①

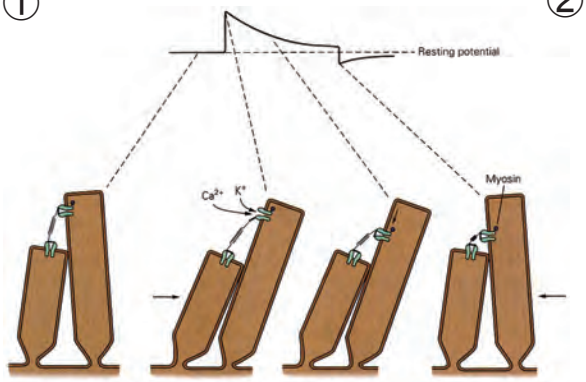

Figure 37.5 **A model of adaptation by hair cells.** A hair bundle may be subjected to prolonged deflection in the positive or negative direction. The electrical response to a positive stimulus displays an initial depolarization, followed by a decline to a plateau and an undershoot at the cessation of the stimulus. Negative stimulation elicits a complementary response: The receptor potential largely abates during stimulation but shows a rebound at the end. Bundle movement in response to positive stimulation increases tip link tension and opens transduction channels. As stimulation continues, however, the tip link's upper attachment moves down the stereocilium, allowing each channel to close during adaptation. During negative stimulation tension is restored to the initially slack tip link by active ascent of the link's upper insertion.

②

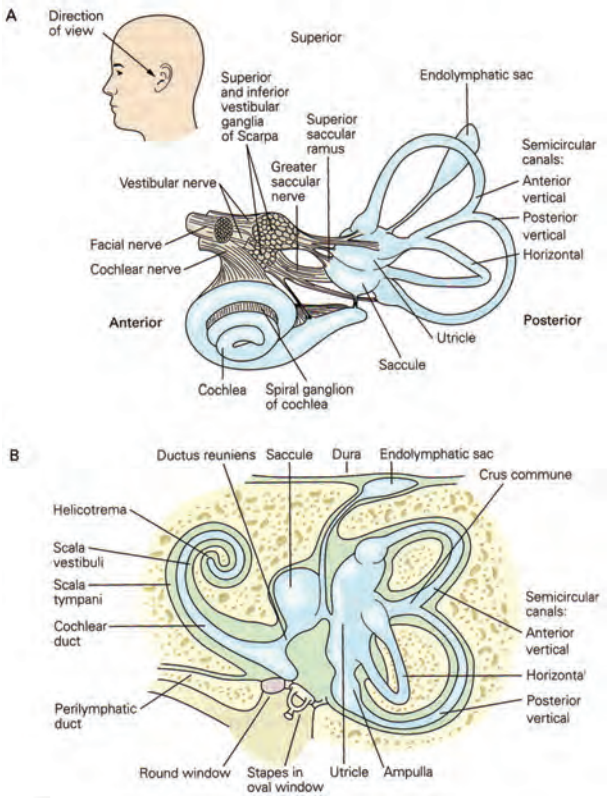

Figure 40-1 **The vestibular labyrinth.**
A. Location of vestibular and cochlear divisions of the inner ear with respect to the head. B. The inner ear is divided into bony and membranous labyrinths. The bony labyrinth is bounded by the petrous portion of the temporal bone. Lying within this structure is the membranous labyrinth, which contains the organs of hearing (the cochlea) and equilibrium (the utricle, saccule, and semicircular ducts). The space between bone and membrane is filled with perilymph, while the membranous labyrinth is filled with endolymph. Sensory cells in the utricle, saccule, and the ampullae of the semicircular ducts respond to motion of the head. (Adapted from Iurato 1967.)

③

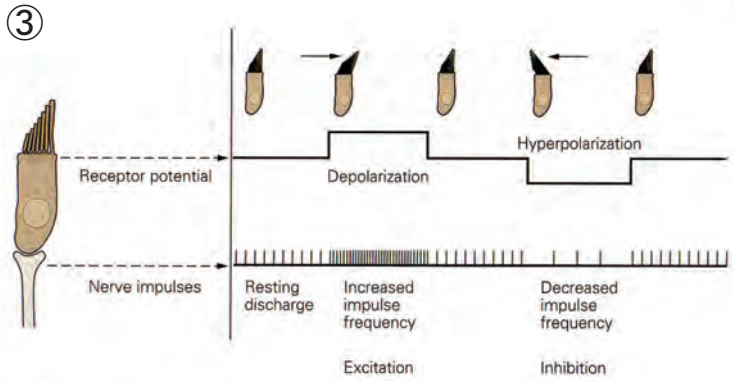

Figure 40-2 **Hair cells in the vestibular labyrinth transduce mechanical stimuli into neural signals.** At the apex of each cell is a hair bundle in which a number of stereocilia taper in length toward a single kinocilium. The membrane potential of the receptor cell depends on the direction in which the hair bundles bent. Deflection toward the kinocilium causes the cell to depolarize and thus increases the rate of firing in the afferent fiber. Rending away from the kinocilium causes the cell to hyperpolarize, thus decreasing the afferent firing rate. (Adapted from Flock 1965.)

