

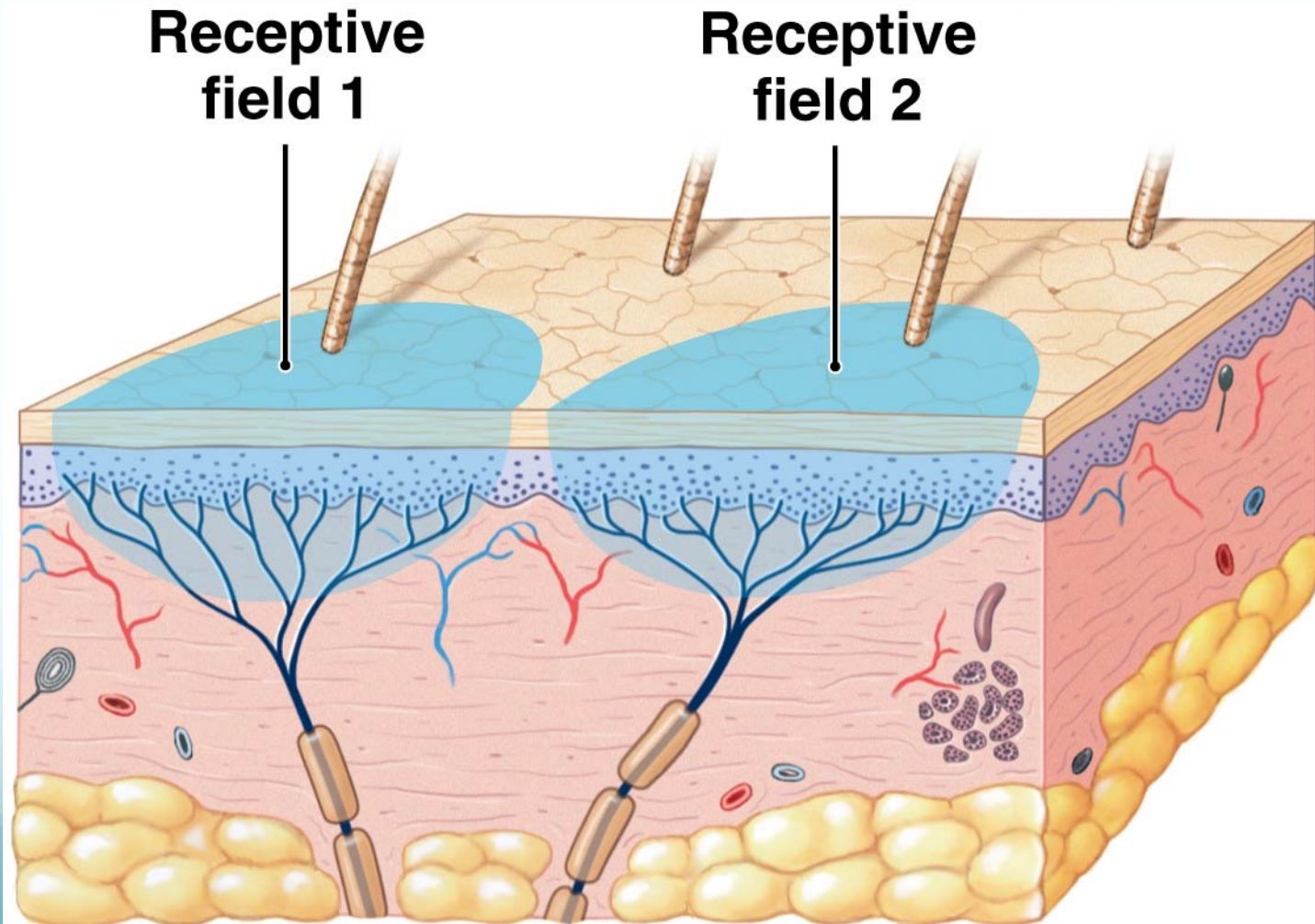
Module 13 General and Special Senses

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Introduction

- Sensation
 - Sensory information arriving at the CNS
- Perception
 - Conscious awareness of a sensation
- 1. General senses
 - Temperature, pain, touch, pressure, vibration, and proprioception
 - Sensations arrive at the primary sensory cortex
- 2. Special senses
 - Smell, taste, balance, hearing, vision
 - Sensations provided by specialized receptor cells

Receptors and Receptive Fields



Sensory Coding

- The identity of the active neuron indicates:
 - Location of the stimulus
 - Nature of the stimulus

Provides information about the strength, duration, variation, and movement of the stimulus
- Classification of Receptors
 - Tonic receptors
 - Always active
 - Phasic receptors
 - Provide information on the intensity and rate of change of a stimulus
 - Combine both
 - Very complicated - proprioceptors

Central Processing And Adaptation

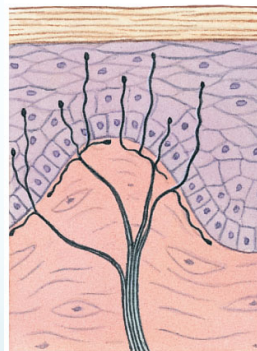
- Adaptation
- Peripheral (sensory) adaptation
 - Phasic receptors - Fast-adapting receptors
 - Tonic receptors – slow-adapting receptors
- Central adaptation

General Senses

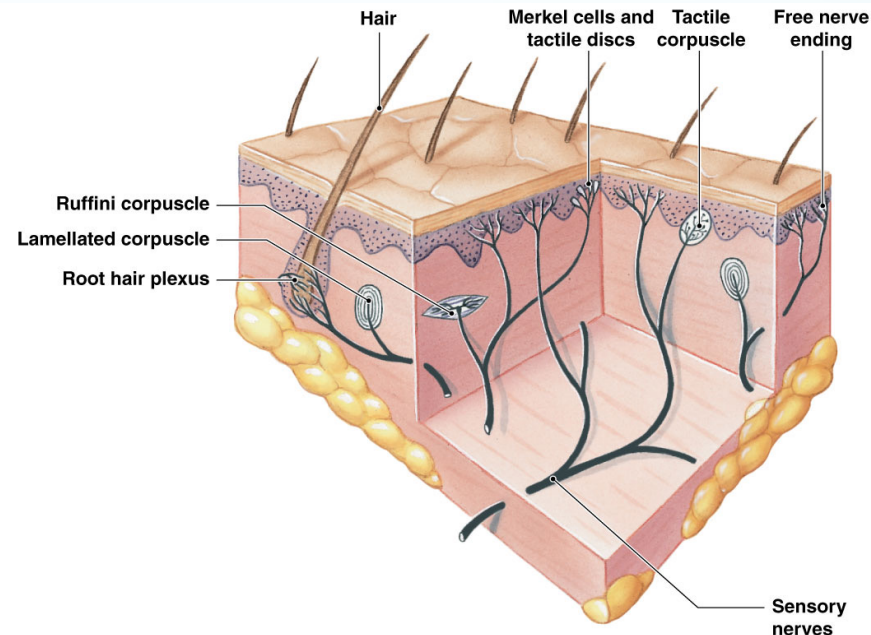
- Simple classification
 1. Exteroceptors
 2. Proprioceptors
 3. Interoceptors
- Classification according to nature of stimulus
 1. Nociceptors
 2. Thermoreceptors
 3. Mechanoreceptors
 4. Chemoreceptors

Nociceptors

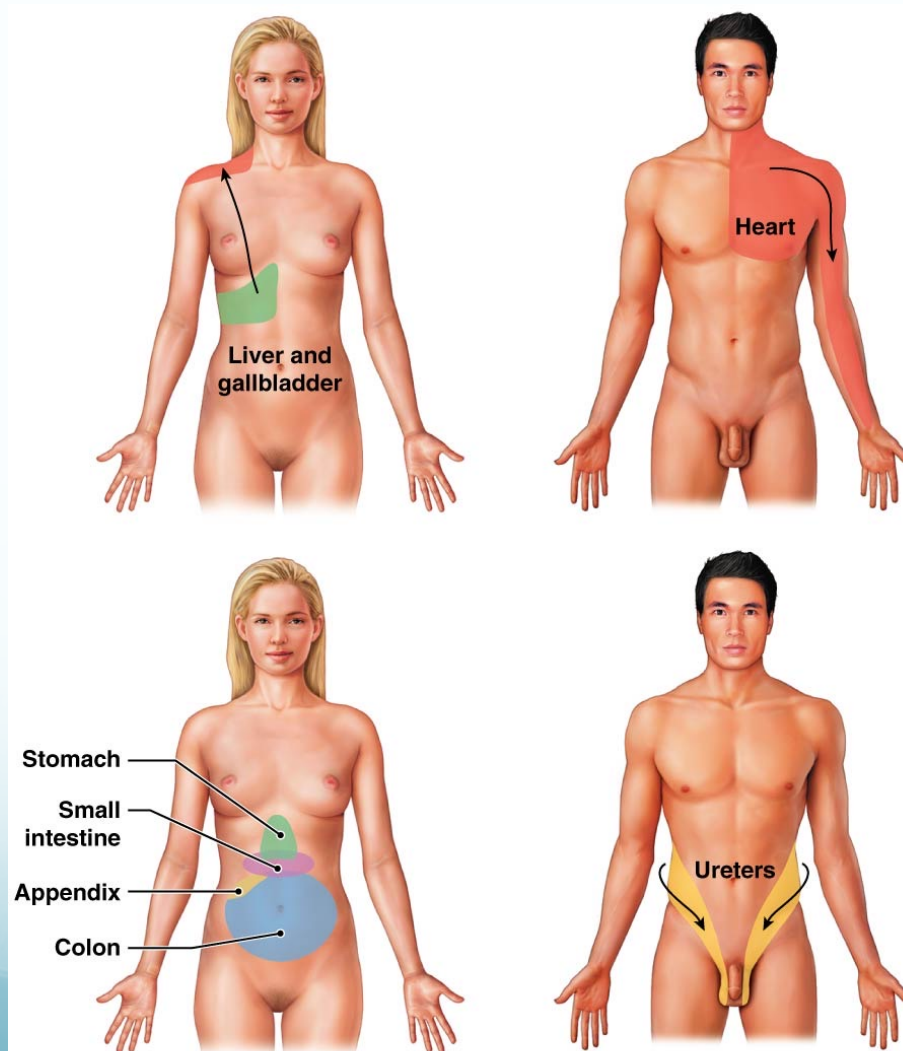
- Three types:
 - Receptors sensitive to extreme temperatures
 - Receptors sensitive to mechanical damage
 - Receptors sensitive to chemicals



