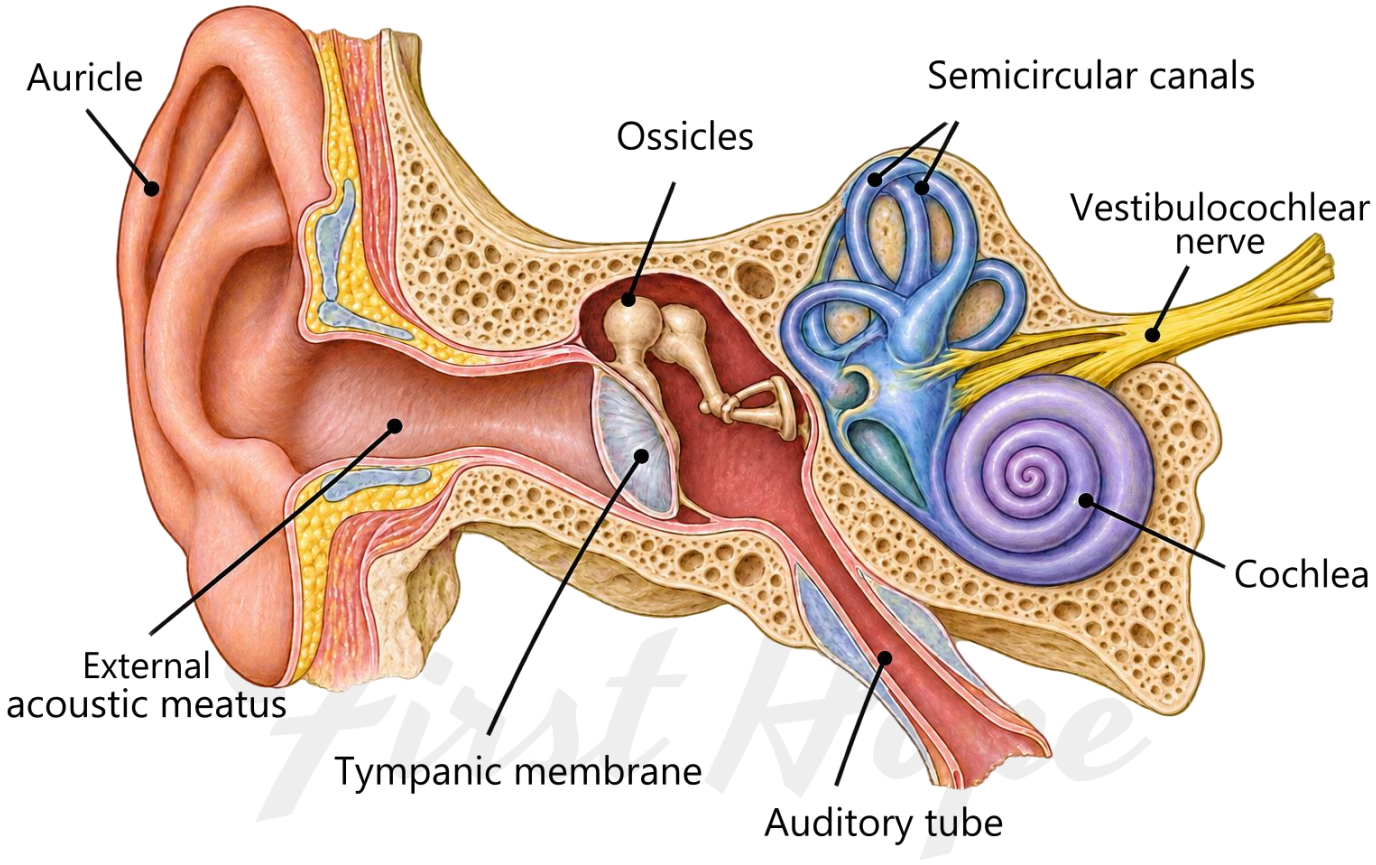
ENT - Topic 1 - Anatomy and Physiology of ear, nose, throat, head & neck

The Ear: Structure and Function

Overview of Ear Anatomy



The external and middle ear conduct sound towards the sensory structures of the inner ear

A Connected System

- The **external ear** collects sound and carries it to the tympanic membrane.
- The **middle ear** transfers vibration from the membrane to the fluid-filled inner ear.
- The **inner ear** contains sensory organs for hearing and balance.
    - Disease in different parts of this system produces different patterns of hearing loss.

Pinna and External Auditory Canal

Pinna

- The pinna is elastic cartilage covered by skin, except for the soft, fatty lobule.
- Its folds help collect sound and contribute to locating its source.

