

ENT

Edition 8.5

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Instructions

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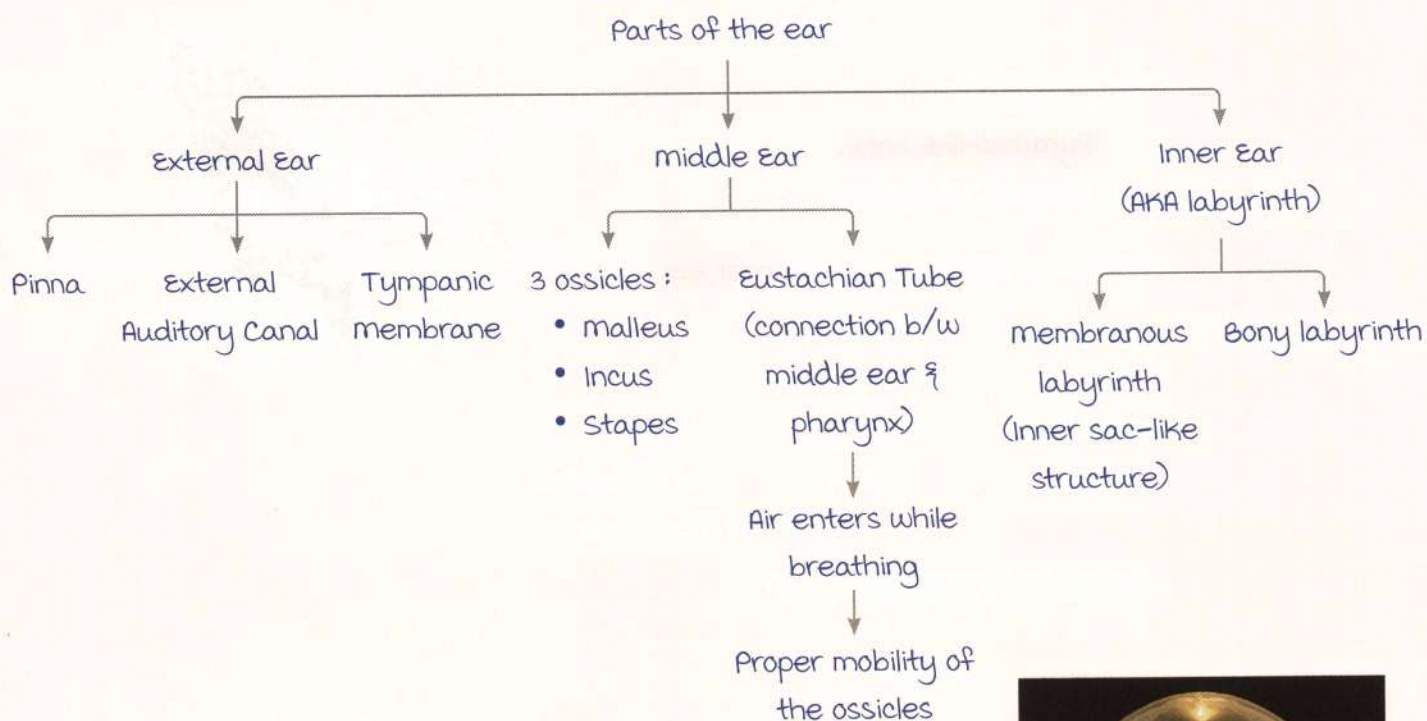
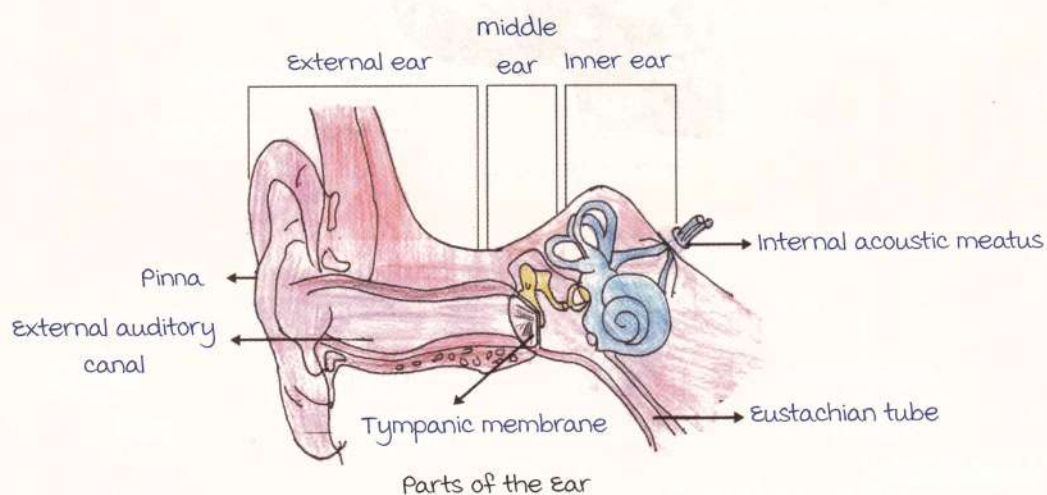
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BASICS OF EAR

