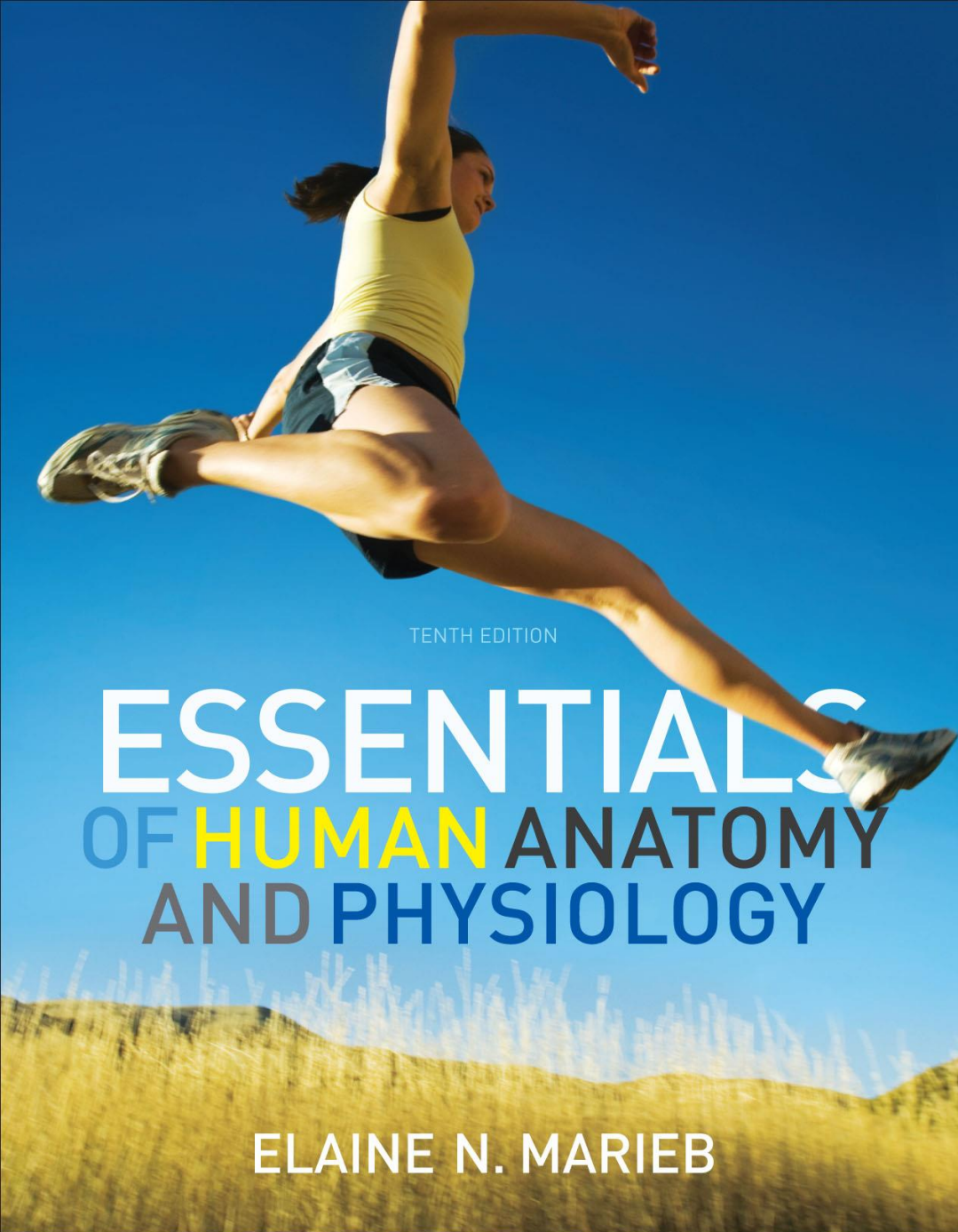


# PowerPoint® Lecture Slides

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Florence-Darlington Technical College

