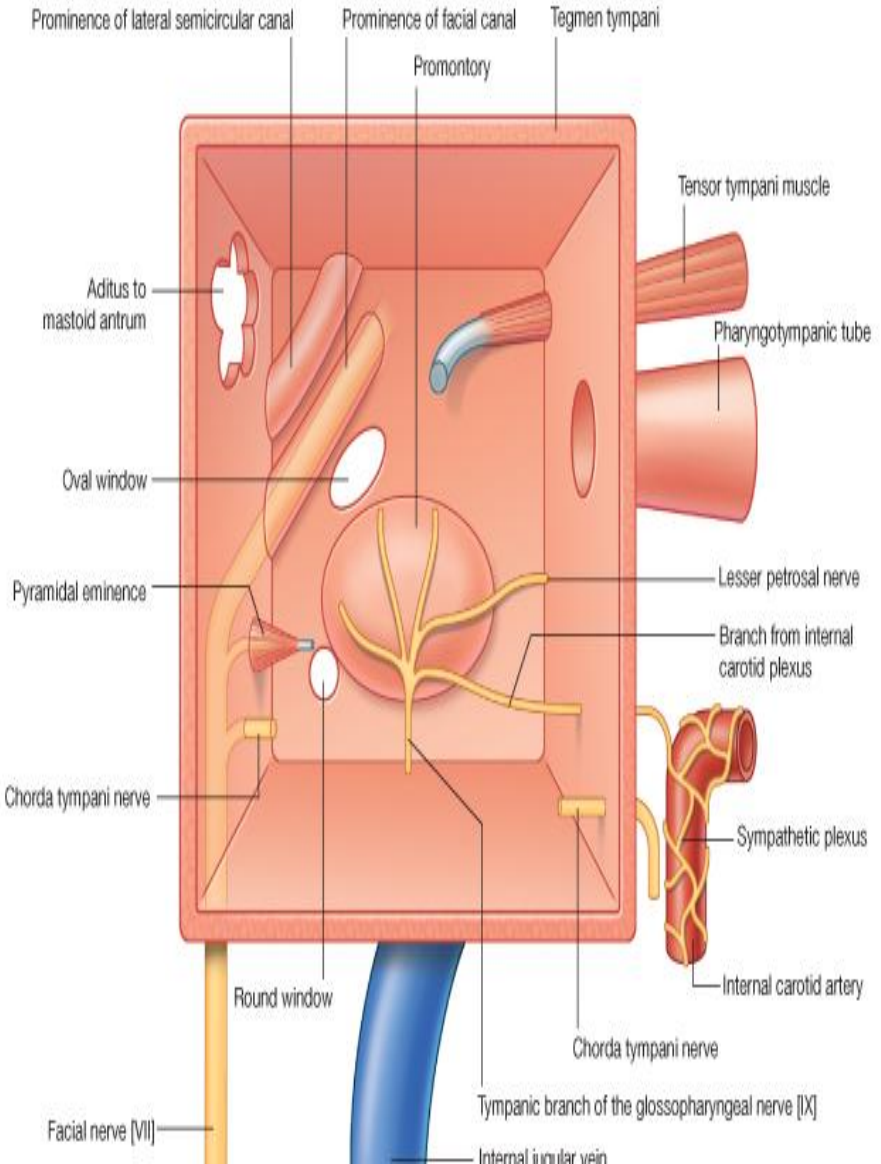


The fenestra cochlea
(f. rotunda)

- is postero-inferior to the fenestra vestibuli and separated from it by the posterior part of the promontory.
- It is placed very obliquely; it opens into the scala tympani of the cochlea.
- It is closed by the secondary tympanic membrane, which is somewhat concave towards the tympanic cavity and convex towards the cochlea.
- The membrane has three layers: an external derived from the tympanic mucosa, an internal from the cochlear lining membrane and a middle, fibrous layer.