a Free nerve endings



Referred Pain



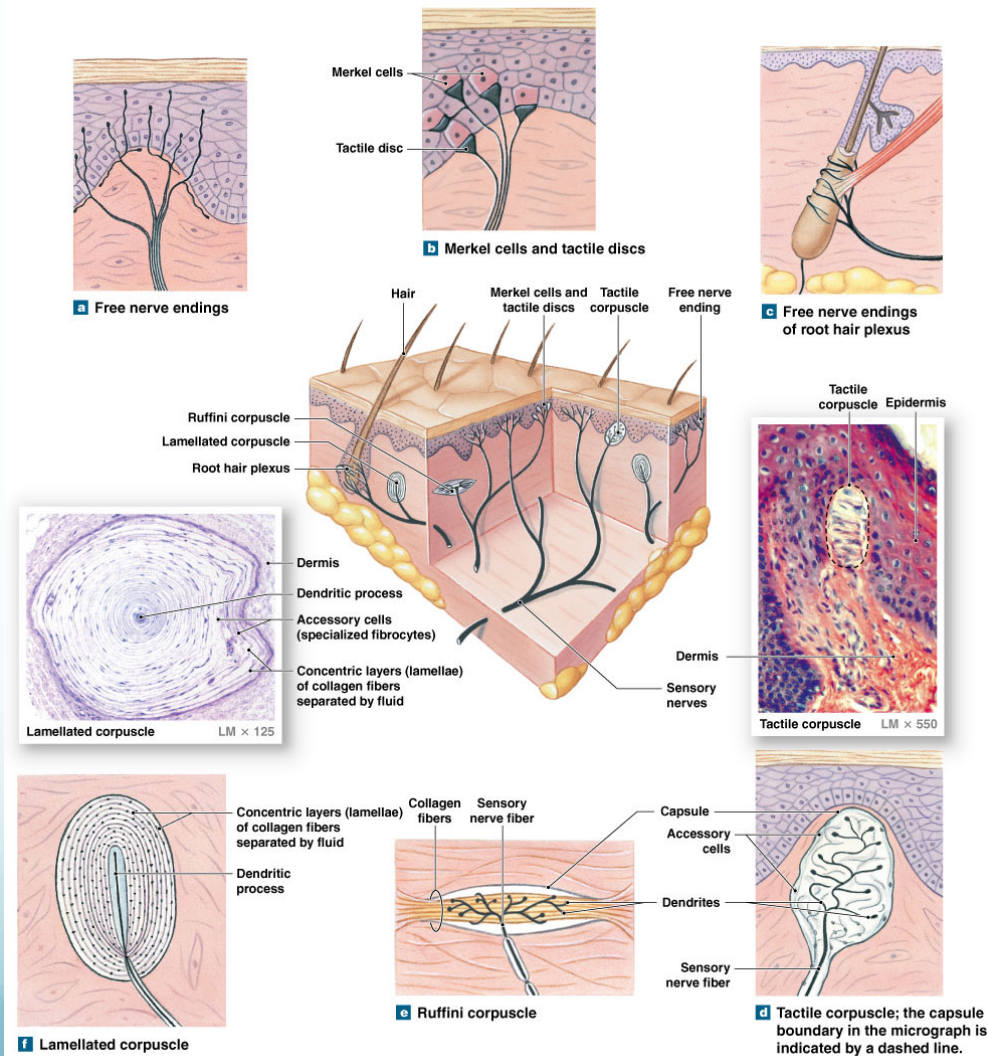
Thermoreceptors

- Location
 - Dermis of skin
 - Skeletal muscles
 - Liver
 - Hypothalamus
- Free-nerve endings
- Cold and warm receptors
 - No structural differences
 - Cold 3X more numerous than warm
 - Conducted along the same pathways that carry pain sensations
 - Are phasic receptors

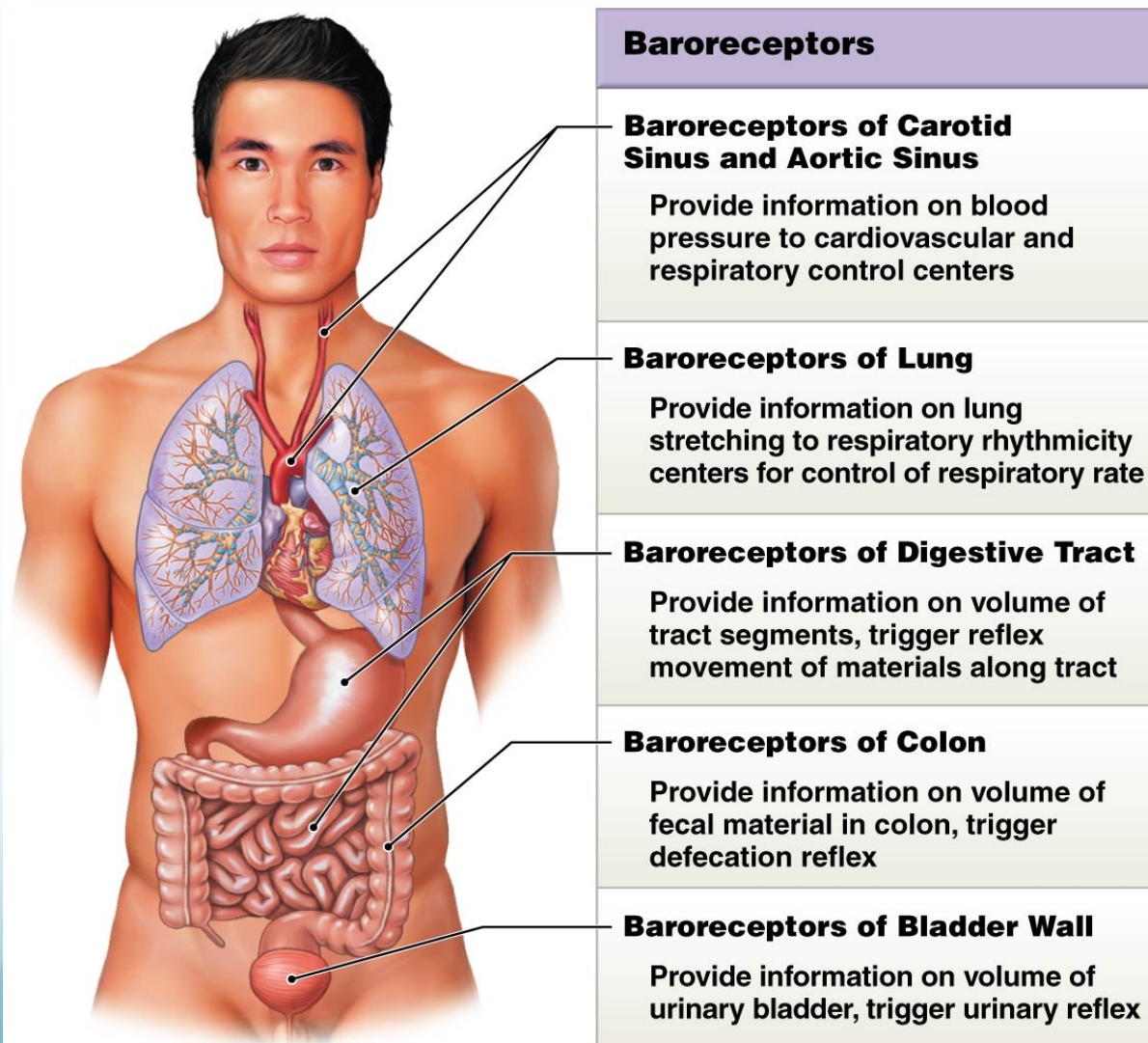
Mechanoreceptors

- Sensitive to stimuli that stretch, compress, twist, or distort their plasmalemma.
- Three classes of mechanoreceptors:
 1. Tactile receptors
 - Provide sensations of touch, pressure, and vibration
 2. Baroreceptors
 - Detect pressure changes in walls of blood vessels and in portions of digestive, reproductive, and urinary tracts
 3. Proprioceptors
 - Monitor positions of joints and muscles
 - Most complex of the general sensory receptors

Tactile Receptors in the Skin



Baroreceptors

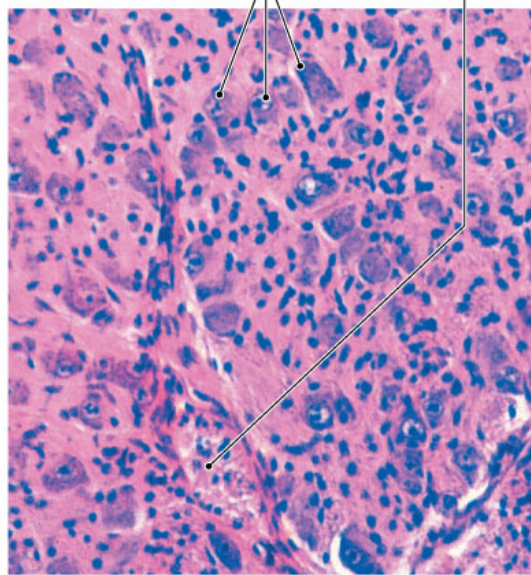


Chemoreceptors

- Specialized neurons that can detect small changes in concentration of specific chemicals or compounds
- In general
 - Respond only to water-soluble and lipid soluble substances dissolved in surrounding fluid