## CHAPTER 8

# Special Senses



TENTH EDITION

# ESSENTIALS OF HUMAN ANATOMY AND PHYSIOLOGY

ELAINE N. MARIEB

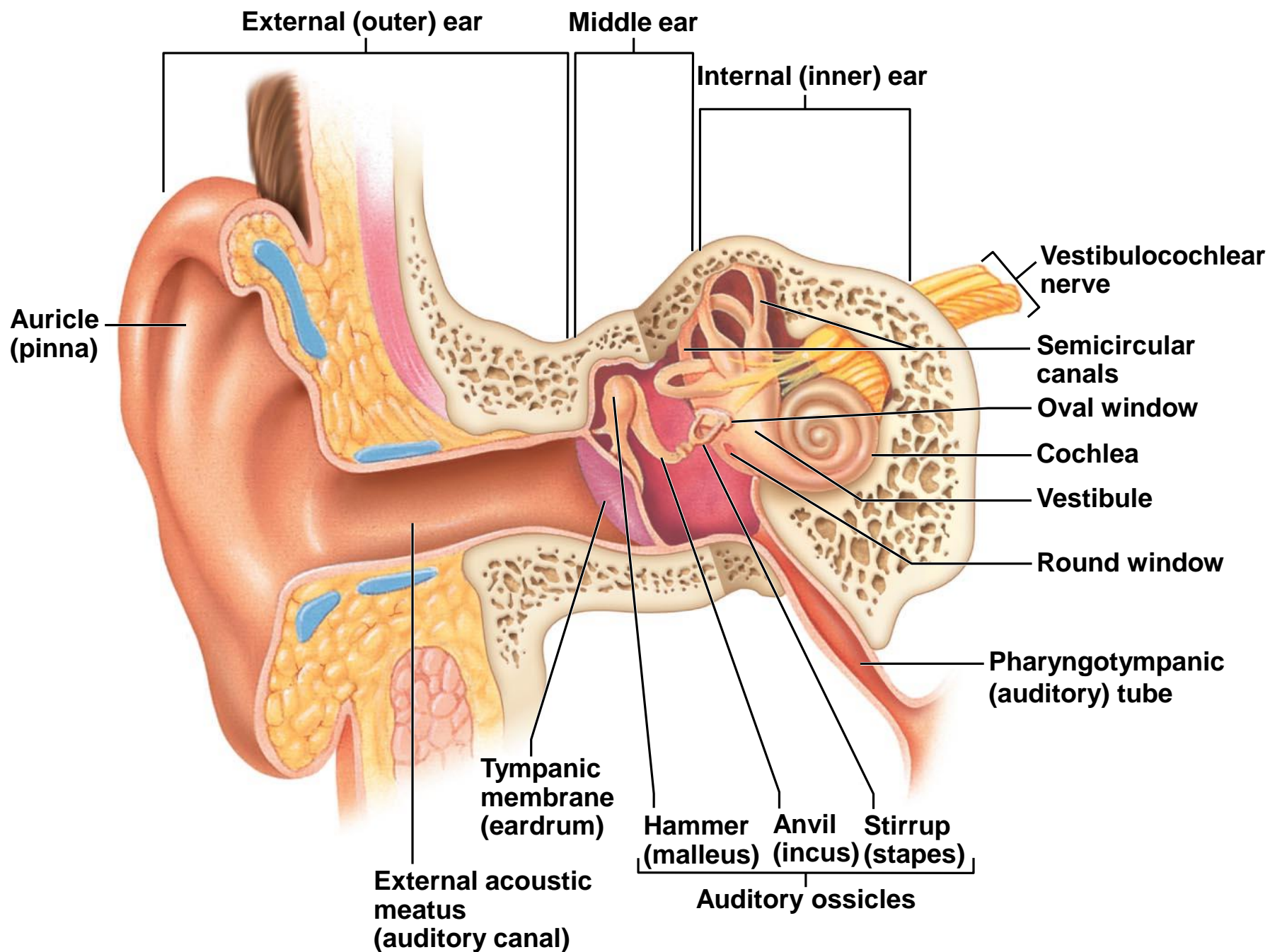
# **SENSE OF HEARING / EQUILIBRIUM**

## (2) The Ear

- Houses two senses
  - Hearing
  - Equilibrium (balance)
- Receptors are mechanoreceptors
- Different organs house receptors for each sense

# Anatomy of the Ear

- The ear is divided into three areas:
  - (a) External (outer) ear
  - (b) Middle ear (tympanic cavity)
  - (c) Inner ear (bony labyrinth)



## (a) The External Ear

- Involved in hearing only
- Structures of the external ear
  - Auricle (pinna)
  - External acoustic meatus (auditory canal)
    - Narrow chamber in the temporal bone
    - Lined with skin and ceruminous (wax) glands
    - Ends at the tympanic membrane

## (b) The Middle Ear (Tympanic Cavity)

- Air-filled cavity within the temporal bone
- Only involved in the sense of hearing

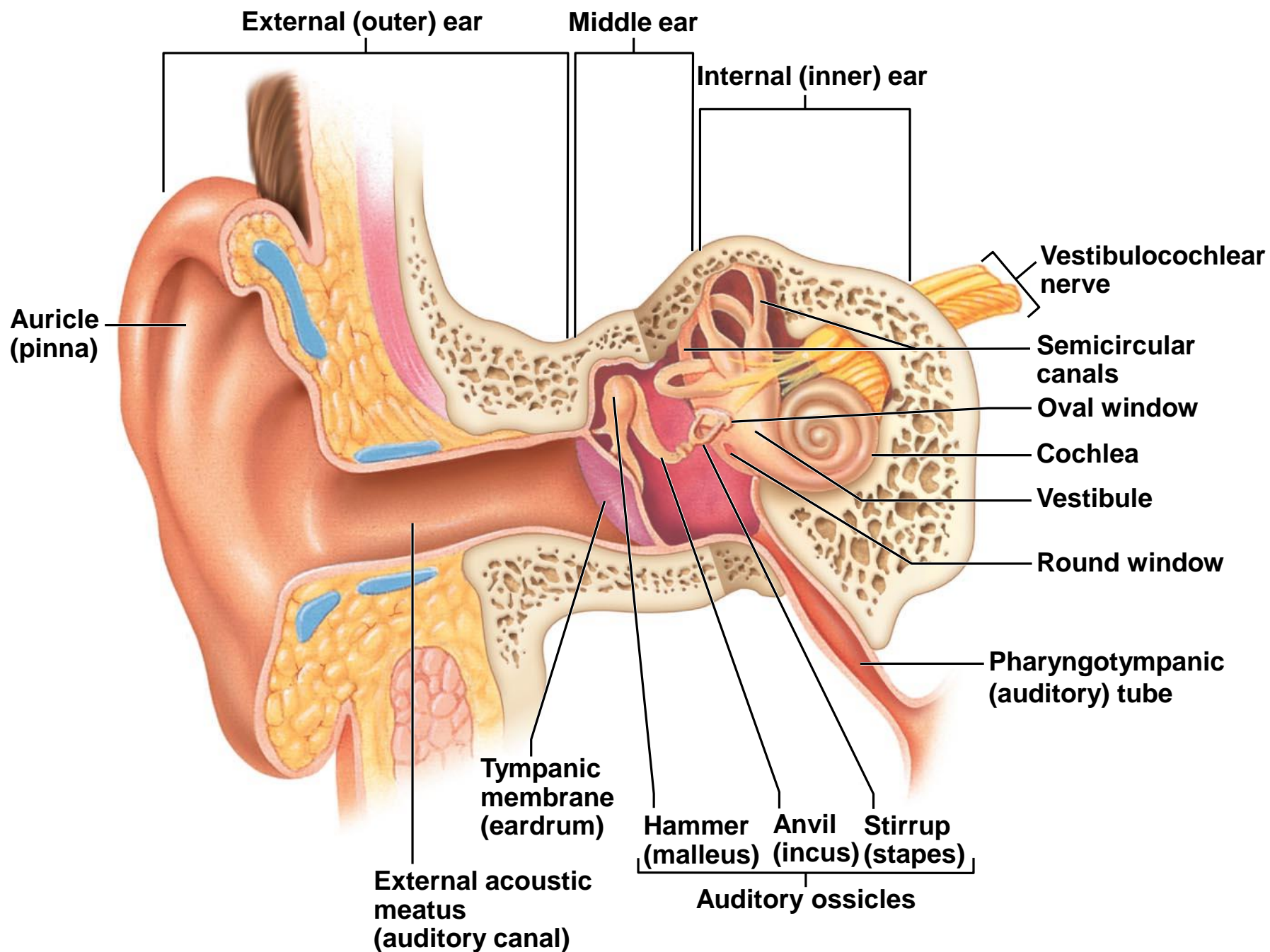
# The Middle Ear (Tympanic Cavity)

- Two tubes are associated with the inner ear
  - (i) **Pharyngotympanic** tube (auditory tube) is the opening from the auditory canal is covered by the tympanic membrane
  - (ii) Connects the middle ear with the throat
    - Allows for equalizing pressure during yawning or swallowing
    - This tube is otherwise collapsed