----- Active space -----

Introduction

00:00:40



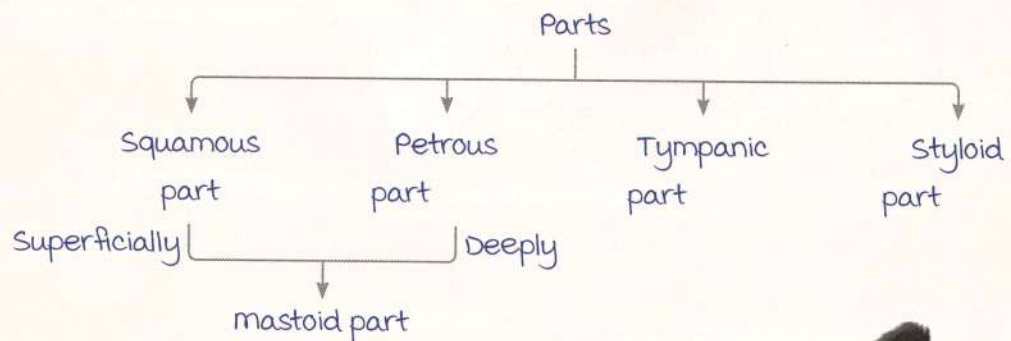
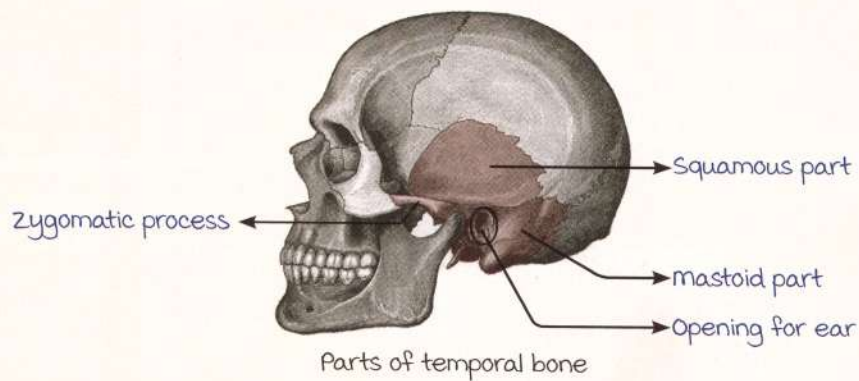
- medial to Inner Ear : Brain (Cranium).
- Base of Skull : Separates inner ear from the brain.
- Internal Acoustic meatus : Opening which connects inner ear to brain.
- Location of ear : Tunnel in the temporal bone.



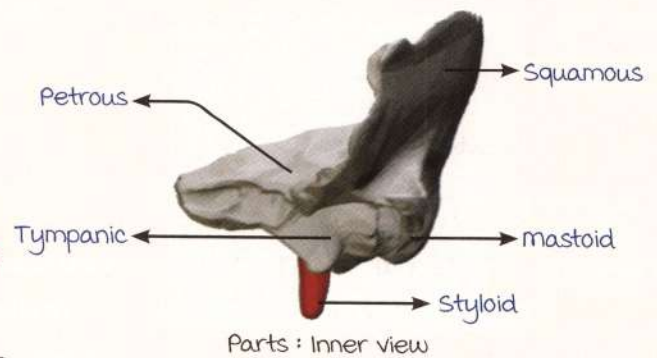
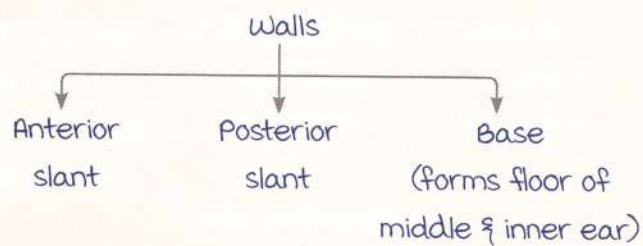
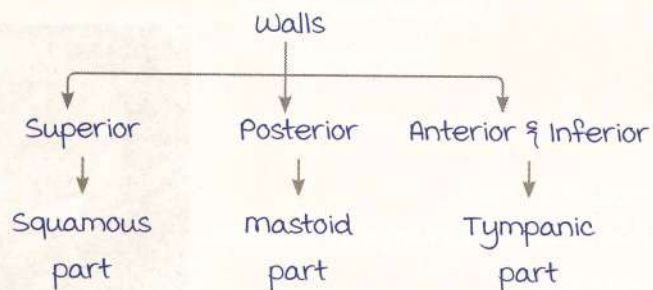
Temporal Bone

Temporal Bone and Its Parts

00:05:45

**Petrous Part :**

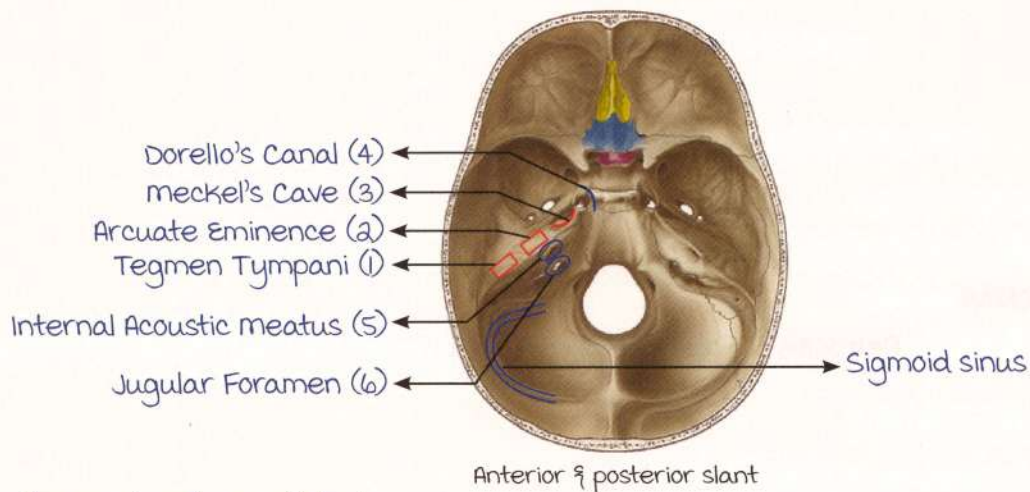
- **Pyramid-like bone.**
- 'Petrous' : Rocklike.