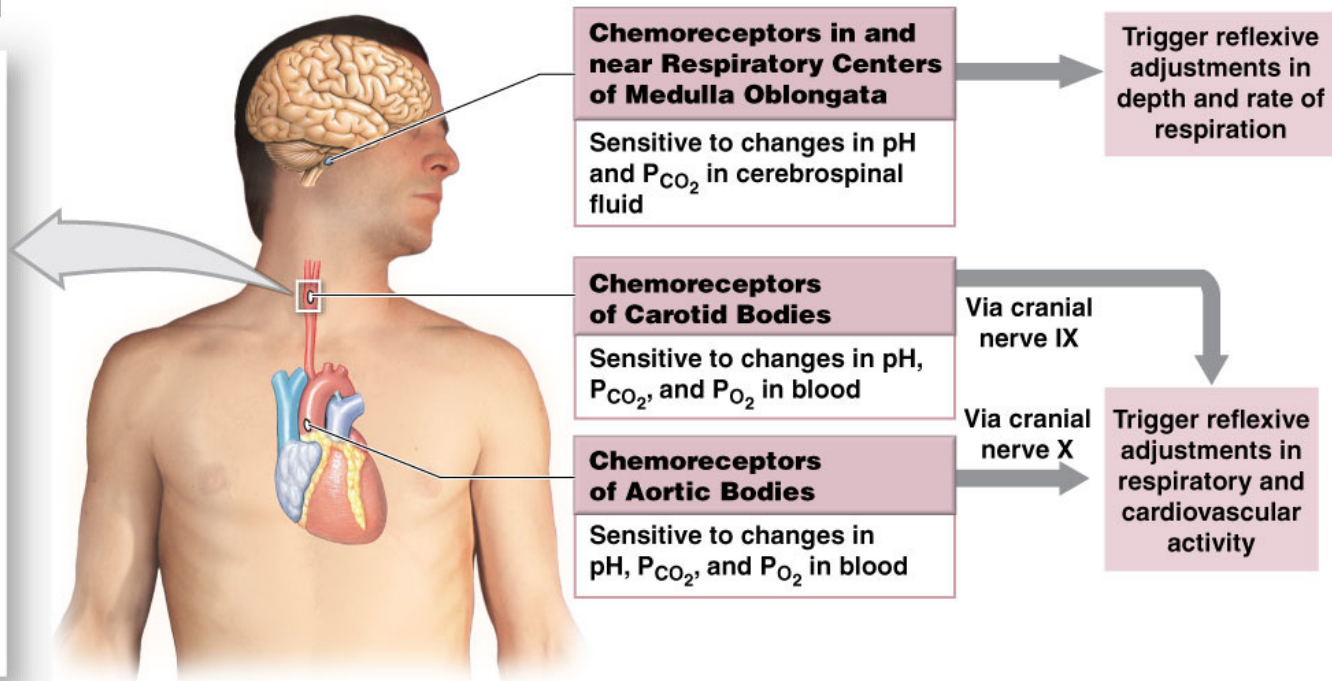
Chemoreceptors

Chemoreceptive neurons
Blood vessel

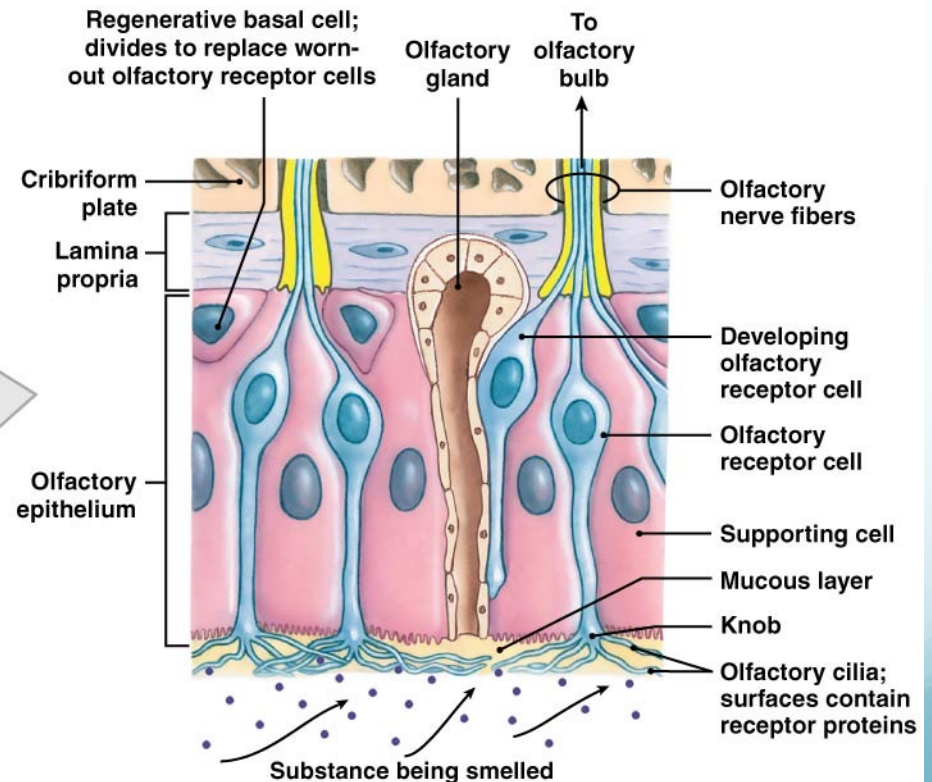
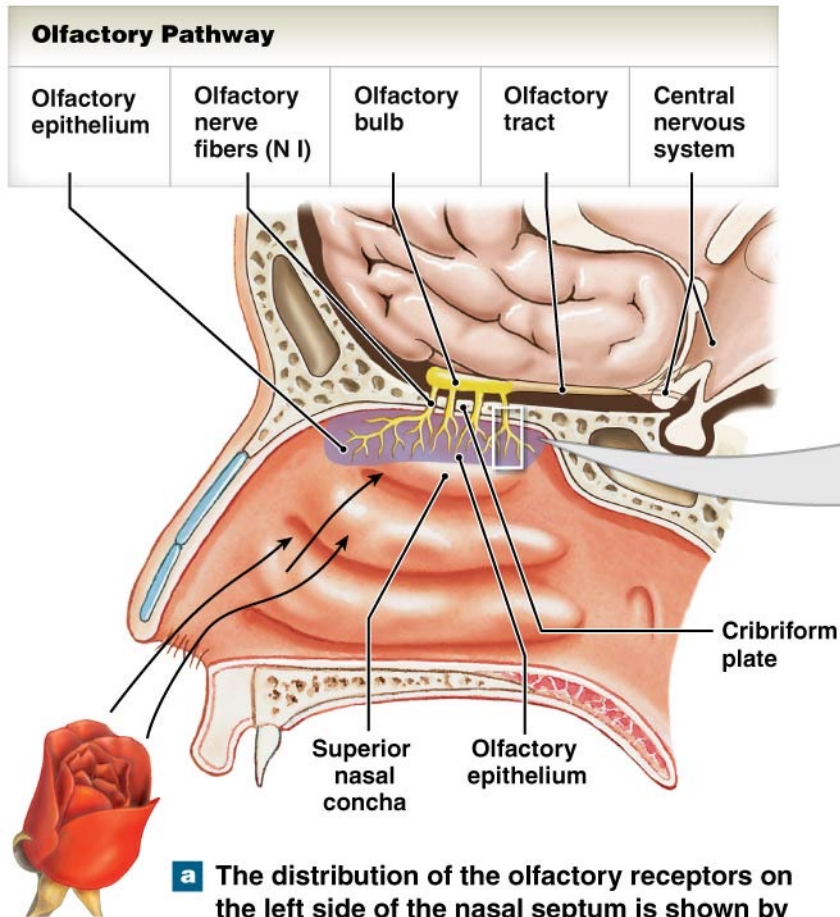