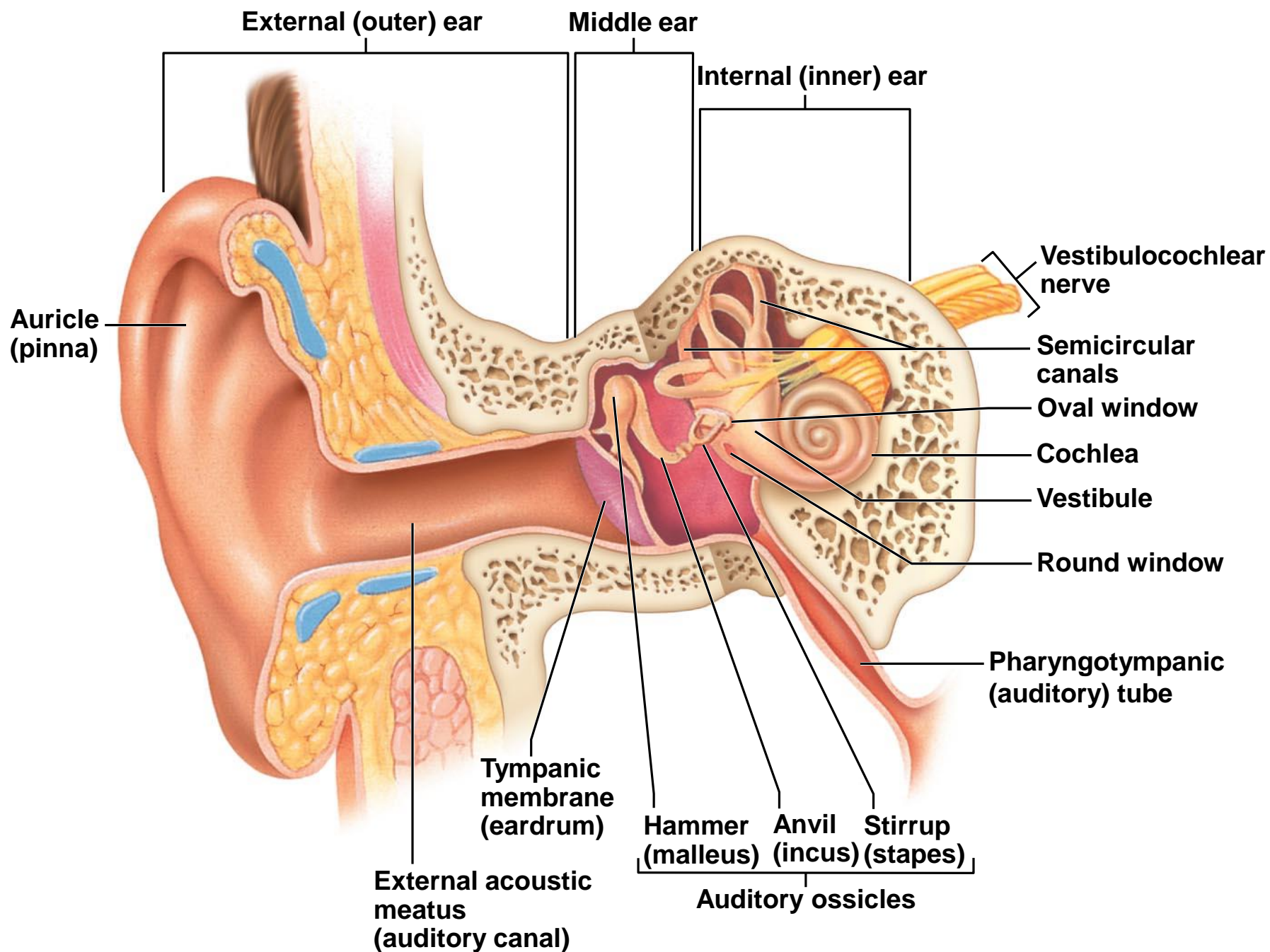
# Bones of the Middle Ear (Tympanic Cavity)

- Three bones (ossicles) span the cavity
  - Malleus (hammer)
  - Incus (anvil)
  - Stapes (stirrup)
- Function
  - Vibrations from eardrum (tympanic membrane) move the:
  - hammer → anvil → stirrup → oval window of inner ear



## (c) Inner Ear or Bony Labyrinth

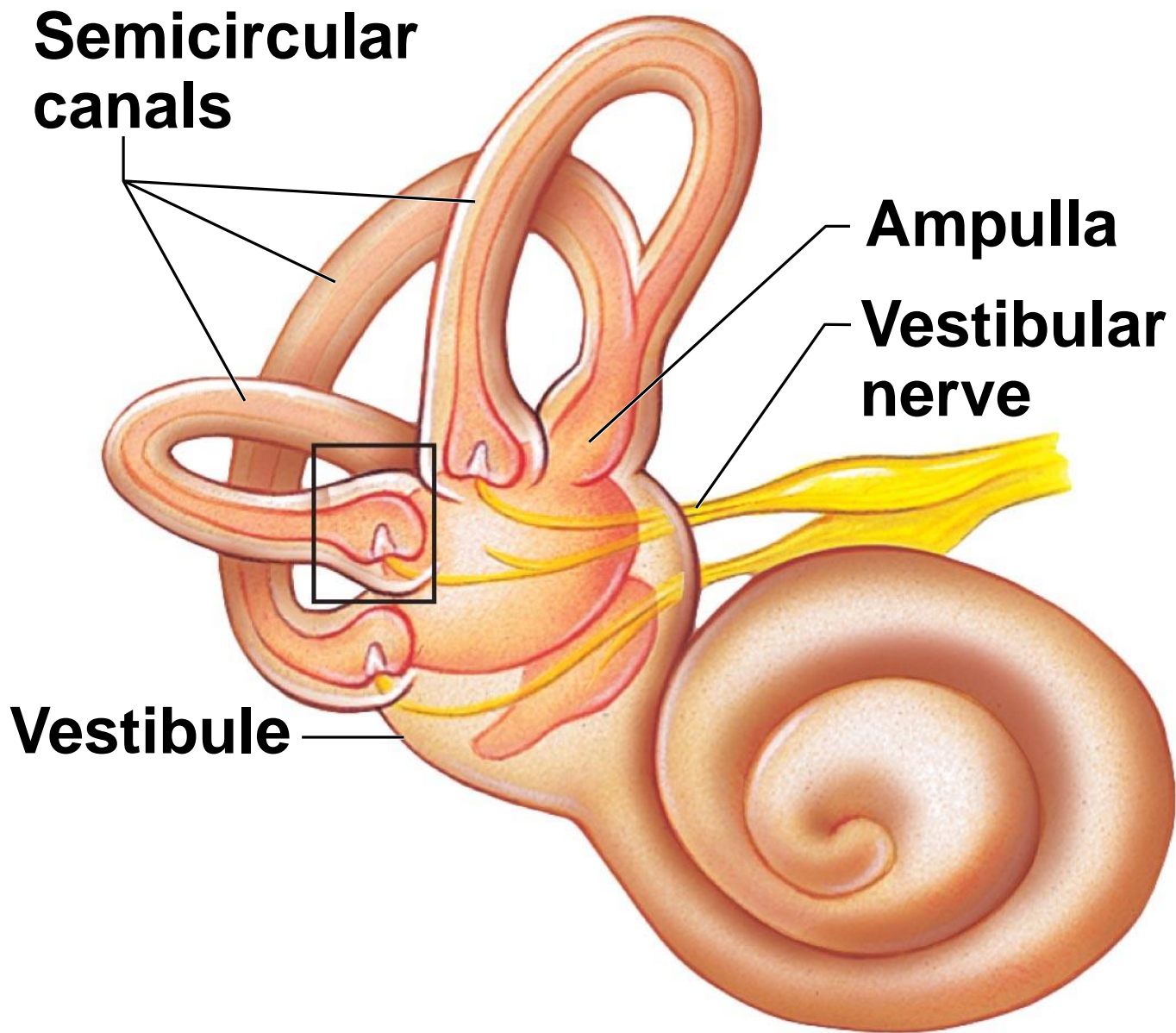
- Includes sense organs for hearing and balance
- Filled with **perilymph and endolymph**
- Contains a maze of bony chambers within the temporal bone
  - **Cochlea**
  - **Vestibule**
  - **Semicircular canals**



