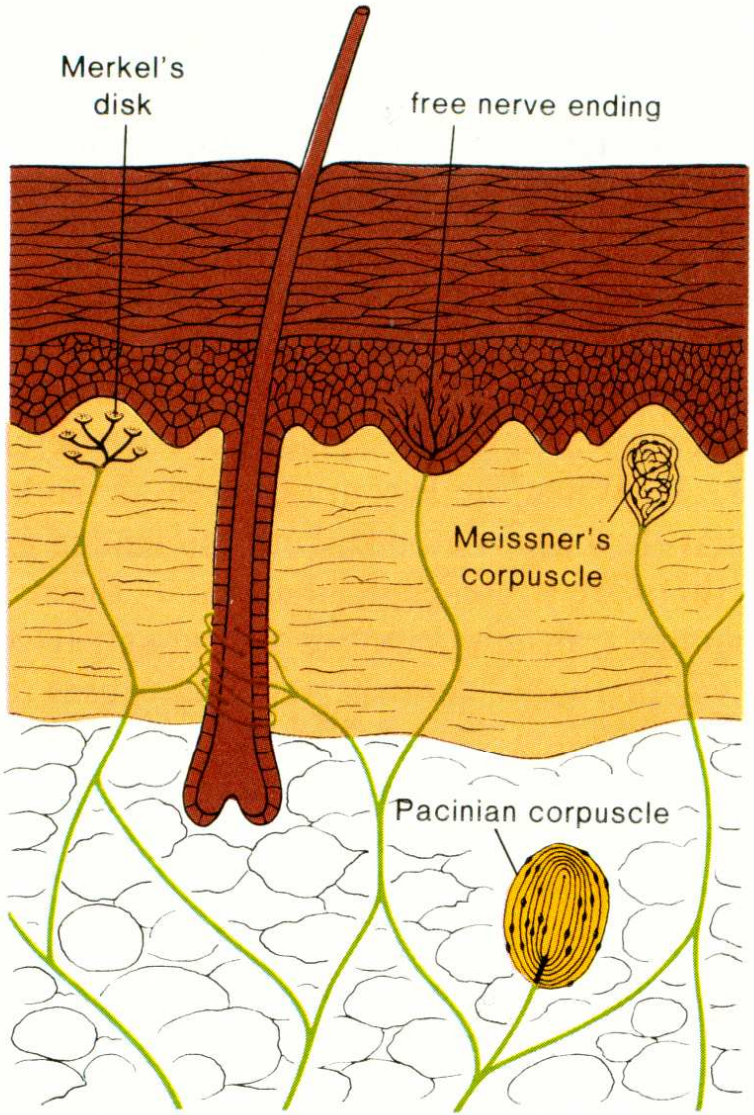


FIGURE 12.2 Receptors in human skin. Free nerve endings are pain receptors; Pacinian corpuscles are pressure receptors; Merkel's disks and Meissner's corpuscles are touch receptors, as are the nerve endings surrounding the hair follicle.

FIGURE 12.4 Taste buds. *a*. Elevations, called papillae, indicate the presence of taste buds. The location of those containing taste buds responsive to sweet, sour, salt, and bitter is indicated. *b*. Drawing of a taste bud shows the various cells that make up a taste bud. Sensory cells in the bud end in microvilli that have receptors for the chemicals that exhibit the tastes noted in *a*. When the chemicals combine with the receptors, nerve impulses are generated.