Contents : middle ear and **inner ear.****Parts Forming External Ear :**

Routes of Infection Spread : Superiorly (Roof)

00:11:45

----- Active space -----



Infection reaches base of skull.

Anterior Slant :

1. Tegmen Tympani :

- Roof of middle ear.
- Separates middle ear from middle cranial fossa (temporal lobe).
- Infection reaches temporal lobe → Temporal lobe abscess.

2. Arcuate Eminence :

- Bulge in roof of Inner ear.
- Produced by **Superior Semicircular Canal (SSC)**.

Note :

SSC dehiscence :

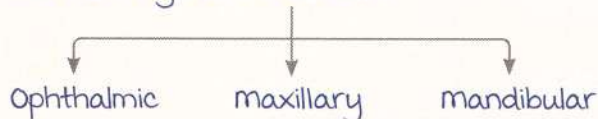
- Bone thin or gaping.
- Significance : Rise in Intra-Cranial Pressure

↓
Stimulates inner ear

↓
Inner ear symptoms

3. meckel's Cave :

- Depression containing **Gasserian ganglion** (ganglion of CN V).
- Here CN V gives 3 branches.



----- Active space -----

Significance : Infection reaches petrous apex

↓
Involvement of CN V↓
Retro-orbital pain with ear symptoms

4. Dorello's Canal :

- Present at petrous apex.
- CN VI passes.

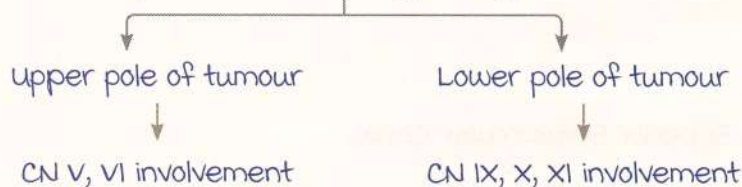
Significance : **Petrositis** → Ear complaints + Diplopia (CN VI supplies lateral rectus).Posterior Slant :

5. Internal Acoustic meatus (IAM) :

- Connects inner ear to posterior cranial fossa.
- **Nerves** passing : CN VII & CN VIII.

Note :

- CN VII → Passes through ear → Gives branches in ear → Exits through stylomastoid foramen → Supplies face.
- Acoustic neuroma spreads intracranially through IAM.



6. Jugular Foramen :

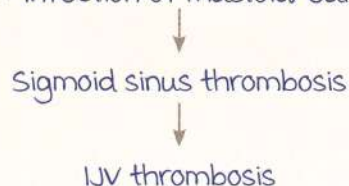
At the junction of petrous and occipital bone.

Structures passing :

- CN IX
 - CN X
 - CN XI
 - Jugular bulb
- } Go to floor of middle ear.

Sigmoid Sinus :

- Forms posterior boundary of mastoid.
- Sigmoid sinus → Jugular bulb → Internal jugular vein (IJV).
- Significance : Infection of mastoid/ear



Routes of Infection Spread : Inferiorly (Floor) & Anteriorly

00:24:50

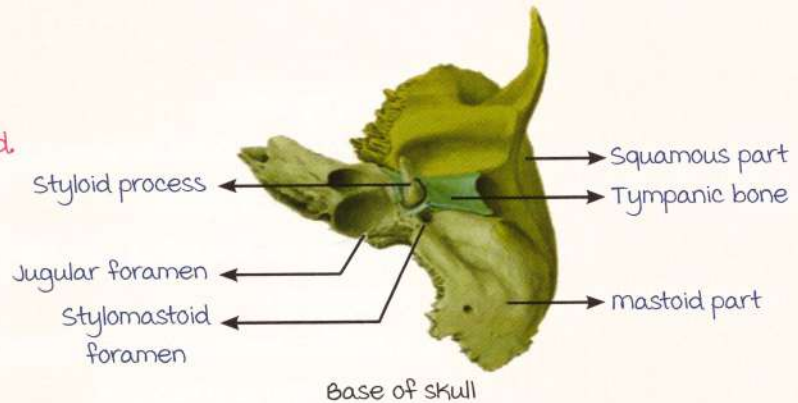
----- Active space -----

Inferiorly (Floor) :

Infection reaches base of skull.