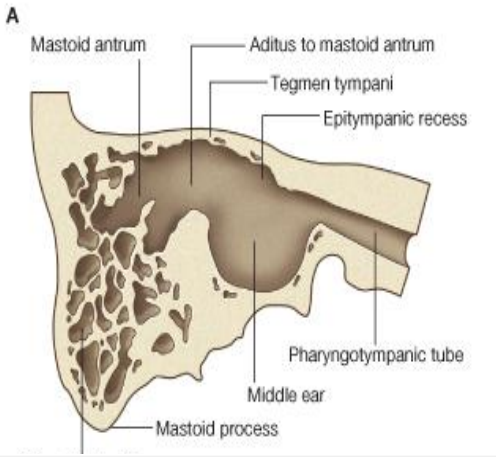
- **The prominence of the facial nerve canal** indicates the position of the upper part of a bony canal for the facial nerve.
- The canal, its lateral wall sometimes being partly deficient, traverses the medial tympanic wall from before backwards, just above the fenestra vestibuli, then curves down into the posterior wall of the cavity.

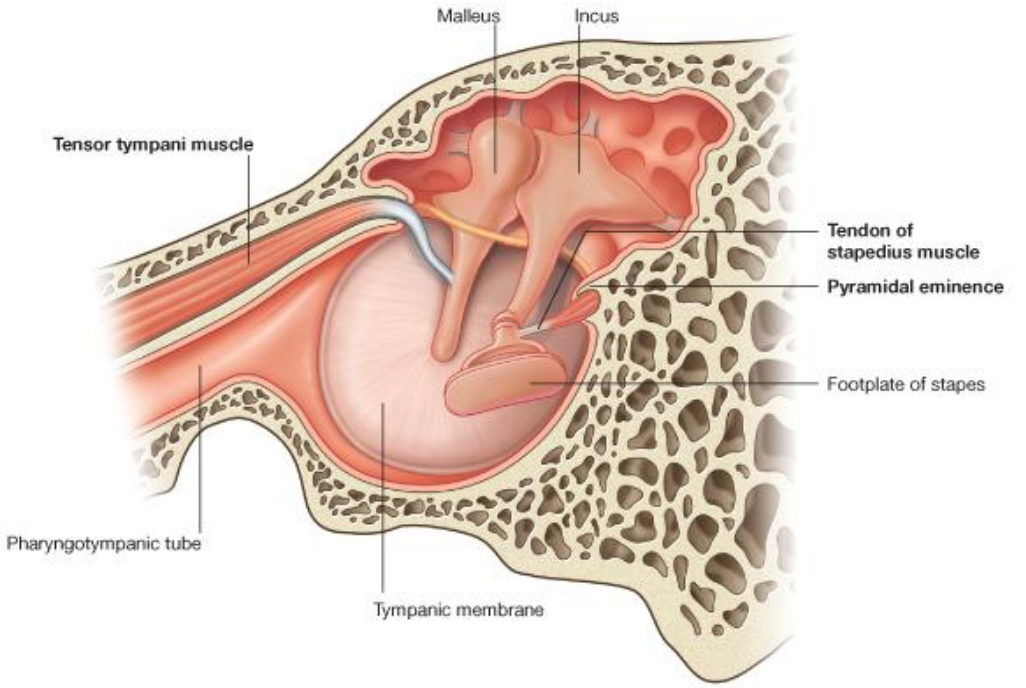