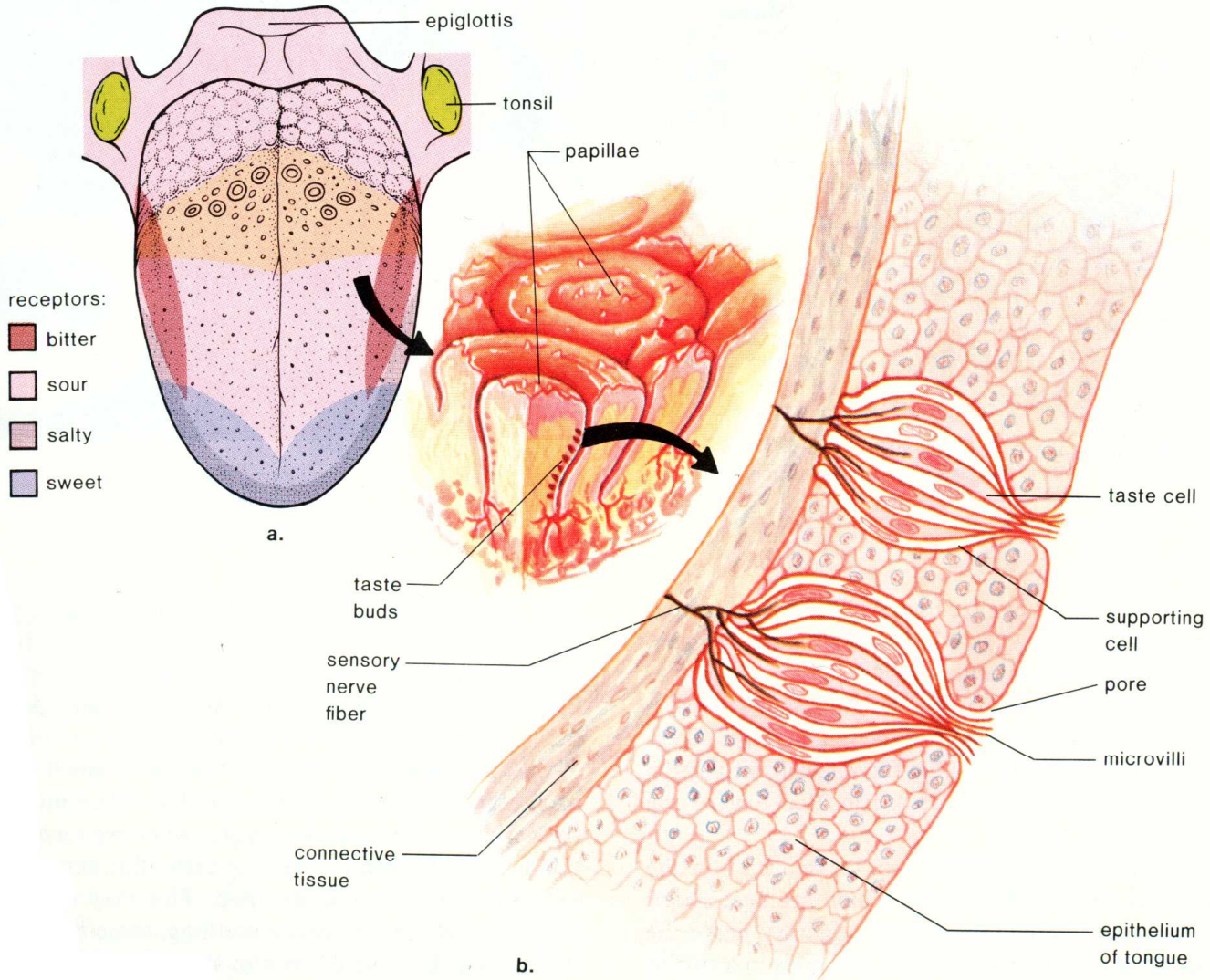
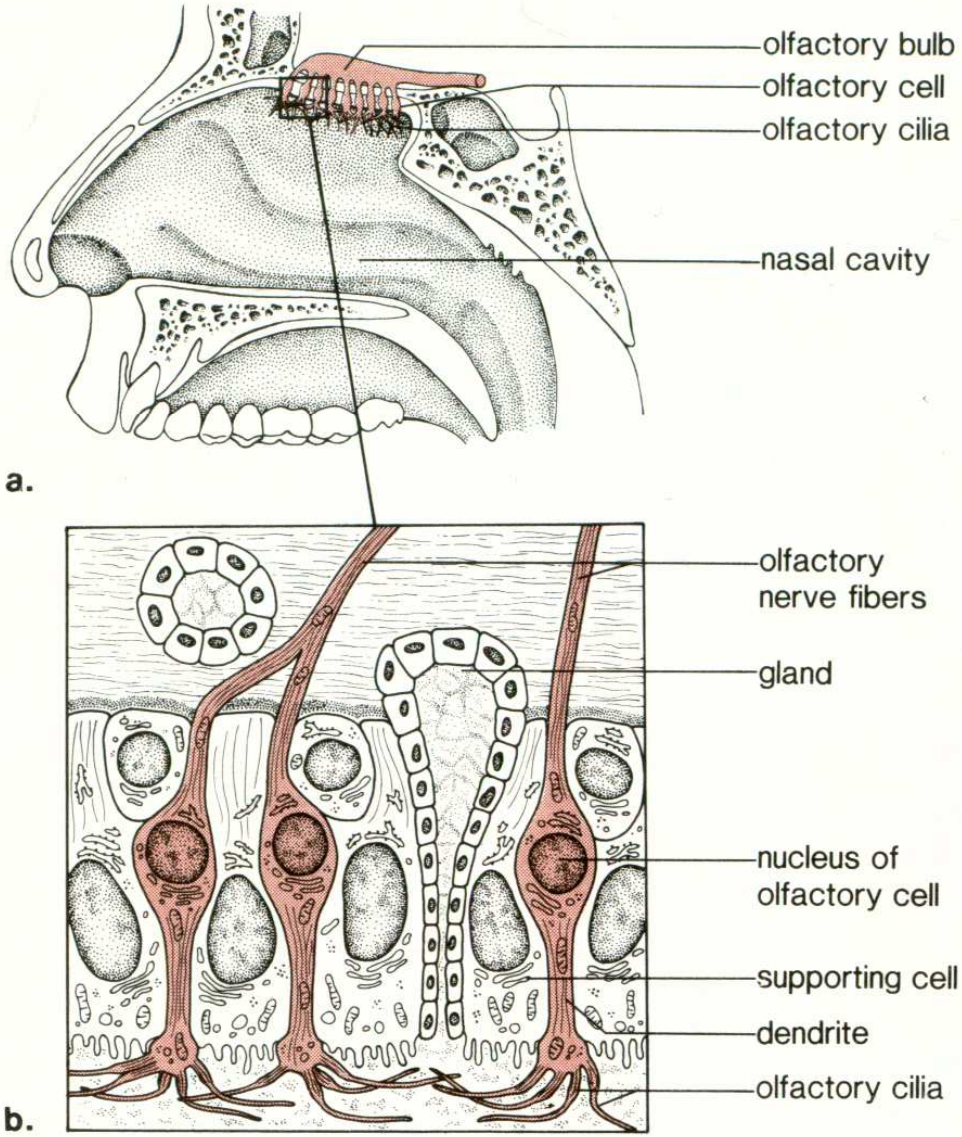


FIGURE 12.5 *a*. Position of olfactory epithelium in a nasal passageway. *b*. The olfactory receptor cells, which have cilia projecting into the nasal cavity, are supported by columnar epithelial cells. When these cells are stimulated by chemicals in the air, nerve impulses begin and are conducted to the brain by olfactory nerve fibers.