Carotid body

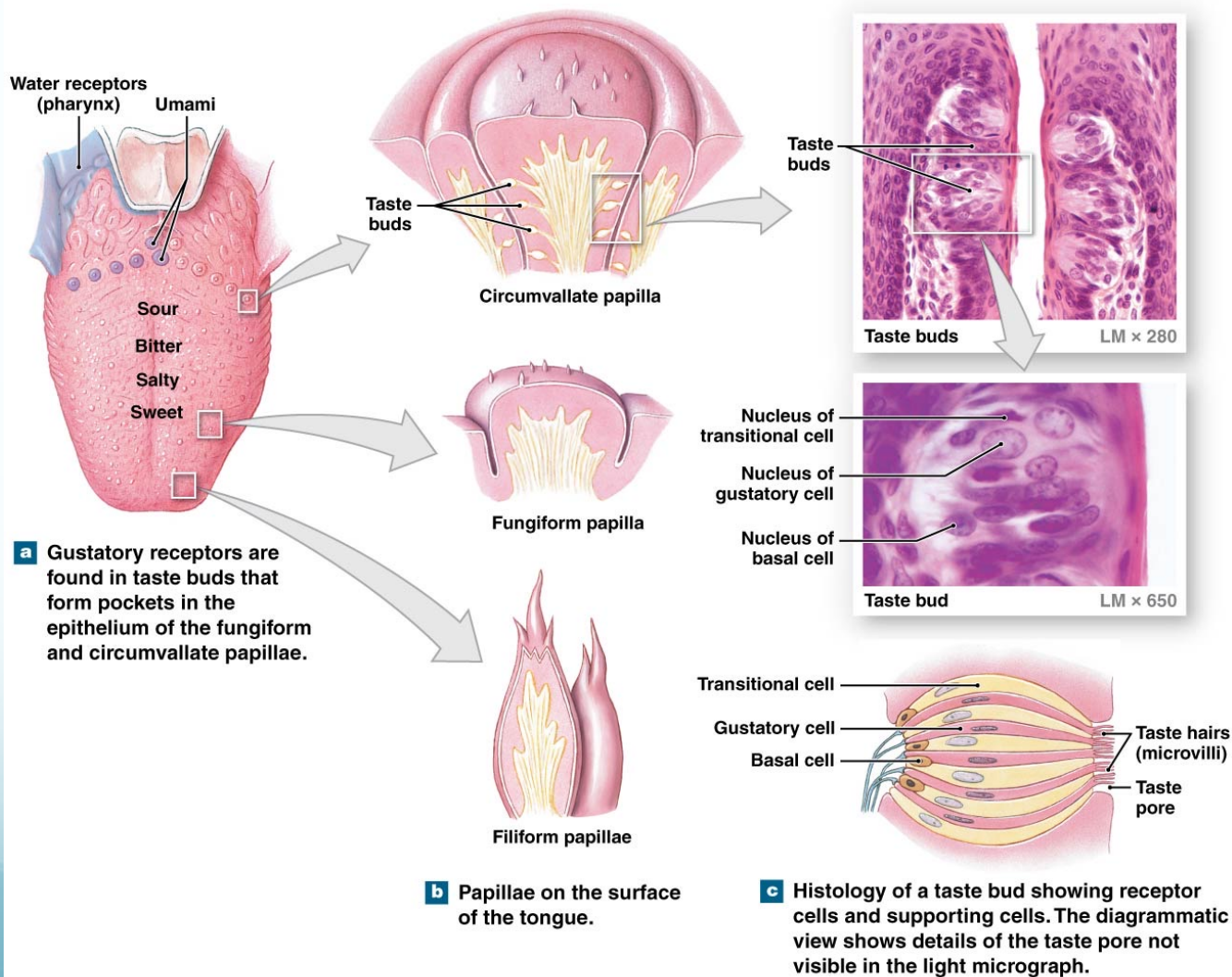
LM × 1500



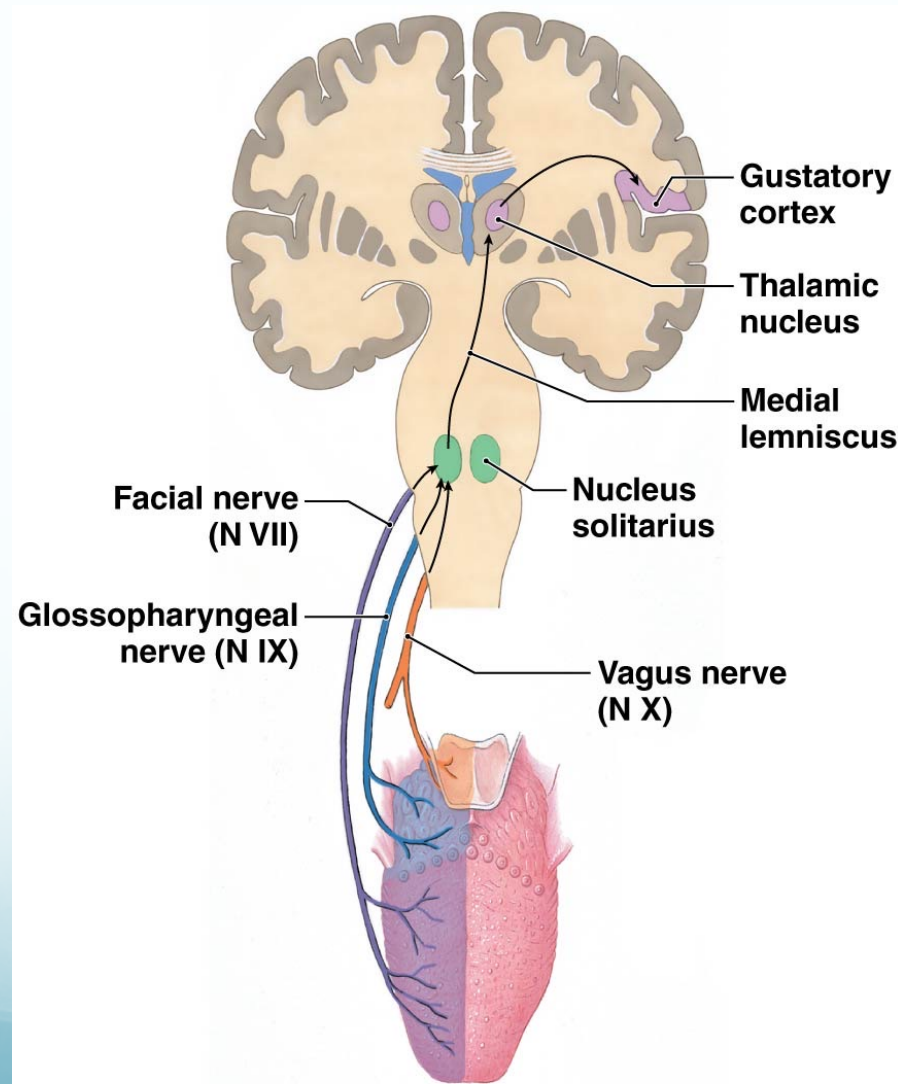
Olfactory Receptors



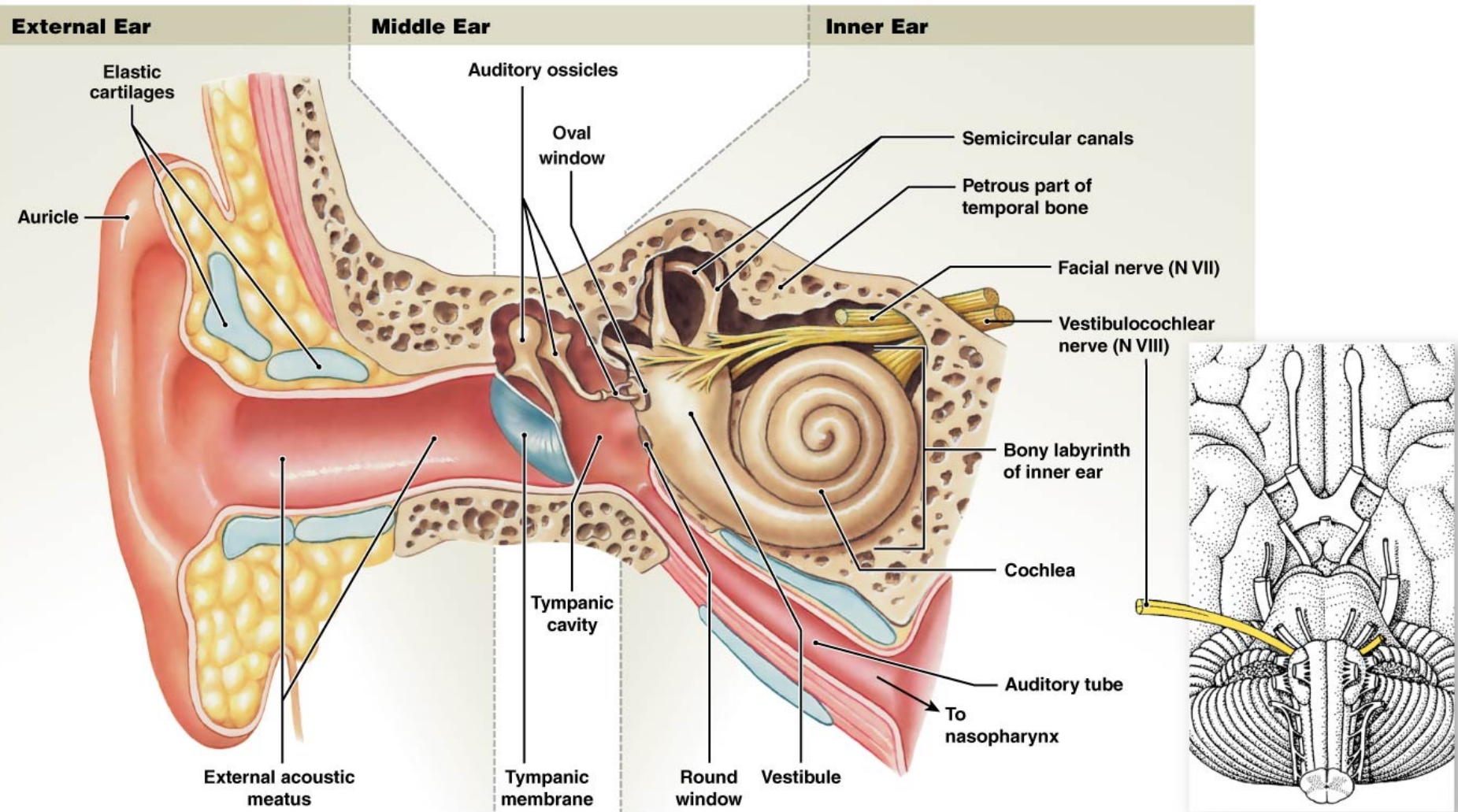
Taste



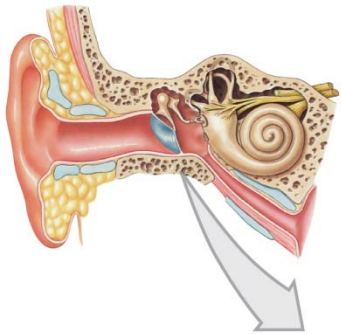
Gustatory Pathways



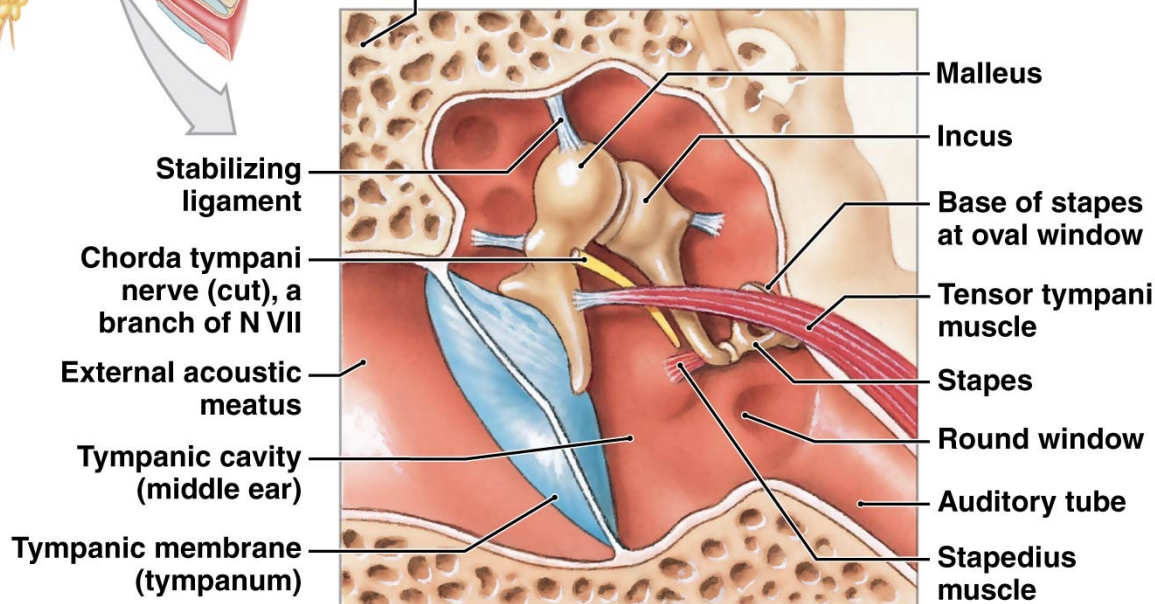
Equilibrium and Hearing



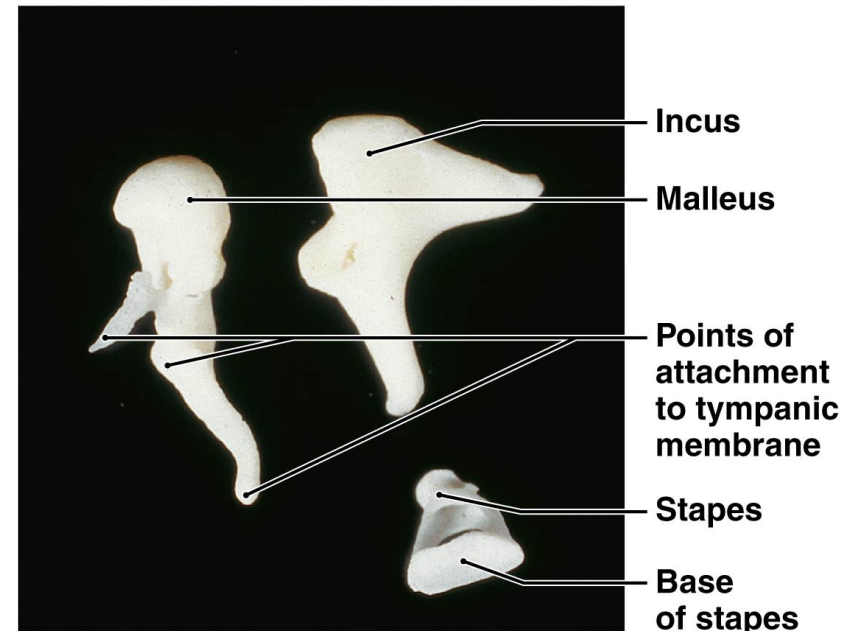
Middle Ear



Temporal bone (petrous part)