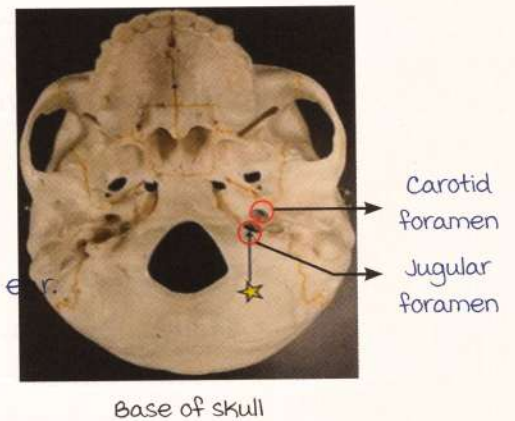
Stylomastoid Foramen :

- Present between **styloid process** & **mastoid**.
- Involvement causes **facial nerve palsy**.
- Significance :



Jugular Bulb :

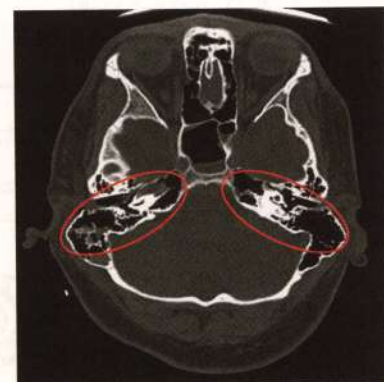
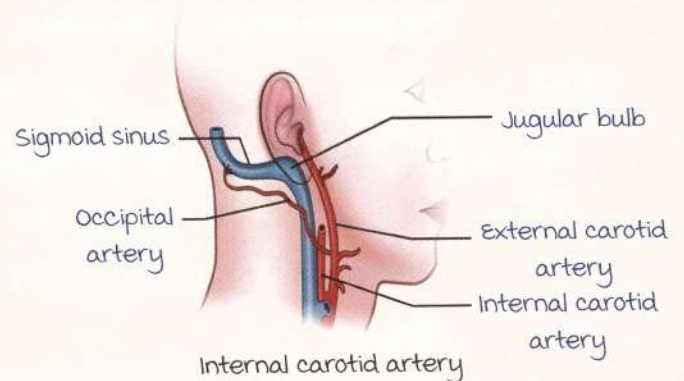
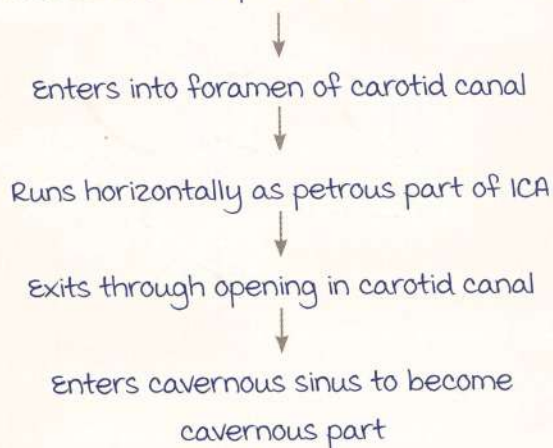
- Lies in the floor of middle ear.
- Significance :
- Tumors of jugular bulb project through floor of middle ear.



Anteriorly :

Internal Carotid Artery (ICA) :

- Related to anterior wall of middle & inner ear.
- Course : Cervical part of ICA



HRCT

Note :

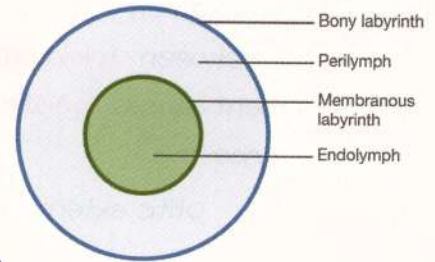
High Resolution CT scan : **Best** investigation for conditions of middle ear & temporal bone fractures.

----- Active space -----

CLINICAL EMBRYOLOGY AND ANATOMY OF INNER EAR : PART 1

Inner ear (Labyrinth) :

- Parts : membranous and bony labyrinth.
- membranous labyrinth :
 - a. Closed sac-like structure filled with endolymph.
 - b. Contains endolymph and sensory end organs of hearing and balance.
- Bony labyrinth : Has openings to connect inner ear to middle ear and brain.



Basic structure of inner ear

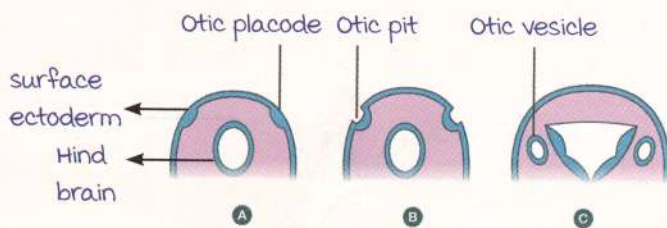
Membranous Labyrinth

00:06:08

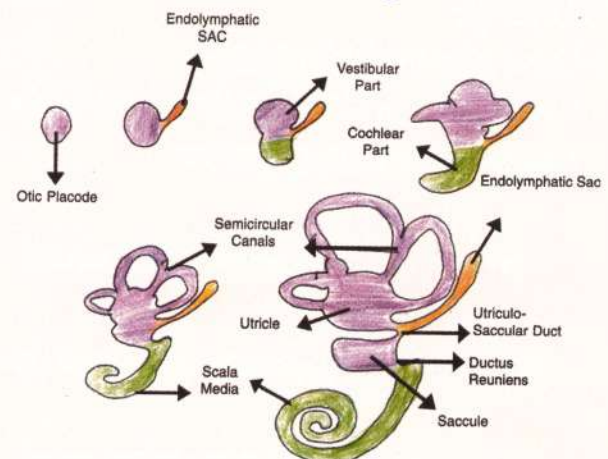
Embryology :

Development :

- Specialized area of **surface ectoderm** overlying the hind brain.
- Stages : Otic placode → Otic pit → Otic vesicle → Outpouchings from otic vesicle → membranous labyrinth.