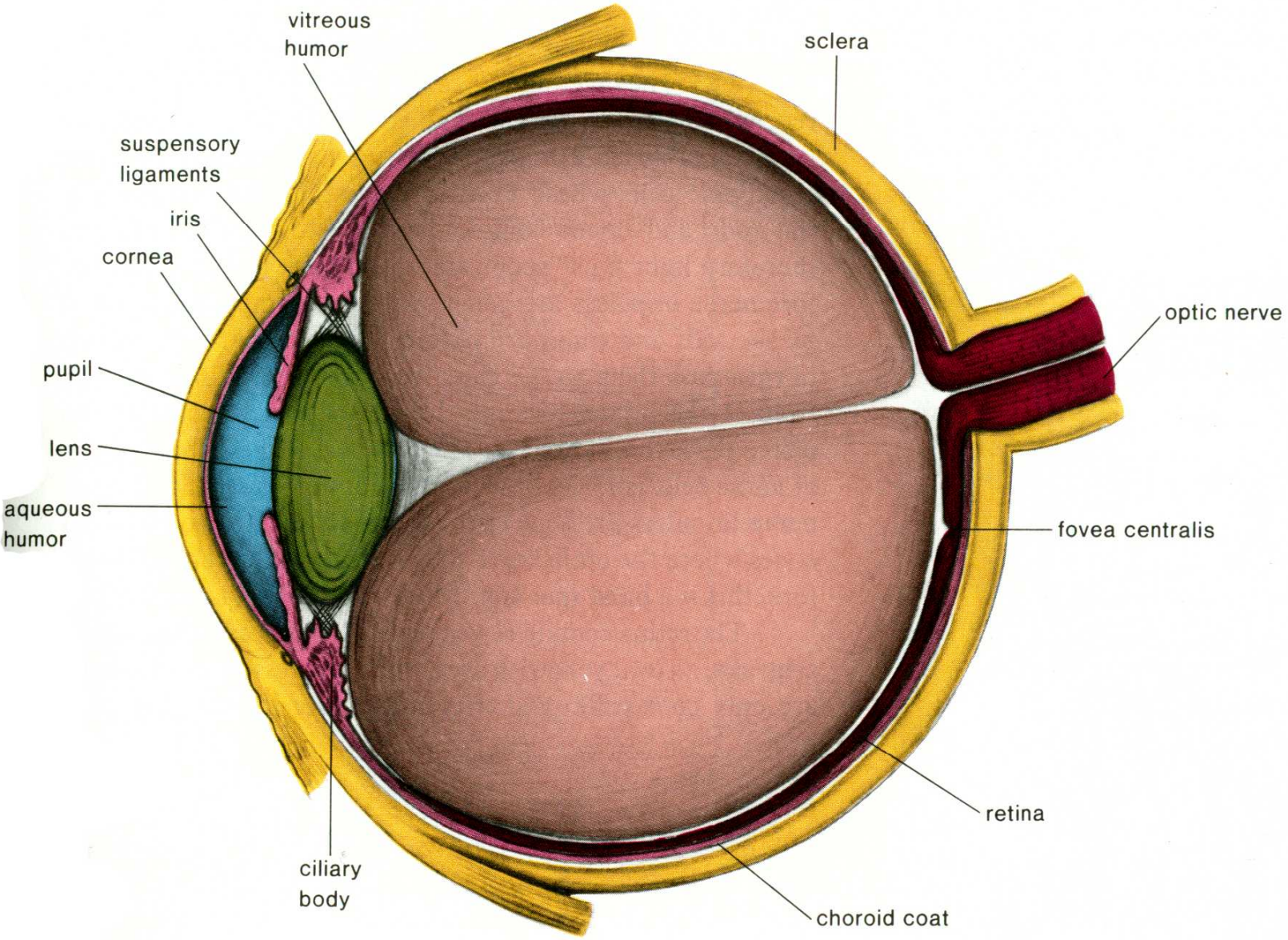
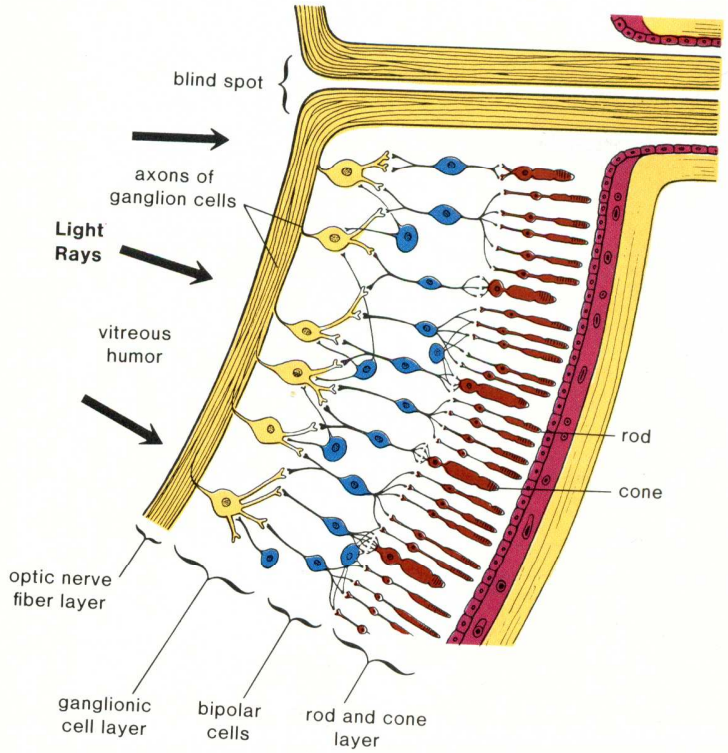
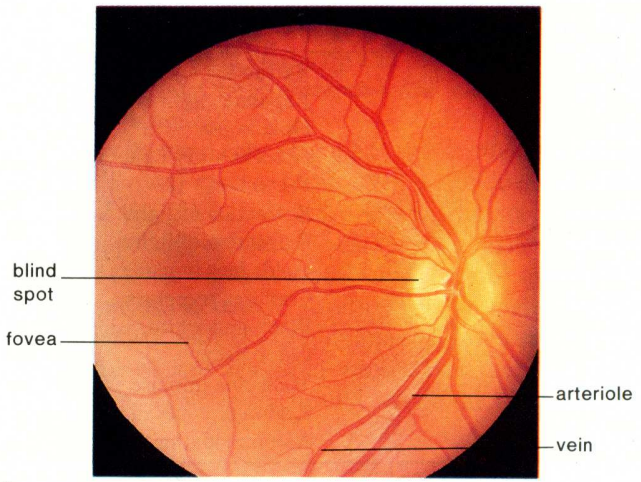


FIGURE 12.7 Anatomy of the human eye. Notice that the sclera becomes the cornea; the choroid becomes the ciliary body and iris. The ciliary body is thrown into 70 to 80 radiating folds that contain the ciliary muscle and ligaments that hold and adjust the shape of the lens. The retina contains the receptors for sight, and vision is most acute in the fovea centralis where there are only cones. A blind spot occurs where the optic nerve leaves the retina, and there are no receptors for sight.