The Posterior Wall of the Tympanic Cavity

- Wider above than below,
- its main features are the

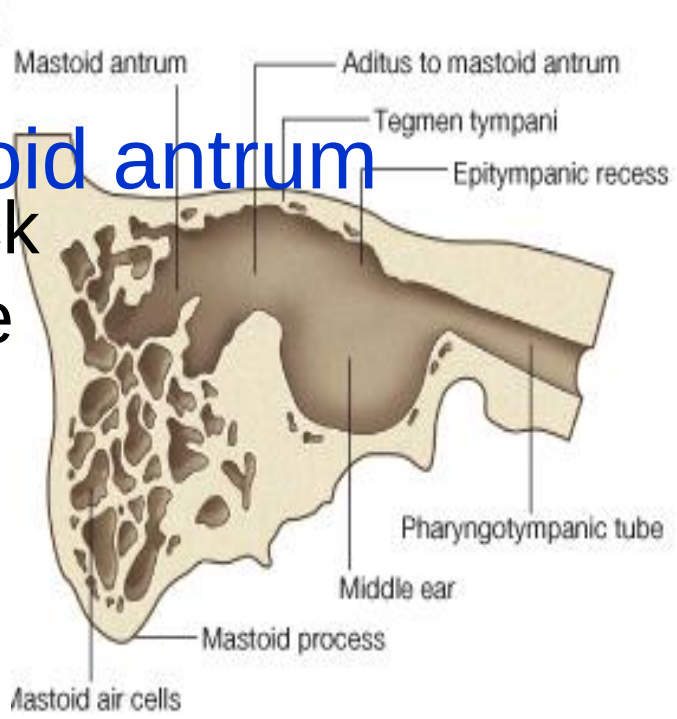
- aditus to the mastoid antrum,
- the pyramid and
- the fossa incudis.

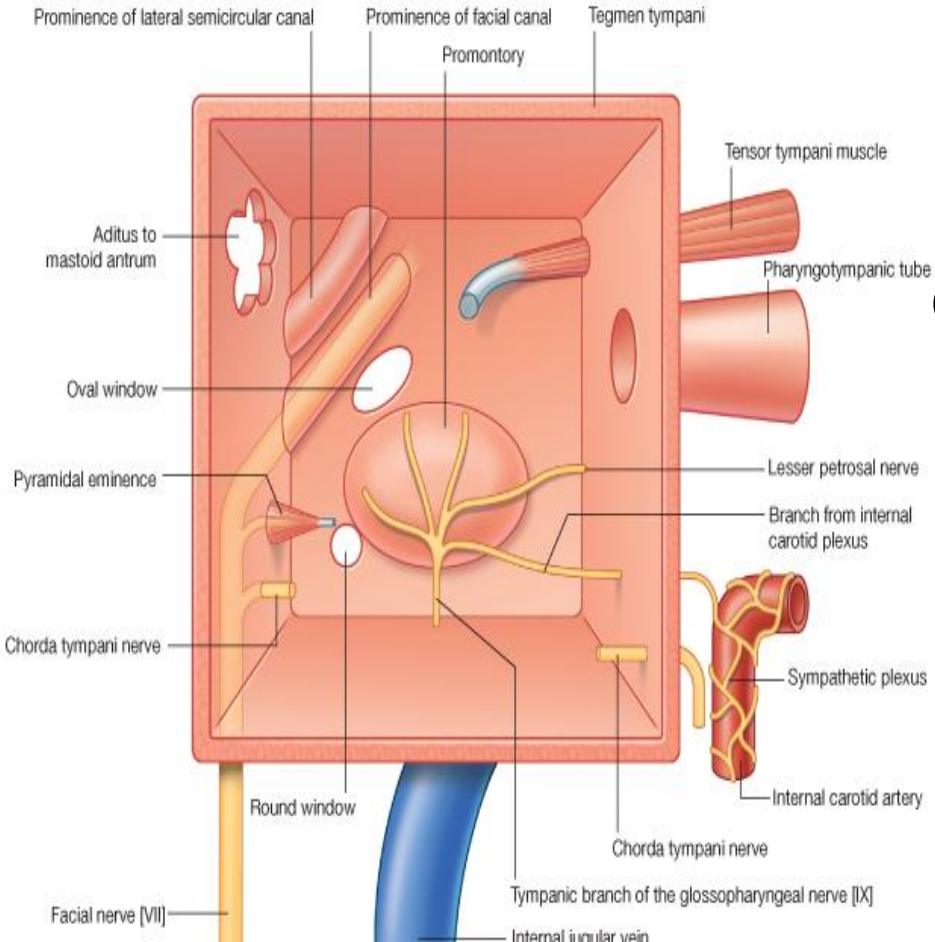




The aditus to the mastoid antrum

A large irregular aperture, leads back from the epitympanic recess into the upper part of the mastoid antrum.