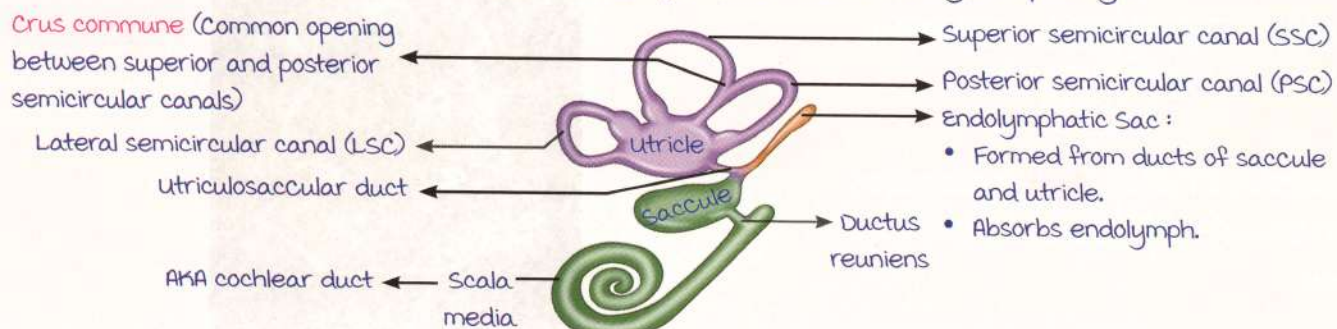


Development of membranous labyrinth



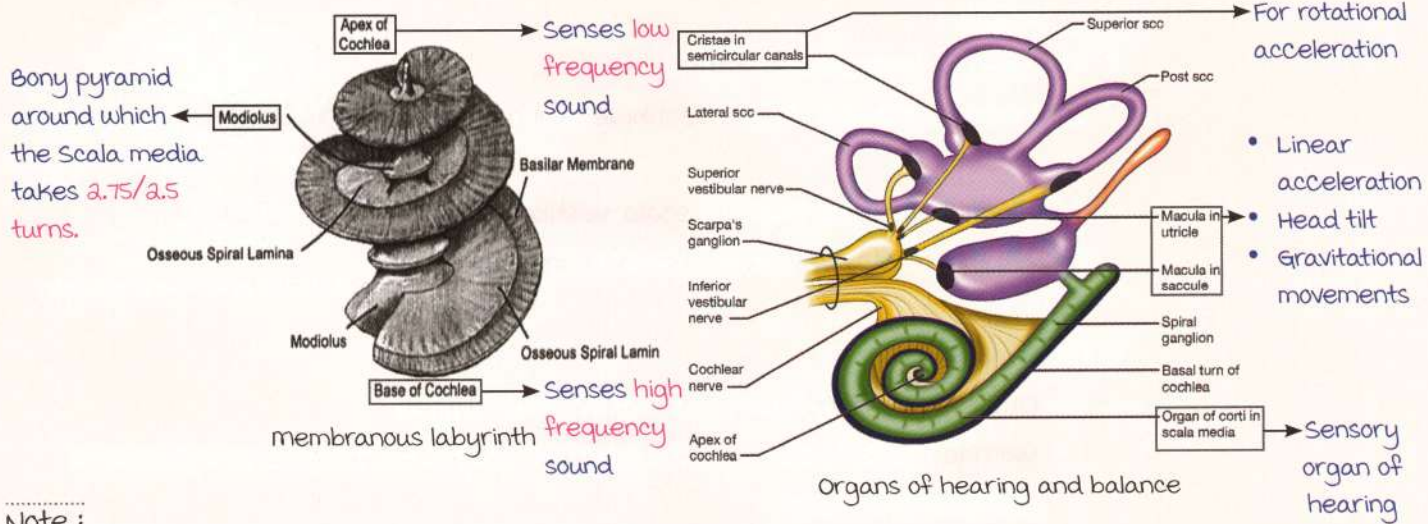
Parts :

The 3 semicircular canals open into utricle through 5 openings.