# Organs of Equilibrium XXXXXXXXXXXXX

- Equilibrium receptors of the inner ear are called the **vestibular apparatus**
- Vestibular apparatus has two functional parts
  - **Static** equilibrium
  - **Dynamic** equilibrium

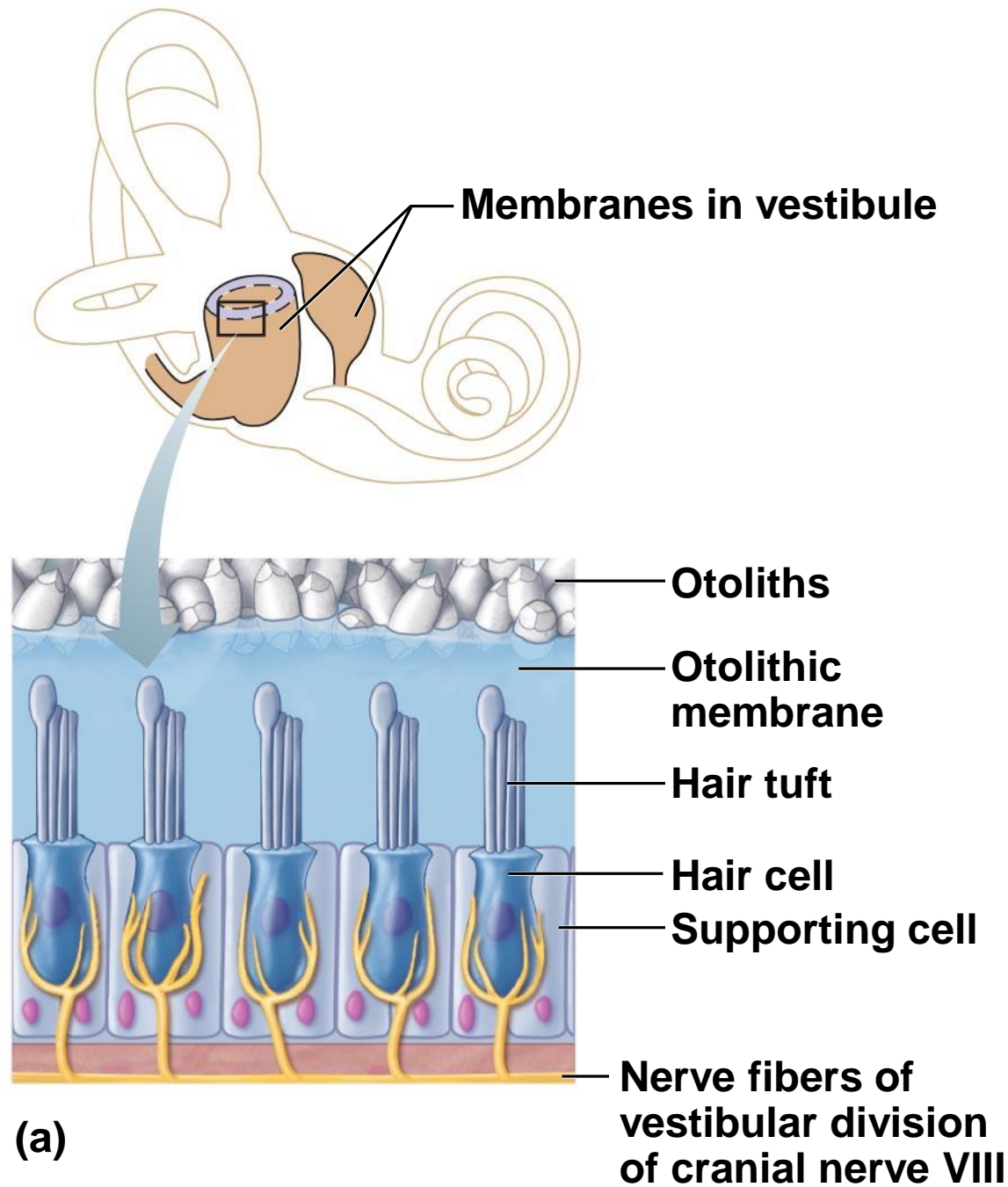




**(a)**

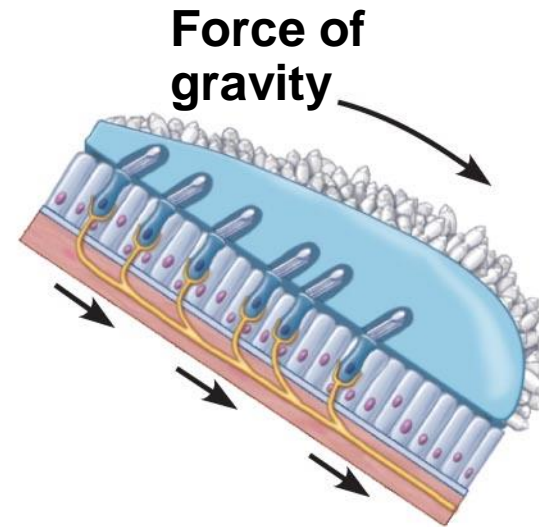
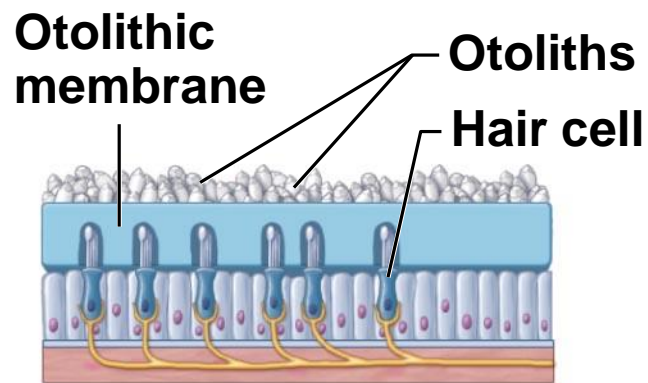
# Static Equilibrium

- **Maculae** — receptors in the vestibule
  - Report on the **position of the head**
  - Send information via the **vestibular nerve**
- Anatomy of the maculae
  - **Hair cells** are embedded in the **otolithic membrane**
  - **Otoliths (tiny stones)** float in a gel around the hair cells
  - Movements cause otoliths to bend the hair cells



