

EAR - CLINICAL PROBLEMS

OUTER EAR

- Wax
- Foreign body
- Otitis externa

INNER EAR

- Otitis media - Acute (\pm blocked auditory tube)
Chronic (cholesteatoma, glue ear)
- Perforation of eardrum
 - Infective
 - Traumatic
 - Direct injury
 - Barotrauma
- CSF leak with fractured skull

DEAFNESS -Conductive and Neural

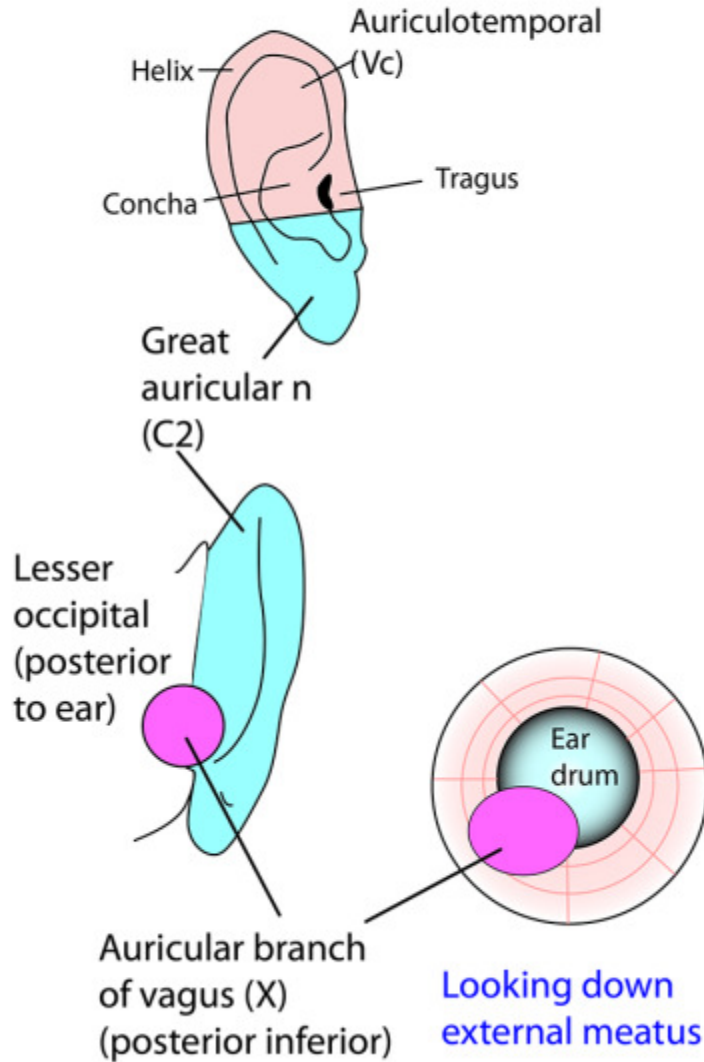
- Post infection
- Traumatic dislocation of ossicles
- Otosclerosis
- Noise injury
- Genetic & senile
- Rubella in pregnancy
- Viruses & drugs
- Tumours of nerves (acoustic neuroma)

VERTIGO (Dizziness)

- Acute labyrinthitis
- Meniere's disease (attacks with deafness & tinnitus)

EAR - RIGHT PINNA & EXTERNAL MEATUS

NERVE SUPPLY



Blood supply:

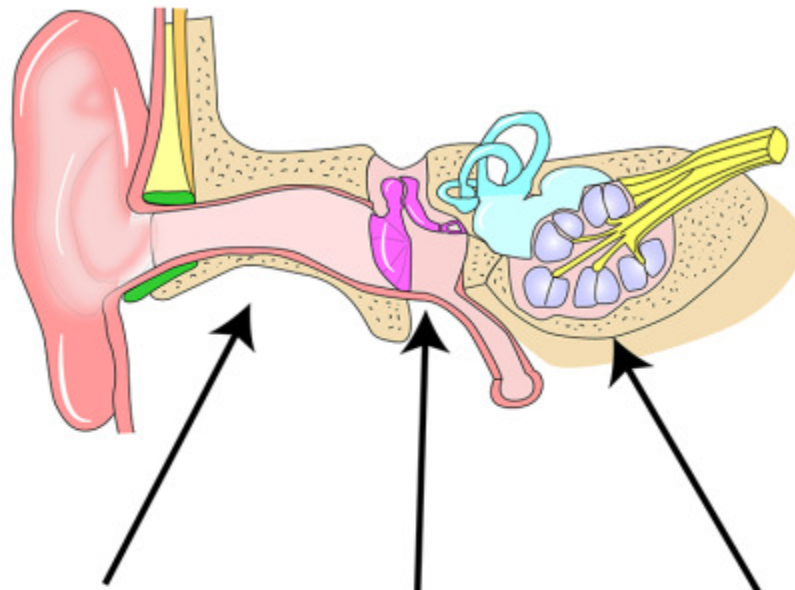
- Posterior auricular
- Superficial temporal
- Deep auricular (maxillary)