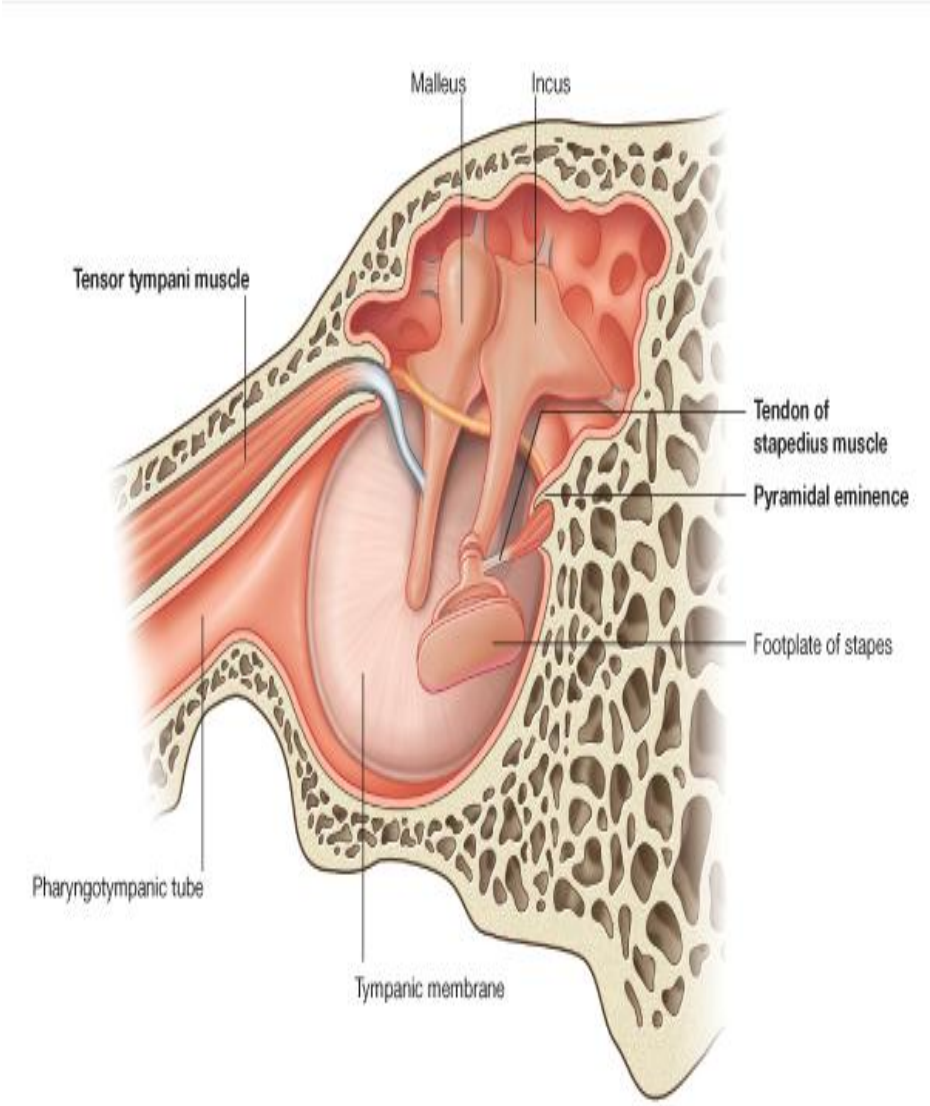




On the medial wall of the aditus is a rounded eminence, above and behind the prominence of the facial nerve canal, due to the underlying lateral semicircular canal.