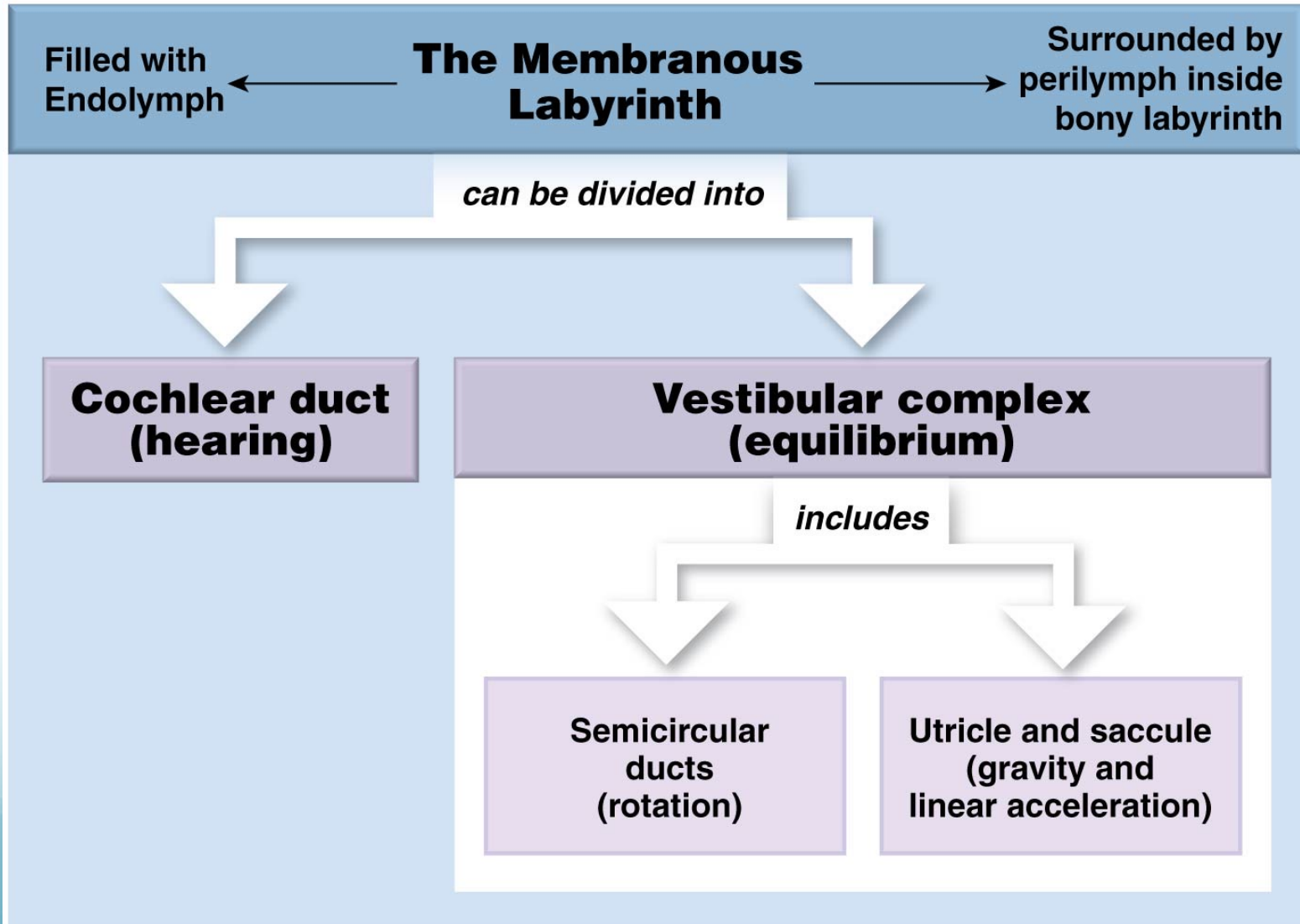
b Structures within the middle ear cavity



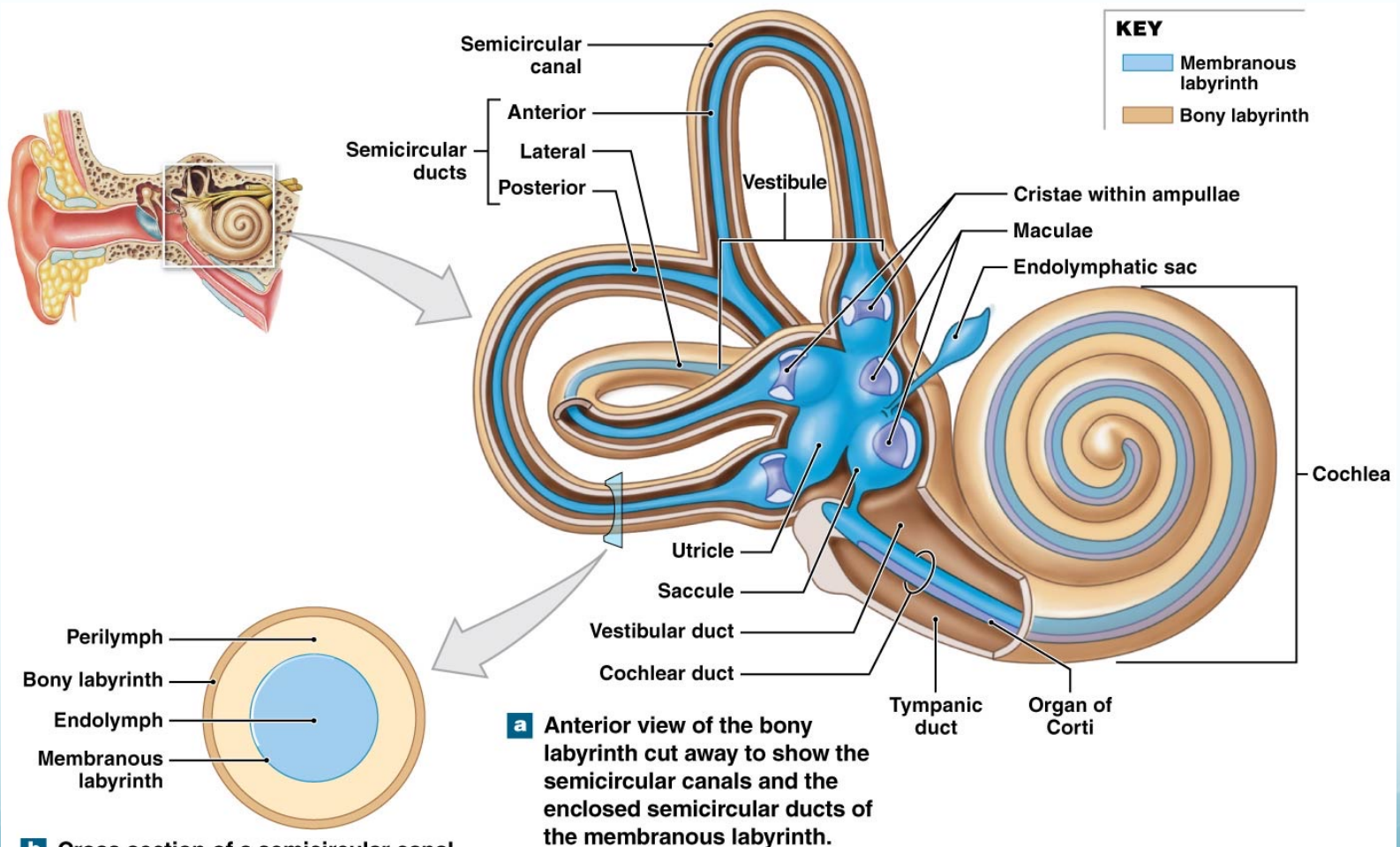
c The isolated auditory ossicles

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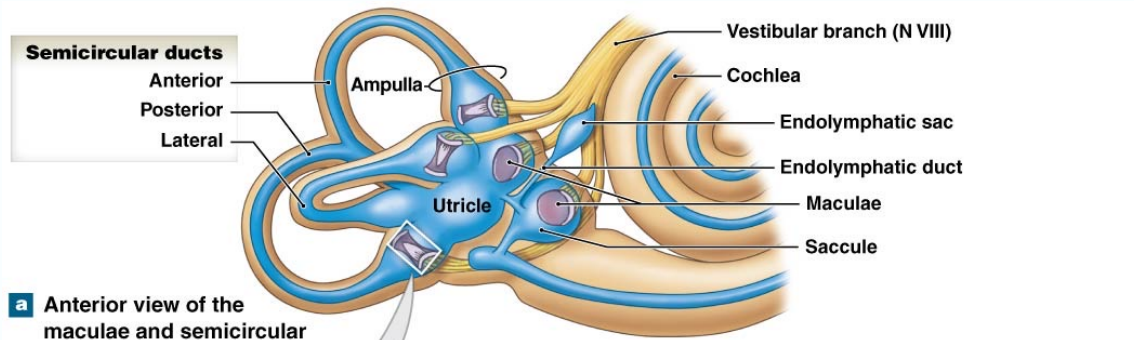
Structural Relationships of Inner Ear



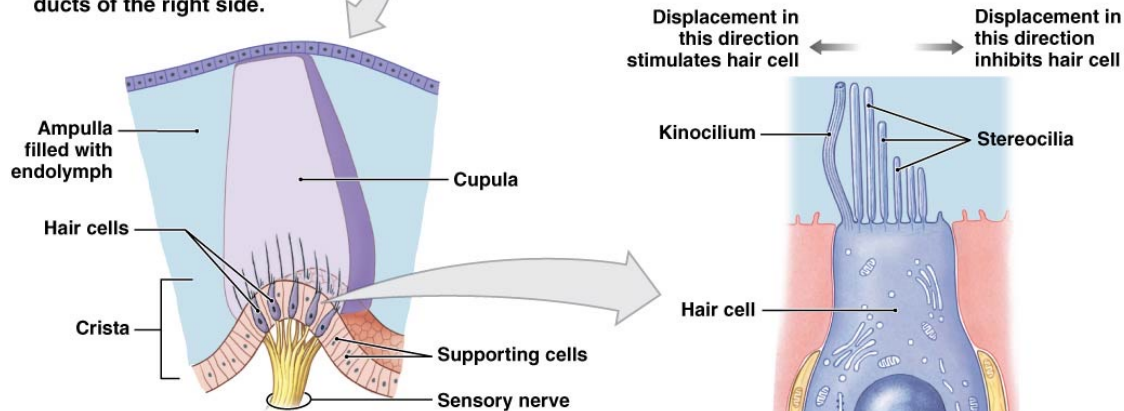
Semicircular Canals and Ducts



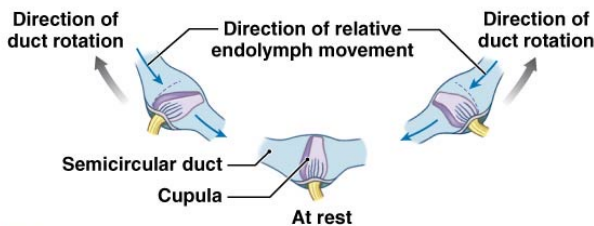
Function of Semicircular Ducts



a Anterior view of the maculae and semicircular ducts of the right side.