Lymph nodes:

- Pre-auricular
- Mastoid
- Superficial cervical

External meatus/drum is supplied by **auriculotemporal** with some **facial (VII)** via tympanic plexus (NB: Ramsay- Hunt syndrome)

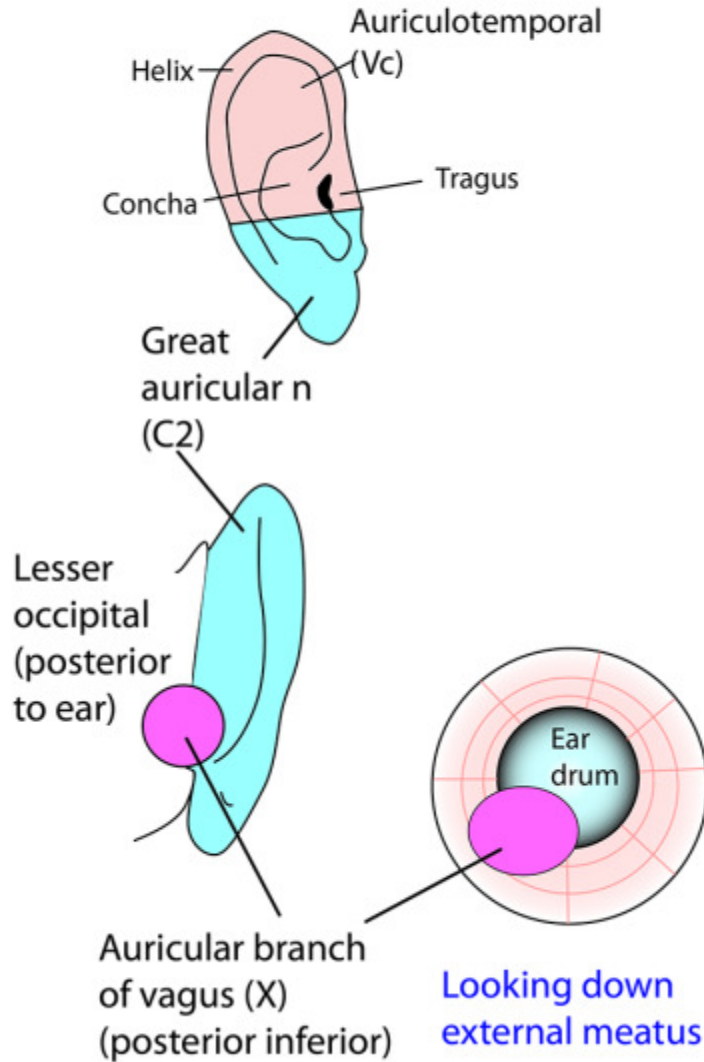
EAR - OVERVIEW



- | EXTERNAL | MIDDLE | INTERNAL |
|---|--|---|
| <ul style="list-style-type: none"> • Pinna <ul style="list-style-type: none"> • Amplification • Localisation • Elastic cartilage • Vascular • External meatus <ul style="list-style-type: none"> • 3cm long • 2/3 bone • 1/3 cartilage • Curves forwards • Hairs • Glands <ul style="list-style-type: none"> • Sebaceous • Ceruminous • Outer eardrum | <ul style="list-style-type: none"> • Ossicles • Facial nerve • Chorda tympani • Inner eardrum • Auditory tube <ul style="list-style-type: none"> • Opens on swallowing to equalise pressure • 3.5cm long • 1/3 bone • 2/3 cartilage • 30 degrees downwards • 45 degrees ant/med • Tubal tonsil at exit in nasopharynx • Mucosa valvelike • Sensory ns - Vb & IX | <ul style="list-style-type: none"> • Labyrinth <ul style="list-style-type: none"> • Cochlea • Semicircular canals |

