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Course :

The physiology of balance :

It is also known as the vestibular system . 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, the semicircular canals, which respond to rotational movements and the utricle and saccule within the vestibule, which respond to changes in the position of the head with respect to gravity . 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.

The vestibular organs and the cochlea are derived embryologically from the same formation, the otic vesicle, their association in the inner ear seems to be a matter more of convenience than of necessity. From both the developmental and the structural point of view, the kinship of the vestibular organs with the lateral line system of the fish is readily apparent. The lateral line system is made up of a series of small sense organs located in the skin of the head and along the sides of the

body of fishes. Each organ contains a crista, sensory hair cells, and a cupula, as found in the ampullae of the semicircular ducts. The cristae respond to waterborne vibrations and to pressure changes.

The three semicircular canals—superior, posterior, and horizontal—are positioned at right angles to one another, they are able to detect movements in three-dimensional space. When the head begins to rotate in any direction, the inertia of the endolymph causes it to lag behind, exerting pressure that deflects the cupula in the opposite direction. This deflection stimulates the hair cells by bending their stereocilia in the opposite direction.

The relation between the vestibular apparatus of the two ears is reciprocal. When the head is turned to the left, the discharge from the left horizontal canal is decreased, and vice versa. Normal posture is the result of their acting in cooperation and in opposition. When the vestibular system of one ear is damaged, the unrestrained activity of the other causes a continuous false sense of turning and rhythmical, jerky movements of the eyes both toward the uninjured side. When the vestibular hair cells of both inner ears are injured or destroyed, as can occur during treatment with the antibiotics gentamicin or streptomycin, there may be a serious disturbance of posture and gait (ataxia) as well as severe vertigo and disorientation.

In younger persons the disturbance tends to subside as reliance is placed on vision and on proprioceptive impulses from the muscles and joints as well as on cutaneous impulses from the soles of the feet to compensate for the loss of information from the semicircular canals. Recovery of some injured hair cells may occur.

Routine tests of vestibular function traditionally have involved stimulation of the semicircular canals to elicit nystagmus and other vestibular ocular reflexes.

Rotation, which can cause vertigo and nystagmus, as well as temporary disorientation and a tendency to fall, stimulates the vestibular apparatus of both ears simultaneously.