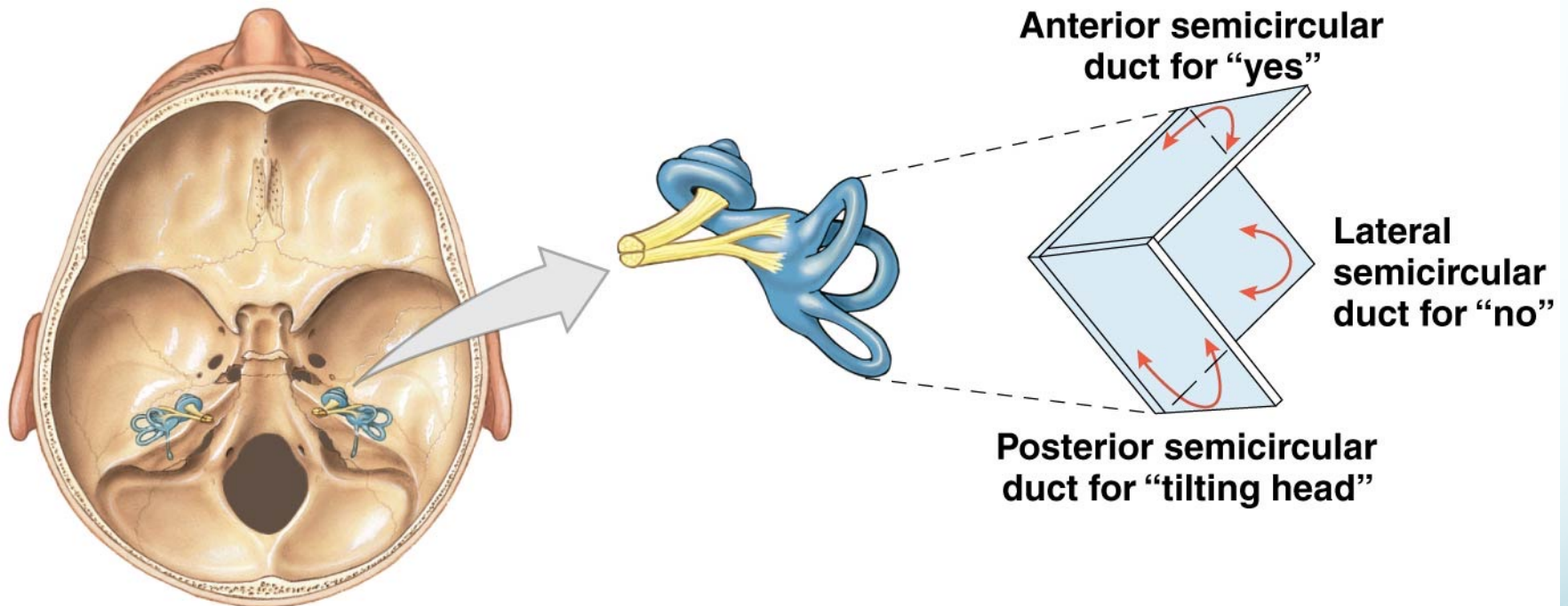
b A section through the ampulla of a semicircular duct.



c Endolymph movement along the length of the duct moves the cupula and stimulates the hair cells.

d Structure of a typical hair cell showing details revealed by electron microscopy. Bending the stereocilia toward the kinocilium depolarizes the cell and stimulates the sensory neuron. Displacement in the opposite direction inhibits the sensory neuron.

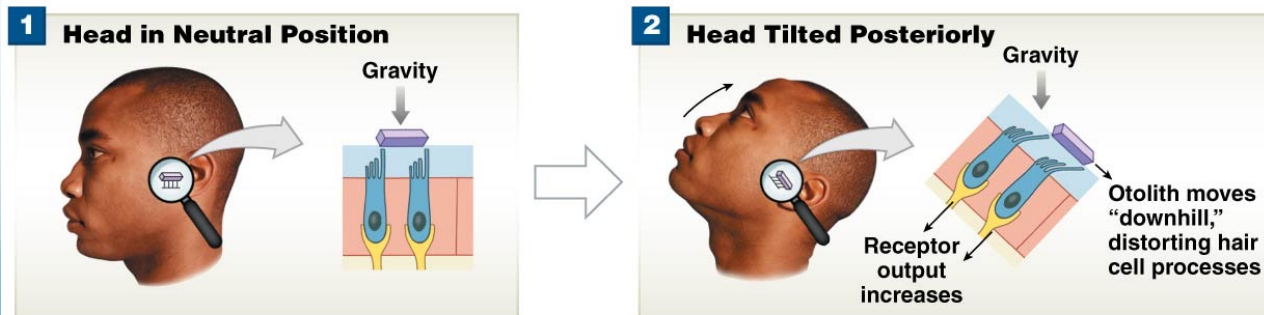
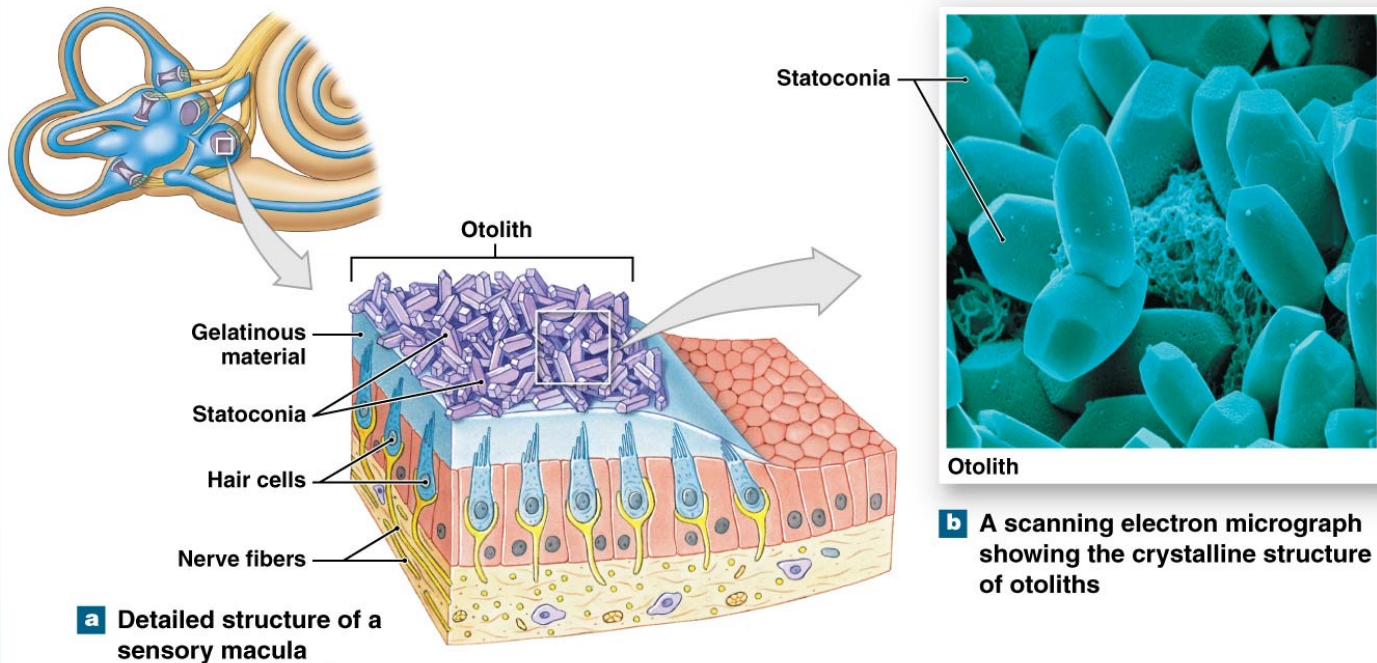
Function of Semicircular Ducts



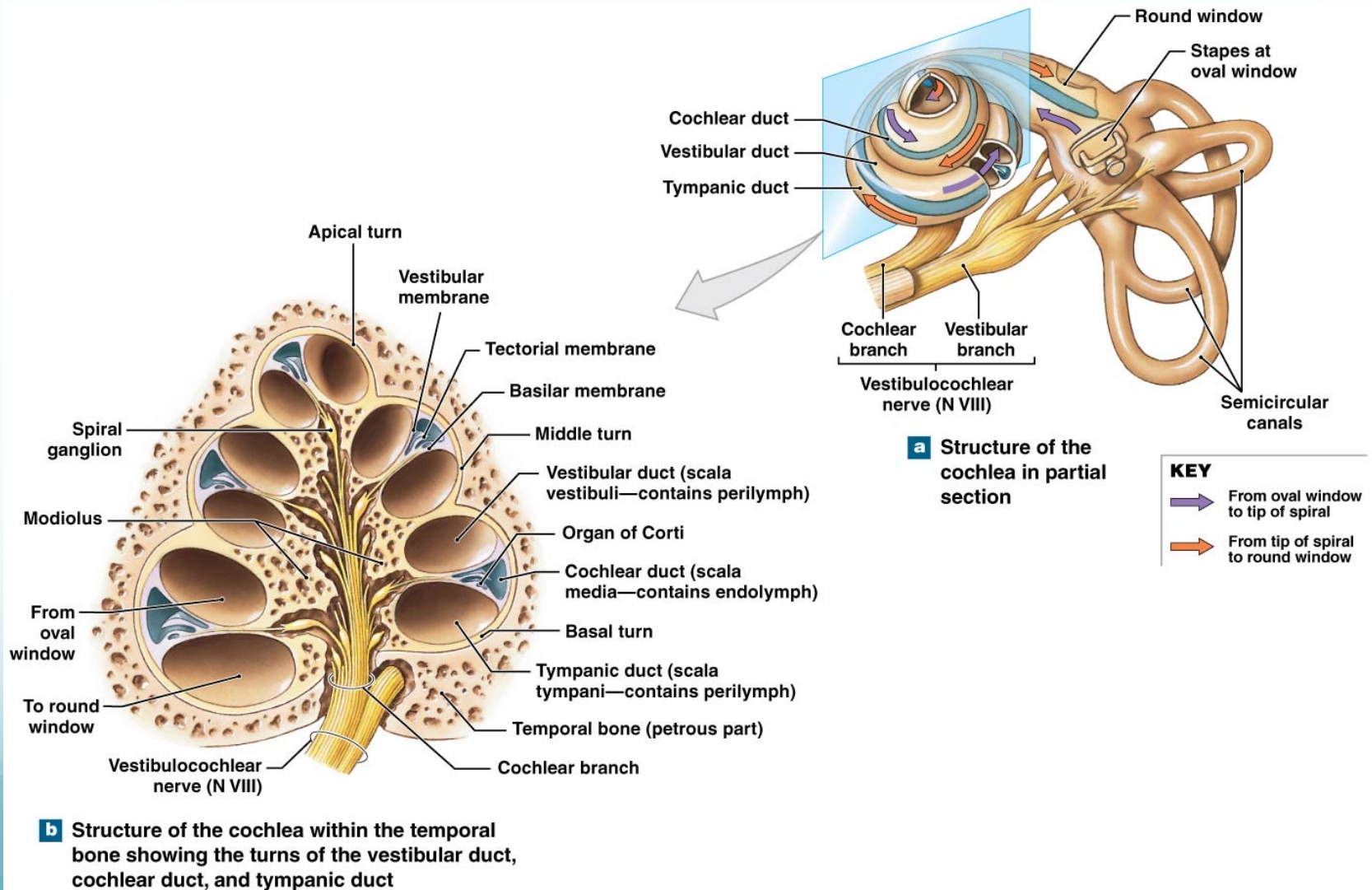
a Location and orientation of the membranous labyrinth within the petrous parts of the temporal bones

