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•PHYSIOLOGY OF BALANCE

The vestibular part or non-auditory part of the internal ear is concerned with the Physiology of Balance and Equilibrium.

The receptor apparatus in the ampulla is crista-ampullaris. It consists of the cupola which is a gelatinous wedge shaped structure running fully across the cross-section of the ampula. Into the thick end of this wedge projects a ridge carrying many hair cells whose processes are embedded in cupola. The utricle and saccule have a patch or macula of hair cells that are also projecting into and embedded in gelatinous mass. This also contains above the hairs an otolith composed of a mass of calcium carbonate crystals called otoconia.

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)

•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.Although 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.

Movement of the head cause flow of endolymph and deflection of cupola of crista-ampularis.As a result of these hairs get bend. As a result impulses are generated in hair cells and are passed on through

vestibular branch of VIII cranial nerve to the brain. Similarly flow of endolymph in otolith organ of utricle and saccule causes the movement of hairs of the hair cells. This causes generation of action potential discharge which is passed on to the brain through vestibular branch of VIII cranial nerve. In brief static equilibrium is the orientation of the body relative to the pull of gravity.

The macule of utricle and saccule are the sense organs of static equilibrium. Dynamic equilibrium is the maintenance of body position in response to movement. Crista ampullaris is the sense organ for the dynamic equilibrium.

- **DISTURBANCE OF THE VESTIBULAR SYSTEM**

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 (vertigo) and rhythmical, jerky movements of the eyes (nystagmus), 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.