External Auditory Canal

- The adult external auditory canal is approximately **2.5 cm long** and has a curved course.
- The lateral one-third is cartilaginous and contains hairs, sebaceous glands and ceruminous glands.

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- The medial two-thirds is bony and has thin skin closely attached to periosteum.
- Swelling in this tightly confined region can cause considerable pain.

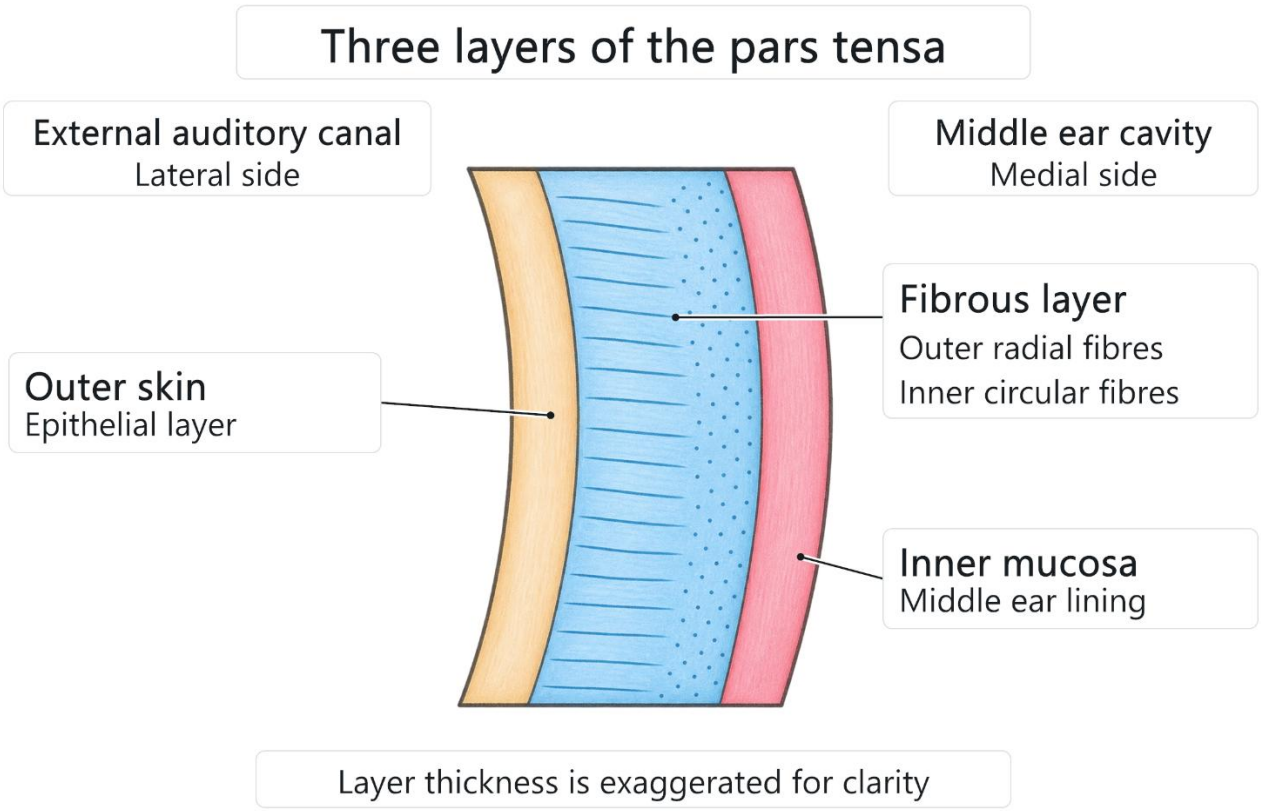
Canal Protection and Examination

- Cerumen traps debris and helps protect the canal surface.
- Normal outward skin migration and jaw movement help clear the canal.
- Cotton buds can push wax deeper and injure the skin or tympanic membrane.
- The adult pinna is usually drawn upward and backward to straighten the canal during otoscopy.

Tympanic Membrane

Structure and Attachments

- The **tympanic membrane** separates the external canal from the middle ear and lies obliquely.
- Its larger, tense part is the **pars tensa**, while the smaller upper part is the **pars flaccida**.
- The pars tensa has outer skin, a middle fibrous layer and an inner mucosal layer.
- The handle of the malleus is attached to its medial surface and ends near the **umbo**.