b A superior view showing the planes of sensitivity for the semicircular ducts

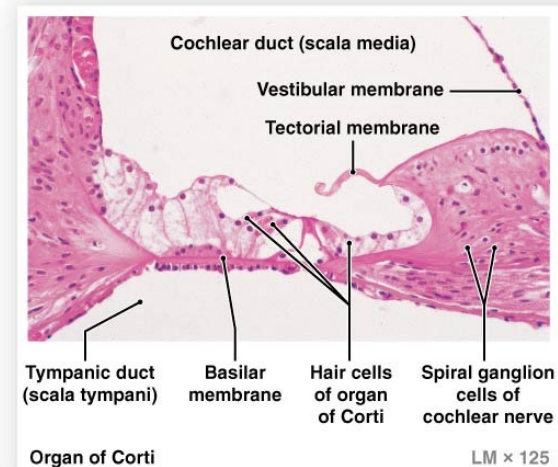
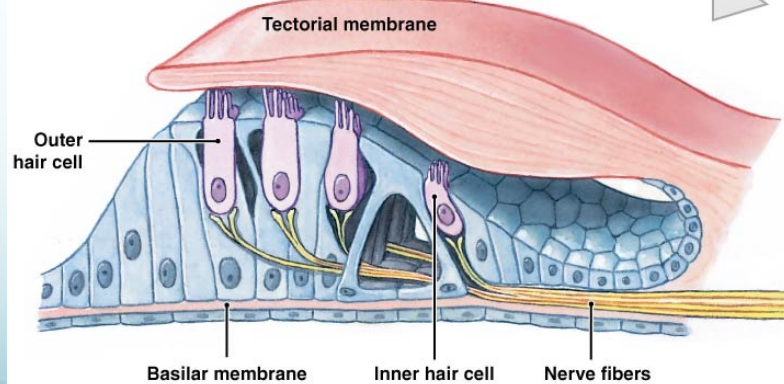
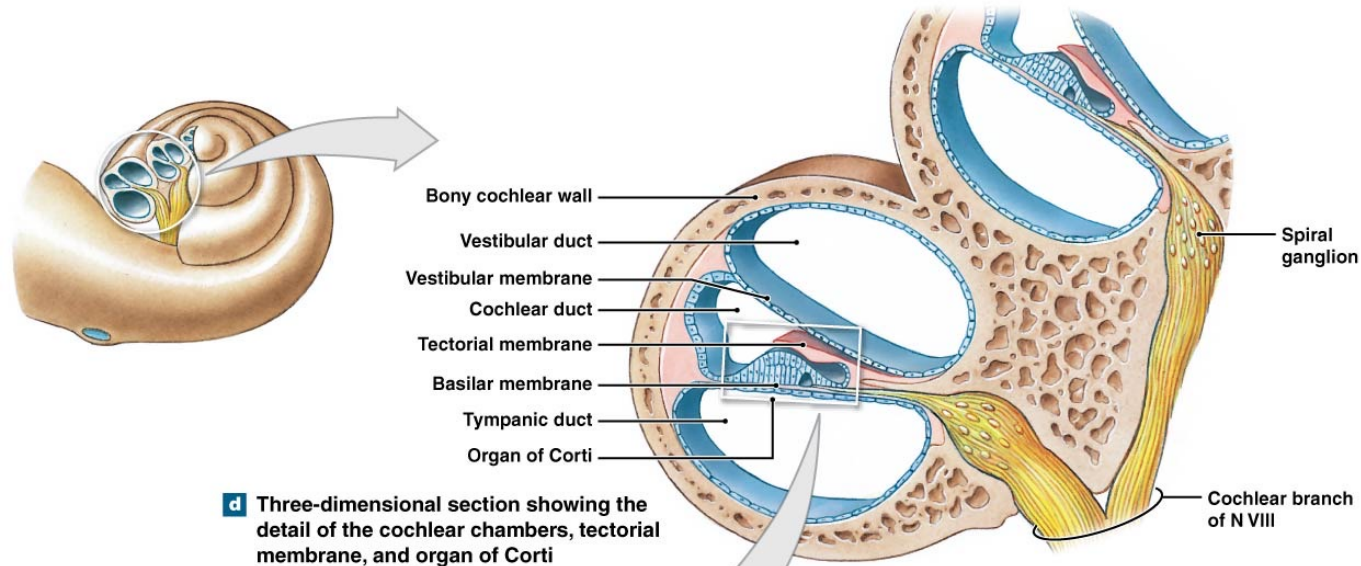
Macula of Vestibule