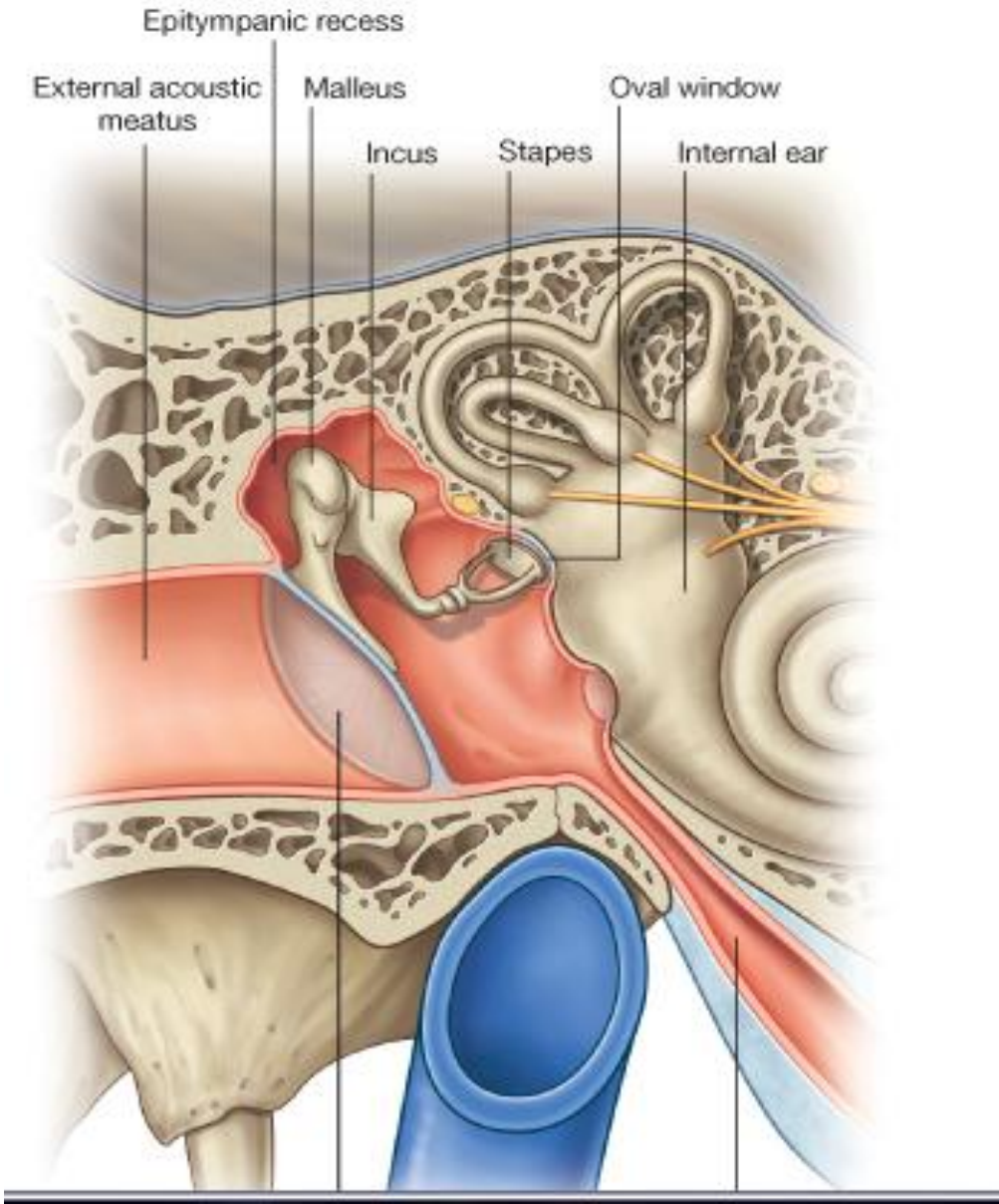
The pyramidal eminence

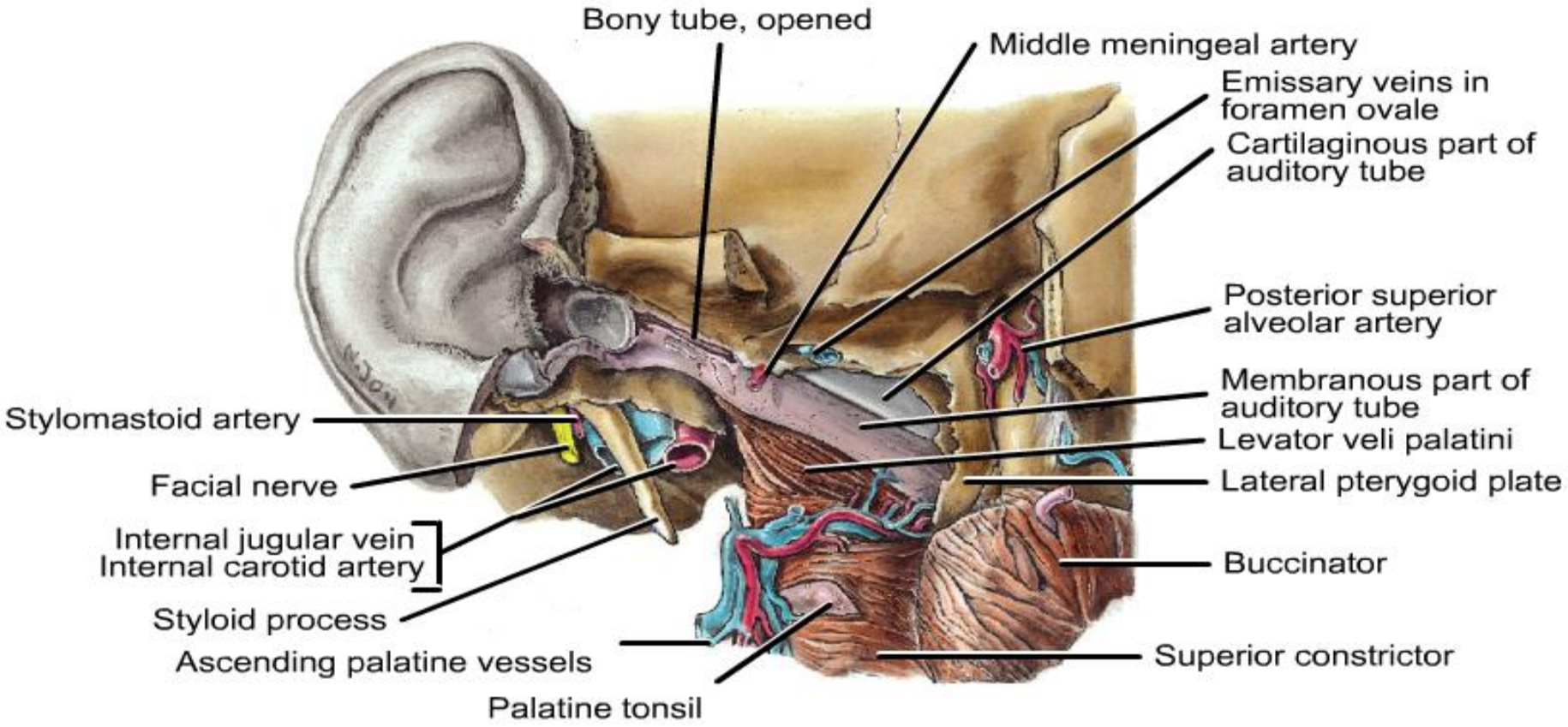
- is just behind the fenestra vestibuli and anterior to the vertical part of the facial nerve canal.
- it contains the stapedius muscle.
- a small apical aperture transmits the muscle's tendon.
- Its cavity is prolonged down and back in front of the facial nerve canal and communicates with the latter by an aperture through which a small branch of the facial nerve passes to the stapedius



The fossa incudis

- , a small depression low and posterior in the epitympanic recess, contains the short process of the incus, fixed to the fossa by ligamentous fibres.





.

1. The general direction of the tube is superior, posterior, and lateral from the nasopharynx to tympanic cavity;
2. The funnel-shaped pharyngeal orifice of the tube is situated just posterior to the inferior concha of the nose;
3. The cartilaginous part of the tube, rests throughout its length on the levator veli palatini muscle;
4. The bony part of the tube passes lateral to the carotid canal; it is narrow at the isthmus, where it joins the cartilaginous part, and wider at its tympanic orifice.

Thank you

PREPERED BY :

Prof. Dr. Talib Jawad

DEAN OF COLLEGE OF MEDICINE

DYIALA UNIVERSITY