membranous labyrinth

----- Active space -----

**Note :**

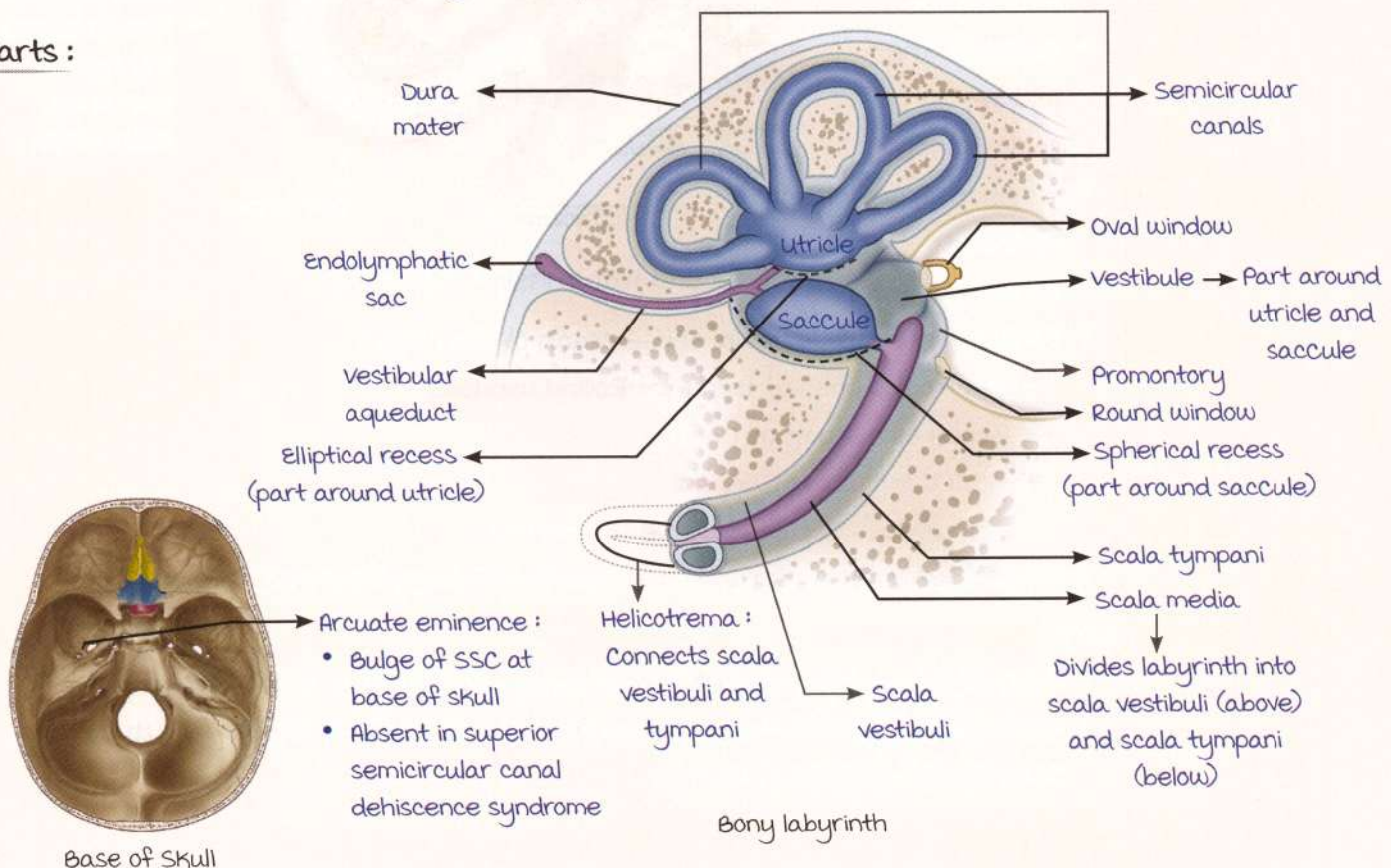
- All of membranous labyrinth except organ of Corti help with balance.
- Hearing loss + Imbalance → Indicative of inner ear pathology.

Bony Labyrinth

00:18:18

Embryology :

- Development : From mesoderm by **enchondral ossification**.
- Enchondral ossification : Cartilage develops into bone.

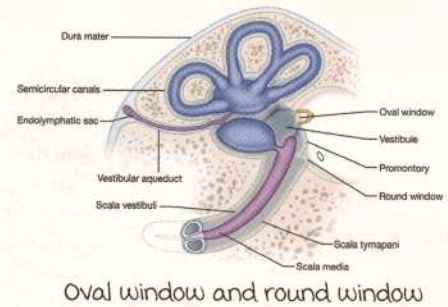
Parts :

Connections Between Middle Ear and Inner Ear

00:25:40

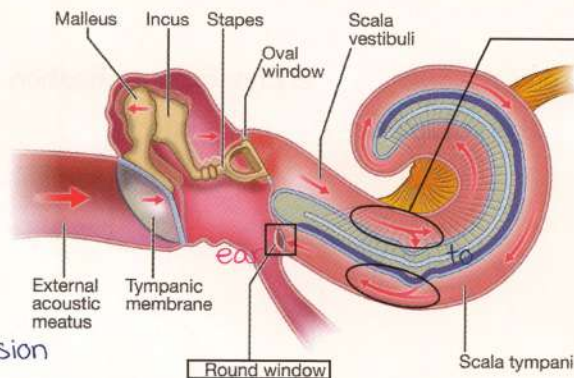
Oval Window :

- Covered by footplate of stapes.
- Connects middle ear to the **vestibule** of inner ear.
- Function : Transmits sound to **scala vestibuli** (movement of stapes causes vibration in scala vestibuli).
- Abnormalities :
 - **Otosclerosis** : D/t fixation of footplate of stapes.
 - **Vertigo** : Hypermobility of footplate of stapes → Stimulates maculae in utricle and saccule.
 - **meniere's disease** (Endolymphatic hydrops) : ↑ in endolymph → Dilatation of utricle and saccule → Close proximity with footplate → Stimulated → Imbalance/vertigo.



Round Window :

- Covered by secondary tympanic membrane.
 - Connects the **middle scala tympani**.
 - Function : Transmission of sound.
 - Clinical significance : Sound transmission : Inner ear
- Cochlear Implant (Artificial sense organ of hearing) :
 - Electrodes passed through : **Round window**.
 - Replaces : Organ of Corti.
 - Placed in : **Scala tympani**
 - Stimulates : **Cochlear nerve** (8th nerve).
 - Drugs (Gentamicin, steroids) are injected through the round window.