**Figure 8.13a**





**Head upright**



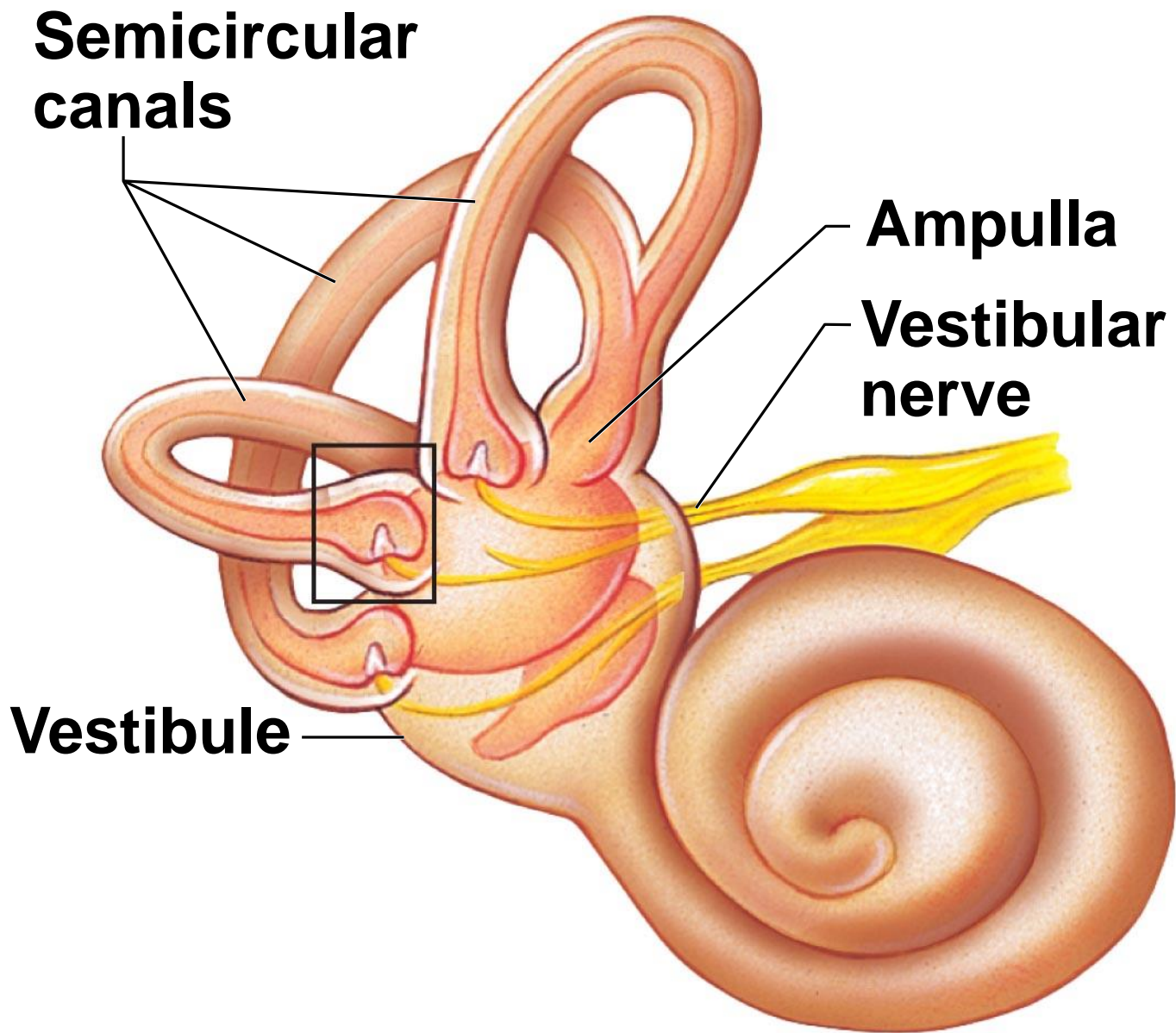
**Head tilted**

**(b)**

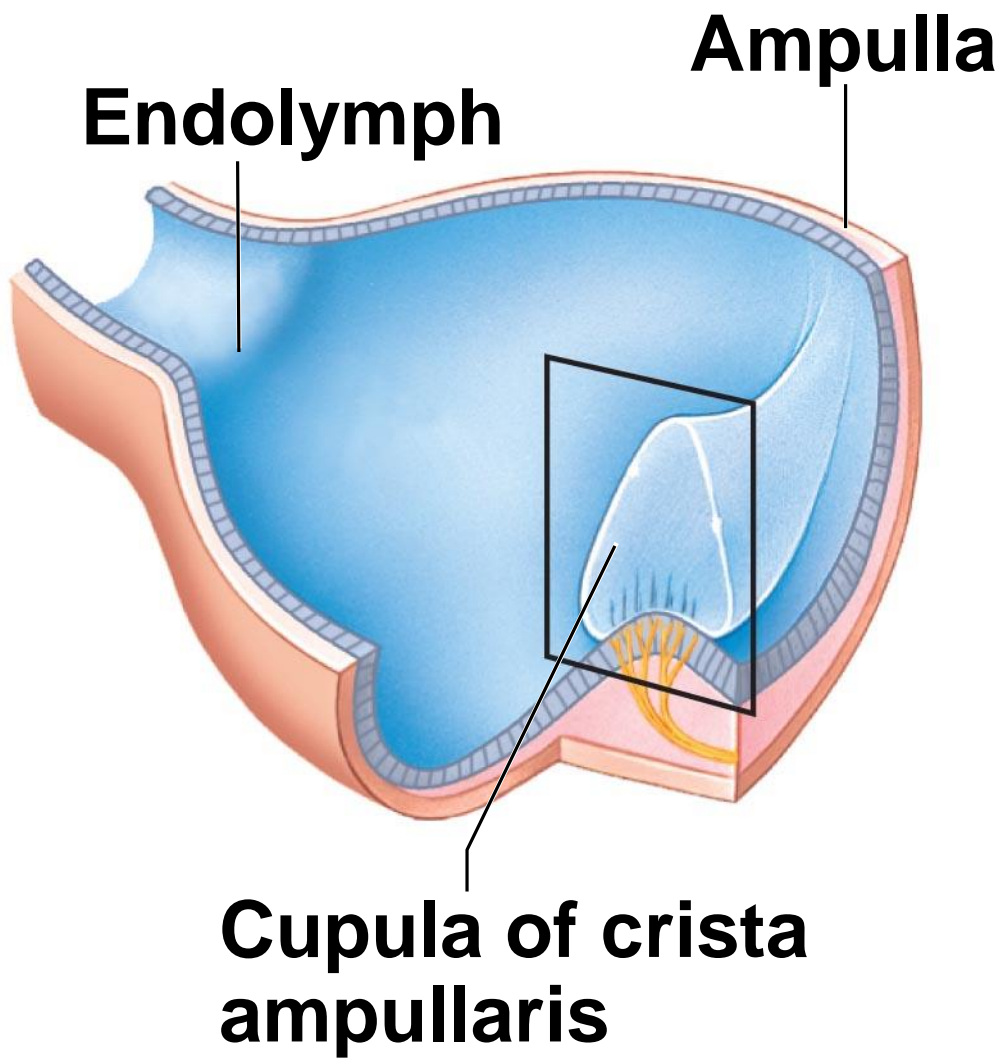
**Figure 8.13b**

# Dynamic Equilibrium

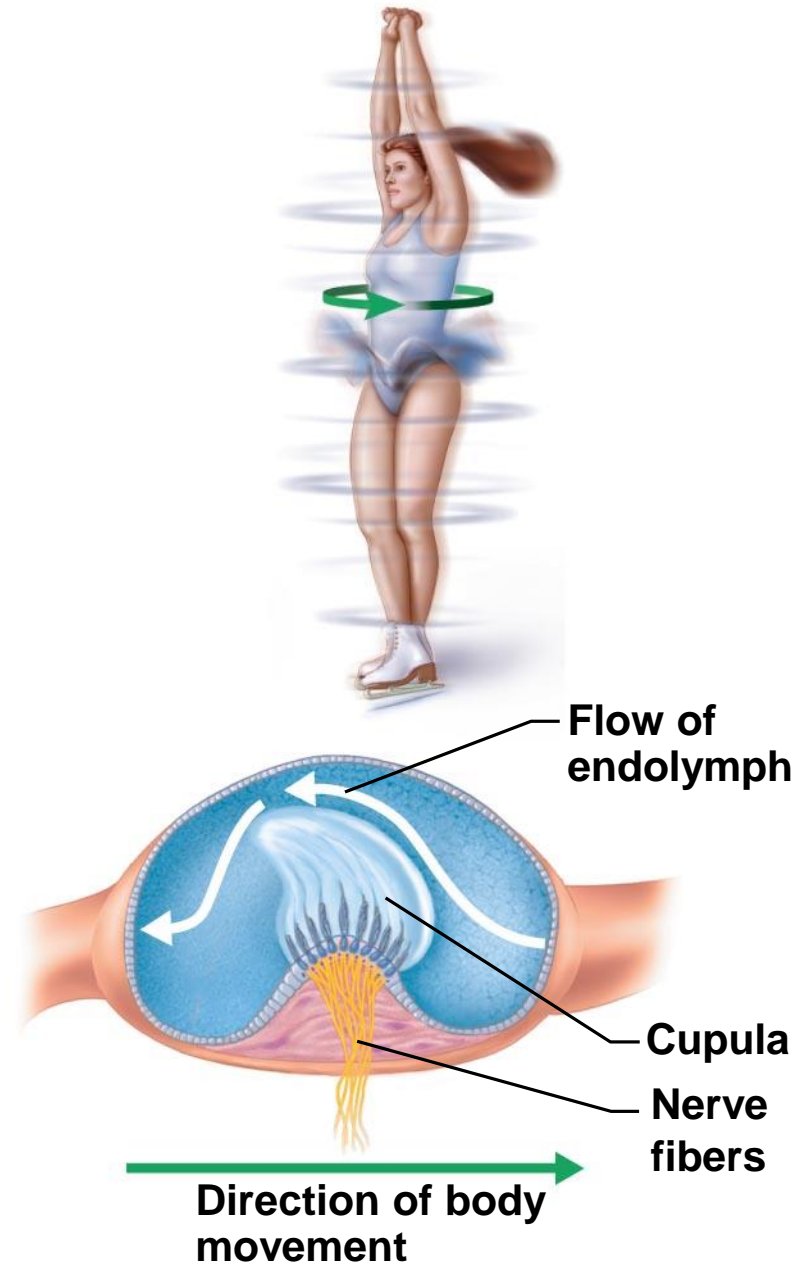
- These receptors respond to **angular or rotary movements**
- **Crista ampullaris** (in the ampulla of each semicircular canal) — dynamic equilibrium receptors are located in the **semicircular canals**
