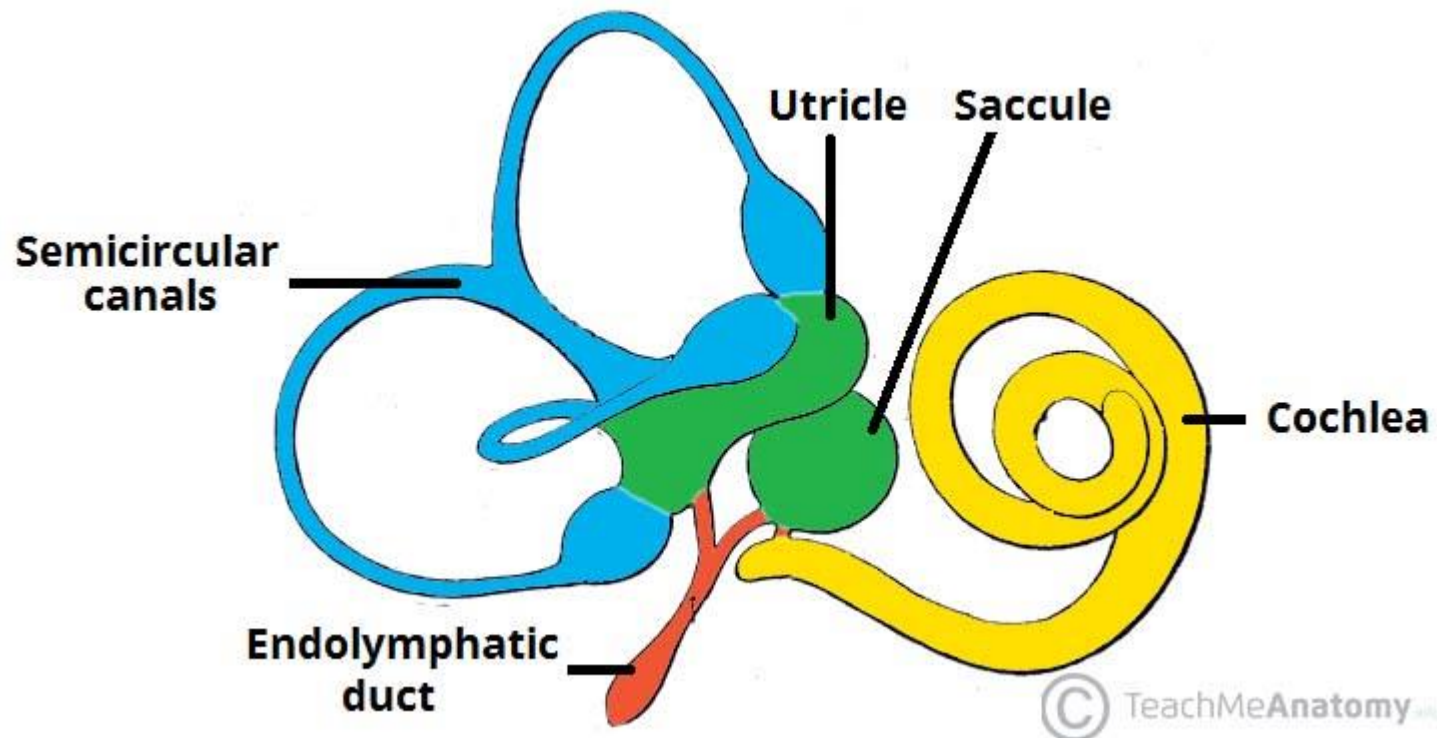


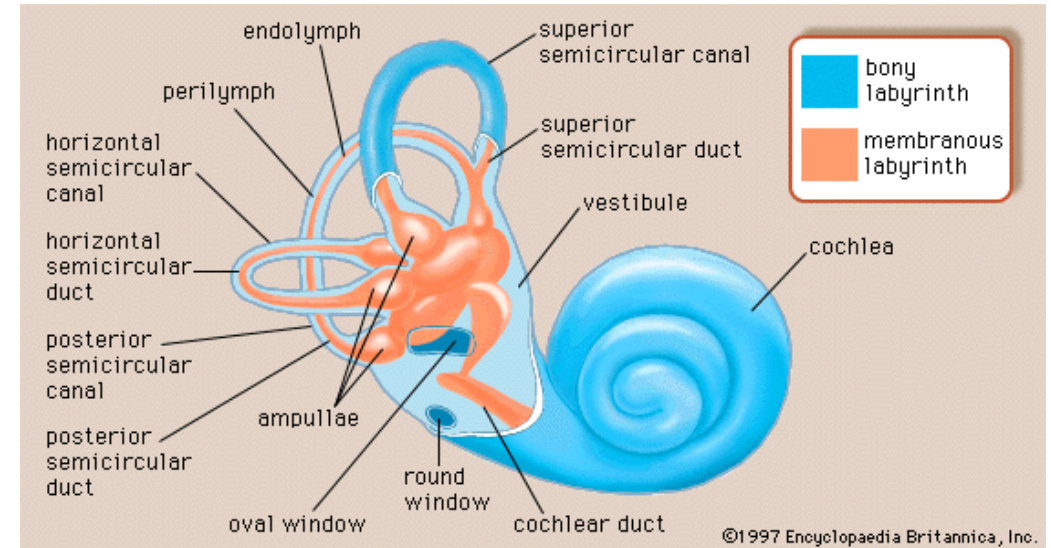
# INTERNAL EAR (LABYRINTH)