EAR - RIGHT PINNA & EXTERNAL MEATUS

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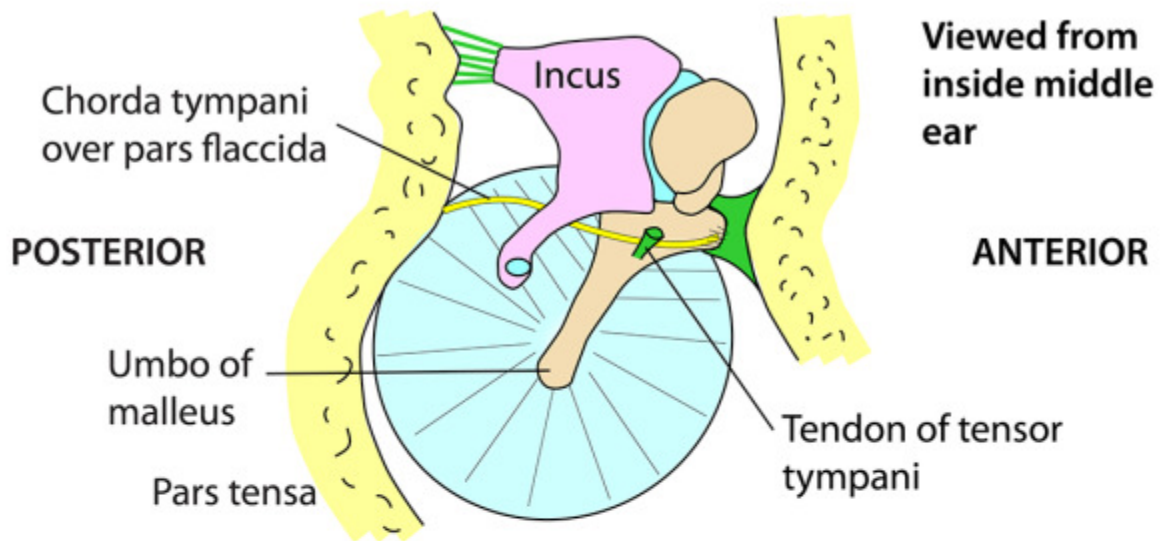
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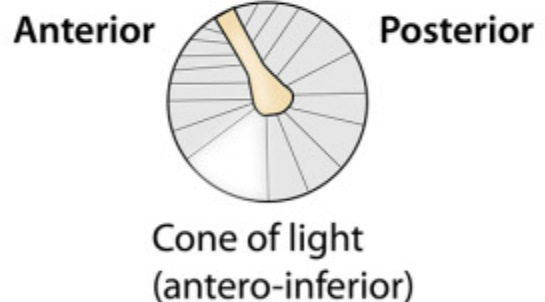
MIDDLE EAR - LEFT TYMPANIC MEMBRANE