FIGURE 12.8 *a.* Structure of retina. Rods and cones are located toward the back of the retina, followed by the bipolar cells and the ganglionic cells whose fibers become the optic nerve. Notice that the rods share bipolar cells but the cones do not. Cones, therefore, distinguish more detail. *b.* The blind spot where the optic nerve pierces the eyeball is clearly visible in eye examinations.

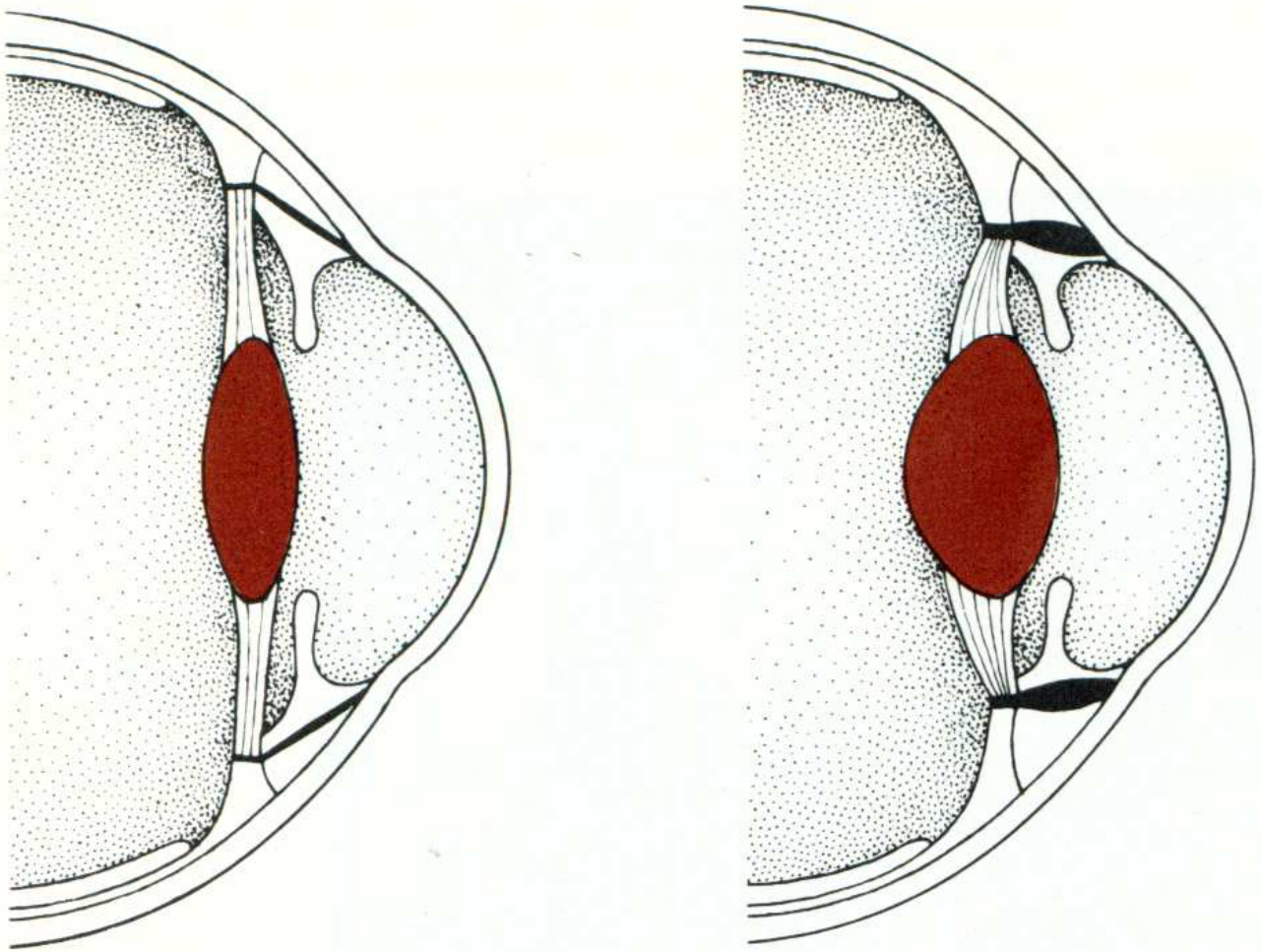


a.



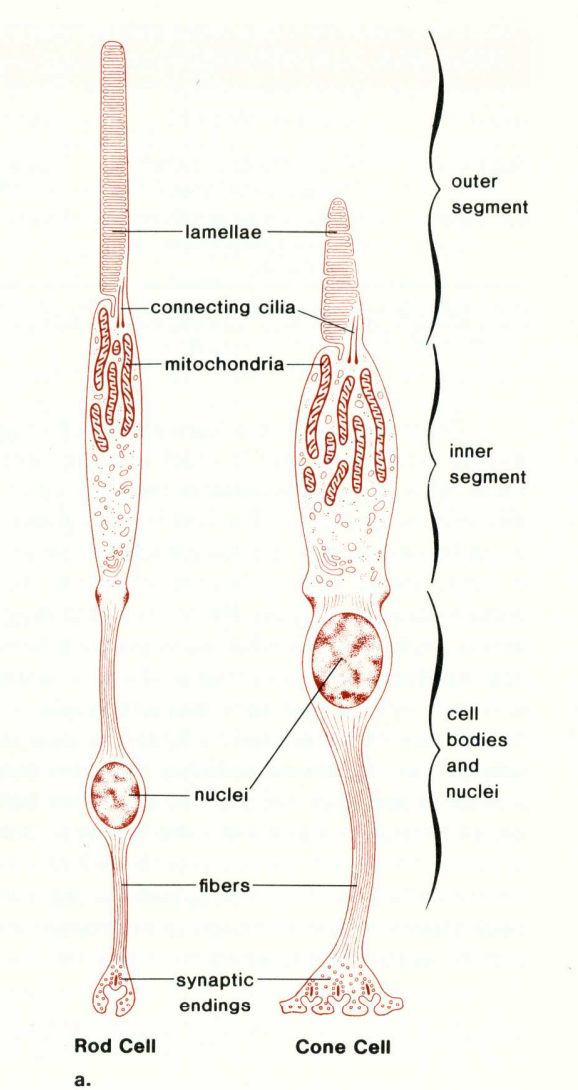
b.