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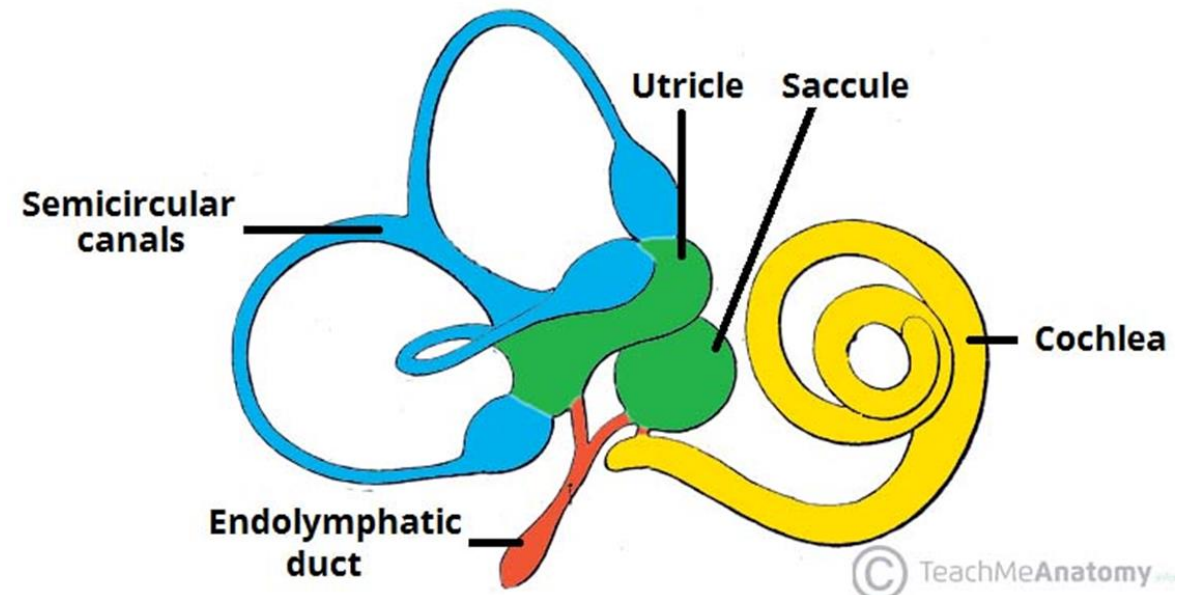
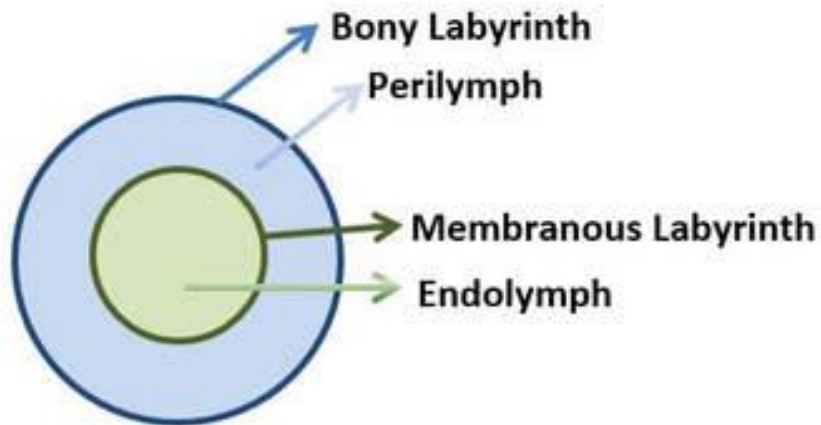
# INTRODUCTION

- Situated in the petrous part of the temporal bone, medial to the middle ear
- Consists of the **bony labyrinth**, comprising a series of cavities within the bone, and
- the **membranous labyrinth**, comprising a series of membranous sacs and ducts contained within the bony labyrinth



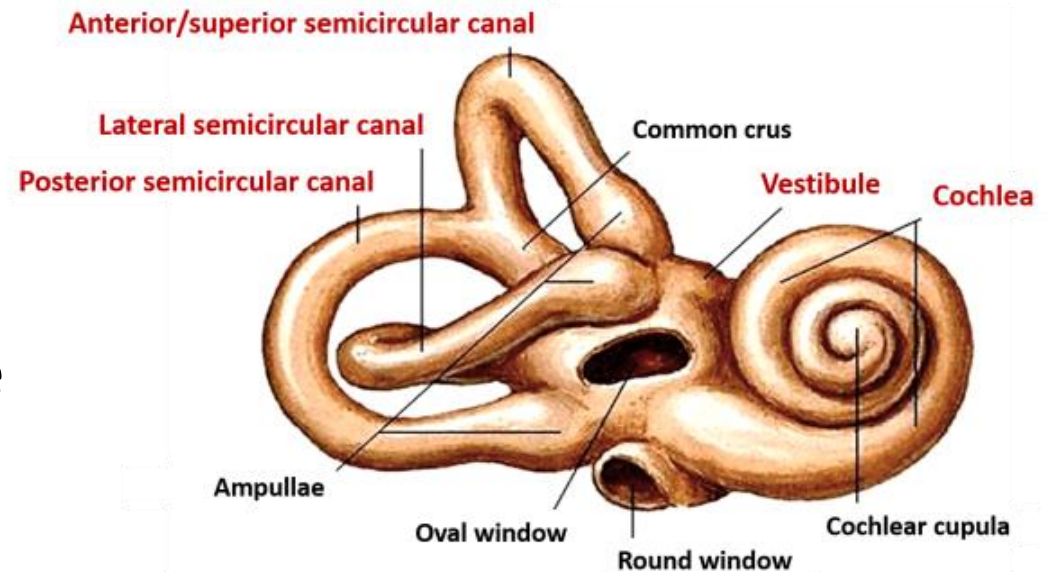
# BONY LABYRINTH

- Consists of **three** parts: the vestibule, the semicircular canals, and the cochlea
- Lined by endosteum and contain a clear fluid, the **perilymph**, in which is suspended the membranous labyrinth