  - Tuft of hair cells covered with cupula (gelatinous cap)
  - If the head moves, the cupula drags against the endolymph



**(a)**



**(b)**



**(c)**

**Figure 8.14b-c**

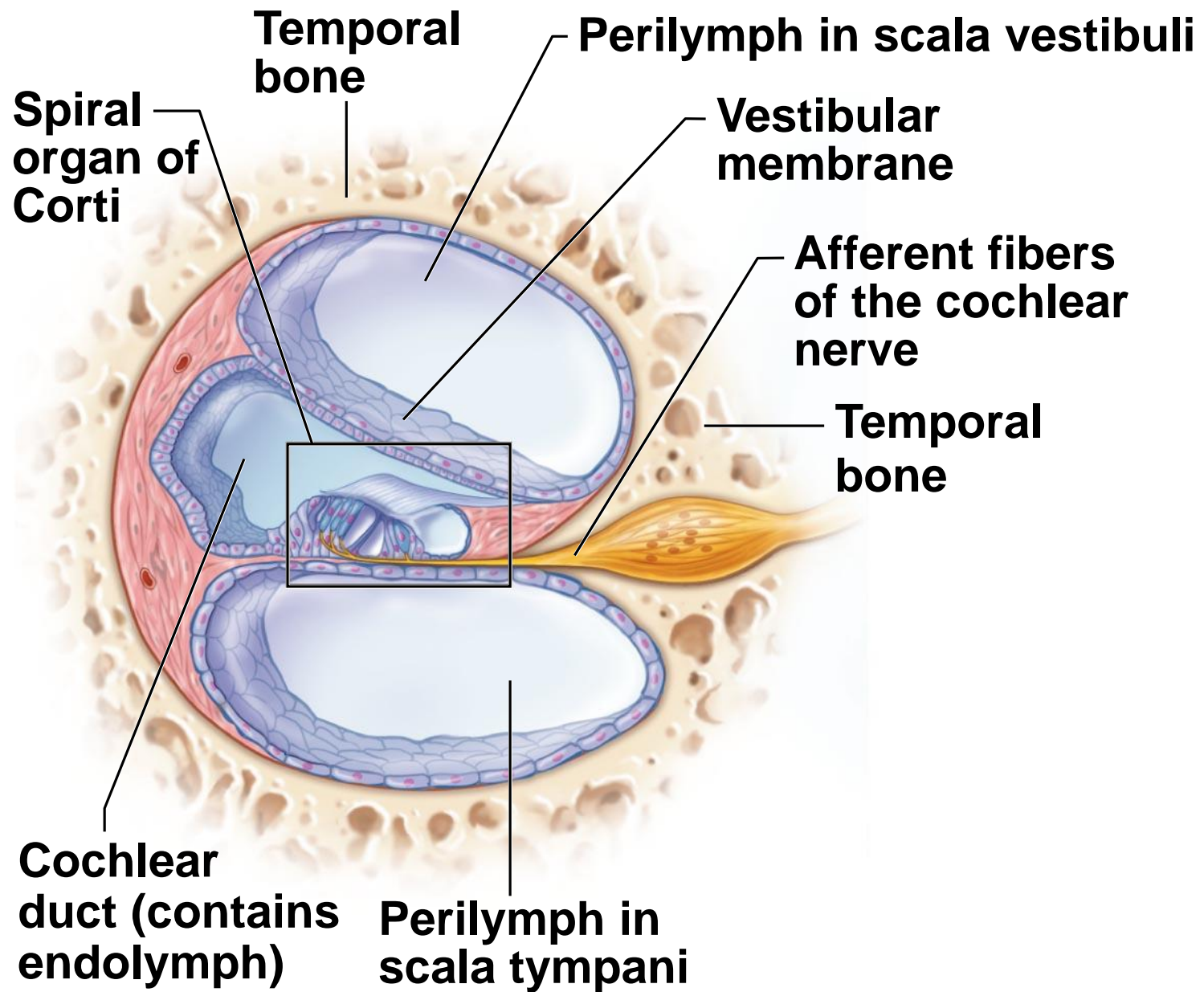
# Dynamic Equilibrium

- Action of **angular head movements**
  - The movement of the cupula stimulates the hair cells
  - An impulse is sent via the vestibular nerve to the cerebellum