Note :

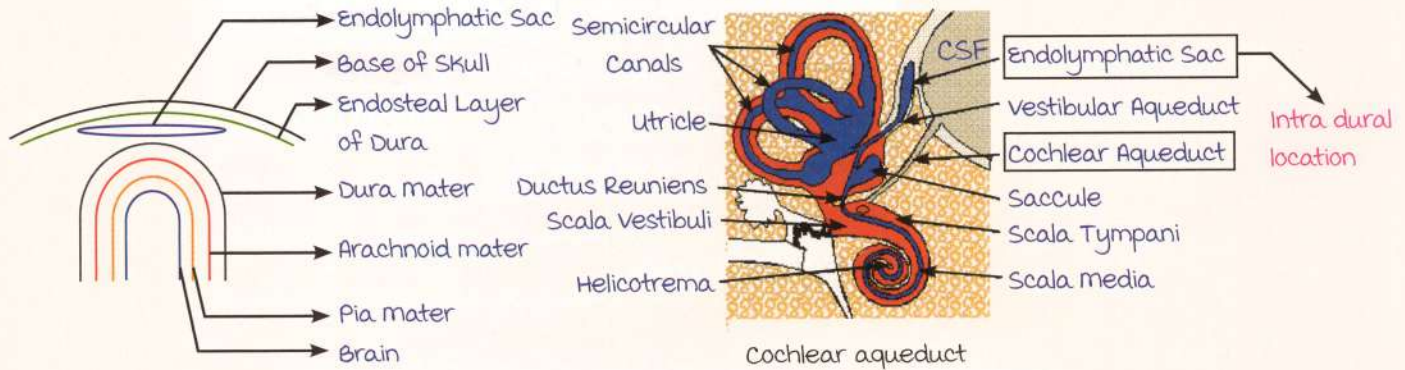
- Oval window is not preferred for passing of electrodes in cochlear implant.
- Electrodes passed through oval window → Stimulate vestibule → utricle and saccule stimulated → vertigo.

Connections Between Inner Ear and Brain

00:40:05

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1. Internal acoustic meatus (passage for 7th, 8th cranial nerves).
2. **Cochlear aqueduct** (Transfers CSF into inner ear for perilymph production).

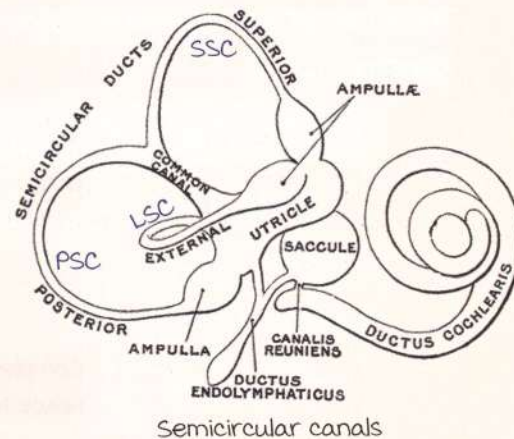
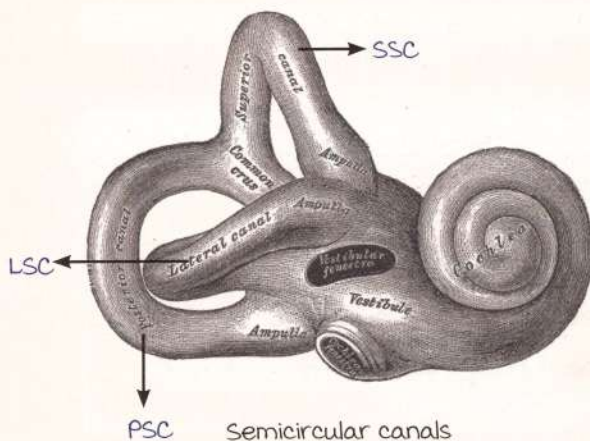


Clinical Significance :

- Spread of infection from brain to inner ear or vice versa (meningitis ↔ Labyrinthitis).
- Patient with meningitis → Recovered → Do **BERA before discharge** (Brainstem Evoked Response Audiometry).
(**Child > adult** since hearing loss in a child needs early intervention and hearing rehabilitation).

Identification of Semicircular Canals :

- Lateral semicircular canal goes in lateral direction.
- Crus commune: Can be used to identify posterior and superior semicircular canals.
- Posterior semicircular canal can be identified with the lateral semicircular canal bisecting it.