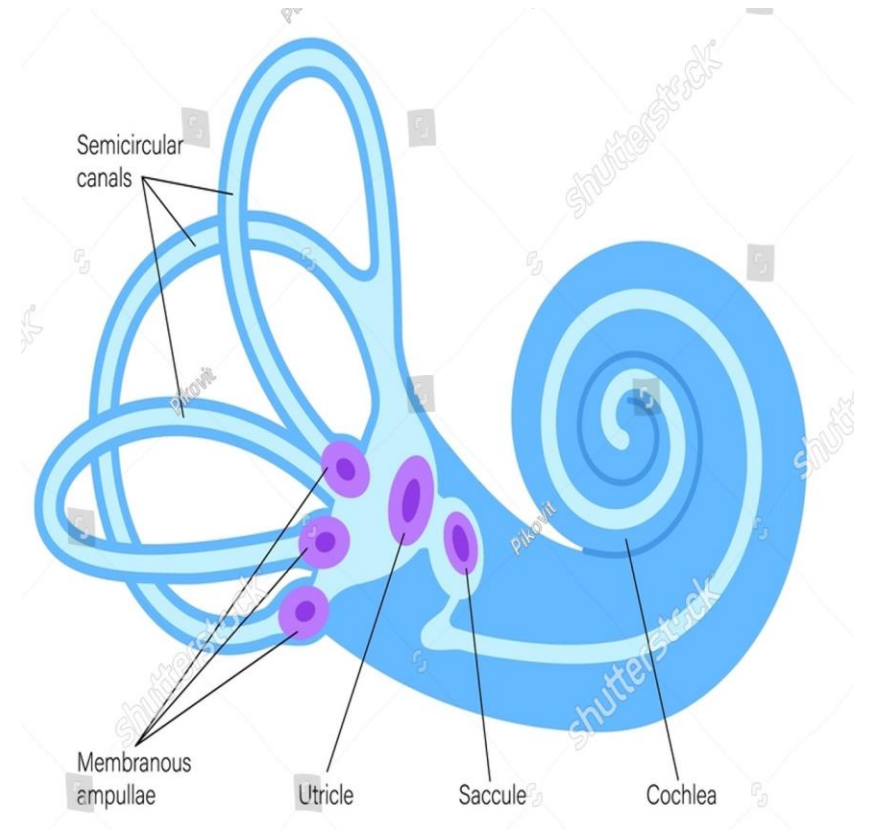
# 1. VESTIBULE

- Central part of the bony labyrinth
- Lies posterior to the cochlea and anterior to the semicircular canals
- Lateral wall has the fenestra vestibule (oval window) and the fenestra cochleae (round window)
- Lodged within the vestibule are the saccule and utricle of the membranous labyrinth

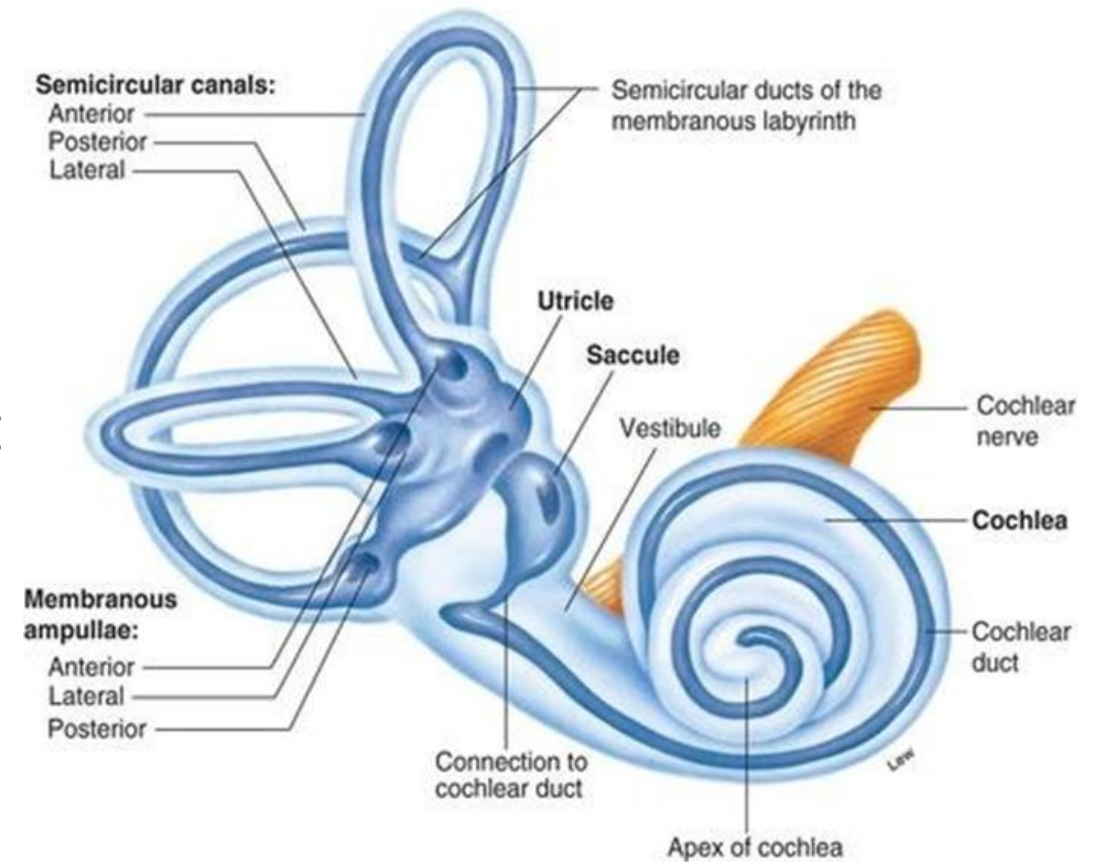


## 2. SEMICIRCULAR CANALS

- 3 semicircular canals—superior, posterior and lateral
- Open into the posterior part of the vestibule
- Each canal has a swelling at one end called the ampulla
- Lodged within the canals are the semicircular ducts