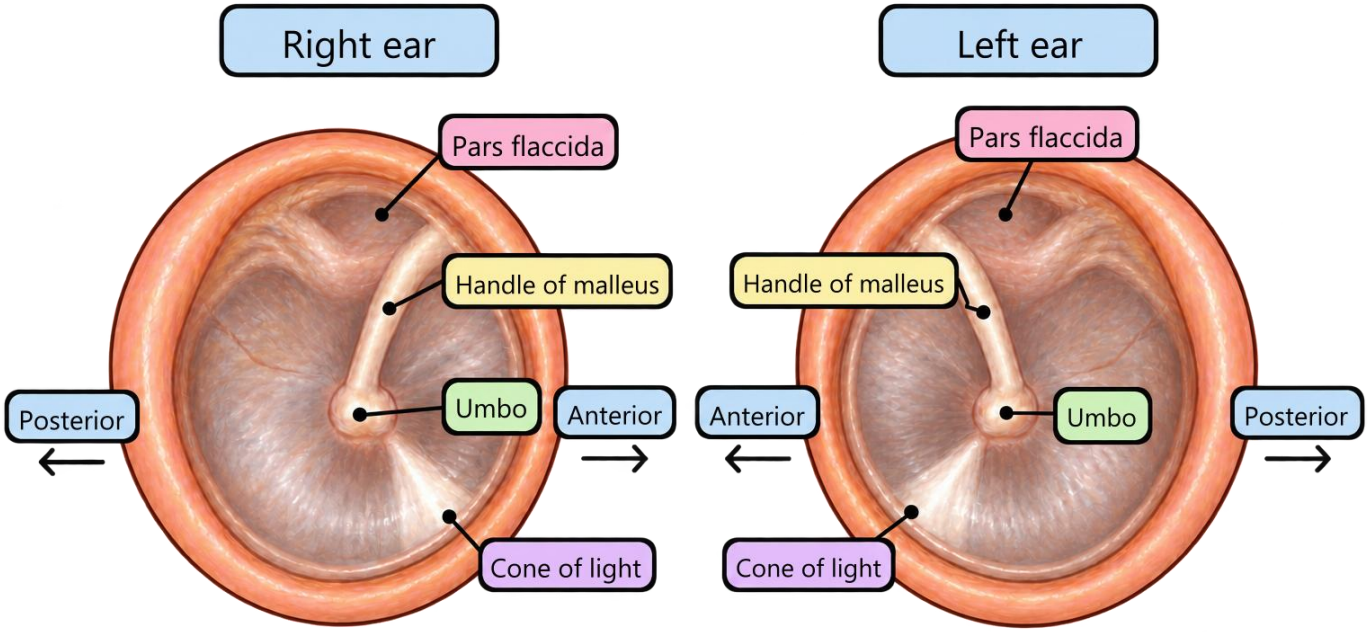
The skin, fibrous and mucosal layers of the pars tensa

Otoscopy Landmarks and Clinical Description

- The cone of light is usually seen in the anteroinferior quadrant of a normally positioned membrane.
- The cone of light is an optical finding, so its absence alone does not establish disease.

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- Quadrants are described using lines through the malleus handle and the umbo.
- The location, size and margin of a perforation should be recorded rather than simply writing that the drum is damaged.



