Internal Ear

- **Introduction**
- **Bony labyrinth:**
  - Cochlea
  - Vestibule
  - Semicircular canals

- **Membranous labyrinth**
  - Cochlear duct
  - Saccule & Utricle
  - Utriculo-saccular duct
  - Receptors in Utricle & Saccule
  - Semicircular ducts
  - Innervation of receptors of vestibular system
Internal [Inner Ear]

- Cochlea
- Oval window
- Round window
Introduction

Components of Internal Ear-
• Bony labyrinth.
• Membranous labyrinth.

Bony Labyrinth-
Location- Petrous part of temporal bone.

• The space between membranous and bony labyrinth is filled with perilymph.

Membranous Labyrinth-
Location- Within bony labyrinth.

• It is a closed system of fluid filled intercommunicating membranous sacs and ducts.

• Fluid in it is called endolymph.
Bony Labyrinth

• It consists of intercommunicating bony cavities and canals.

Location-
• Petrous part of temporal bone.

Parts- 3 (from before backwards)
• Cochlea (anterior part)
• Vestibule (middle part)
• Semicircular canals (posterior part).
It consists of:
- Modiolus
- Cochlear canal

A spiral ridge of bone called **spiral lamina**, divides the cochlear canal into:
- Scala Vestibuli above &
- Scala Tympani below

Scala Vestibuli and Scala Tympani communicate with each other at the apex of cochlea by a small opening called **helicotrema**.
Close to the basal turn of cochlea, scala tympani presents 2 features:

- **Fenestra cochleae (Round Window).**

- **Aqueduct of cochlea.**

Through **Aqueduct of cochlea**, cochlea communicates with subarachnoid space.

- **Aqueduct of cochlea** passes through cochlear canaliculus.
Vestibule

- It lies medial to middle ear cavity.

- Its lateral wall communicates with middle ear through fenestra vestibuli (Oval Window).
Semicircular Canals

**Number**: 3

- Anterior (Superior)
- Posterior
- Lateral (Horizontal)

- Anterior semicircular canal is convex upwards.
- Its position is indicated on the anterior surface of petrous part as **arcuate eminence**.
Membranous Labyrinth

- It consists of: (from before backwards)
  - Cochlear duct.
  - Saccule.
  - Utricle.
  - Semicircular ducts.
Cochlear Duct [Scala Media]

Location-
- It lies in the middle part of bony cochlear canal.
- It is the anterior part of membranous labyrinth.
- It has 2 & 3/4th turns.
- It contains sensory receptor for hearing which is Spiral Organ of Corti.

Spiral Organ of Corti-
- It has:
  - Tunnel of Corti.
  - Hair Cells- Outer and Inner
  - Supporting Cells- Deiter’s and Hansen’s Cells.
  - Membrana Tectoria.

Tunnel of Corti-
- It contains:
  - Outer and Inner rod cells.
  - Corticolymph.

Hair Cells-
- These are receptor cells of hearing.
- Inner hair cells are richly supplied by Cochlear nerve fibers.
Saccule & Utricle

Location-
- Within bony vestibule

Saccule-
- It is a small **globular** membranous sac.
- It lies in the **anteroinferior** part of vestibule.
- It is connected to the basal turn of cochlear duct by **ductus reuniens**.
- It is connected to the utricle by utriculo-saccular duct.

Utricle-
- It is an **oblong** membranous sac, larger than saccule.
- It lies in the **posterosuperior** part of vestibule.
- It receives **3 semicircular ducts** through **5 openings**.
Utriculo-Saccular Duct

- It is ‘Y’ shaped.
- Utriculo-saccular duct continues as **endolymphatic duct** and its dilated end is called **endolymphatic sac**.
- Endolymphatic duct passes through a bony canal (**Aqueduct of Vestibule**).
- Aqueduct of Vestibule is present in the posterior part of petrous part of temporal bone.
Receptors in Saccule & Utricle

Maculae - Location -

• In medial wall of Saccule and Utricle.
• Maculae maintain the ‘static balance’.
• These receptors sense the position of head in response to gravity and linear acceleration.
Semicircular Ducts

**Number**- 3
- Anterior
- Posterior
- Lateral

- These 3 ducts lie within 3 corresponding semicircular canals.
- Each duct has one dilated end called **ampulla**.
- Ampullae have sensory receptors called ‘**cristae**’.
- **Cristae** maintain the ‘**kinetic balance**’.
- These receptors respond to ‘**angular acceleration**’.
Head in still position

Head rotating

As the head rotates, cupula bends in opposite direction of the rotation.

Rotational equilibrium: receptors in ampullae of semicircular canal.

Gravitational equilibrium: receptors in utricle and saccule of vestibule.
Innervation of Receptors of Vestibular System

**Vestibular/Scarpa’s Ganglion**

**Location**
- Lateral part of internal acoustic meatus.

- This ganglion has bipolar neurons.

- **Peripheral processes** of these neurons innervate hair cells of crista and maculae.

- **Central processes** aggregate to form vestibular nerve.
Thank You