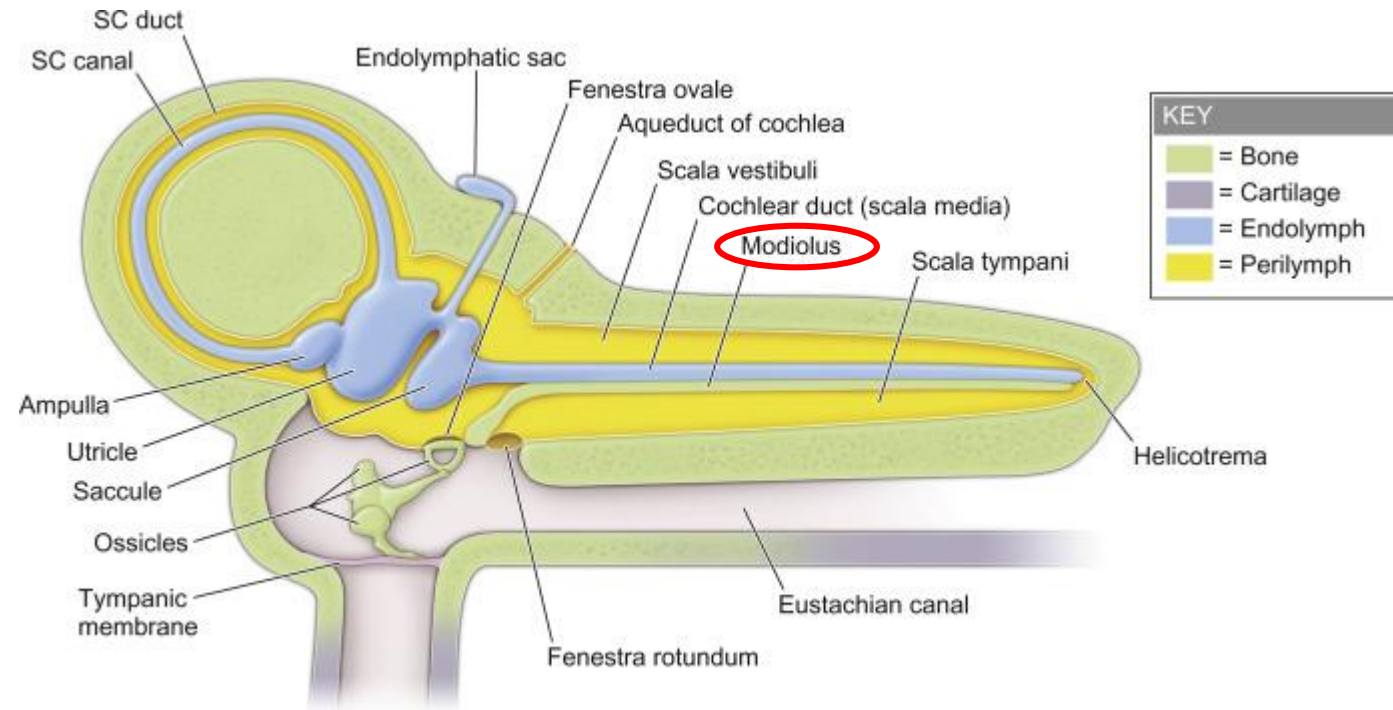


- The superior semicircular canal is vertical and placed at right angles to the long axis of the petrous bone
- The posterior canal is also vertical but is placed parallel with the long axis of the petrous bone
- The lateral canal is set in a horizontal position



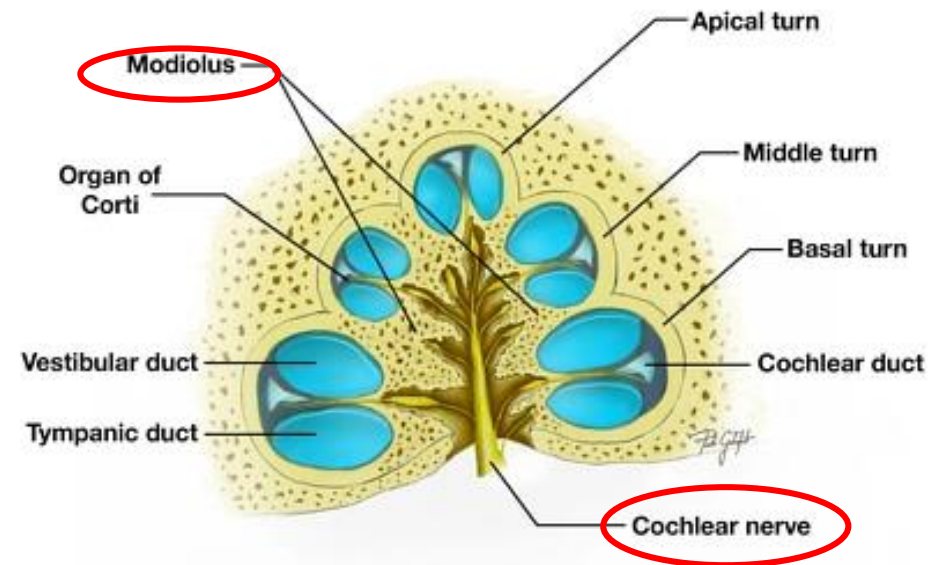
# 3. COCHLEA

- Opens into the anterior part of the vestibule
- Consists of a central pillar, the **modiolus**, around which a hollow bony tube makes two and one half spiral turns
- Modiolus is a conical shaped structure consisting of spongy bone located in center of cochlea



- The **modiolus** has a broad base, which is situated at the bottom of the internal acoustic meatus. It is perforated by branches of the cochlear nerve