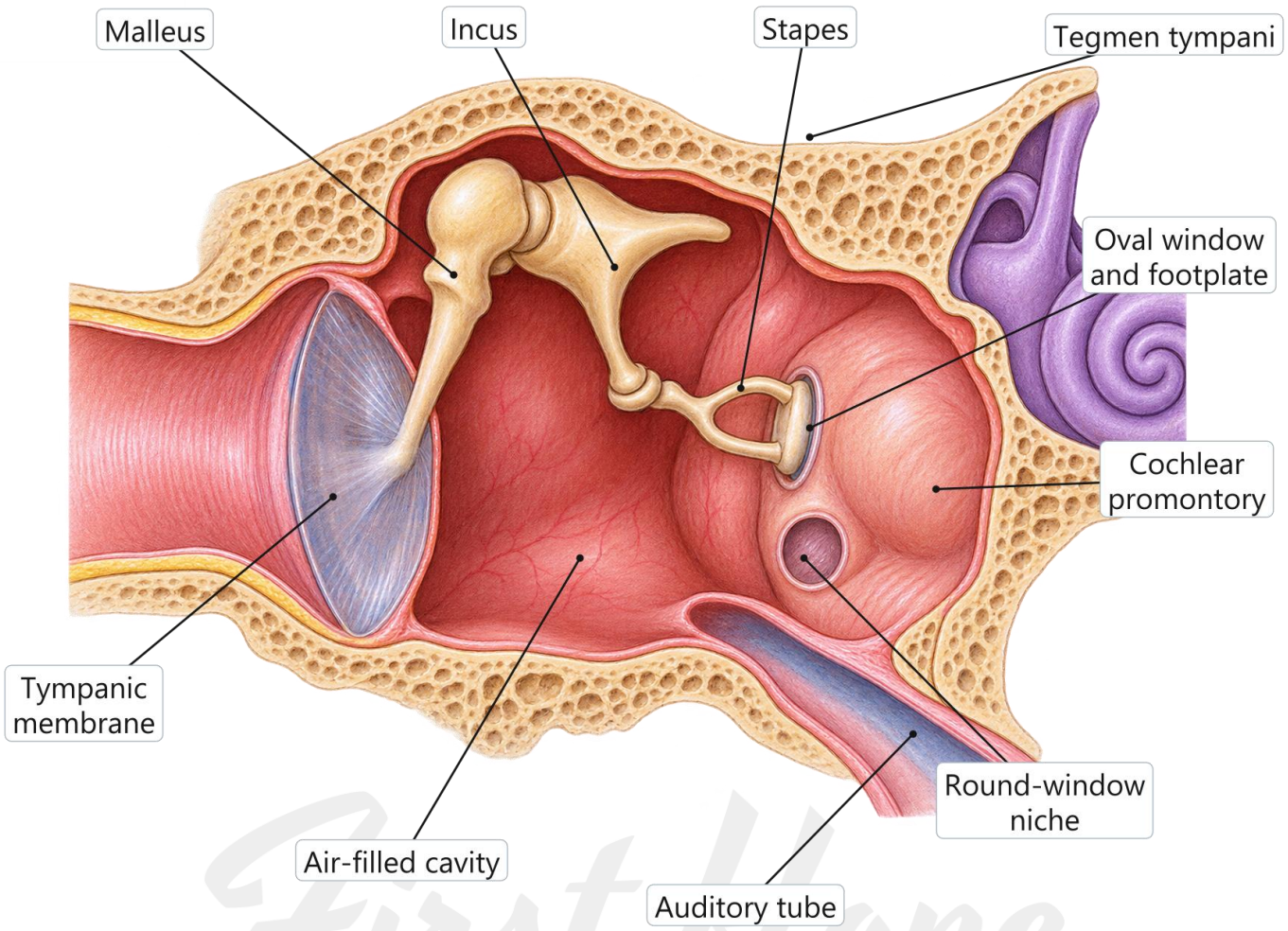
Right and left tympanic membranes with their main otoscopic landmarks

Middle-Ear Cavity and Ossicles

Cavity and Ossicular Chain

- The middle ear is an air-containing cavity within the temporal bone.
- Its three ossicles are the **malleus, incus and stapes**.
- The malleus receives membrane movement, the incus transmits it and the stapes footplate moves at the oval window.
- The round window allows displacement within the essentially incompressible cochlear fluid system.

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The tympanic membrane, ossicular chain and medial wall of the middle ear

Connections and Nearby Structures

Middle-Ear Communications

- The cavity communicates posteriorly with the mastoid antrum and mastoid air cells through the aditus.
- Its anterior connection with the nasopharynx is the **Eustachian tube**.

Roof and Adjacent Cranial Cavity

- The roof, called the tegmen tympani, separates the cavity from the middle cranial fossa.

Facial Nerve and Chorda Tympani

- The facial nerve runs in a bony canal close to the middle ear.
- Middle-ear infection or surgery can therefore affect facial function.
- The chorda tympani crosses the middle ear and carries taste fibres from the anterior two-thirds of the tongue.

Middle-Ear Muscles

- The tensor tympani is supplied through the mandibular division of the trigeminal nerve.
- The stapedius is supplied by the facial nerve and contributes to the acoustic reflex.

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Walls and Clinically Important Relations of the Middle Ear

Walls and Adjacent Structures

- The **lateral wall** consists mainly of the tympanic membrane, with the lateral attic wall above it.
- The **medial wall** bears the promontory over the basal cochlear turn, the oval window and the round-window niche.
- The **floor**, or jugular wall, separates the tympanic cavity from the superior bulb of the internal jugular vein.
- The **anterior wall** is related to the internal carotid artery and contains openings for the auditory tube and tensor tympani canal.
- The **posterior wall** includes the aditus to the mastoid antrum and the pyramidal eminence from which the stapedius tendon emerges.

Compartments and Disease Extension

- The epitympanum lies above the membrane, the mesotympanum opposite it and the hypotympanum below it.
- These compartments explain why attic disease can extend into the mastoid before it is obvious on routine otoscopy.

Surgical Relations of the Facial Nerve

- The labyrinthine facial-nerve segment reaches the geniculate ganglion, where the nerve makes its first bend.
- The tympanic segment passes above the oval window, and the mastoid segment descends towards the stylomastoid foramen.
- The tympanic facial canal may be naturally dehiscent, leaving the nerve more vulnerable to middle-ear disease or instrumentation.
- The chorda tympani enters and leaves the tympanic cavity without supplying the ossicles or hearing organ.

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