# Organs of Hearing

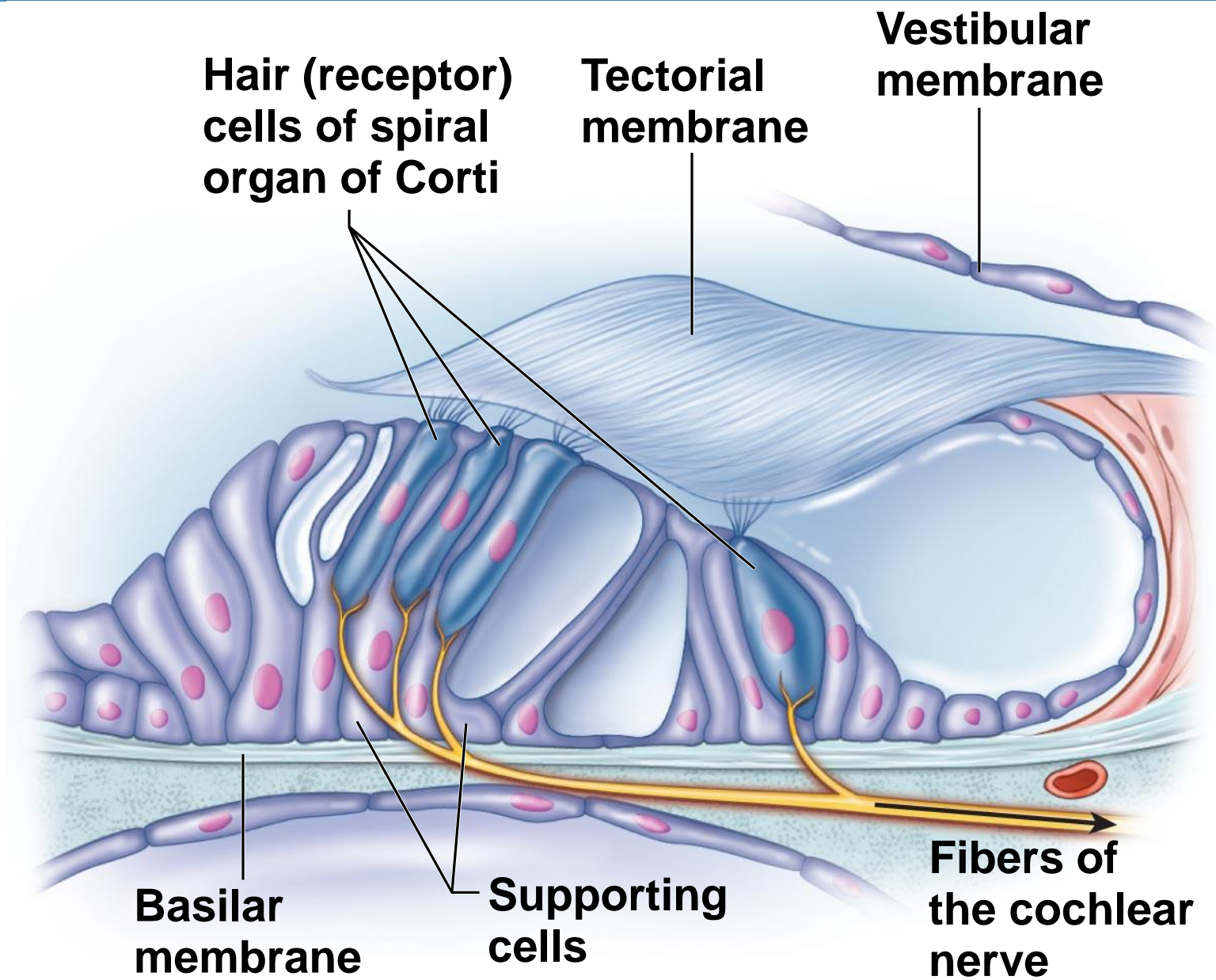
- Organ of Corti
  - Located within the cochlea
  - Receptors = hair cells on the basilar membrane
  - Gel-like tectorial membrane is capable of bending hair cells
  - Cochlear nerve attached to hair cells transmits nerve impulses to auditory cortex on temporal lobe





**(a)**

**Figure 8.15a**



**(b)**



# Mechanism of Hearing [NOTE WELL]

- Vibrations from sound waves move tectorial membrane
- Hair cells are bent by the membrane
- An action potential starts in the cochlear nerve
  - Impulse travels to the temporal lobe
- Continued stimulation can lead to adaptation