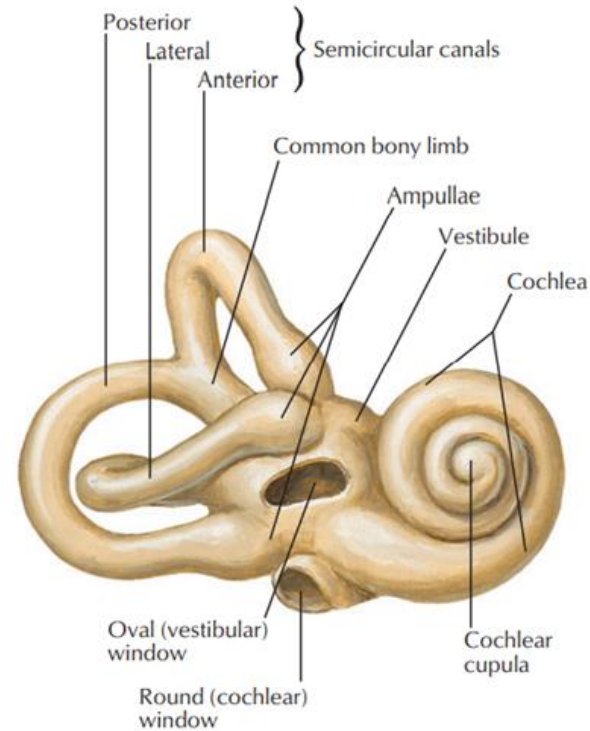
## Cochlea



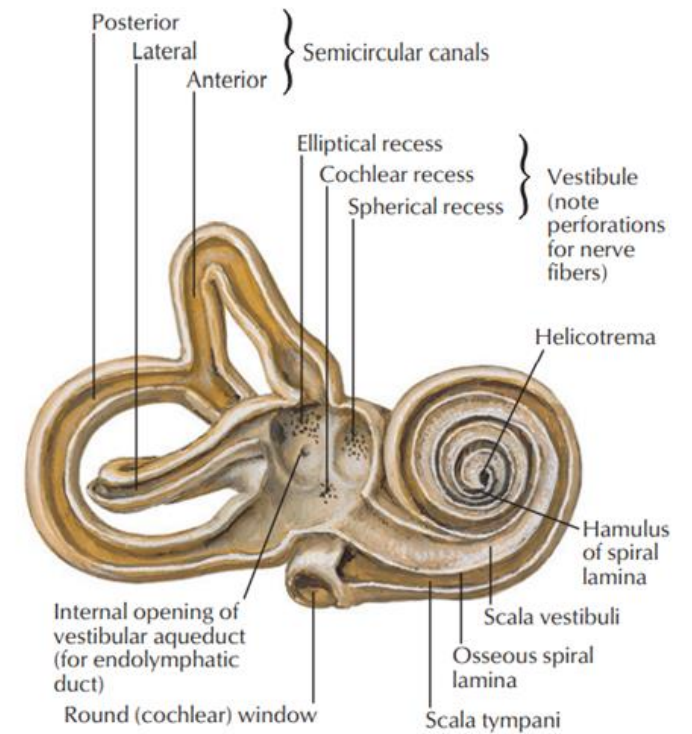


- The apex of cochlea faces anterolaterally and the base faces posteromedially
- The first basal turn of the cochlea forms the promontory on the medial wall of the middle ear

Right bony labyrinth (otic capsule), anterolateral view: surrounding cancellous bone removed

