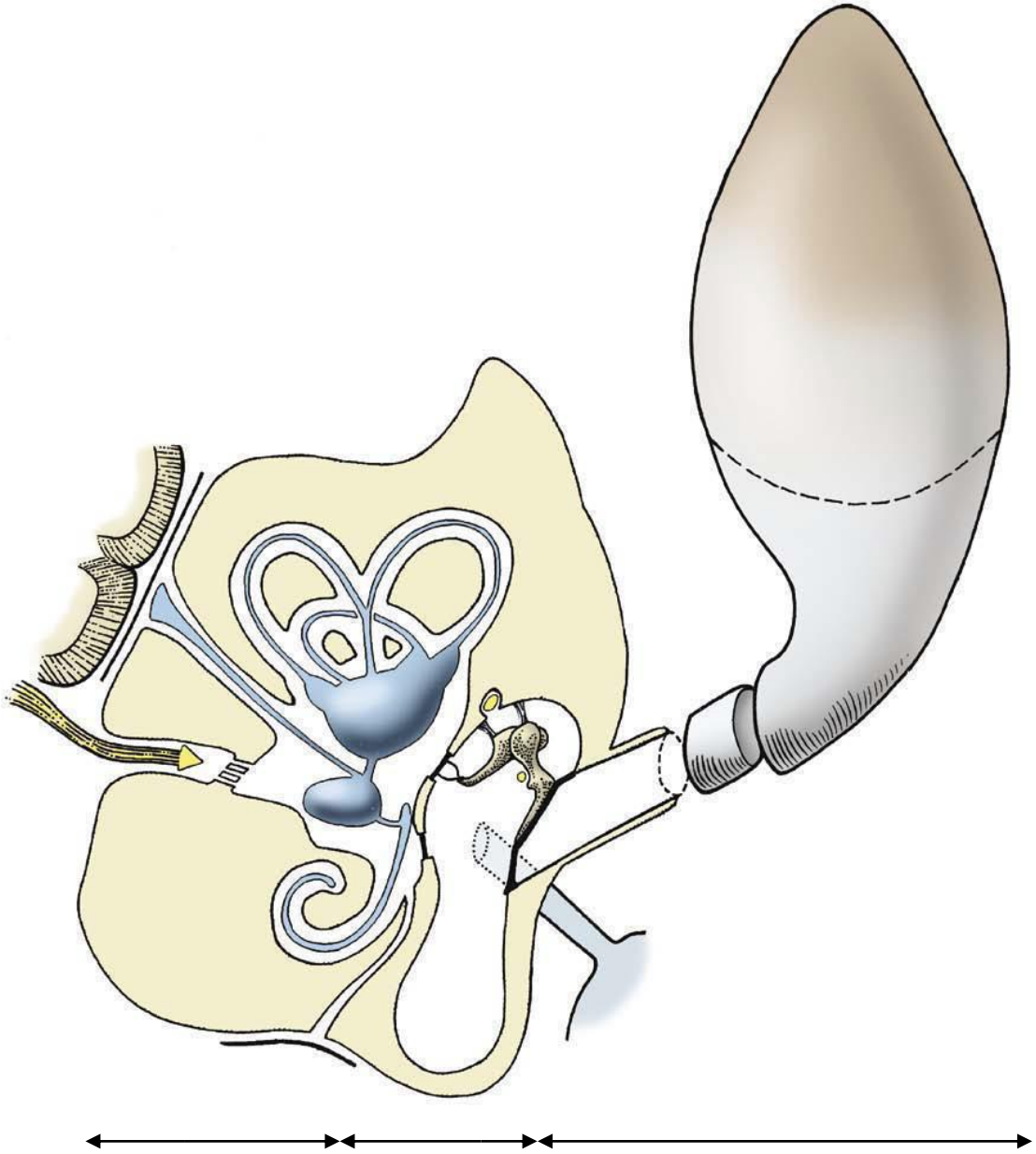
EAR

organum vestibulocochleare

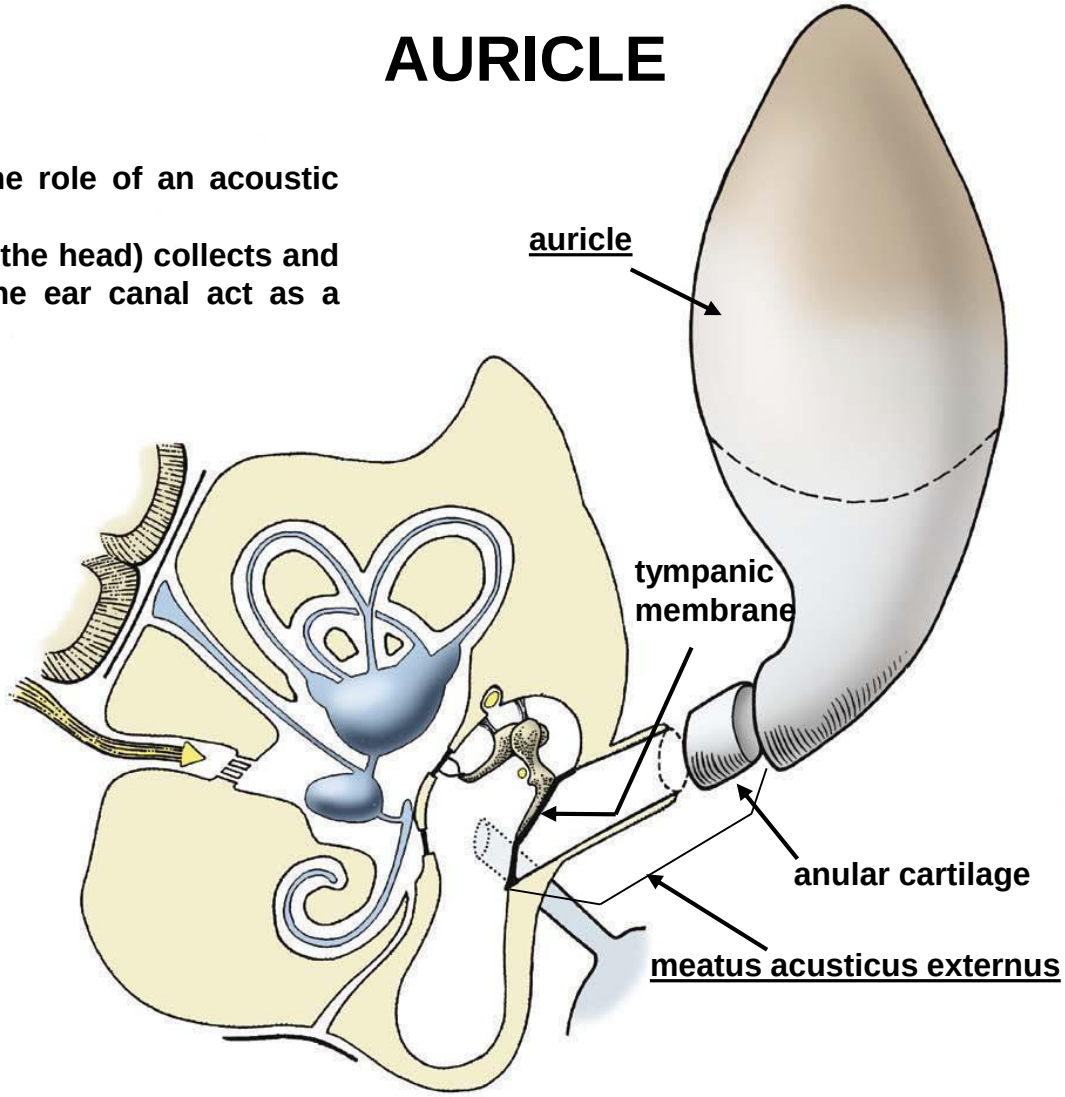

INTERNAL EAR
MIDDLE EAR
EXTERNAL EAR

PETROSAL BONE- Eq

EXTERNAL EAR

AURICLE

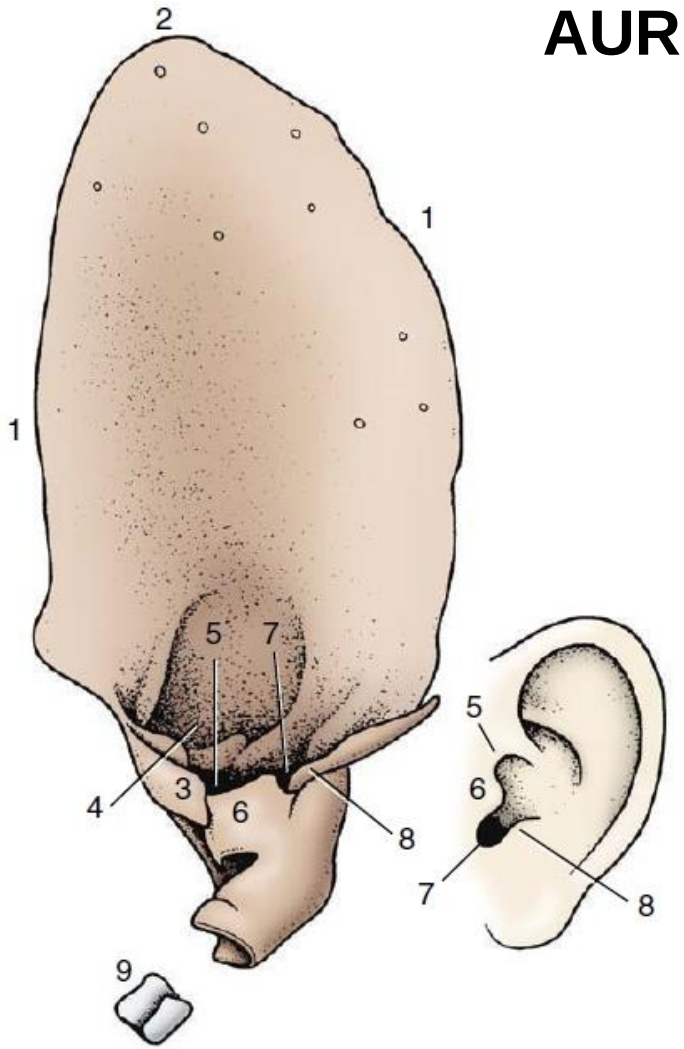
The external ear plays the role of an acoustic antenna:
the auricle (together with the head) collects and focuses sound waves, the ear canal act as a resonator.