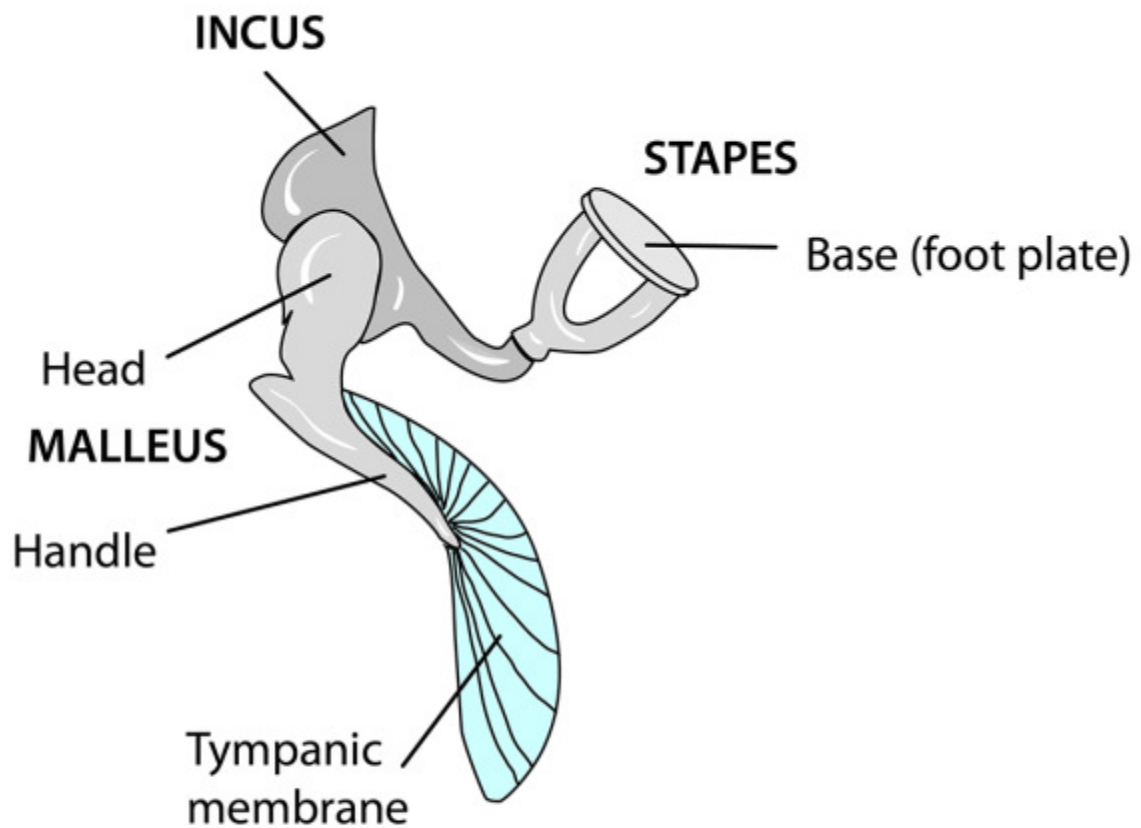
TYMPANIC MEMBRANE

- 3 layers
- Inner - low columnar
- Middle - fibrous
- Outer - stratified squamous
- 1cm diameter
- Pearly grey & shiny
- 55 degrees to horizontal
- Concave outwards
- Faces downwards, forwards & laterally
- Pulled inwards by tensor tympani
- Sensory supply
 - Inner - glossopharyngeal (IX)
 - Outer - auriculotemporal (Vc)
- Vibrates with incoming sound
- Needs equal air pressure on each side of it (see auditory tube)

View down an auroscope



MIDDLE EAR - OSSICLES



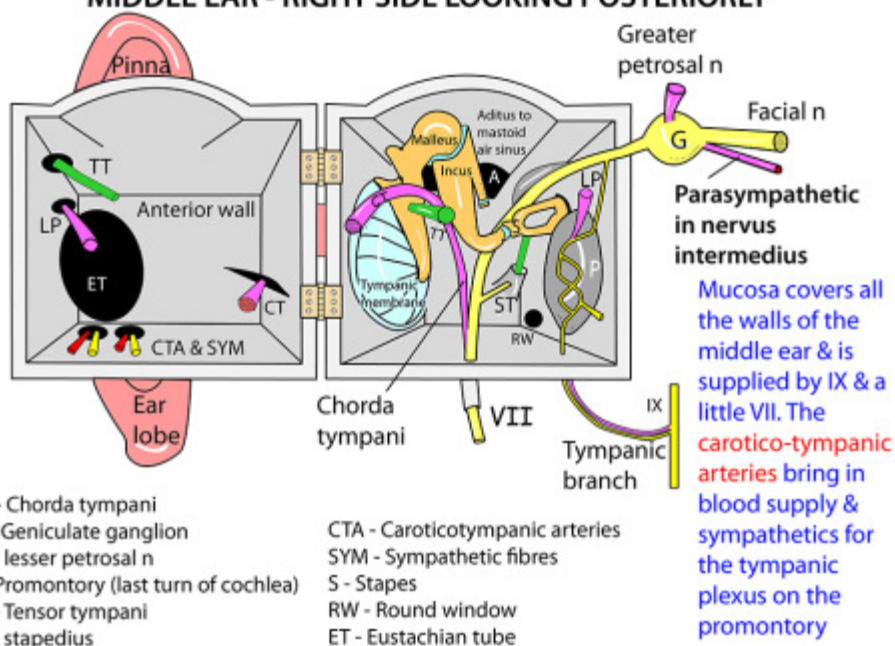
- They increase the amplitude of the vibrations 15-20 times because of:
 - a. leverage
 - b. eardrum to oval window ratio
- Synovial joints between them
- Almost adult size at birth