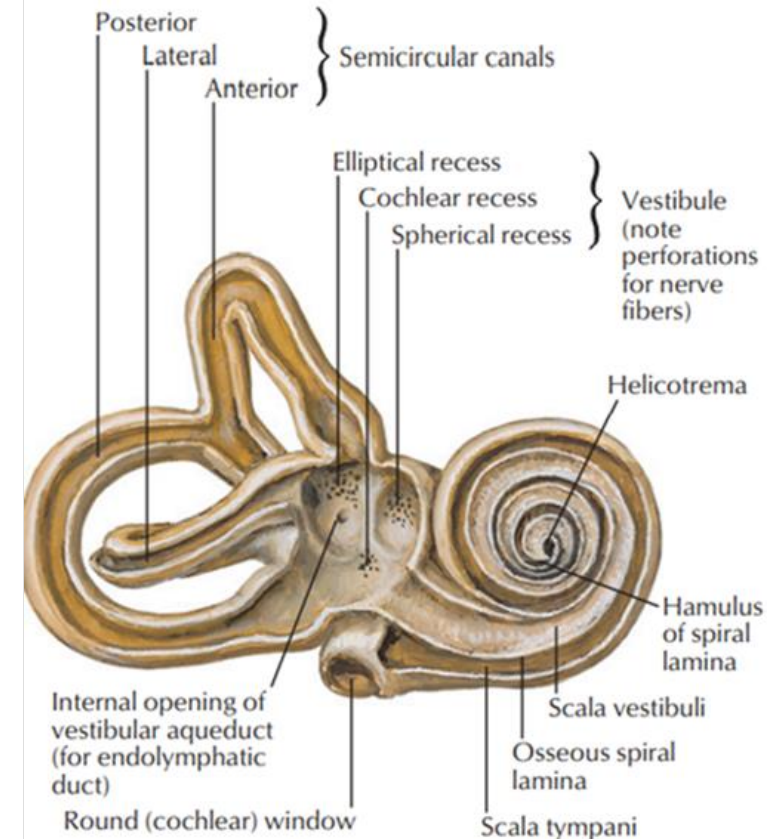


Dissected right bony labyrinth (otic capsule): membranous labyrinth removed

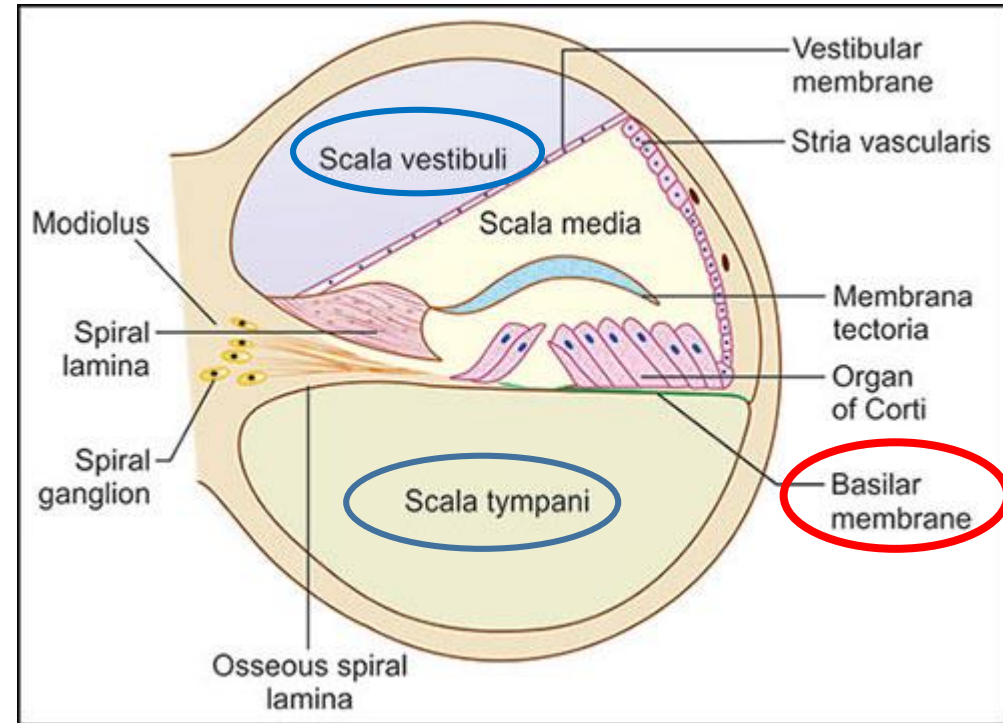


- Near the summit of cochlea the lamina ends in a hook shaped process called **Hamulus** which forms a boundary of a small opening called Helicotrema
- **Helicotrema** is an opening at the apex of cochlea through which the fluid in scala vestibuli and scala tympani communicate so that sound vibrations can pass to the round window

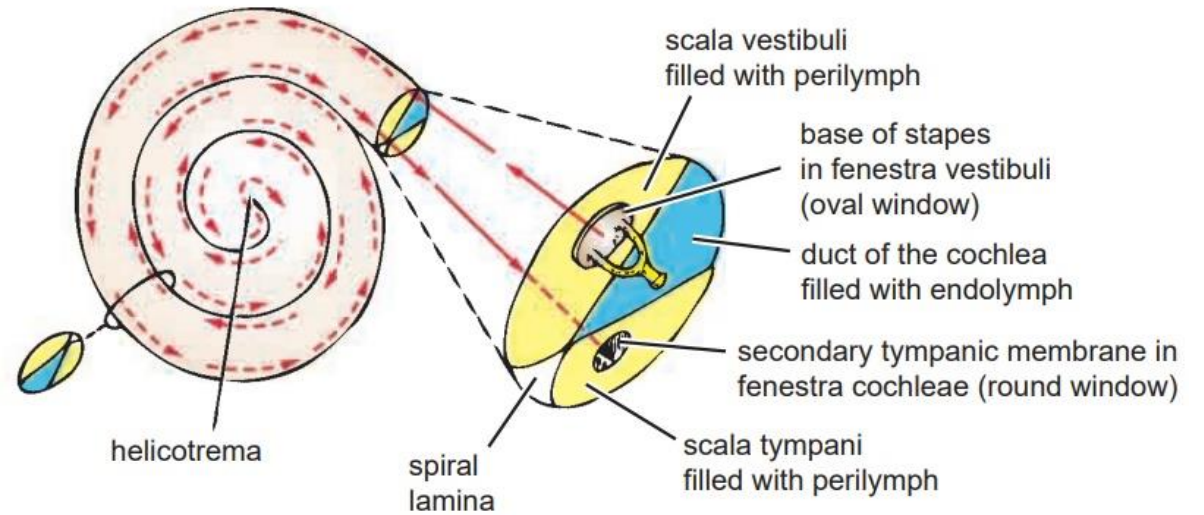
Dissected right bony labyrinth (otic capsule):  
membranous labyrinth removed



- The **basilar membrane** stretches from the free edge of the spiral lamina to the outer bony wall, thus dividing the cochlear canal into the scala vestibuli above and the scala tympani below



- The **perilymph within the scala vestibuli** is separated from the middle ear by the base of the stapes and the annular ligament at the fenestra vestibuli
- The **perilymph in the scala tympani** is separated from the middle ear by the secondary tympanic membrane in the fenestra cochleae