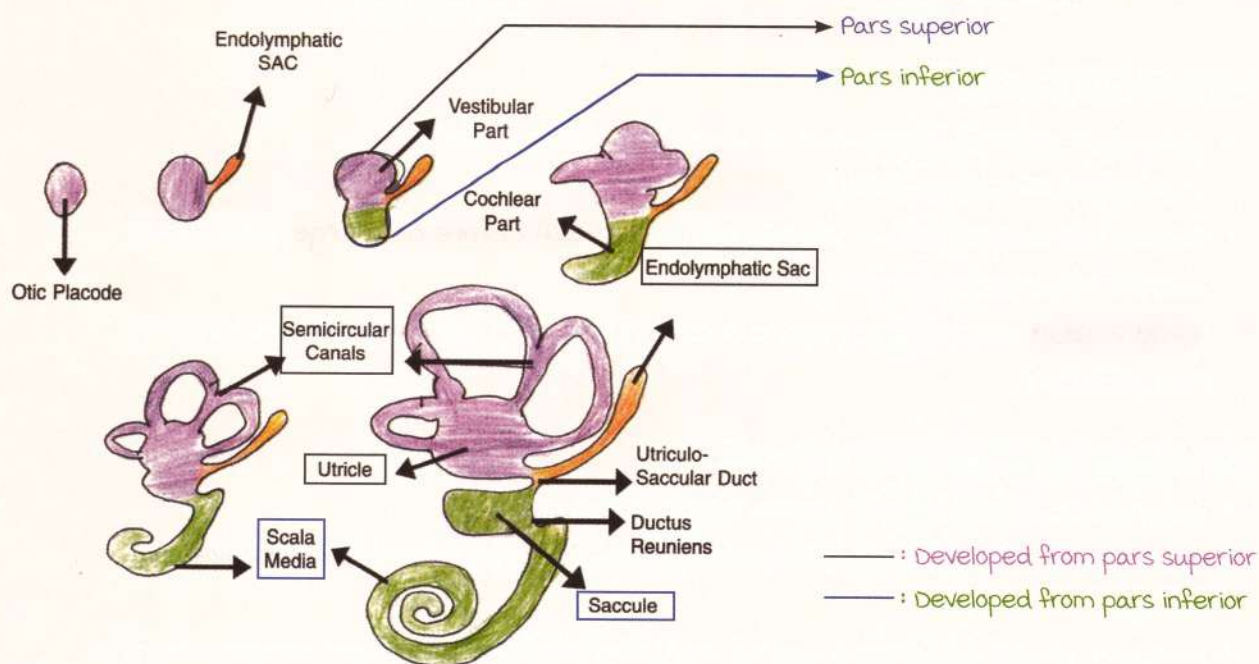


Congenital Abnormalities

00:48:15

Inner ear development : Fully complete at **20 weeks (5 months)** of intrauterine life.

Derivatives of pars superior	Derivatives of pars inferior
Superior semicircular canal	Saccule
Lateral semicircular canal	Scala media
Posterior semicircular canal	-
Utricle	-
Endolymphatic sac	-



Defects :

most congenital anomalies occur due to defect in pars inferior as pars inferior develops later.

Defect	Features
Scheibe aplasia	m/c congenital abnormality. - Defect : Saccule + Cochlea.
mondini aplasia	Cochlea has only 1.5 turns .
Alexander aplasia	Defect in basal turn of cochlea.
Michel aplasia	Complete absence of bony and membranous labyrinth. Absolute C/i for cochlear implant.

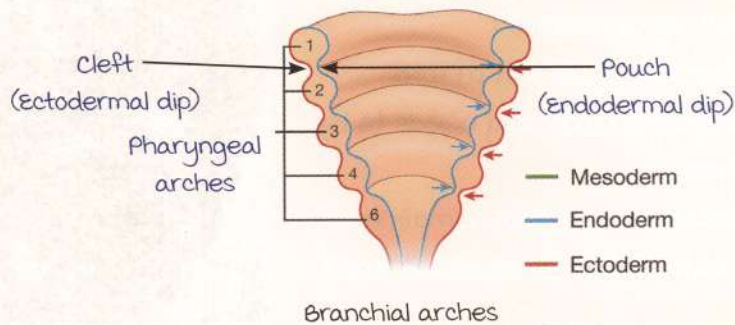
CLINICAL EMBRYOLOGY OF EXTERNAL AND MIDDLE EAR

----- Active space -----

External & Middle Ear Development

00:00:30

- Developing fetus : Has 6 branchial arches of which 5th arch disappears.
- Each arch : Has ectodermal (Outside) & endodermal (Inside) lining.

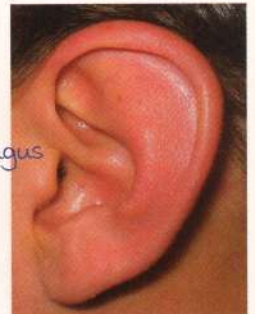


Hillocks of His :

- 6 mesodermal thickenings : Around 1st cleft.
- Fuse to form : Pinna (Single elastic cartilage).
 - 1st arch → Development of tragus.
 - 2nd arch → Rest of the pinna.



Hillocks of His



Tragus
Small part of ascending crus of helix (1st arch derivative)

Developmental Disorders :

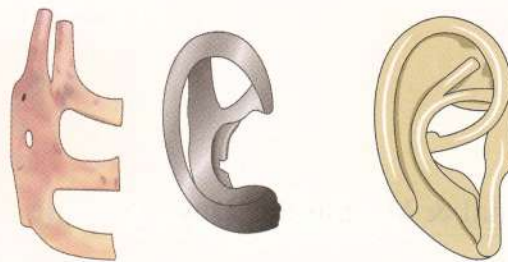
Preauricular sinus	Accessory auricle/tags	microtia	Anotia
• Fusion defect of the auricular tubercle. • m/c site: Root of helix.  Preauricular sinus	 Accessory auricle/tags	 microtia	Absent pinna  Anotia

----- Active space -----

management of microtia/Anotia :

Pinna reconstruction :

- AKA otoplasty/pinnaplasty.
- Graft used : **Costal (Rib) cartilage**.
- Not done **before 6 years**.
 - Opposite pinna reach adult size by 6 years → Reference for symmetrical reconstruction.
 - Costal cartilage attain full development, only by 6 yrs.



Pinna reconstruction Pinna cartilage framework

Bone anchored hearing aid (BAHA) :

- Indication : Patients who cannot afford surgery but hearing needs to be saved.
- Use : Congenital or external abnormalities of pinna or external auditory canal (EAC).



BAHA

External Auditory Canal (EAC) :

- medial extension of the 1st pharyngeal cleft.
- At birth : **Only cartilaginous part** present.
- External acoustic meatus : Develops from 1st arch.

Collaural fistula :

- Connection b/w neck and external auditory canal.
- 1st cleft developmental abnormality.
- Fistula : 2 openings
 - External opening : B/w angle of mandible & sternocleidomastoid.
 - Internal opening : Floor of external auditory canal.
 - Closely related to the **facial nerve**.



Collaural fistula

• management :

Repeated infection : excision of fistula tract (may injure facial nerve).