FIGURE 12.11 Accommodation. *a*. When the eye focuses on a far object, the lens is flat because the ciliary muscle is relaxed and the suspensory ligament is taut. *b*. When the eye focuses on a near object, the lens rounds up because the ciliary muscle contracts, causing the suspensory ligament to relax.



a. Normal Distant Focus

b. Near Focus


outer segment
lamellae
connecting cilia
mitochondria
inner segment
cell bodies and nuclei
nuclei
fibers
synaptic endings
Rod Cell
Cone Cell

a.

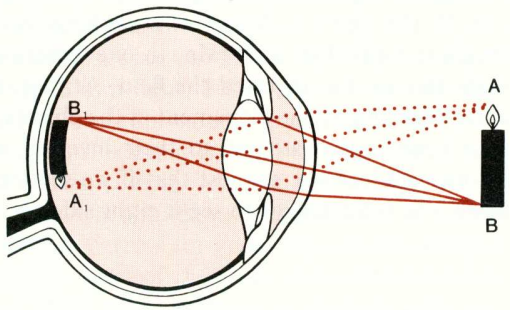

A
B1
A1
B

FIGURE 12.12 Both eyes "see" the entire object, but information from the right half of each retina goes to the right visual cortex and information from the left half of each retina goes to the left visual cortex. When the information is pooled the brain "sees" the entire object and "sees" it in depth.

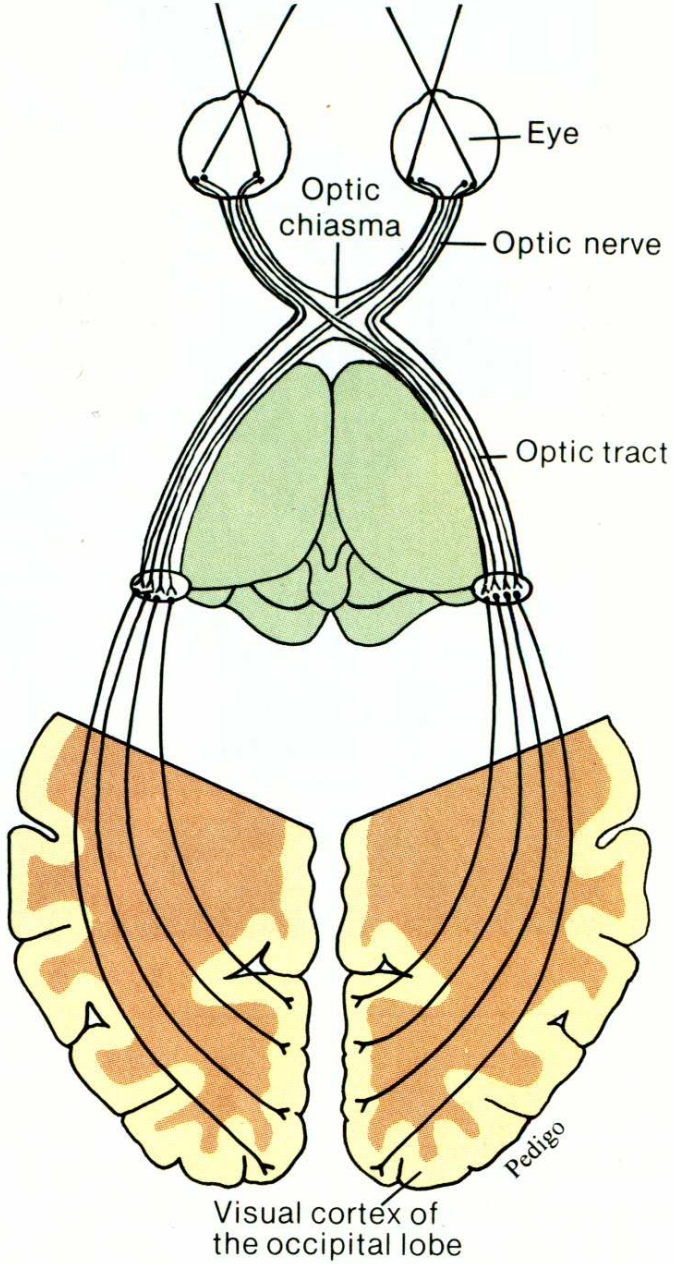
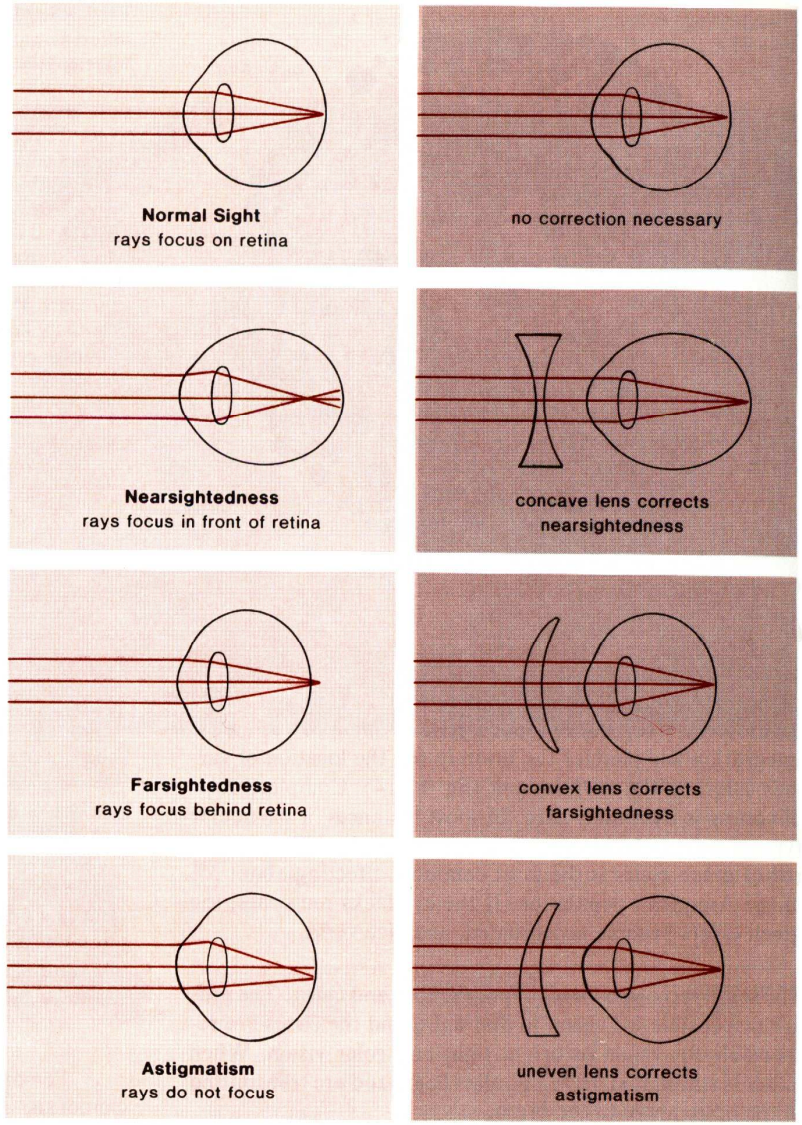