MIDDLE EAR - NOTES

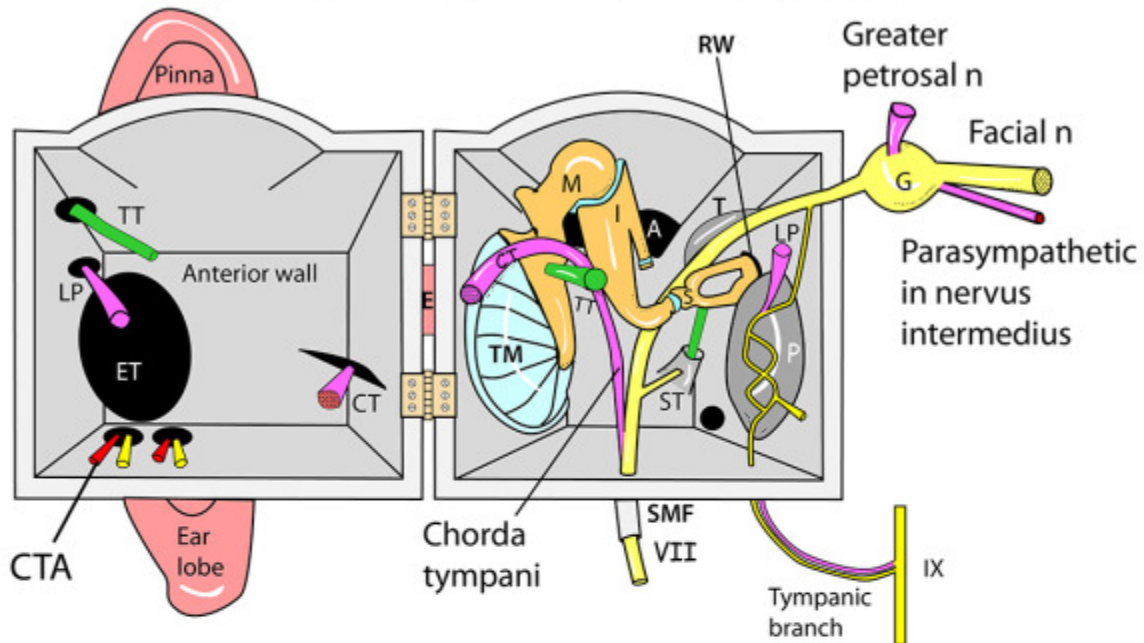
The middle ear:

- Transfers & enhances vibrations of the tympanic membrane by means of the ossicles - **malleus, incus and stapes**. The signal is then passed via the foot plate of the stapes in the oval window to the labyrinth of the inner ear.
- Is a small air filled cavity in the petrous part of the temporal bone
- Connects via an aditus posteriorly to the mastoid air sinus which contains air cells
- Connects to the nasopharynx via the auditory tube for access of air & to keep the air pressure equilibrated by opening with each swallow
- Contains two small muscles - tensor tympani (Vc) & stapedius (VII) which attach to malleus & stapes respectively, & dampen down movements of these ossicles to avoid over-vibration during low pitched sounds.
- Has the facial (VII) nerve passing through it from the internal acoustic meatus to the stylomastoid foramen. It is joined by nervus intermedius, carrying general sensory, taste & parasympathetic fibres, at the geniculate ganglion. Greater petrosal nerve leaves at this ganglion to pass eventually to the pterygopalatine ganglion. Facial nerve also gives a small motor branch to stapedius and then the chorda tympani leaves just before it exits the middle ear. The chorda tympani passes back into the middle ear, crosses the pars flaccida of the tympanic membrane then exits forwards from the middle ear finally to join the lingual nerve.
- Has a tympanic branch of the glossopharyngeal nerve (IX) supplying sensation to it & it also supplies parasympathetic to the parotid gland via the lesser petrosal nerve & otic ganglion.
- Has mucous membrane covering all its contents.
- Has a sensory supply largely from glossopharyngeal (IX) with a small contribution from facial (VII)
- Has blood supply from a tympanic branch of maxillary & a stylomastoid branch of posterior auricular artery.
- May fill with fluid or pus when infected & transmission of sound via the ossicles is less efficient than sound passing directly through the bone. This is tested with a tuning fork.