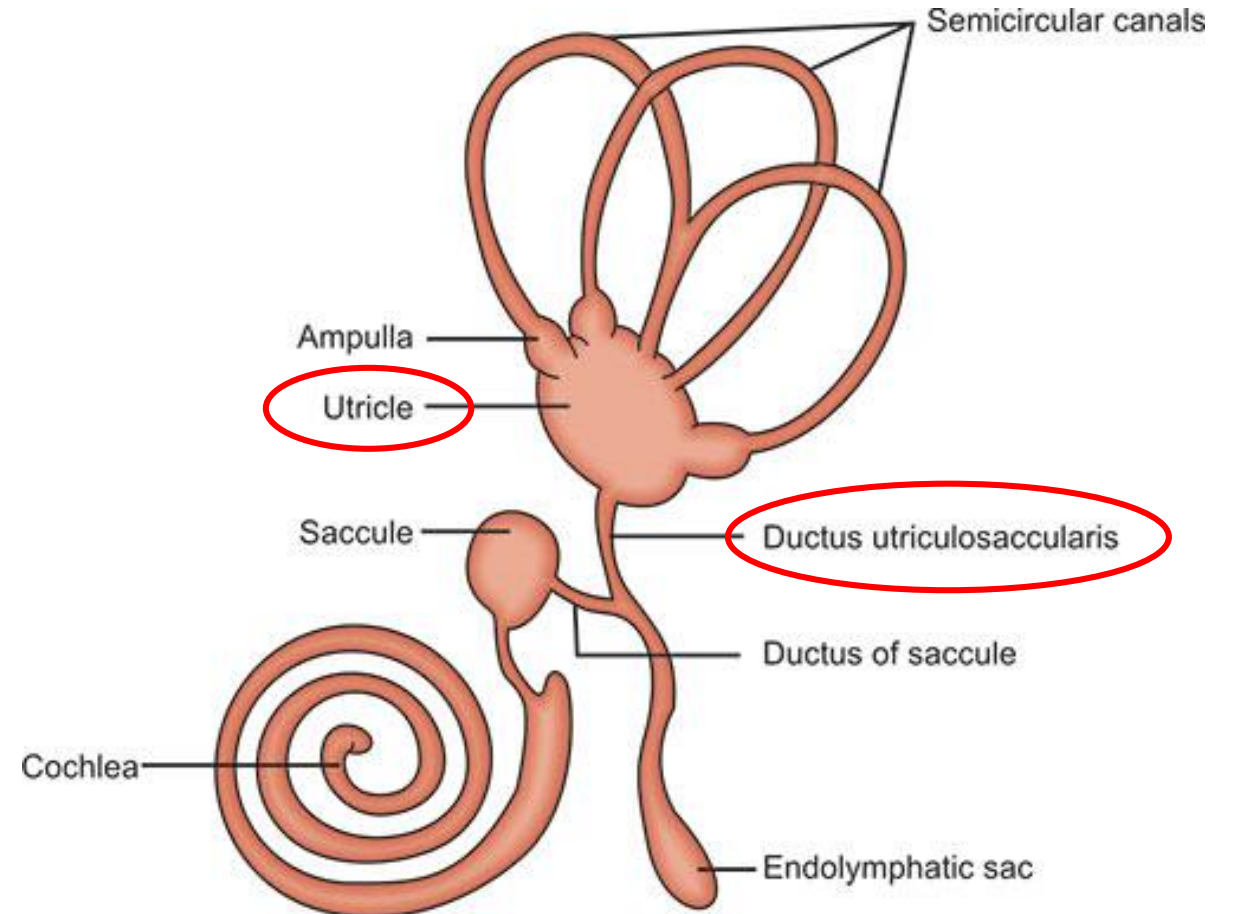


# MEMBRANOUS LABYRINTH

- Lodged within the bony labyrinth
- Filled with **endolymph** and surrounded by perilymph
- Consists of the utricle and saccule, the three semicircular ducts and the duct of the cochlea, which lies within the bony cochlea
- All these structures freely communicate with one another

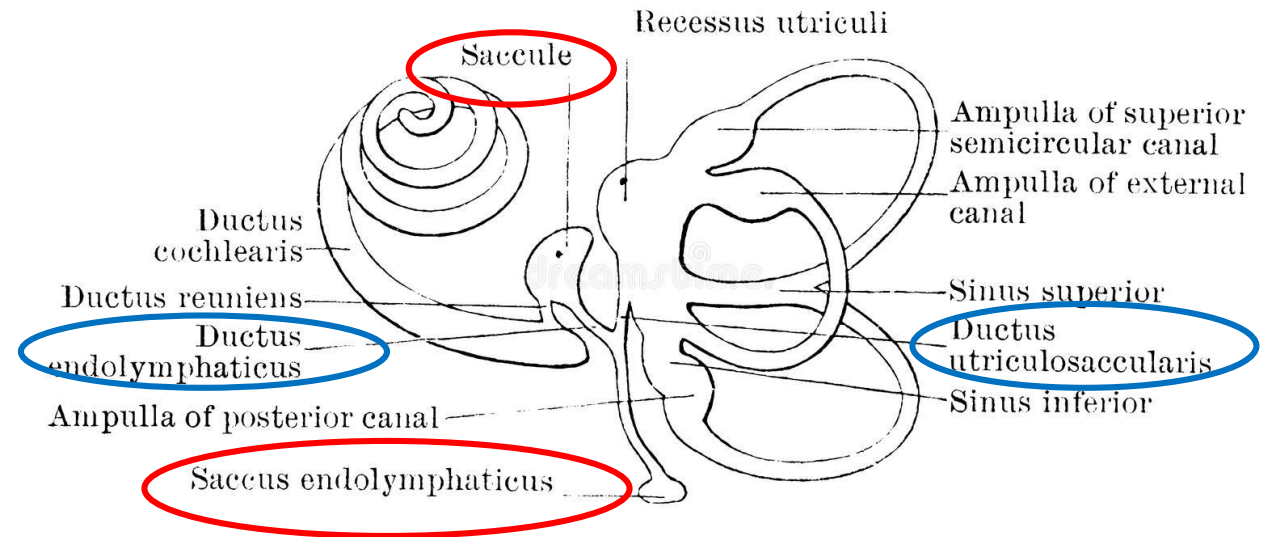
# 1. URTICLE

- Larger of the two vestibular sacs
- Indirectly connected to the saccule and the ductus endolymphaticus by the ductus utriculosaccularis