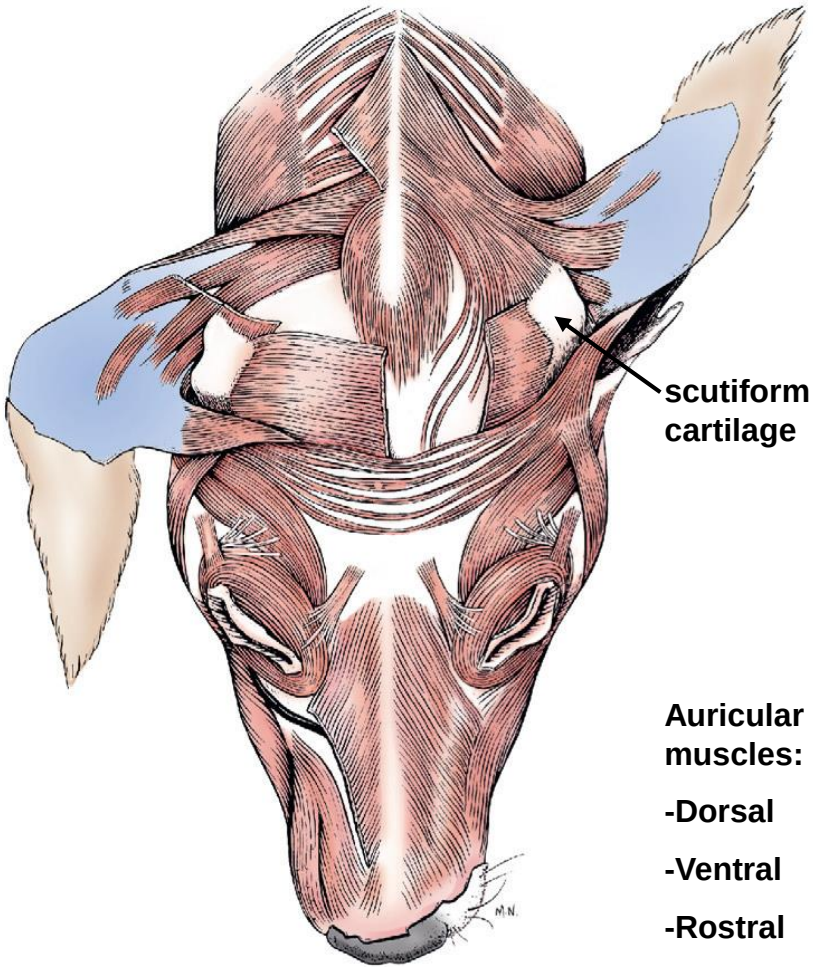


EXTERNAL EAR

EXTERNAL EAR

AURICLE





Auricular muscles:

-Dorsal

-Ventral

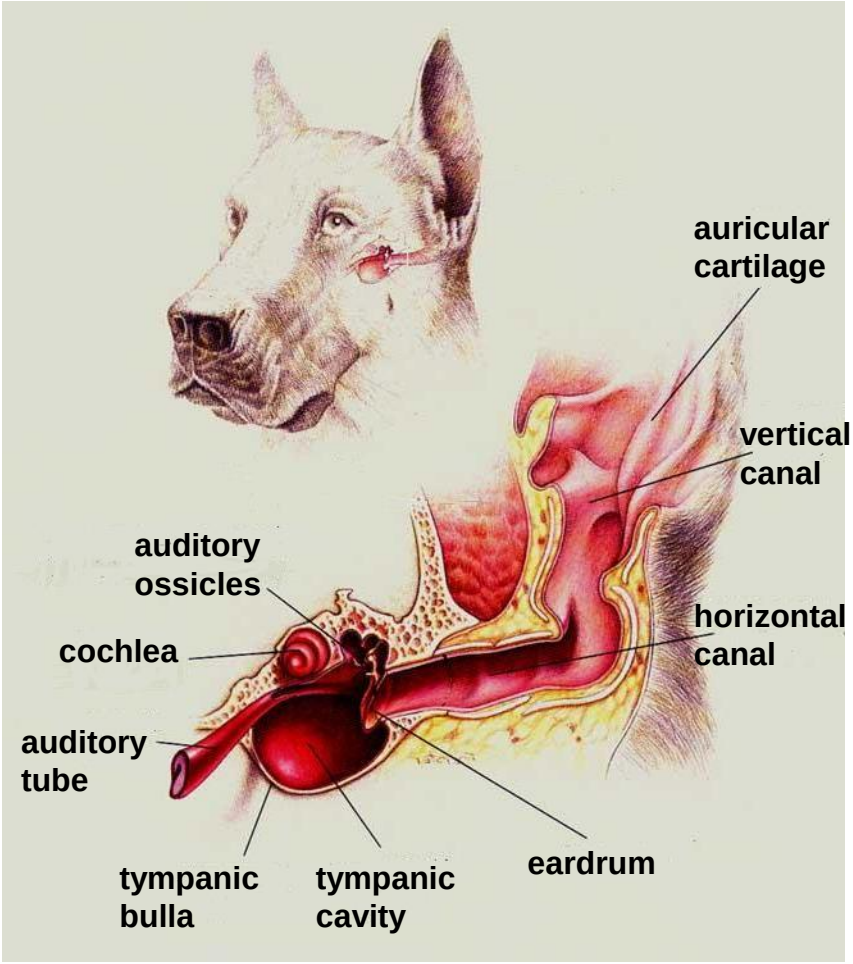
-Rostral

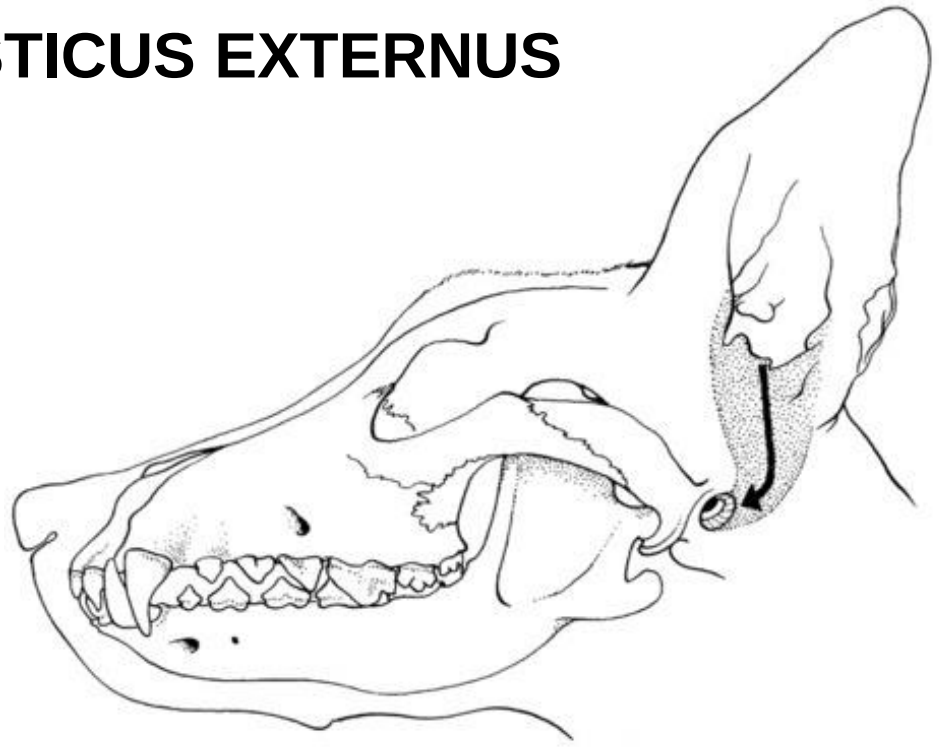
-Caudal

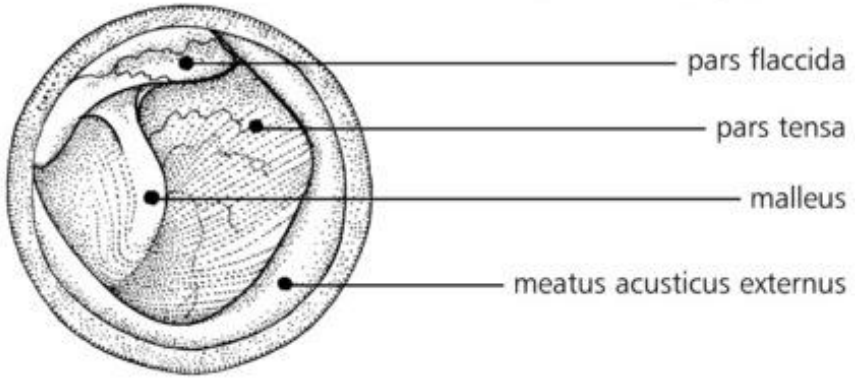
Figure 9–25 Left auricular cartilage of dog compared with human ear. *1,* Helix; *2,* apex; *3,* medial crus of helix; *4,* lateral crus of helix; *5,* pretragic notch; *6,* tragus; *7,* intertragic notch; *8,* antitragus; *9,* annular cartilage.