FIGURE 12.15 *a.* Diagram illustrating common abnormalities of the eye. Both the cornea and the lens function in bringing light rays (*lines*) to focus, but sometimes they are unable to compensate for the shape of the eyeball or for an uneven cornea. *b.* Corrective lenses can be provided to allow the individual to see normally. *c.* Ophthalmologists can examine the fit of a contact lens by using a narrow beam of light from a "slit lamp" while looking through a biomicroscope.



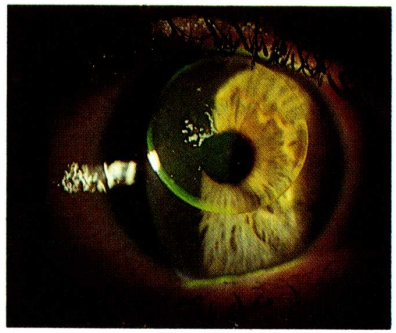


FIGURE 12.16 Anatomy of the human ear. *a.* In the middle ear, the hammer, anvil, and stirrup amplify sound waves. Otosclerosis is a condition in which the stirrup becomes attached to the inner ear and unable to carry out its normal function. It can be replaced by a plastic piston, and thereafter the individual hears normally because sound waves are transmitted as usual to the cochlea, which contains the receptors for hearing. *b.* Inner ear. The sense organs for balance are in the inner ear: the vestibule contains the utricle and saccule, and the ampullae are at the bases of the semicircular canals. The receptors for hearing are also in the inner ear: the cochlea has been cut to show the location of the organ of Corti.