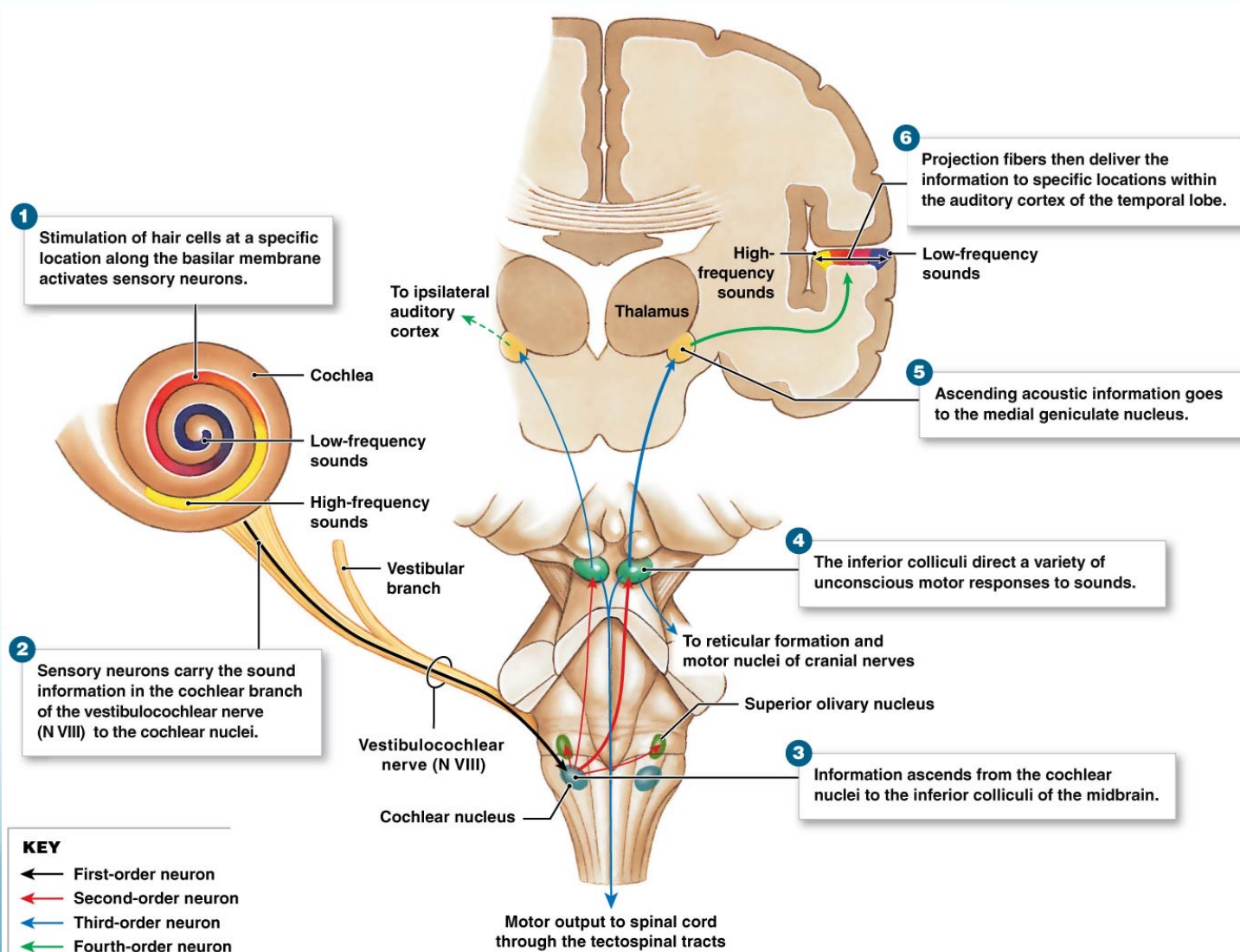
Cochlea and Organ of Corti



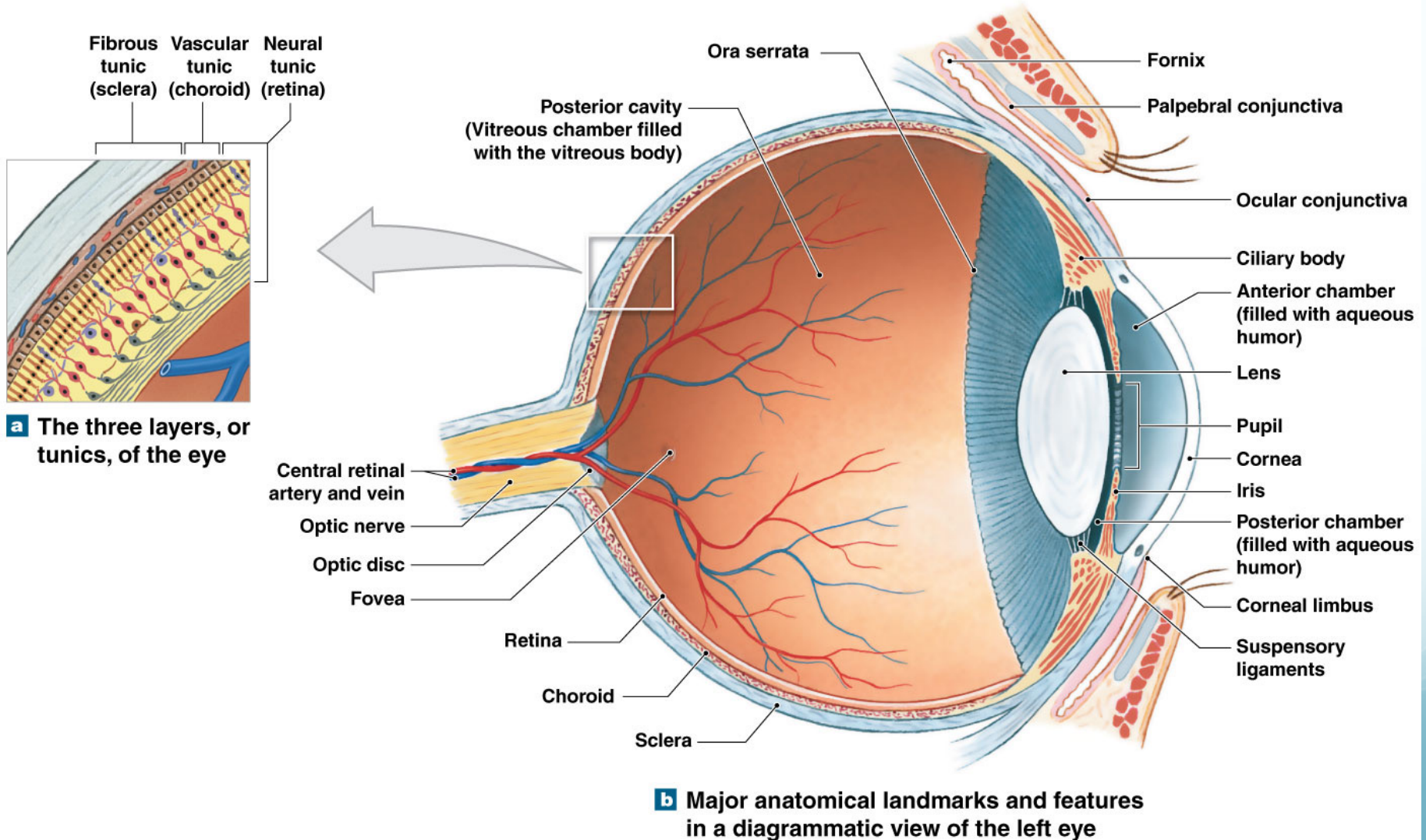
Sound Detection



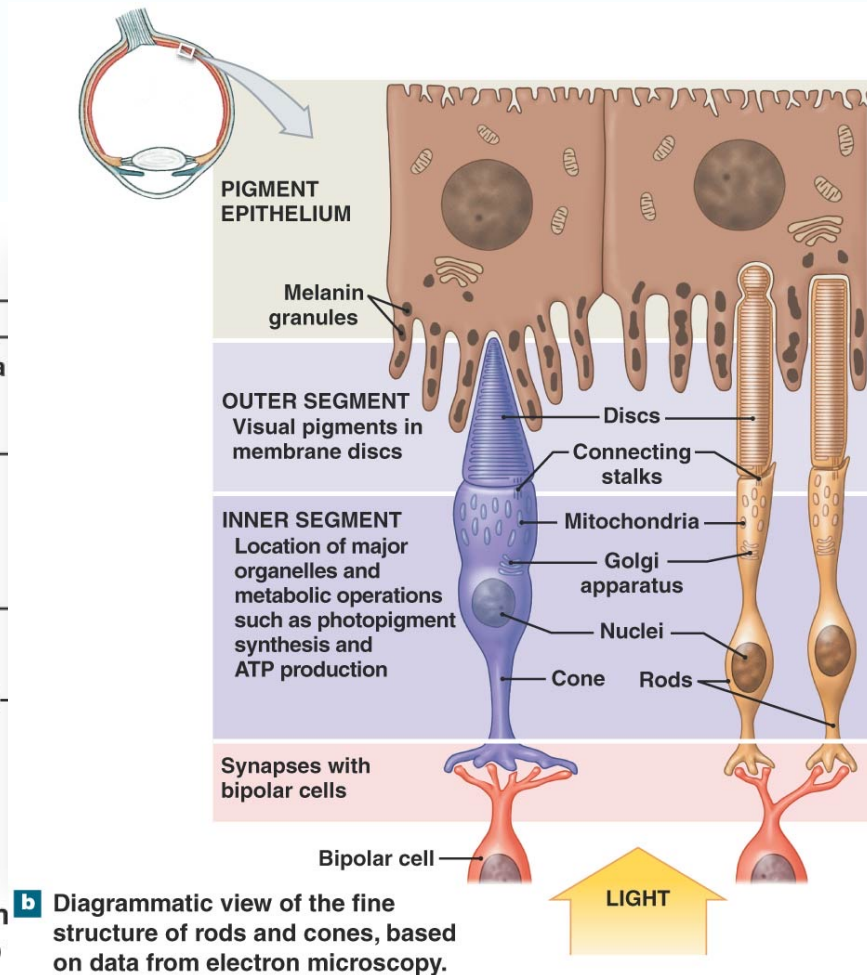
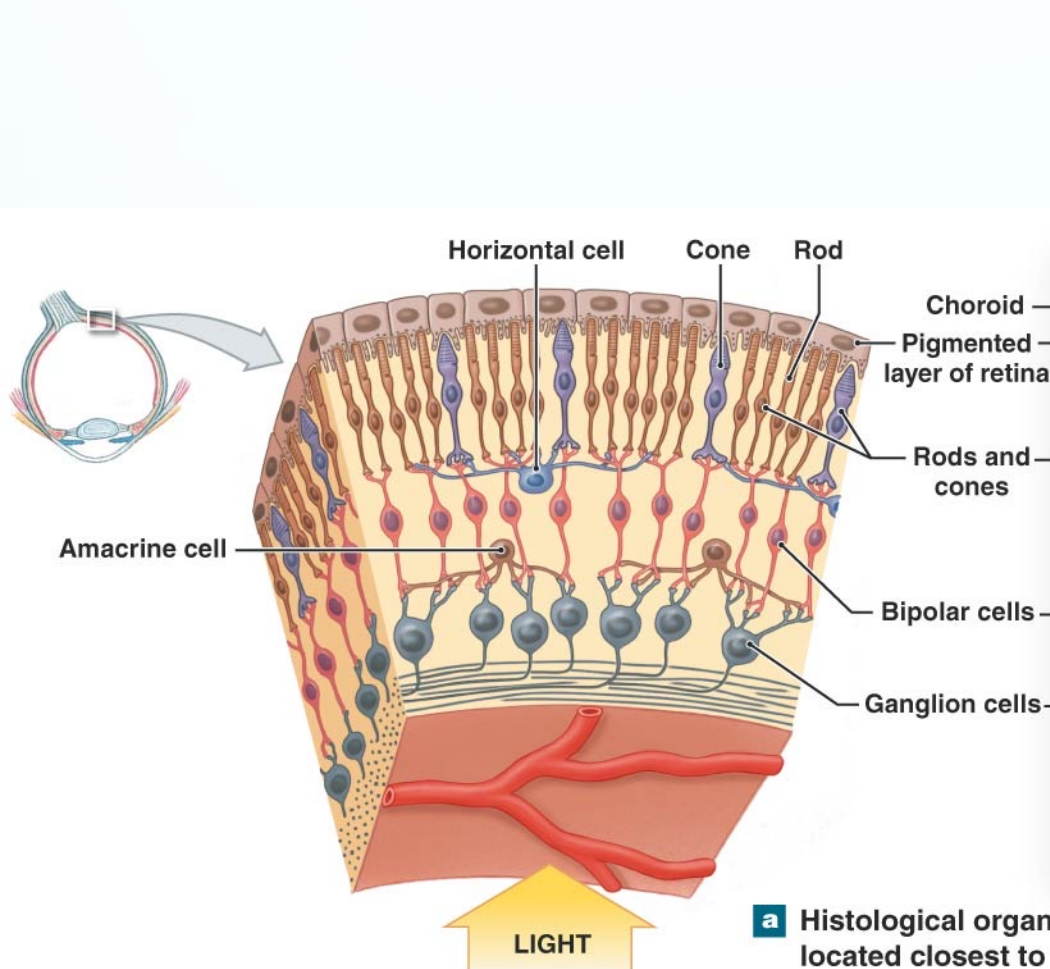
Auditory Sensation Pathways



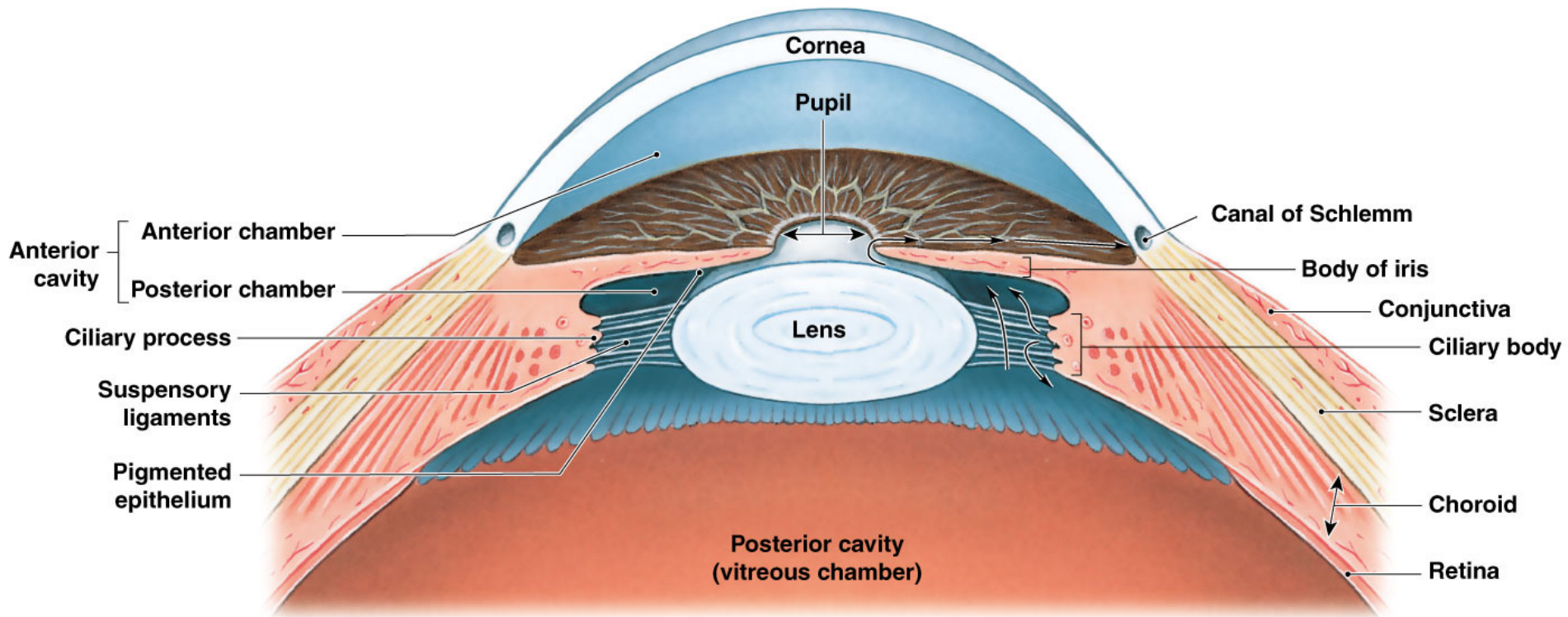
The Eye



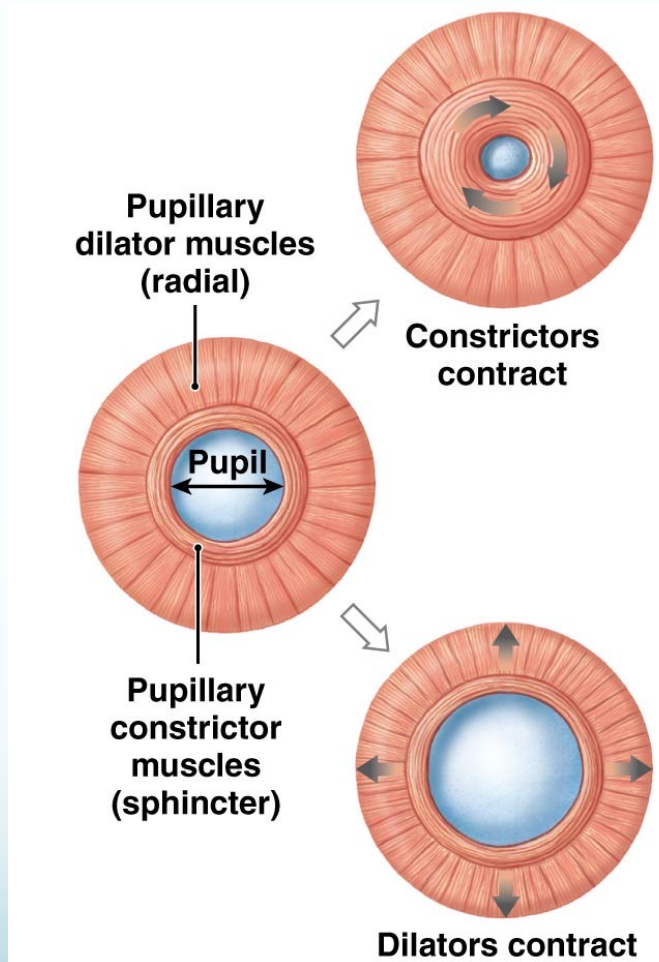
Retinal Organization



Circulation of Aqueous Humor



Action of Pupillary Muscles



c The action of pupillary muscles and changes in pupillary diameter