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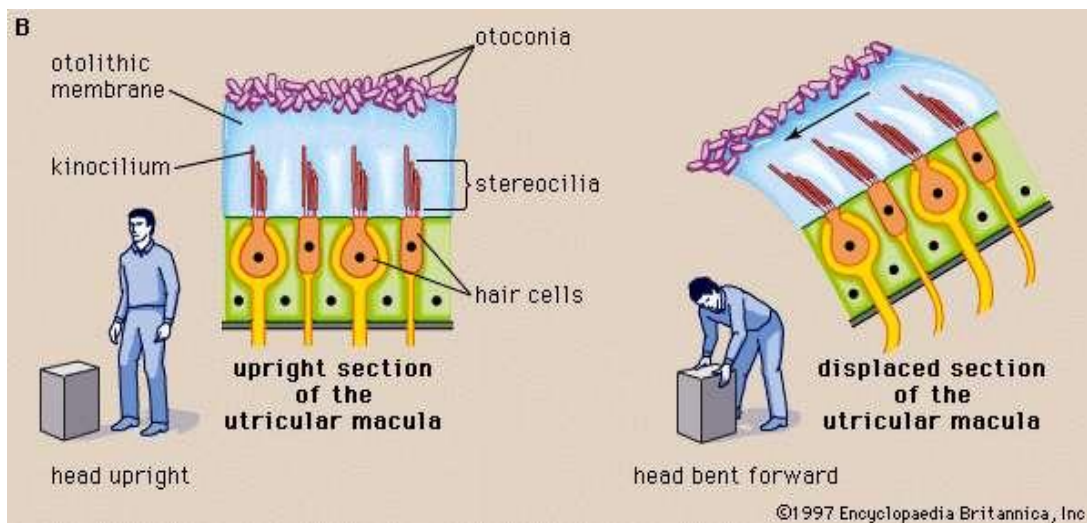
COURSE TITLE: PHYSIOLOGY

QUESTION

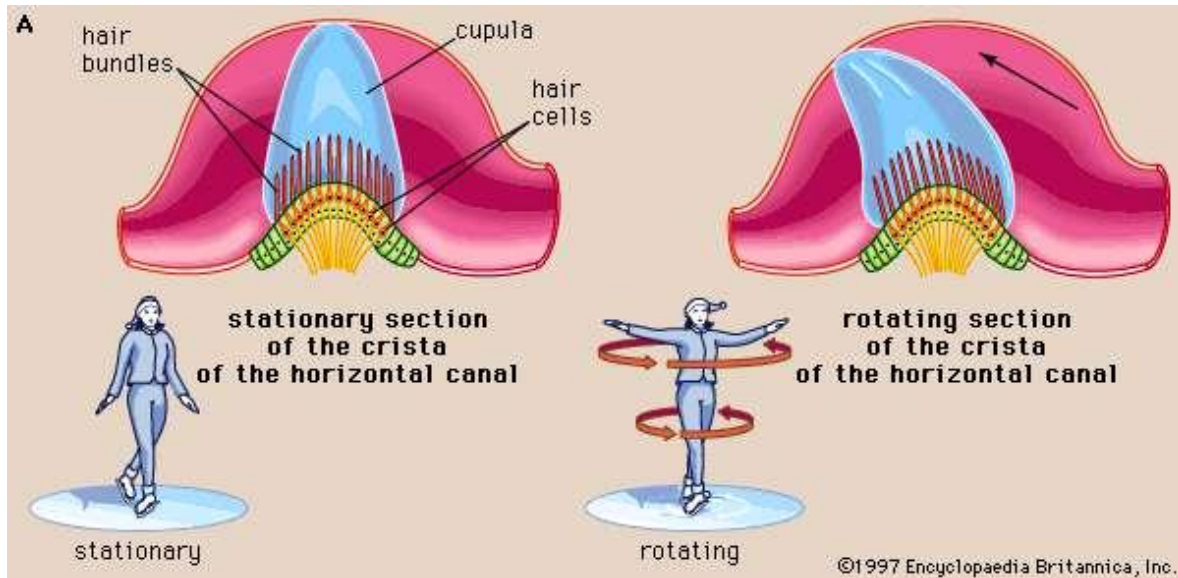
Discuss the physiology of balance

Physiology of Balance

The vestibular system is the sensory apparatus of the inner ear that helps the body maintain its postural equilibrium. The information furnished by the vestibular system is also essential for coordinating the position of the head and the movement of the eyes. There are two sets of end organs in the inner ear, or labyrinth: the semicircular canals, which respond to rotational movements (angular acceleration); and the utricle and saccule within the vestibule, which respond to changes in the position of the head with respect to gravity (linear acceleration). The information these organs deliver is proprioceptive in character, dealing with events within the body itself, rather than exteroceptive, dealing with events outside the body, as in the case of the responses of the cochlea to sound. Functionally these organs are closely related to the cerebellum and to the reflex centres of the spinal cord and brainstem that govern the movements of the eyes, neck, and limbs



In vertebrates the utricular maculae in the inner ear contain an otolithic membrane and otoconia (particles of calcium carbonate) that bend hair cells in the direction of gravity. This response to gravitational pull helps animals maintain their sense of balance.



The cristae of the semicircular ducts, which form one of the two sensory organs of balance (the second being the maculae of the utricle and saccule), respond to rotational movements and are involved in dynamic equilibrium.

Postural balance is controlled by intricate connections between the vestibular, visual and proprioception system. Among these, the vestibular system is one of the key factors in coordinating and maintaining balance. The peripheral apparatus for the vestibular system consists of the semicircular canals, which sense head rotation; and the otoliths, which sense gravity and linear acceleration. The central vestibular pathways form a large network from the vestibular nuclei, ocular motor nuclei, integration centers in the pons and rostral midbrain, vestibulocerebellum, thalamus, to the multisensory vestibular cortex areas in the temporoparietal cortex. The most important structures for the central vestibular pathways are those mediating the vestibulo-ocular reflex (VOR), and the descending pathways into the spinal cord along the medial and lateral vestibulospinal tract which mediate postural control. The cortical structures involved in vestibular function are the parietoinsular vestibular cortex, the retroinsular cortex, the superior temporal gyrus and the inferior parietal lobule. Activation of the cortical network during vestibular stimulation is not symmetrical; dominance is stronger in the nondominant hemisphere, in the hemisphere ipsilateral to the stimulated ear and in the hemisphere ipsilateral to the slow phase of the vestibular caloric nystagmus. Disorder of the vestibular pathway, anyway along its various tracts, may result in balance and coordination impairments and lead to misperception of motion.