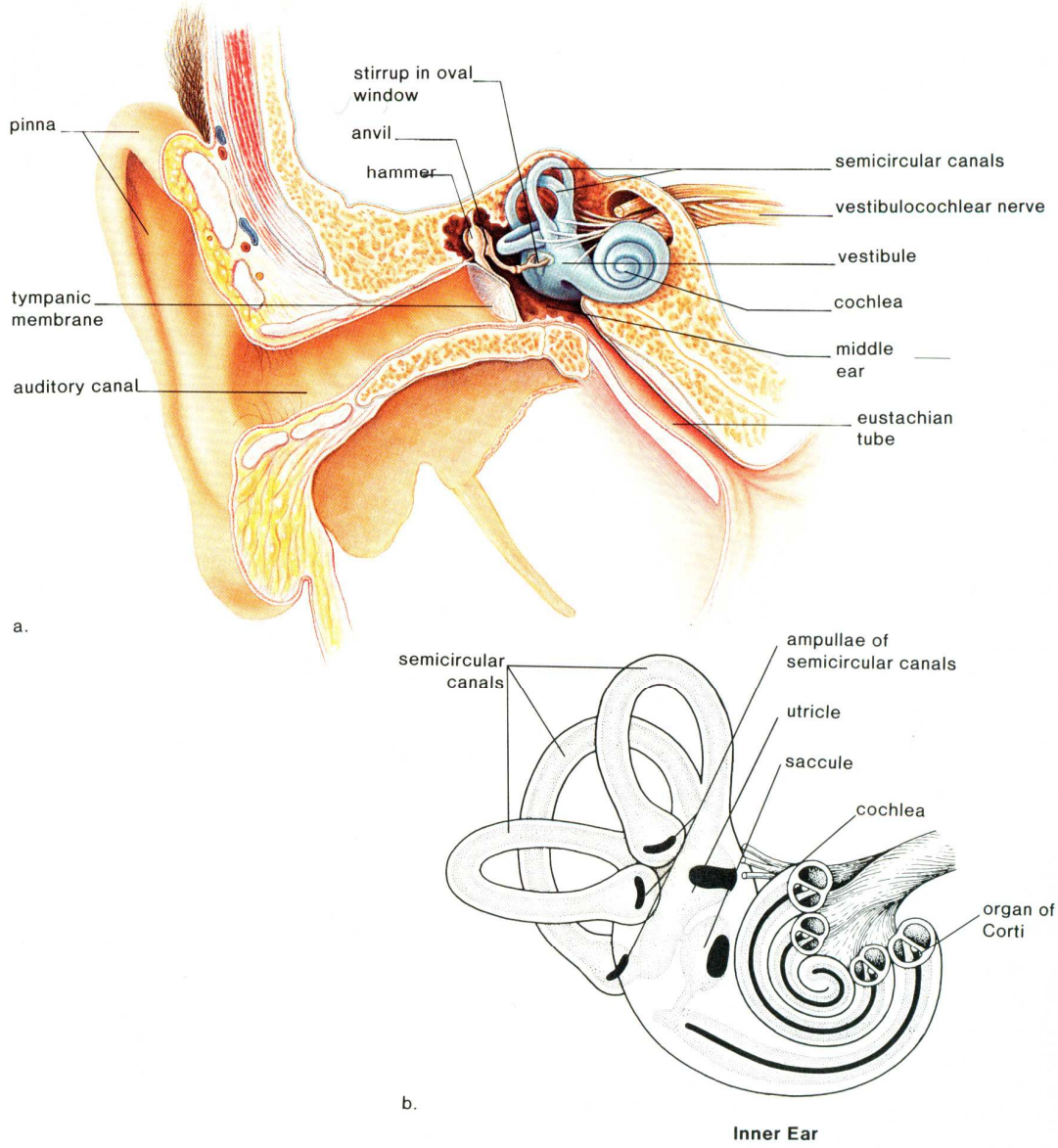
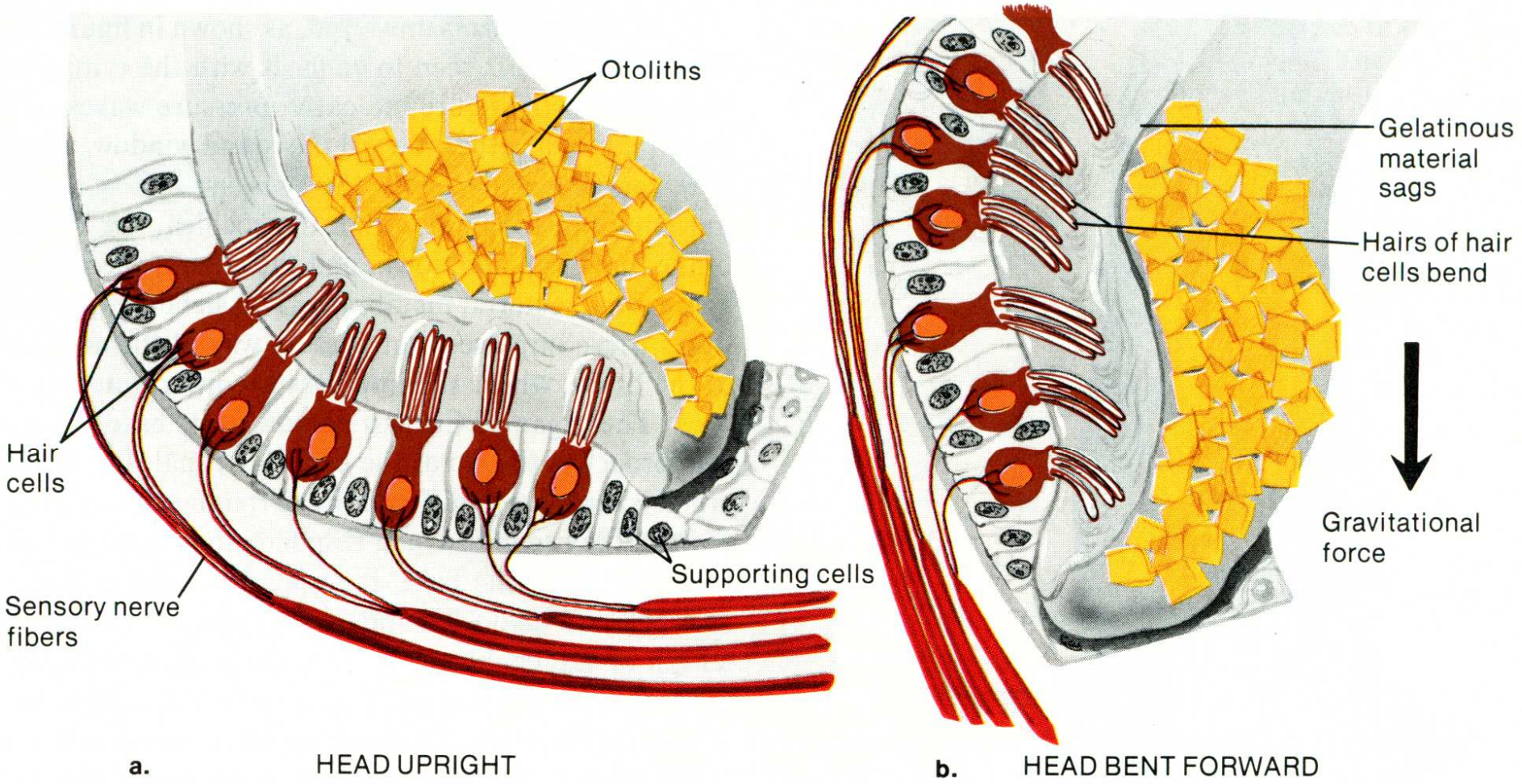
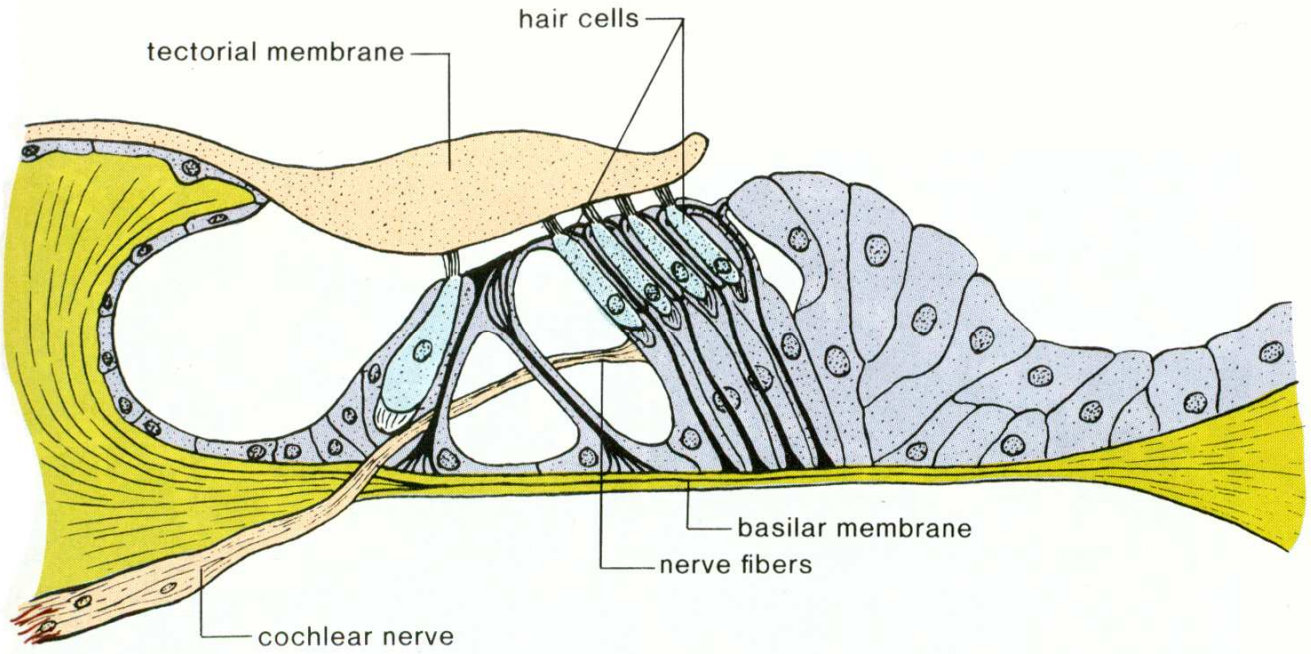