MIDDLE EAR - RIGHT SIDE LOOKING POSTERIORLY



MIDDLE EAR - RIGHT SIDE LOOKING POSTERIORLY

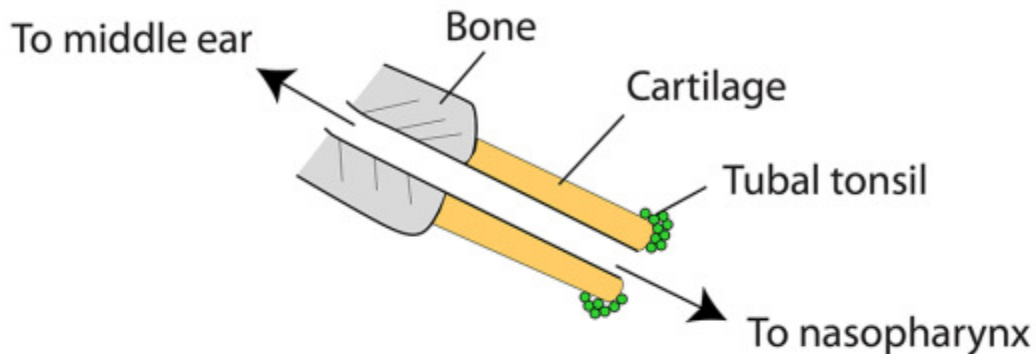


Right hand box is a view of the right middle ear looking posteriorly. The left hand box is the anterior wall of the right box. Hinges are to illustrate how it would close to become the anterior wall

- A = Aditus to mastoid air sinus
- E = External auditory meatus
- G = Geniculate ganglion
- I = Incus
- LP = lesser petrosal n
- M = Malleus
- P = Promontory (last turn of cochlea)
- RW = Round window
- S = Stapes
- ST = Stapedius
- SMF = Stylomastoid foramen (VII emerging)
- T = Bony tunnel for facial n

Mucosa covers all contents & is supplied by IX & a little VII. The carotico-tympanic arteries (CTA) bring in blood supply & sympathetics for the tympanic plexus on the promontory

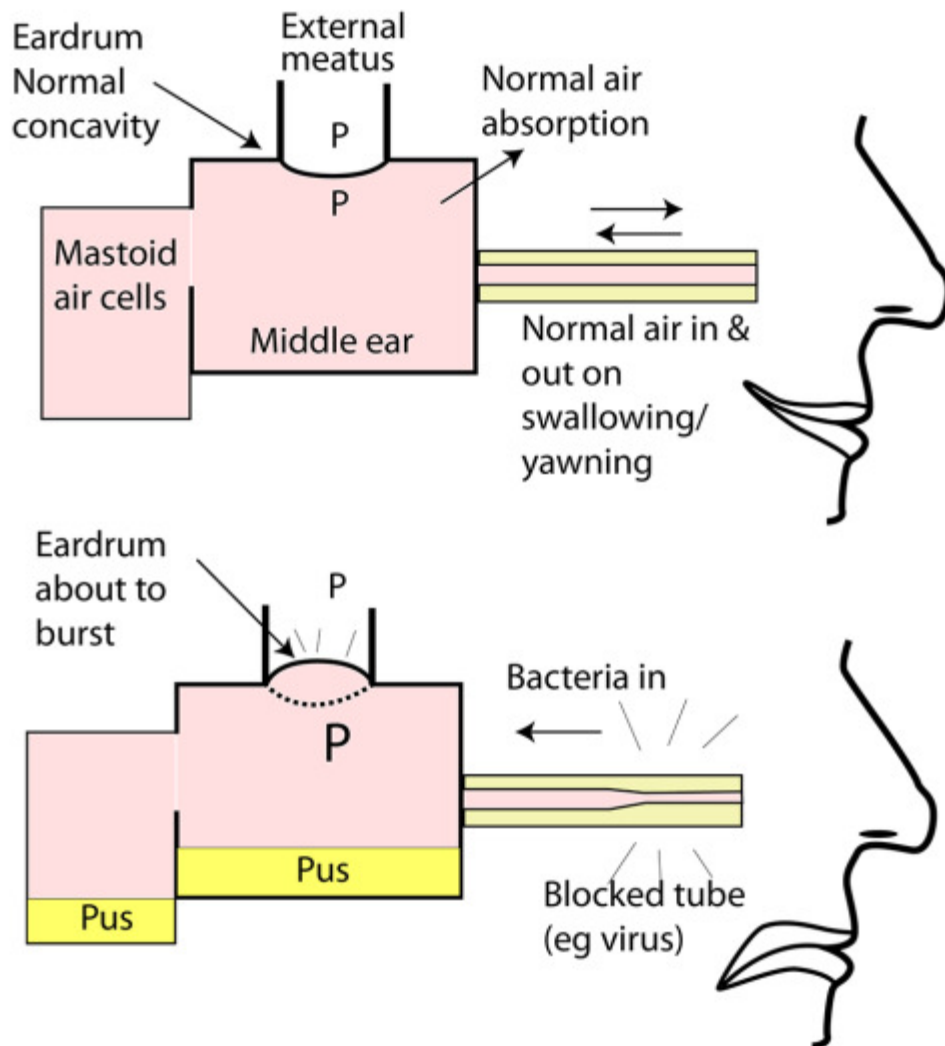
MIDDLE EAR - AUDITORY (EUSTACHIAN) TUBE - TOPOGRAPHY