EXTERNAL EAR

MEATUS ACUSTICUS EXTERNUS



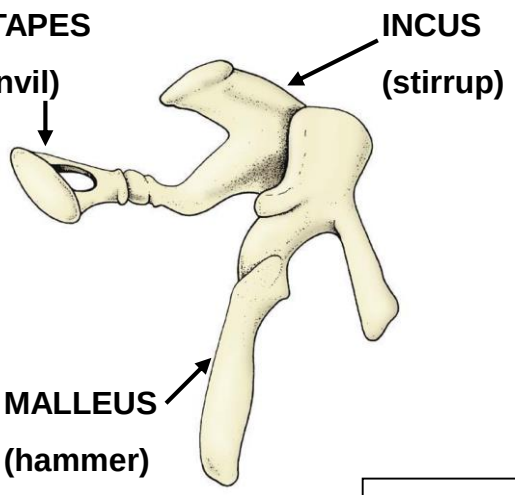




tympanic membrane

MIDDLE EAR

Auditory ossicles



Tympanic cavity:

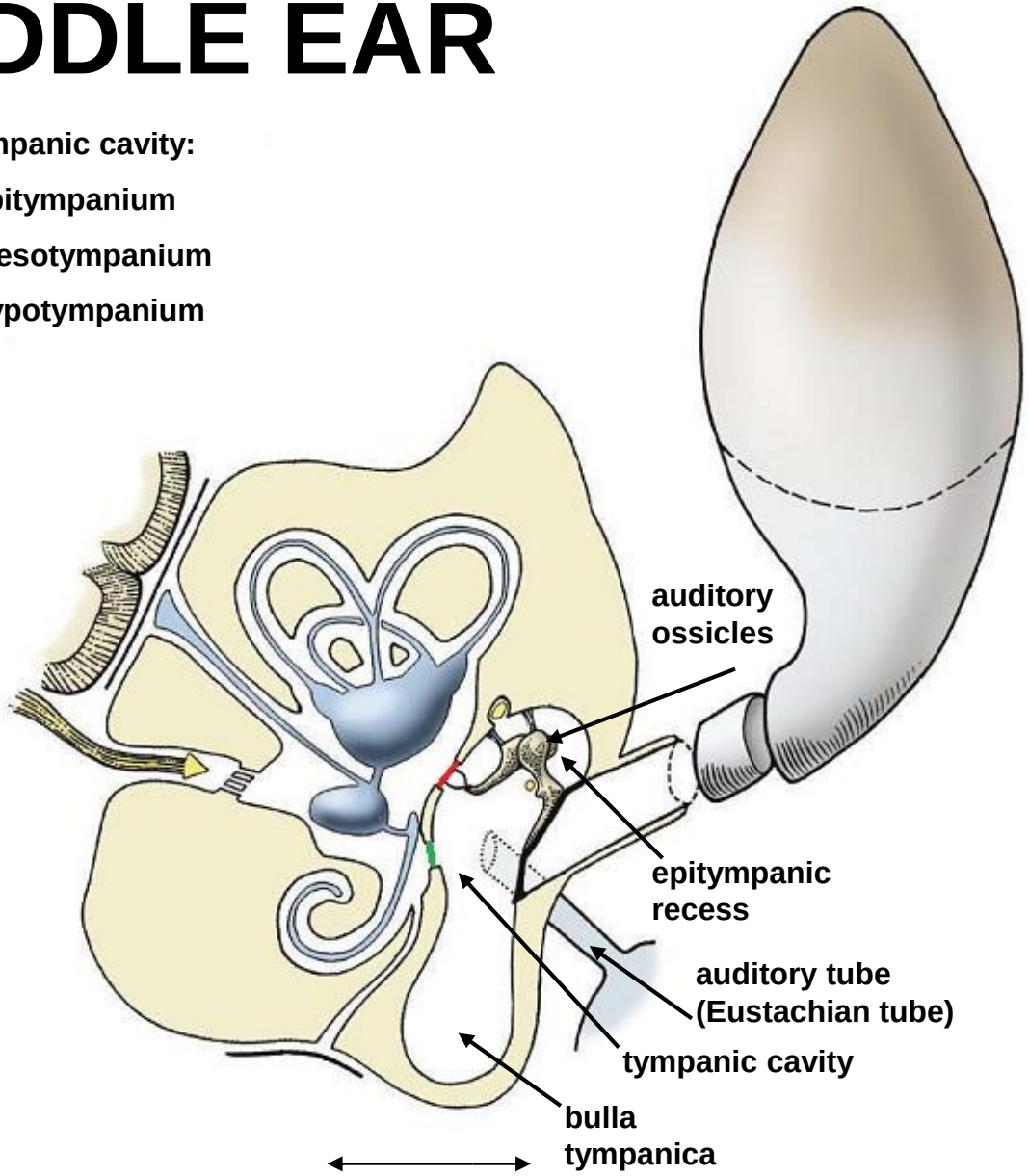
- **epitympanium**
- **mesotympanium**
- **hypotympanium**

vestibular window-
or oval window

through which mechanical stimuli (transmitted by the auditory ossicles) enter the internal ear for translation into nerve impulses

cochlear window-
or round window

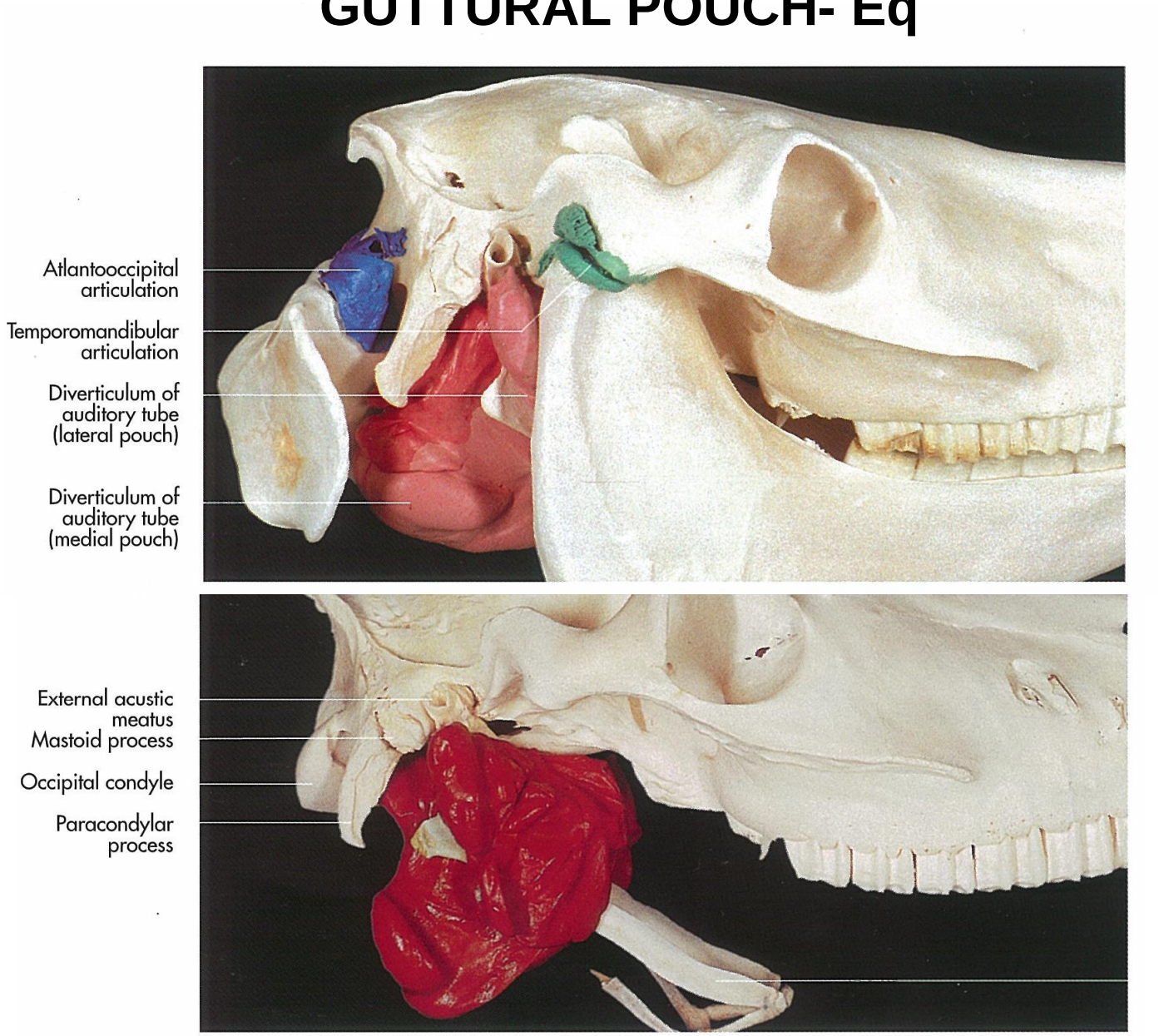
through which the vibration of the perilympha is absorbed