FIGURE 12.17 Receptor hair cells in the utricle and saccule are involved in our sense of static equilibrium: responsiveness to movement sideways or up and down. *a.* When the head is upright otoliths are balanced directly on the cilia of hair cells. *b.* When the head is bent forward the otoliths shift, and the cilia are bent causing nerve impulses to begin.





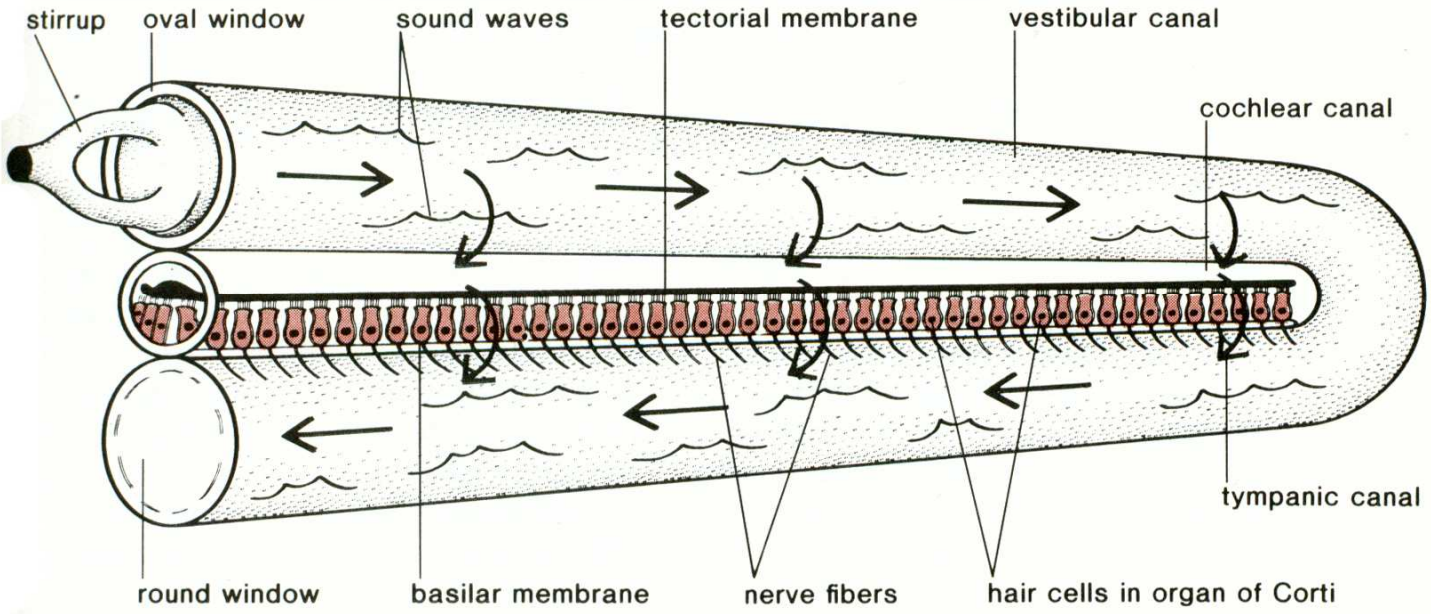


FIGURE 12.19 Organ of Corti. *a*. Enlarged cross section through the organ of Corti, showing the receptor hair cells from the side. *b*. Cochlea unwound, showing the placement of the organ of Corti along its length. The arrows represent the pressure waves that move from the oval window to the round window. These cause the basilar membrane to vibrate and the cilia of at least a portion of the 15,000 hair cells to bend against the tectorial membrane. The resulting nerve impulses result in hearing.