NOTES

- Develops from 1st pharyngeal pouch
- 3-3.5cm long
- Blood supply from ascending pharyngeal & middle meningeal
- 30 degrees downwards, 45 degrees anteromedially
- Tubal tonsil at exit in nasopharynx
- 1/3 bone
- 2/3 cartilage
- Opens on swallowing to equalise pressure
- Mucosa is valvelike
- Sensation via pharyngeal branch of maxillary nerve (Vb) in lower part and glossopharyngeal (IX) in upper part (hence referred pain to middle ear from tonsils and oropharynx)
- Bony part in petrous temporal bone has columnar epithelium
- Cartilaginous part in squamotympanic fissure has ciliated columnar epithelium
- Muscles opening it are:
 - Salpingopharyngeus
 - Levator palati
 - Tensor palati

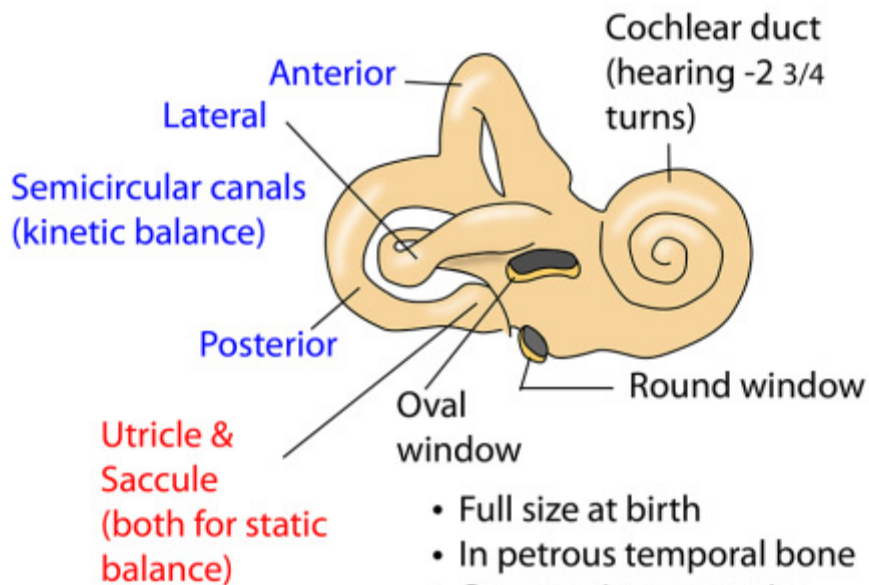
MIDDLE EAR - AUDITORY (EUSTACHIAN) TUBE - EFFECT OF BLOCKAGE



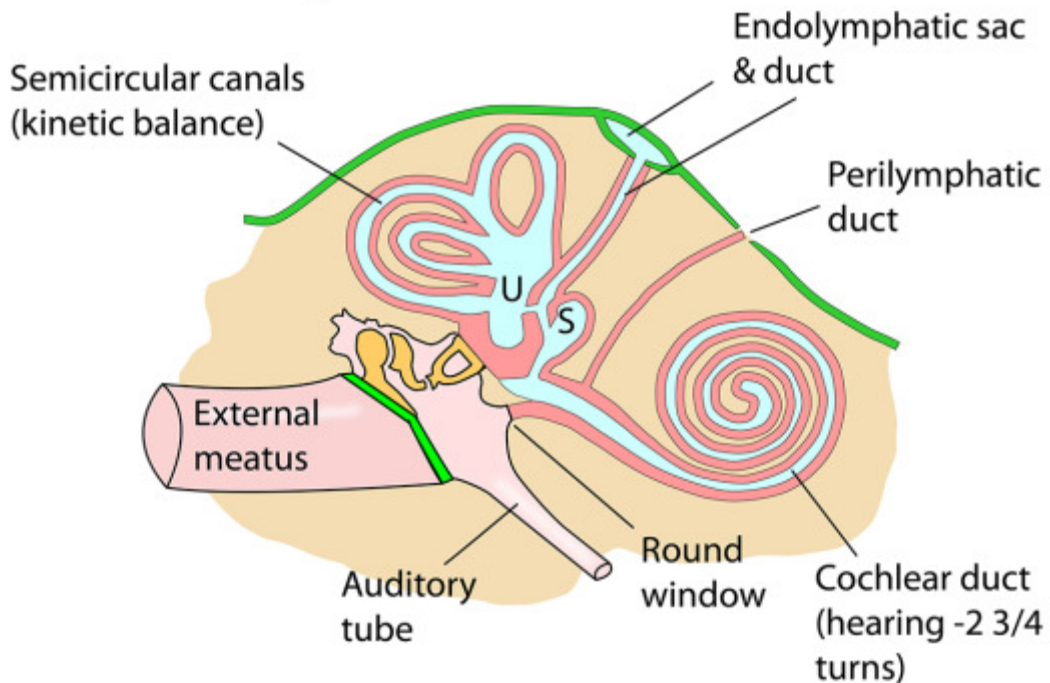
Effects of blocked auditory tube:

1. At first air is still absorbed - drum sucked in more
2. Giving poor ossicle/drum movement - deafness
3. Then viral/bacterial exudate becomes infected
4. Middle ear +/- mastoid air cells fill with pus (otitis media)
5. Then pressure rises - drum bulges outwards, may burst
6. Infection may spread to - inner ear, venous sinuses, extradural, subdural, meninges, brain abscess
7. **THEN EITHER:**
 - Drains and heals
 - Becomes chronic, +/- glue ear or cholesteatoma
 - Persistent perforation of drum, +/- necrosis of ossicles

INNER EAR - BONY & MEMBRANOUS LABYRINTHS



Membranous labyrinth lies within osseous labyrinth

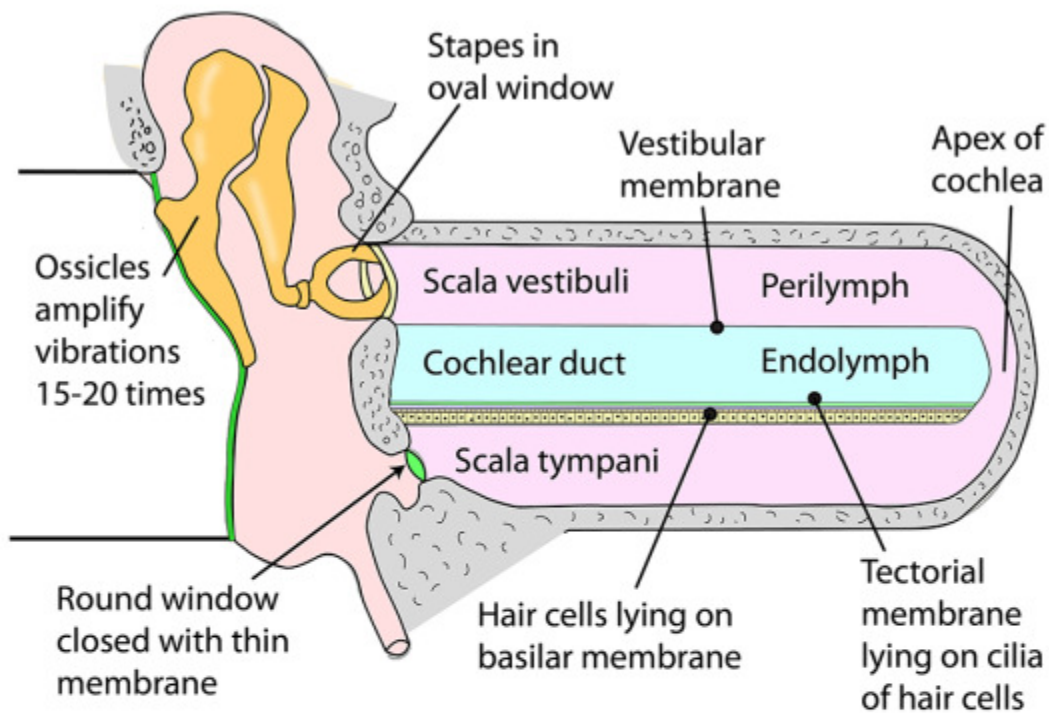


Endolymph
 Perilymph

U= Utricle
S= Saccule
(both for static balance)

Blood supply via labyrinthine artery

INNER EAR - COCHLEA STRAIGHTENED OUT TO AID UNDERSTANDING



HEARING MECHANISM

Sound waves → Pinna → External meatus →

Tympanic membrane → Ossicles → Stapes →

Vibrations in perilymph → Basilar membrane →

Hair cells (convert acoustic energy to action potentials) →

Tectorial membrane →

Cochlear part of vestibulocochlear nerve (VIII) → Auditory cortex