④

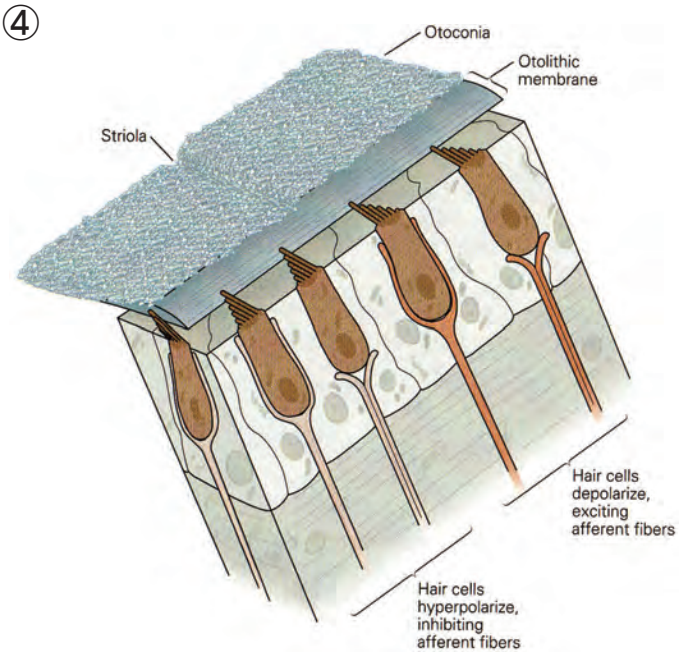

Figure 40-3 **The utricle is organized to detect tilt of the head.** The hair cells in the epithelium of the utricle have apical hair bundles that project into the otolithic membrane, a gelatinous material embedded with calcium carbonate stones (otoconia). The hair bundles are polarized, but not all cells are oriented in the same direction. The response of an individual hair cell in the utricle to a tilt of the head depends on the direction in which its hairs are bent by the gravitational force of the otoliths. When the head is tilted in the direction of the axis of polarity for a particular hair cell, that cell depolarizes and excites the afferent fiber. When the head is tilted in the opposite direction, the hair cell hyperpolarizes and inhibits the afferent fiber (see Figure 40-2). (Adapted from Iurato 1967.)

⑤

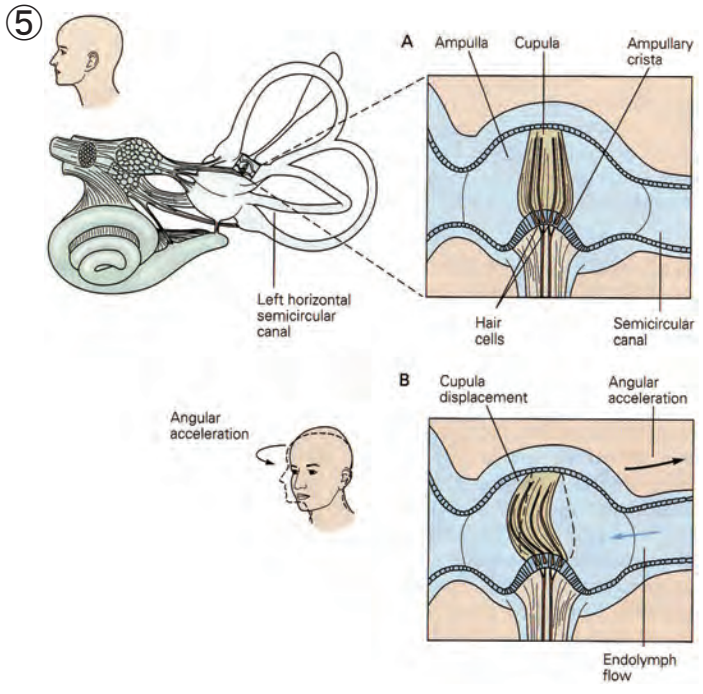

Figure 40-5 **The organization of the ampulla of a semicircular canal.**
A. A thickened zone of epithelium, the ampullary crista, contains the hair cells. The hair bundles of the hair cells extend into a gelatinous diaphragm called the cupula, which stretches from the crista to the roof of the ampulla.
B. The cupula is displaced by the flow of endolymph when the head moves. As a result, the hair bundles extending into the cupula are also displaced.