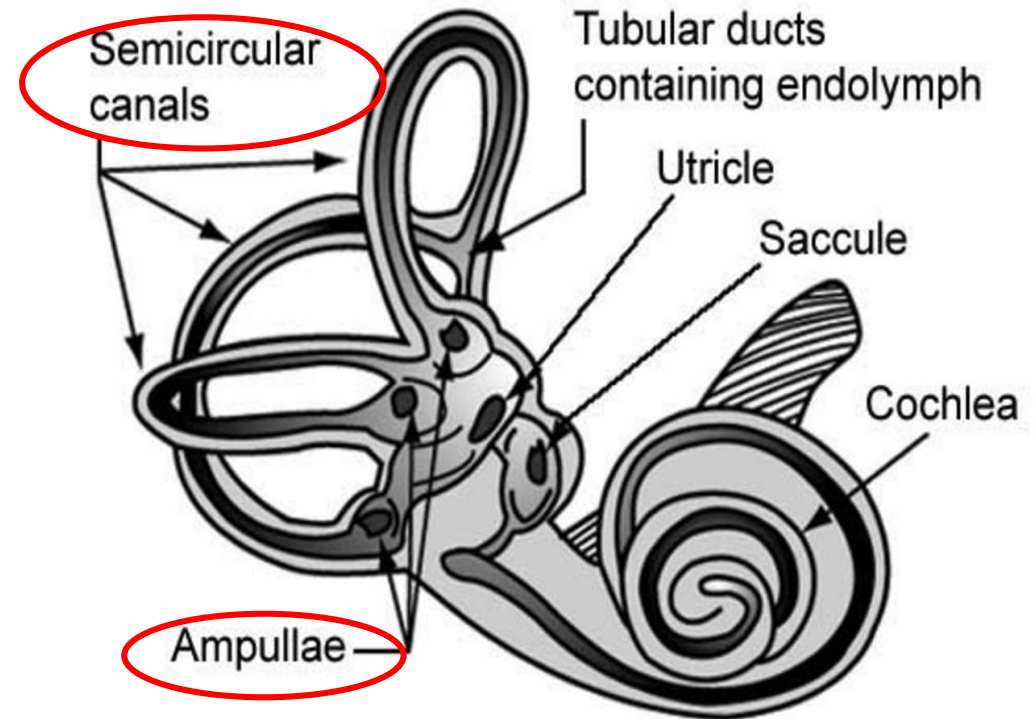
## 2. SACCCULE

- Globular and connected to the utricle
- The ductus endolymphaticus, after being joined by the ductus utriculosaccularis, passes on to end in a small blind pouch, the saccus endolymphaticus



# 3. SEMICIRCULAR DUCTS

- The **semicircular ducts**, although much smaller in diameter than the semicircular canals, have the same configuration
- They are arranged at right angles to each other so that all three planes are represented
- The change in head movement is detected by the sensory receptors in the **ampullae** of the semicircular ducts

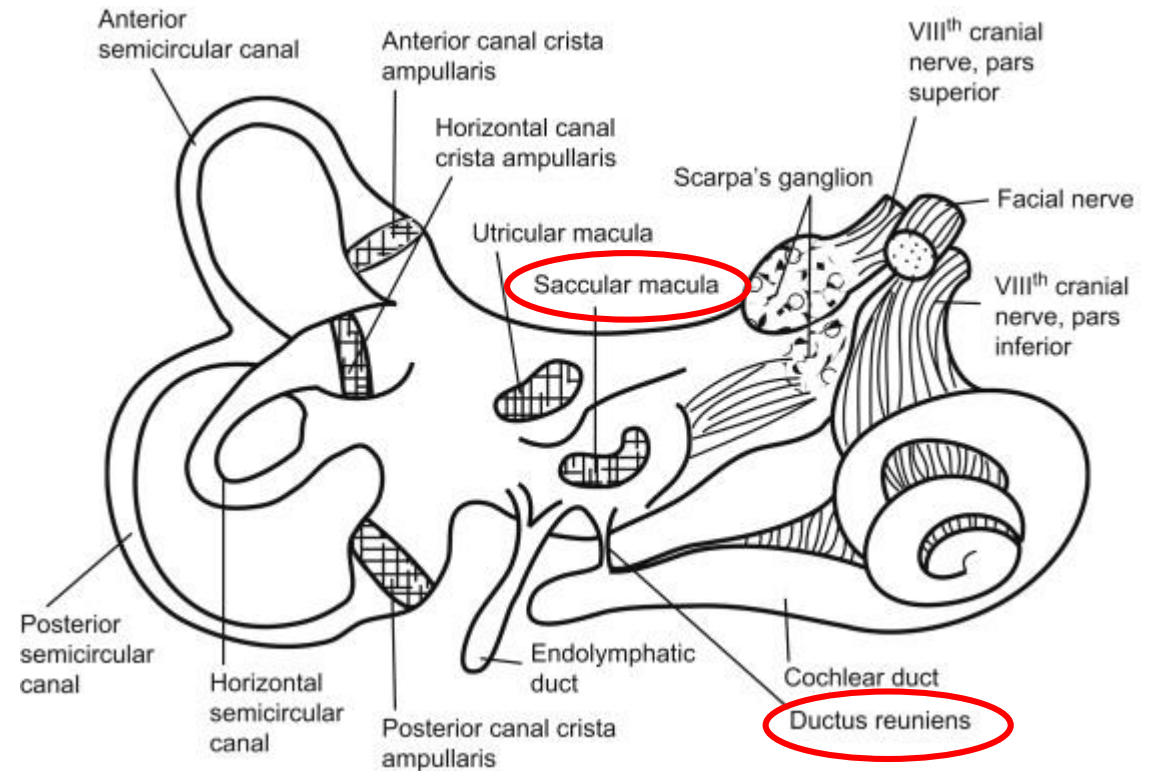


The Vestibular System - semicircular canals and otolith organs



# 4. DUCT OF COCHLEA

- It is triangular in cross section and is connected to the saccule by the ductus reuniens
- The highly specialized epithelium that lies on the basilar membrane forms the spiral organ of Corti and contains the sensory receptors for hearing



# NERVE SUPPLY:

- The inner ear is innervated by the **vestibulocochlear nerve**
- It divides into the **vestibular nerve** (responsible for balance) and the **cochlear nerve** (responsible for hearing)

# BLOOD SUPPLY

## **Bony labyrinth:**

1. Anterior tympanic branch (from maxillary artery)
2. Petrosal branch (from middle meningeal artery)
3. Stylomastoid branch (from posterior auricular artery)

## **Membranous labyrinth:**

1. Labyrinthine artery (branch of the inferior cerebellar artery) which divides into Cochlear branch and Vestibular branches X2

# CLINICAL CORRELATIONS:

- Meniere's disease is a disorder of the inner ear, characterised by episodes of vertigo, low-pitched tinnitus, and hearing loss
- The symptoms are thought to be caused by an excess accumulation of endolymph within the membranous labyrinth, causing progressive distension of the ducts
- The resulting pressure fluctuations damage the thin membranes of the ear that detect balance and sound