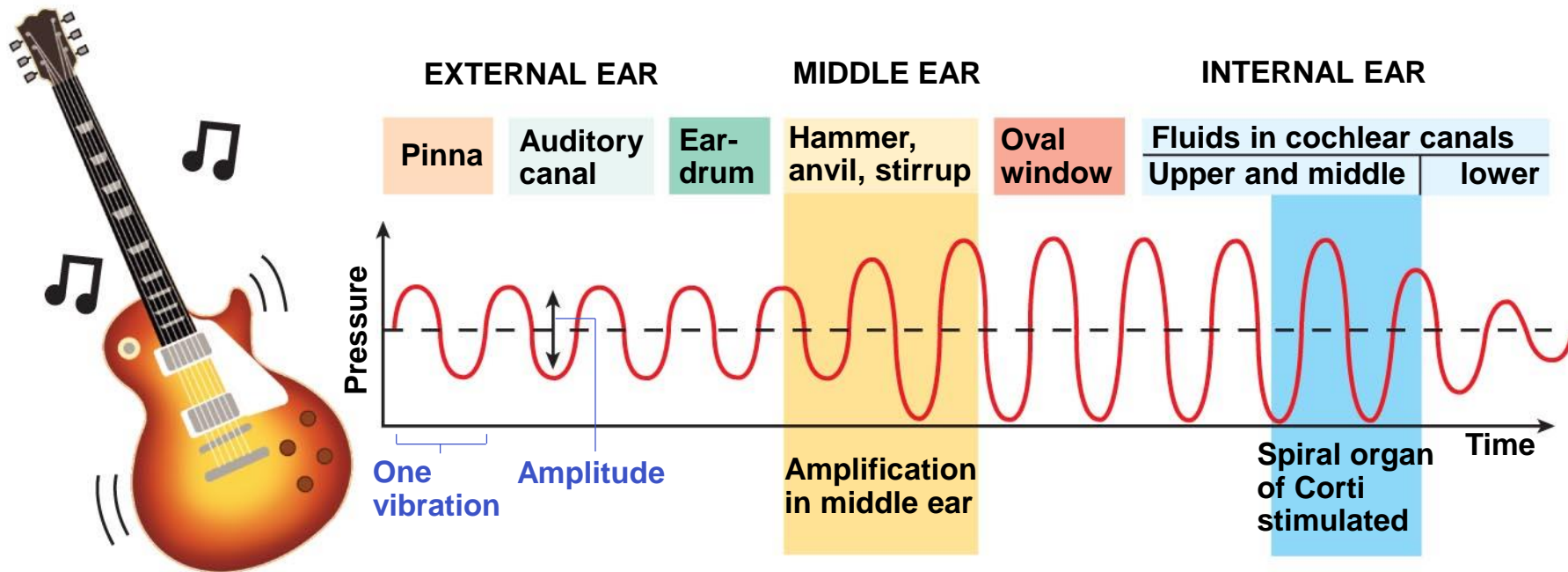


Figure 8.16

# Mechanism of Hearing

- **High-pitched sounds** disturb the **short**, stiff fibers of the basilar membrane
  - Receptor cells close to the oval window are stimulated
- **Low-pitched sounds** disturb the **long**, floppy fibers of the basilar membrane
  - Specific hair cells further along the cochlea are affected

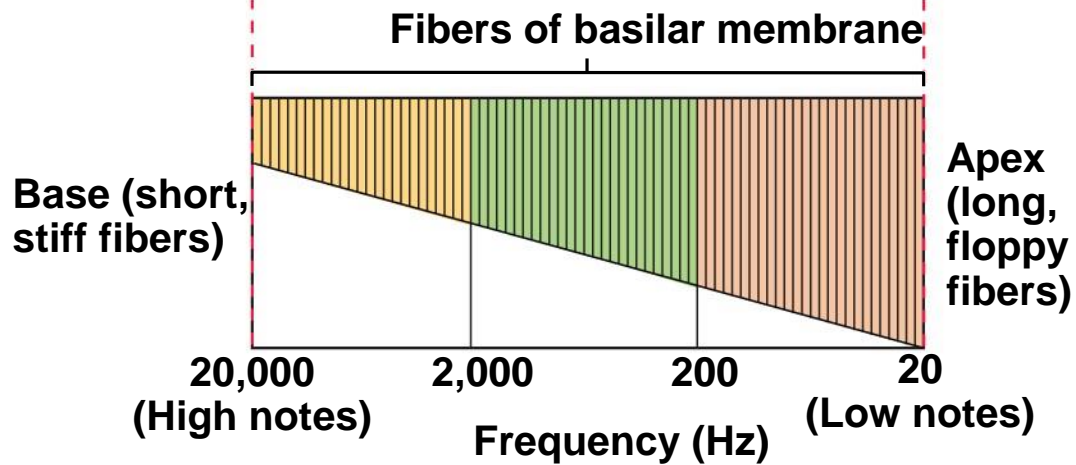
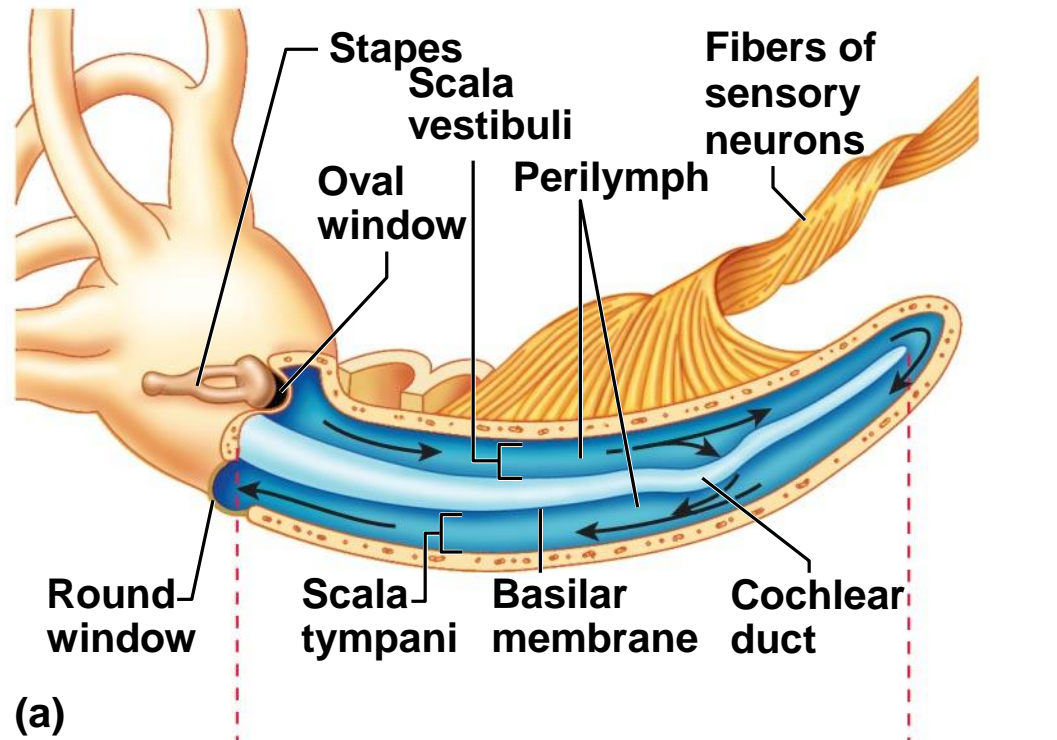


Figure 8.17

# Developmental Aspects of the Special Senses

- Ear problems
  - **Presbycusis** — type of sensorineural deafness
  - **Otosclerosis** — ear ossicles fuse
  - **Tinnitus** — a noise or ringing in the ears

# Page 166 and 167 #15

- |                               |                                 |
|-------------------------------|---------------------------------|
| 1. E External Acoustic Meatus | 11. N Vestibule                 |
| 2. I Pinna                    | 12. B Pharyngotympanic Membrane |
| 3. M Tympanic Membrane        | 13. M Tympanic Membrane         |
| 4. C Cochlea                  | 14. C Cochlea                   |
| 5. K Semicircular Canals      | 15. B Pharyngotympanic Membrane |
| 6. N Vestibule                | 16. K Semicircular Canals       |
| 7. A Anvil                    | 17. N Vestibule                 |
| 8. F Hammer                   | 18. G Oval window               |
| 9. L Stirrup                  | 19. D Endolymph                 |
| 10. K Semicircular Canals     | 20. H Perilymph                 |