MIDDLE EAR

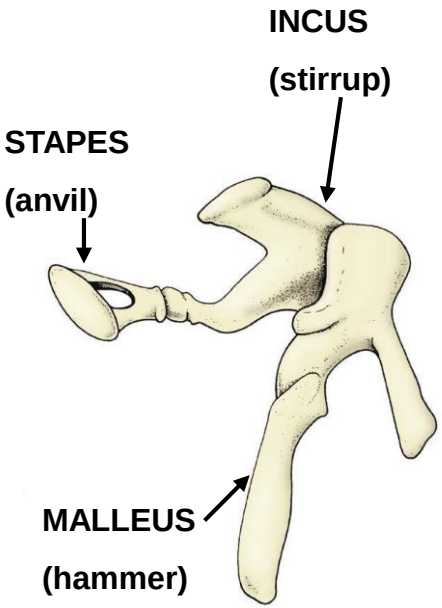
MIDDLE EAR

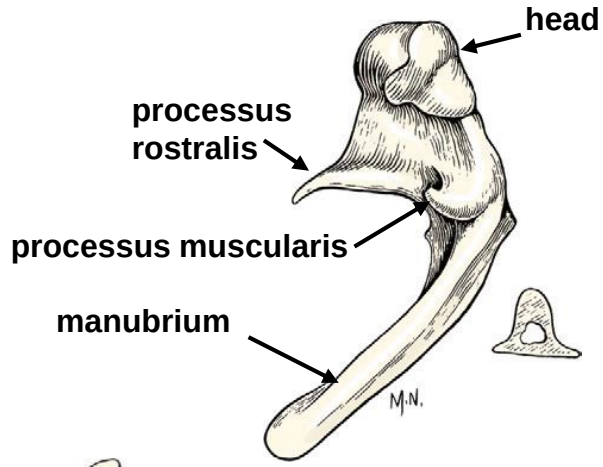
GUTTURAL POUCH- Eq

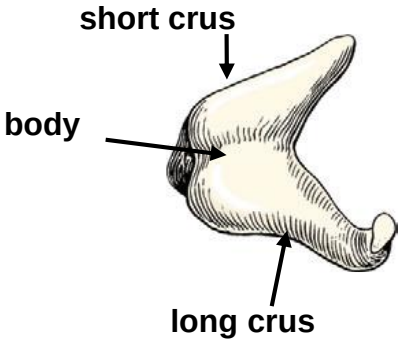


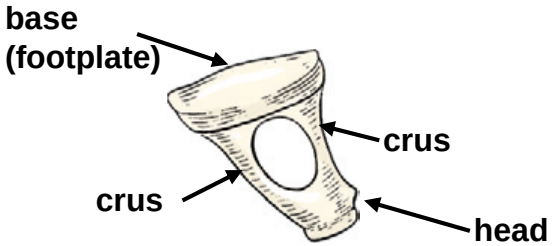
MIDDLE EAR

AUDITORY OSSICLES









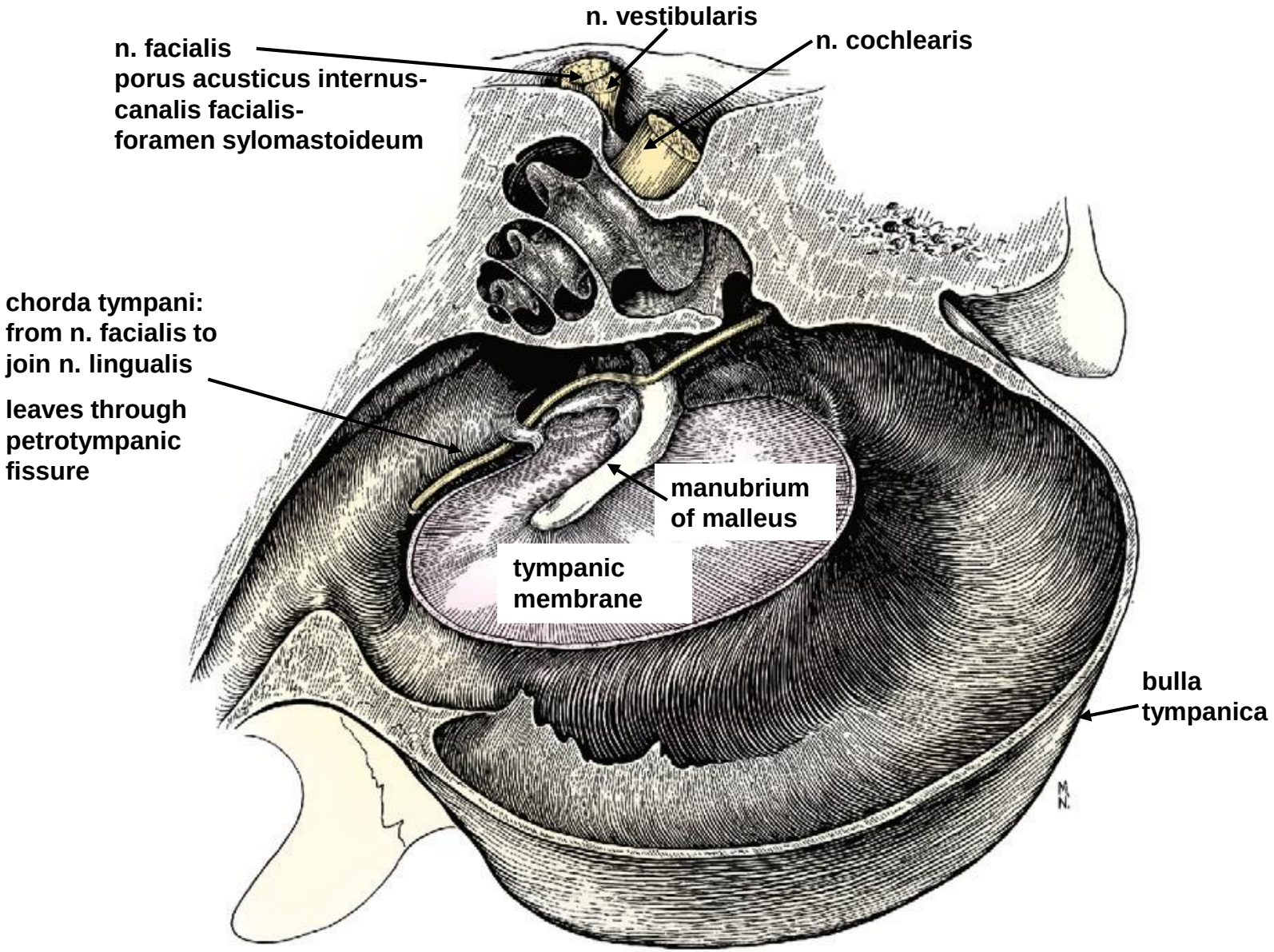
Two muscles of the ossicles:

m. tensor tympani- n. tensoris tympani ex. n. mandibularis
m. stapedius- n. stapedius
ex. n. facialis

The muscles fix the bones and protect the cochlea against the harmful effects caused by very loud sounds as contraction of the muscles attenuates sound conduction.

MIDDLE EAR

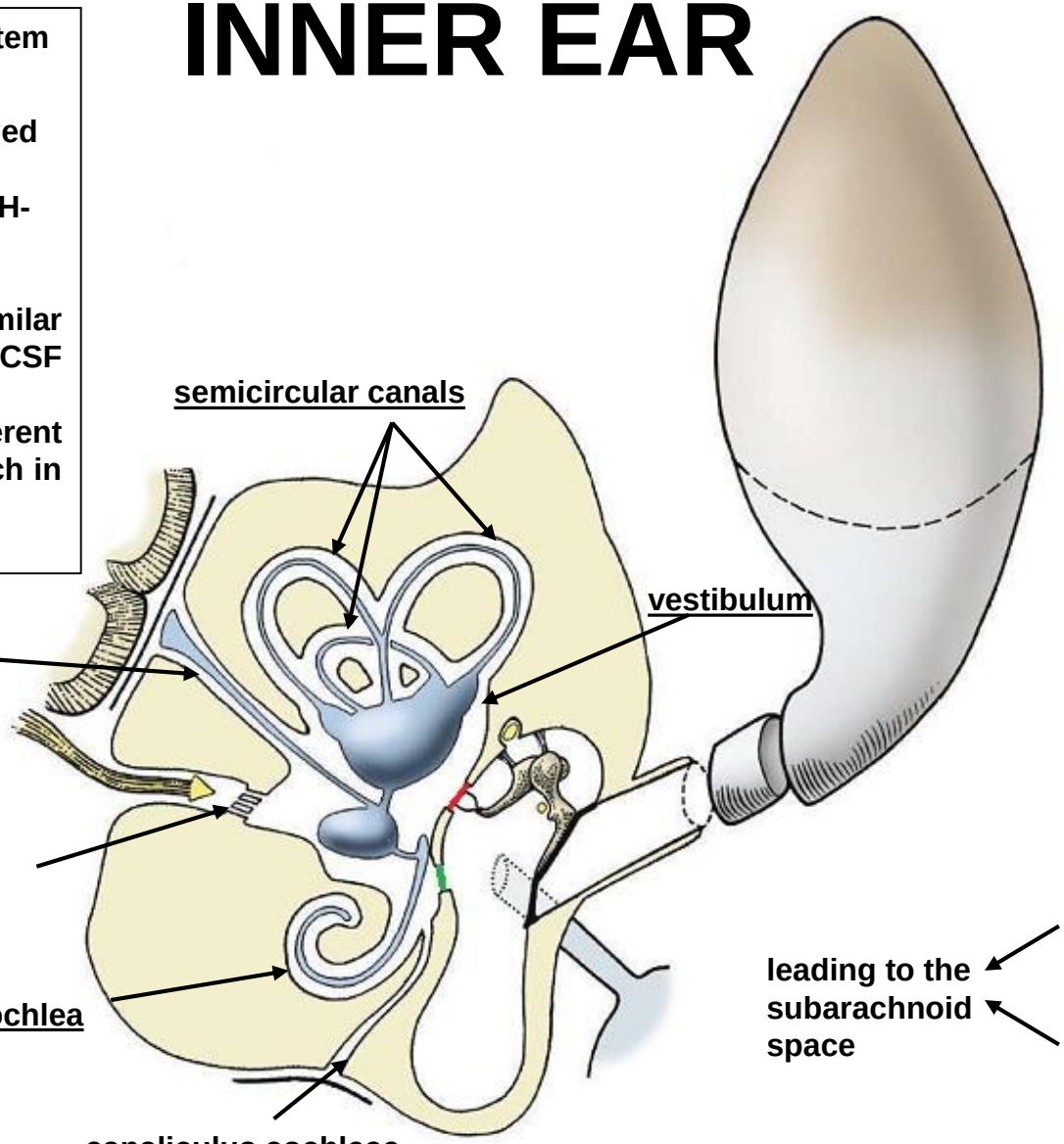
TYMPANIC CAVITY



INNER EAR

Consists of an irregular system of canals and cavities:
- OSSEOUS LABYRINTH- filled with perilympha
- MEMBRANOUS LABYRINTH- filled with endolympha

The perilympha has similar ionic composition as the CSF (rich in sodium ions), but the endolympha has a different and unique composition (rich in potassium ions).



Openings:

-porus acusticus internus

- vestibular window

-cochlear window

leading to the subarachnoid space:

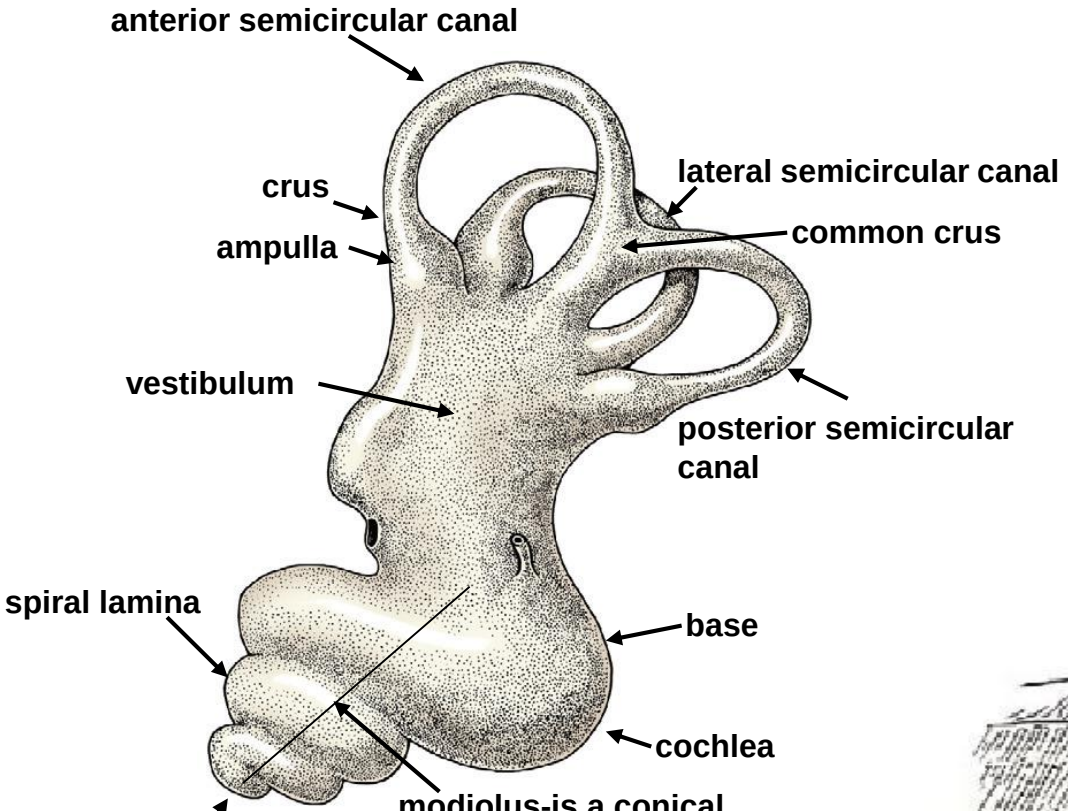
-canaliculus cochleae

-aqueductus vestibuli

INTERNAL EAR

INNER EAR

OSSEOUS LABYRINTH



Consists of three perilympha-filled compartments:

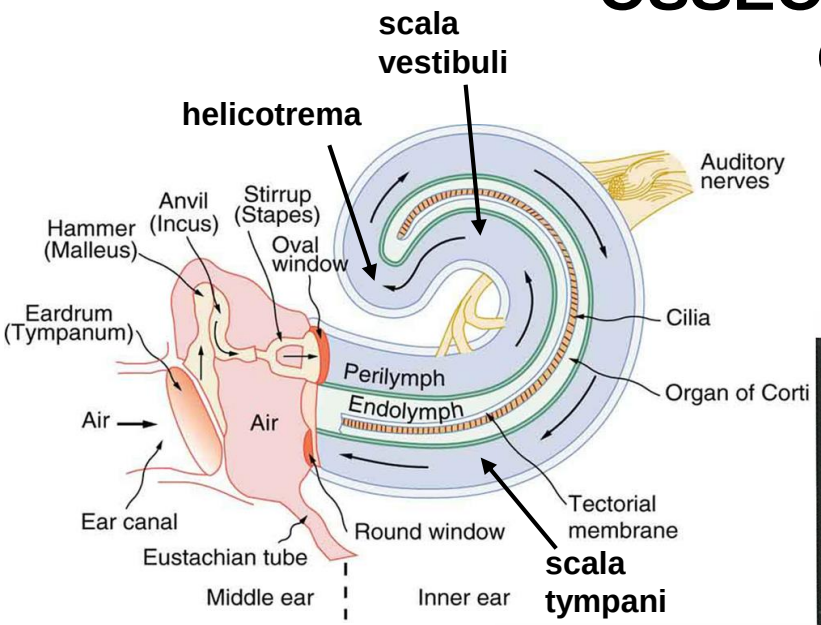
-<u>three semicircular canals</u>
-<u>cochlea</u>
-<u>vestibulum</u>

Source of perilympha:
- from CSF through perilymphatic duct in the cochlear canaliculus
- ultrafiltrate from blood vessels

INNER EAR

OSSEOUS LABYRINTH

COCHLEA

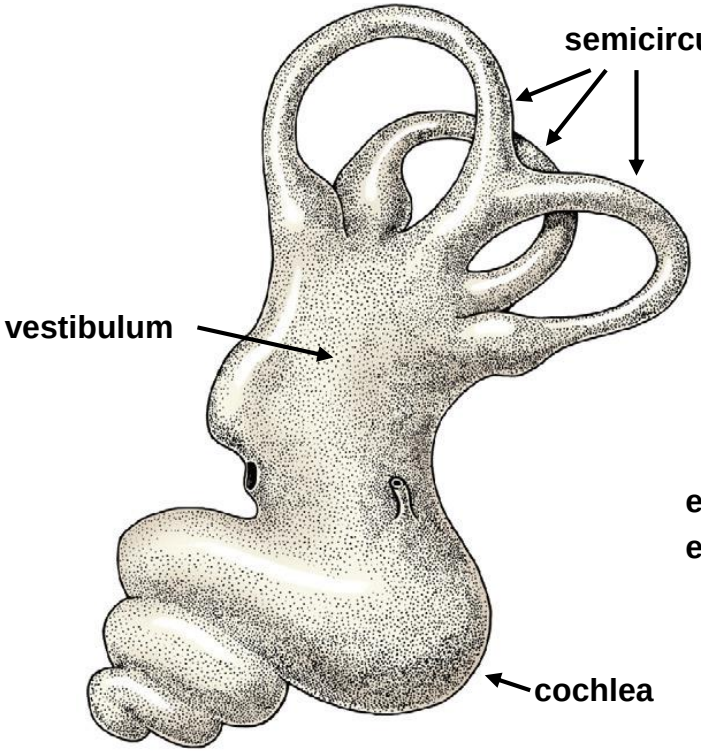


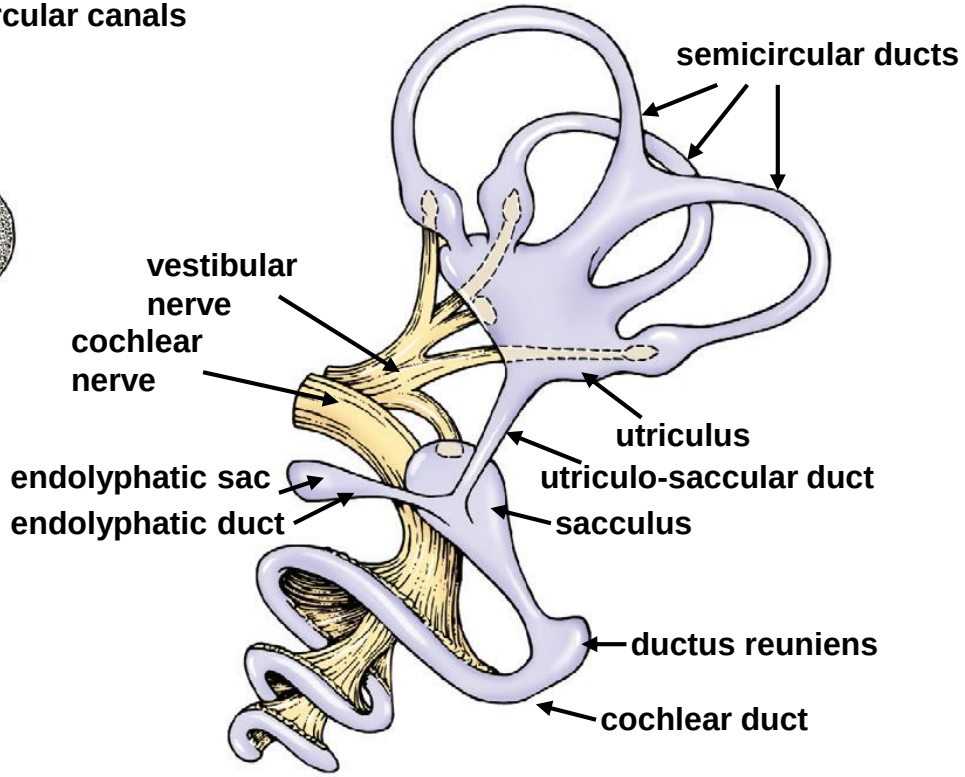
The two scalae communicate at the apex of the cochlea (helicotrema).

At the base of the cochlea the scala vestibuli begins at the vestibular window, and the scala tympani ends at the cochlear window.

INNER EAR

OSSEOUS AND MEMBRANOUS LABYRINTHS





Consists of four endolympha-filled compartments:

-sacculus

-utriculus

-three semicircular ducts

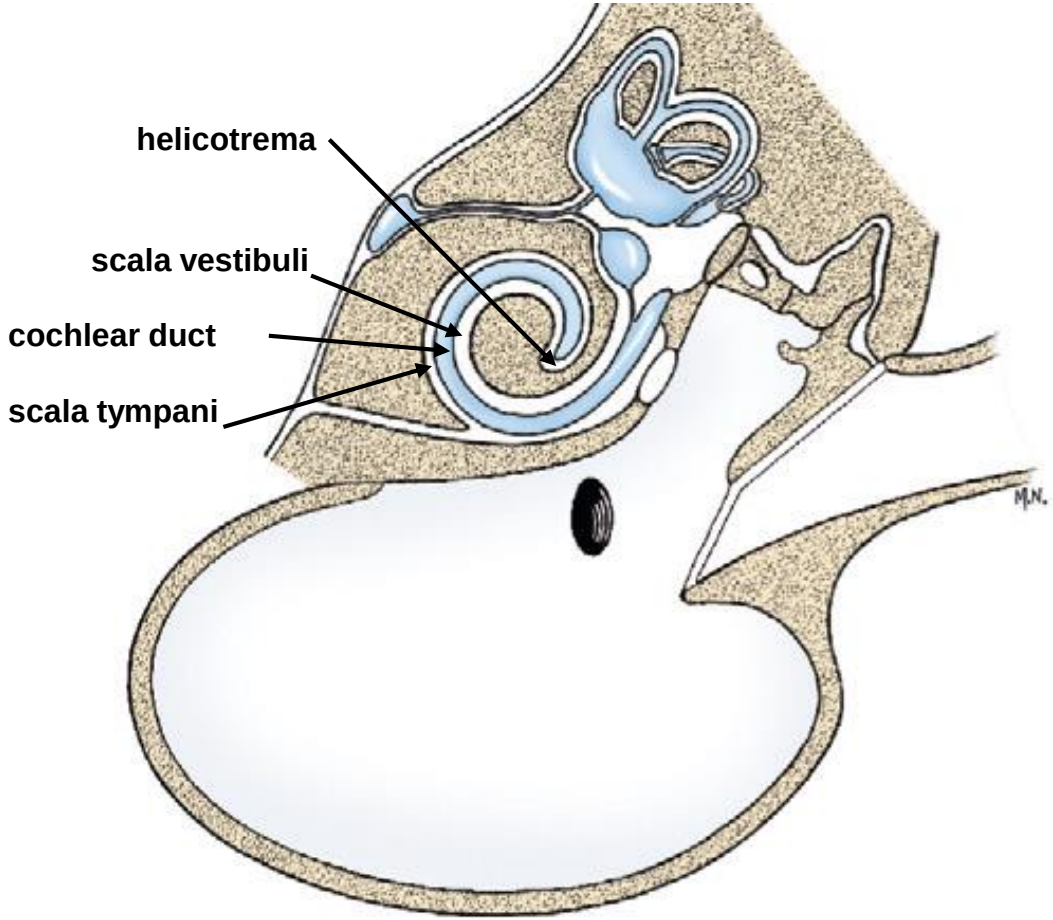
-cochlear duct

Source of endolympha:
- ultrafiltrate from stria vascularis of the cochlear duct

INNER EAR

OSSEOUS AND MEMBRANOUS LABYRINTHS

COCHLEA

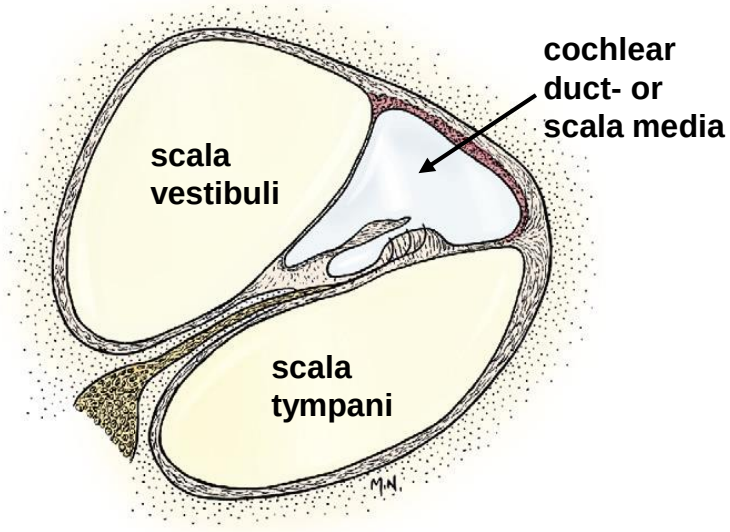


Cochlea is divided into 3 channels:

- scala vestibuli

- scala tympani

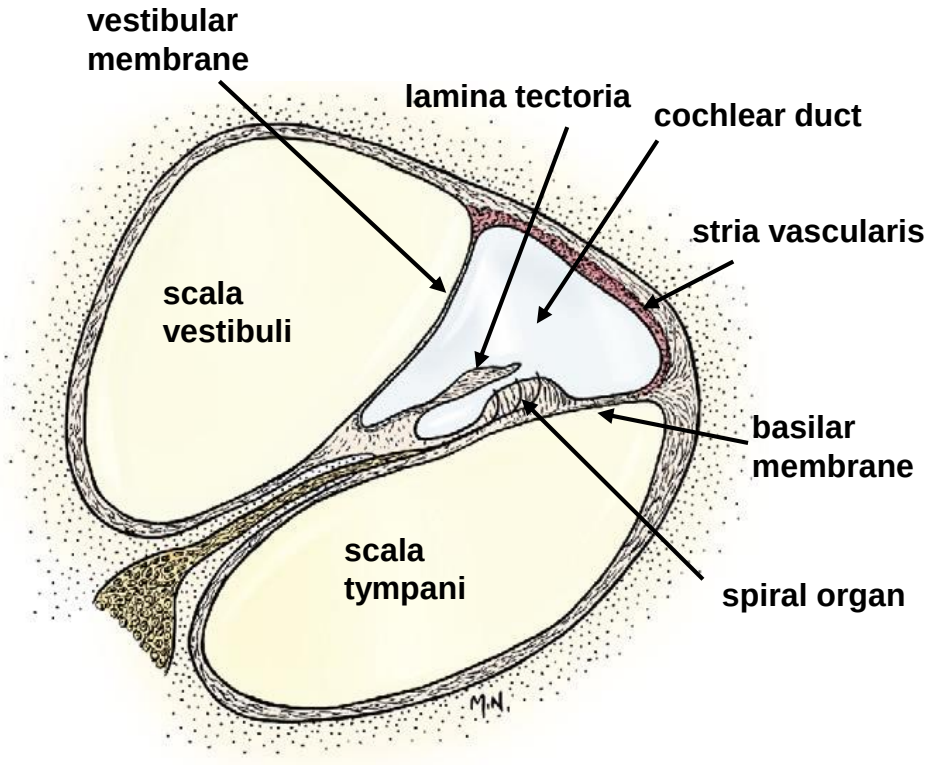
- scala media

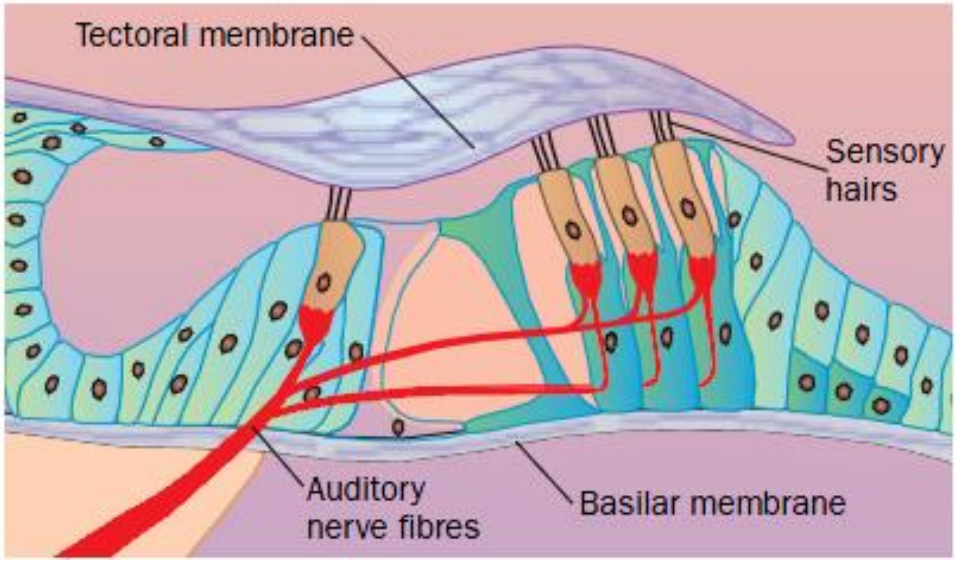


INNER EAR

MEMBRANOUS LABYRINTH

COCHLEA: HEARING





Receptor organ:

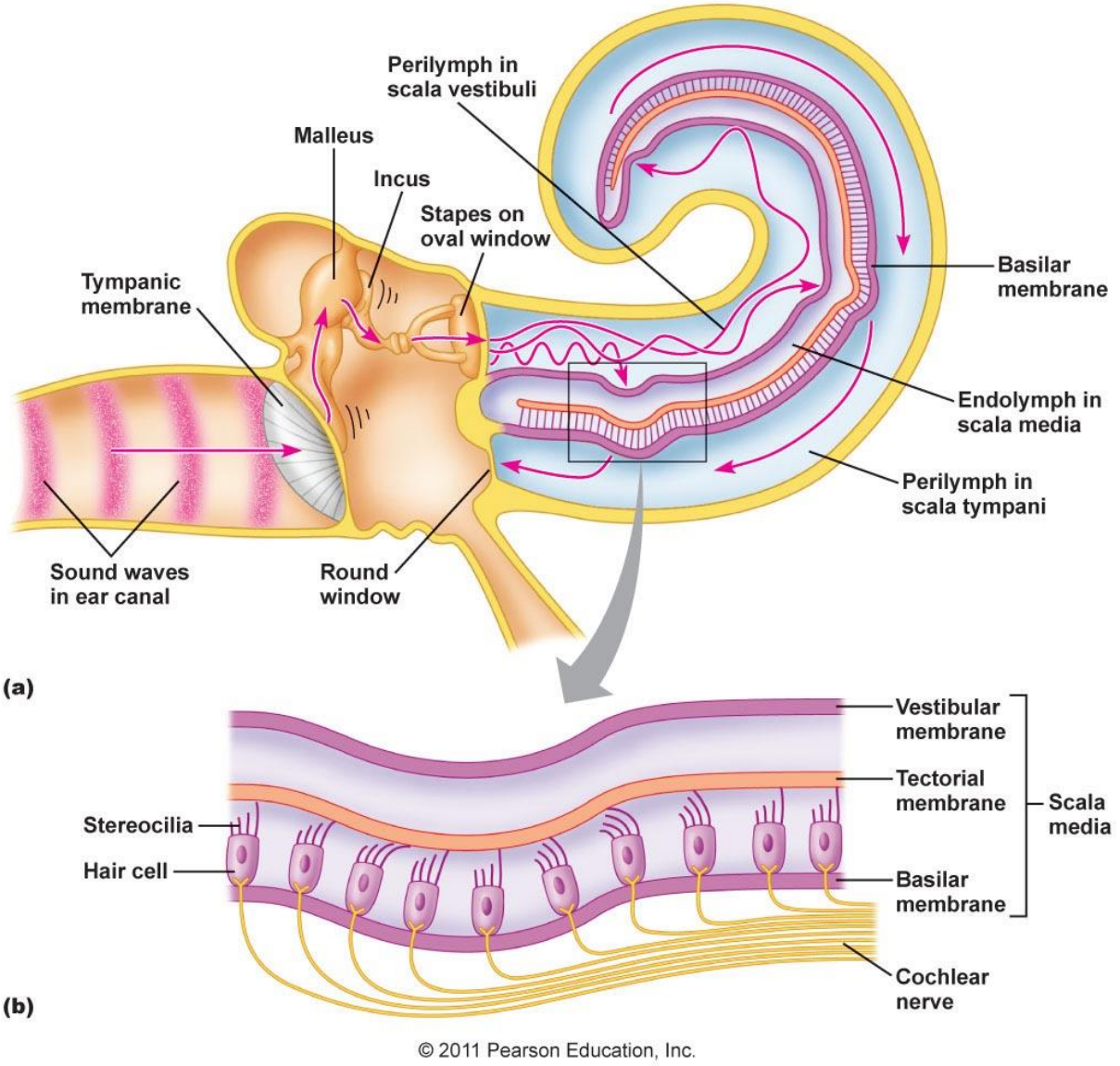
SPIRAL ORGAN (organ of Corti)

INNER EAR

MEMBRANOUS LABYRINTH

COCHLEA: HEARING

The cochlea is concerned with hearing:
-sound waves picked up by the external ear vibrate the eardrum
-in the tympanic cavity the oscillation in the air is converted into oscillation of the auditory ossicles as the eardrum mobilizes the ossicular chain of the middle ear.
-the footplate of the stapes applies a mechanic pressure on the vestibular window and the vibration reaches the perilymphatic fluid of the cochlea.
-oscillation of the perilympha stimulates the SPIRAL ORGAN by the vibration of the basilar membrane (first the oscillations reach the scala vestibuli until the helicotrema and then they reach the scala tympani, as the basal membrane can only be stimulated through the scala tympani)
-each sound frequency resonates with a different part of the basilar membrane: low sounds near helicotrema, high sounds at the base.

