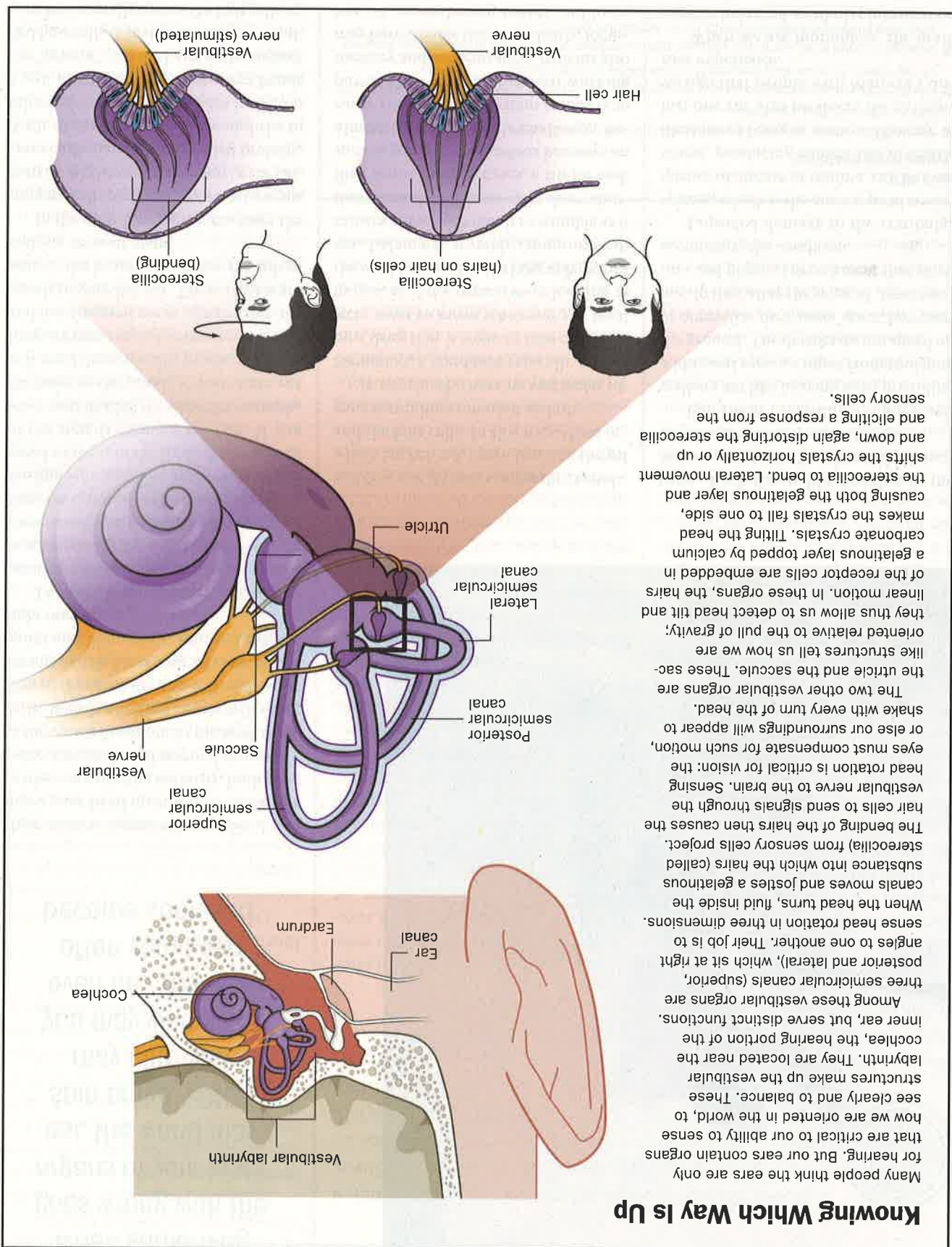


Knowing Which Way Is Up

Many people think the ears are only for hearing. But our ears contain organs that are critical to our ability to sense how we are oriented in the world, to see clearly and to balance. These structures make up the vestibular labyrinth. They are located near the cochlea, the hearing portion of the inner ear, but serve distinct functions. Among these vestibular organs are three semicircular canals (superior, posterior and lateral), which sit at right angles to one another. Their job is to sense head rotation in three dimensions. When the head turns, fluid inside the canals moves and jostles a gelatinous substance into which the hairs (called stereocilia) from sensory cells project. The bending of the hairs then causes the hair cells to send signals through the vestibular nerve to the brain. Sensing head rotation is critical for vision: the eyes must compensate for such motion, or else our surroundings will appear to shake with every turn of the head. The two other vestibular organs are the utricle and the saccule. These are like structures tell us how we are oriented relative to the pull of gravity; they thus allow us to detect head tilt and linear motion. In these organs, the hairs of the receptor cells are embedded in a gelatinous layer topped by calcium carbonate crystals. Tipping the head makes the crystals fall to one side, causing both the gelatinous layer and the stereocilia to bend. Lateral movement shifts the crystals horizontally or up and down, again distorting the stereocilia and eliciting a response from the sensory cells.



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