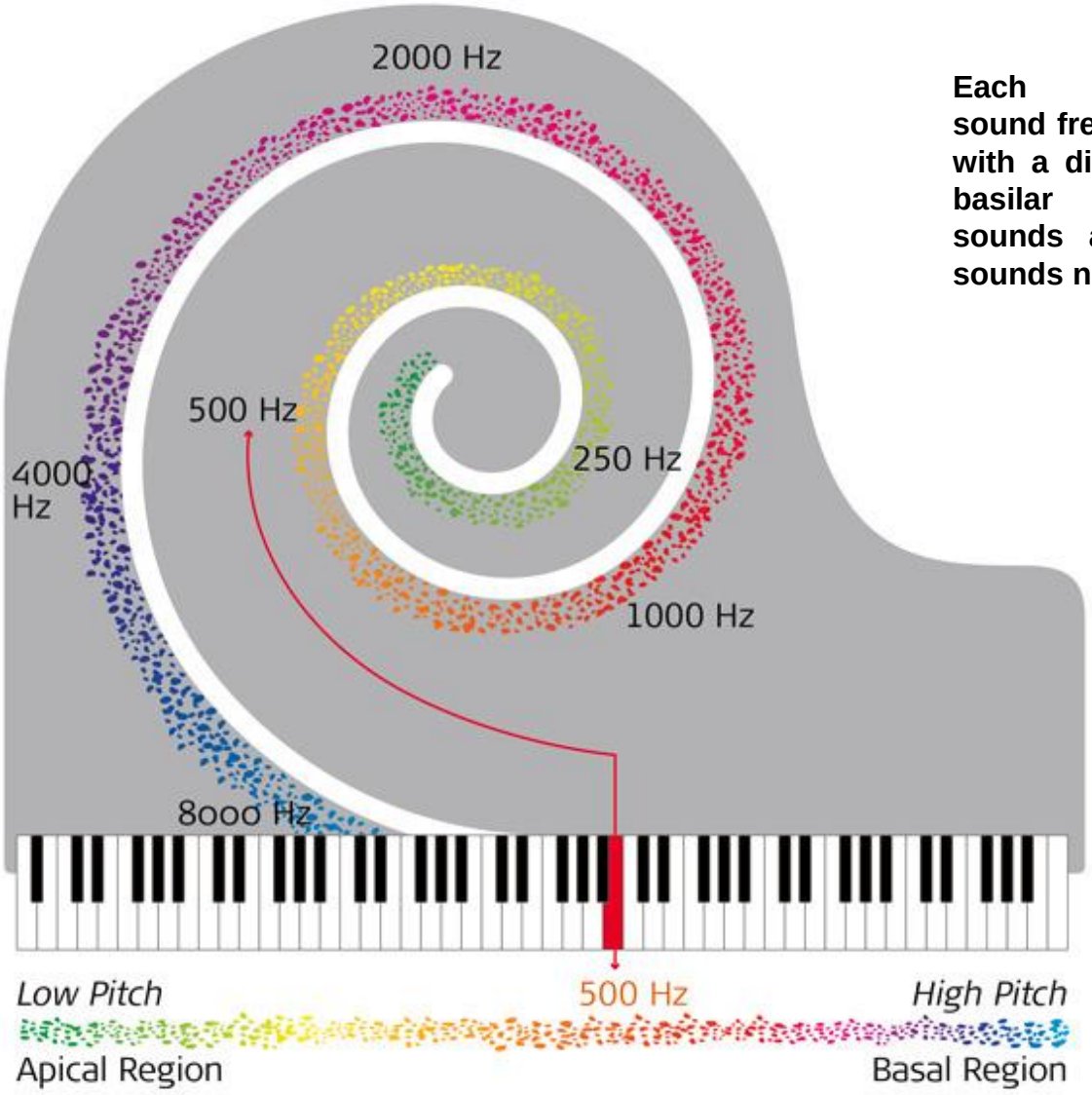


INNER EAR

MEMBRANOUS LABYRINTH

COCHLEA: HEARING

Basal membrane is about 1mm at its base increasing in width to about 5mm at its apex. Its stiffness is about one hundred times greater at its base than its apex. These characteristics become the determinants of its frequency response patterns.

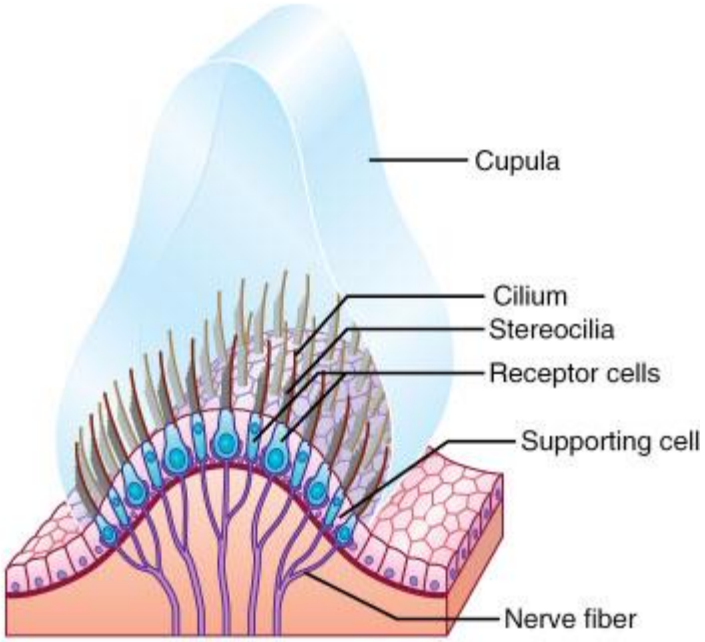


Each sound frequency resonates with a different part of the basilar membrane: high sounds at the base, low sounds near helicotrema.

INNER EAR

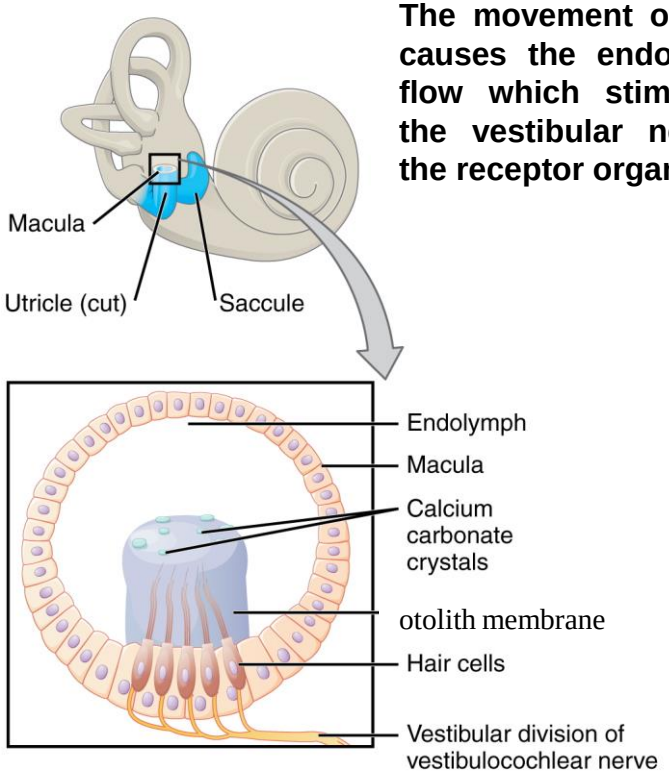
MEMBRANOUS LABYRINTH

VESTIBULAR SYSTEM: SENSE OF THE POSITION OF THE BODY AND BALANCING



CRISTA AMPULLARIS

Situated within the ampullae of the semicircular ducts. Because the three semicircular ducts are all at right angles to each other, movement of the head in any plane or angular rotation affects a crista ampullaris and stimulates vestibular neurons. They function in dynamic equilibrium.



The movement of the head causes the endolympha to flow which stimulates the the vestibular neurons by the receptor organs.

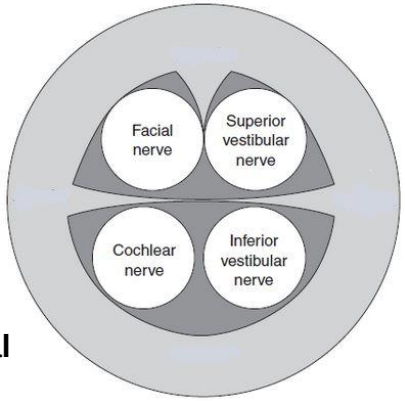
MACULA

The the macula of the utriculus is in a horizontal direction (dorsal plane), whereas macula of the saccule is oriented in a vertical direction (sagittal plane). These structures are responsible for the sensation of the static position of the head and linear acceleration or deceleration.
They function in static equilibrium.

INNER EAR

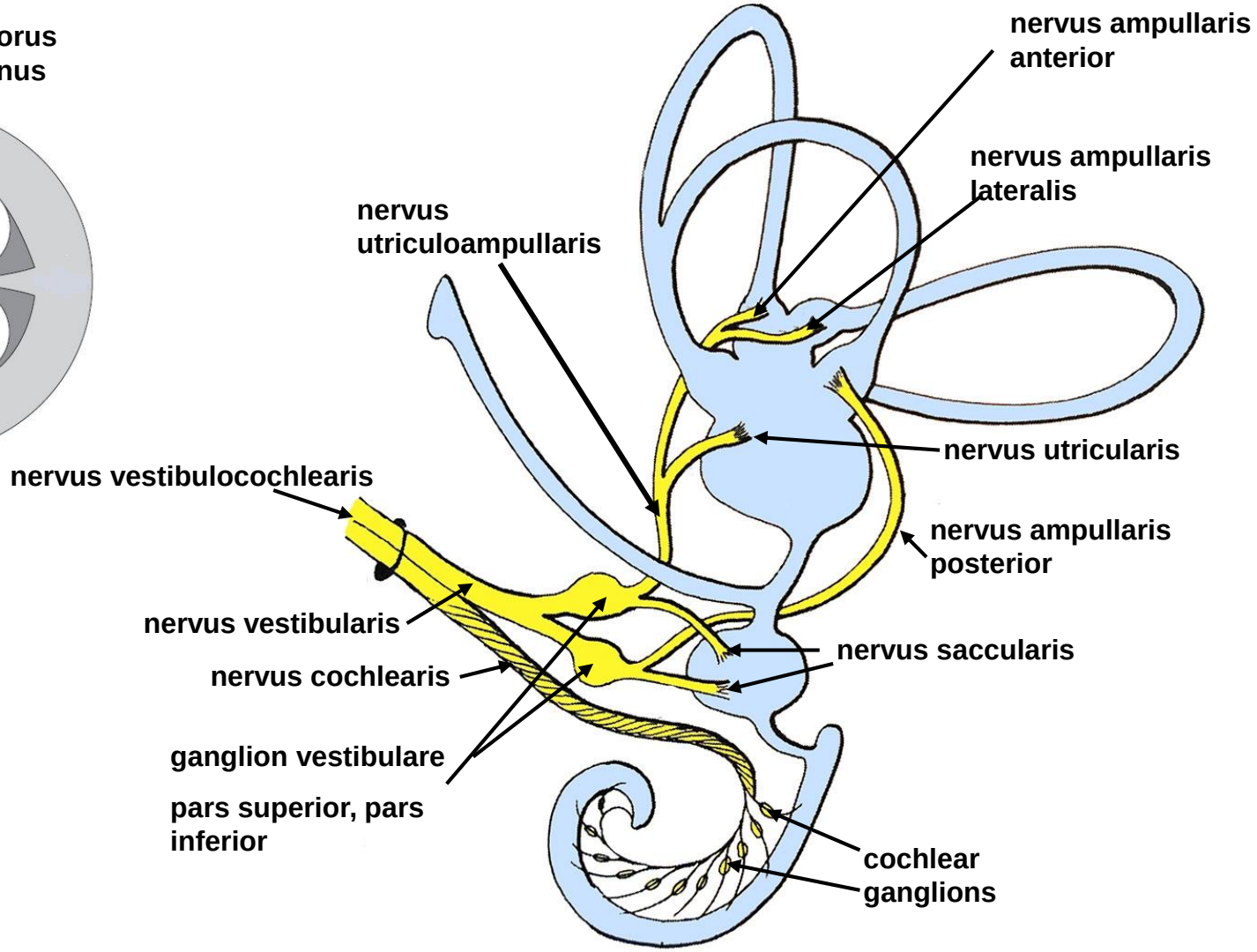
THE NERVUS VESTIBULOCOCHLEARIS (VIII.)

nerves in the porus acusticus internus

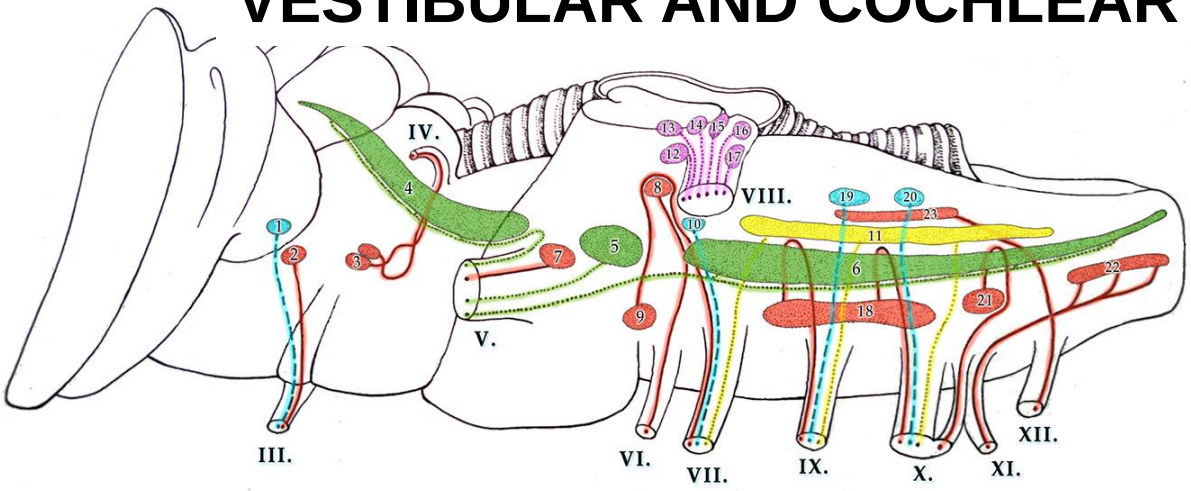


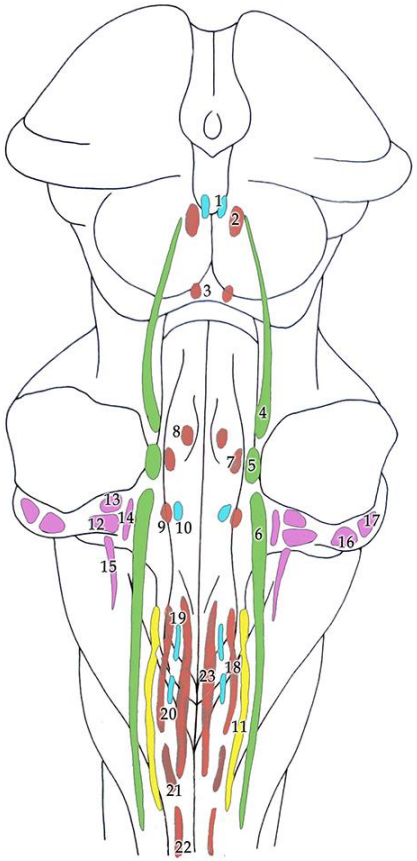
rostral

ventral



VESTIBULAR AND COCHLEAR NUCLEI





N. oculomotorius (III.)
1) Nucleus parasympathicus n. oculomotorii
2) Nucleus motorius n. oculomotorii
N. trochlearis (IV.)
3) Nucleus motorius n. trochlearis
N. trigeminus (V.)
4) Nucleus tractus mesencephalici n. trigemini
5) Nucleus sensibilis pontinus n. trigemini
6) Nucleus tractus spinalis n. trigemini
7) Nucleus motorius n. trigemini
N. abducens (VI.)
8) Nucleus motorius n. abducentis
N. facialis (VII.)
9) Nucleus motorius n. facialis
10) Nucleus parasympathicus n. intermedii et facialis (Nucleus salivatorius rostralis)
11) Nucleus tractus solitarii
N. vestibulocochlearis (VIII.)
12) Nucleus vestibularis lateralis (Deiters)
13) Nucleus vestibularis rostralis (Bechterew)
14) Nucleus vestibularis medialis (Schwalbe)
15) Nucleus vestibularis caudalis (Roller)
16) Nucleus cochlearis dorsalis
17) Nucleus cochlearis ventralis
N. glossopharyngeus (IX.)
11) Nucleus tractus solitarii
18) Nucleus ambiguus
19) Nucleus parasympathicus n. glossopharyngei (Nucleus salivatorius caudalis)
N. vagus (X.)
11) Nucleus tractus solitarii
18) Nucleus ambiguus
20) Nucleus parasympathicus n. vagi
N. accessorius (XI.)
21) Nucleus motorius radicis cranialis n. accessorii
22) Nucleus motorius radicis spinalis n. accessorii
N. hypoglossus (XII.)
23) Nucleus motorius n. hypoglossi

Functional classification

Afferent (A) - sensory

Somatic (S)
- general (GSA)
  V. (temperature, touch, noxious stimuli)
- special (SSA)
  II. (vision), **VIII.** (hearing)

Visceral (V)
- general (GVA)
  VII., IX., X. (visceral perception)
- special (SVA)
  I. (olfaction), **VII., IX., X.** (taste)

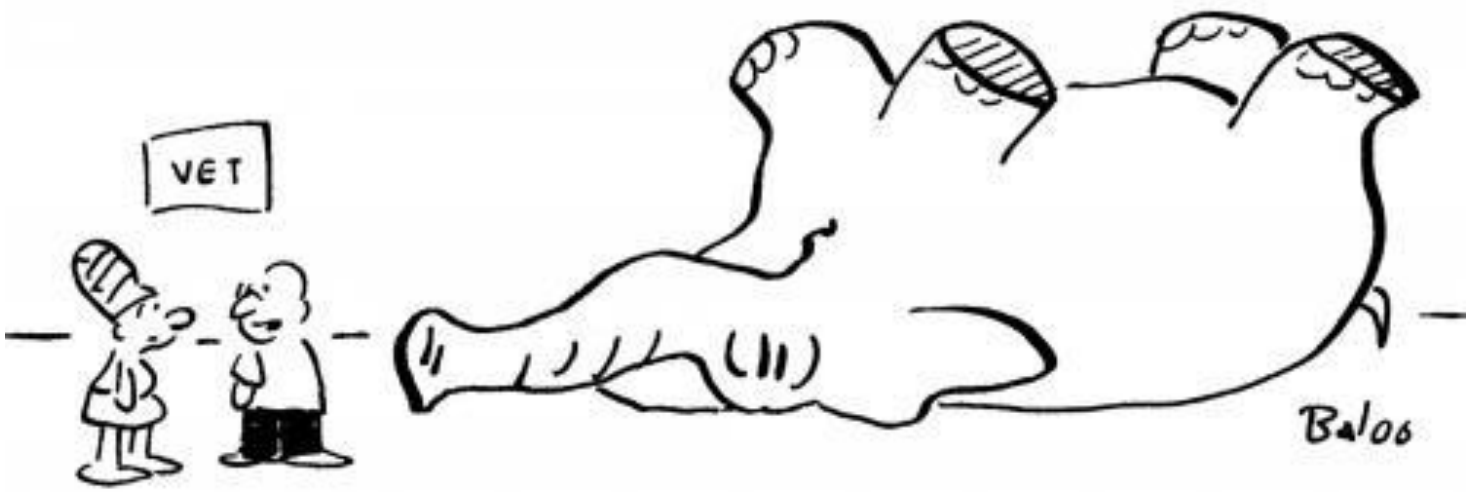
Proprioception (P)
- general (GP)
  V. (state of muscles and joints)
- special (SP)
  VIII. (vestibular system)

Efferent (E) - motor

Somatic (S)
- general (GSE)
  III., IV., V., VI., VII., IX., X., XI., XII. (striated skeletal muscle)

Visceral (V)
- general (GVE)
  III., VII., IX., X. (smooth and cardiac muscle and glands)

The majority of vestibular nerve axons terminate in the VESTIBULAR NUCLEI (12. lateral, 13. rostral, 14. medial spinal vestibular nuclei) at the level of the medulla and pons. A few course directly into the cerebellum (15. caudal vestibular nuclei)
The cochlear axons synapse in the COCHLEAR NUCLEI (16. dorsal, and 17. ventral) on the lateral side of the medulla oblongata.



"It may be his inner ear."