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**COURSE TITLE: RENAL PHYSIOLOGY, BODY FLUID & TEMPERATURE
REGULATION AND AUTONOMIC NERVOUS SYSTEM**

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ASSIGNMENT: DISCUSS THE PHYSIOLOGY OF BALANCE

PHYSIOLOGY OF BALANCE

Balance is mediated by the vestibular nuclei in the brain stem. The labyrinth which is a part of the inner ear is a major organ of the vestibular (balance system) system. The three semicircular canals of the labyrinth is associated with sensing rotary motion. The brain senses the direction and speed of rotation of the head by the movement of fluid in the semicircular canals. Balance is maintained by the interactions between the labyrinth and other systems in the body such as the visual and skeletal system. The main input into the balance system are the;

- Vestibular labyrinths
- Visual system (eyes)
- Somatosensory system especially proprioception

The main output from the vestibular nuclei are;

- Vestibular-ocular: permitting reflex eye movements related to posture.
- Vestibular-spinal which supply : anti-gravity muscles in the lower limbs and reflex arcs which control gait.

Postural balance is controlled by intricate connection between the vestibular, visual and the proprioception system. The vestibular is one of the key factors in maintaining balance. The peripheral apparatus for the vestibular system consist of the semicircular canals which sense head rotation, the otoliths senses gravity and linear acceleration. The sense of balance or equilibrioception is the perception of balance and spatial; orientation. It helps

prevent humans and nonhuman animals from falling over when standing or moving. Equilibrioception is the result of a number of sensory systems working together: the eyes (visual system), the inner ears (vestibular system) and the body's sense of where it is in space (proprioception) ideally need to be intact. The vestibular system, the region of the inner ear where three semicircular canals converge, works with the visual system to keep objects in focus when the head is moving. This is called the vestibule-ocular reflex (VOR). The balance system works with the visual and skeletal systems (the muscles and joints and their sensors) to maintain orientation or balance. Visual signals sent to the brain about the body's position in relation to its surroundings are processed by the brain and compared to information from the vestibular and skeletal systems. The vestibular system is a complex set of structures and neural pathways that serves a wide variety of functions that contribute to our sense of proprioception and equilibrium. These functions include the sensation of orientation and acceleration of the head in any direction with associated compensation in eye movement and posture. These reflexes are referred to as the vestibule-ocular and vestibulospinal reflexes respectively. The centrally located vestibular system involves neural pathways in the brain that respond to afferent input from the peripheral vestibular system in the inner ear and provide efferent signals that make these reflexes possible. Current data suggest that the vestibular system that the consciousness and dysfunctions of the system can cause cognitive deficits related to spatial memory, learning and navigation. The body's balance system works through a constant process of position detection, feedbacks and adjustment using communication between the inner ear, eyes, muscles, joints and the brain. Deep inside the ear, positioned just under the brain, is the inner ear. While one part of the inner ear enables hearing, another



part called the vestibular system is designed to send information about the position of the head to the brain's movement control centre, the cerebellum. The cerebellum is a small part of the brain positioned at the back of the head, where it meets the spine which acts as the body's movement and balance control centre. It receives messages about the body's position from the inner ear, eye, muscles and joints and sends messages to the muscles to make any postural adjustment required to maintain balance. It also coordinates the timing and force of muscles movements initiated by other part of the brain. The vestibular system in each inner ear is made up of three semi-circular canals and two pockets called the otolith organs which together provide constant feedbacks to the cerebellum about head movement. Each semicircular canal has a different orientation to detect a variety of movement such as nodding or rotation. Movement of fluid inside the canals caused by head movement stimulates tiny hairs that send messages via the vestibular nerve to the cerebellum. The two otolith organs called saccule and utricle send messages to the brain about body movement in a straight line and also about where the head is in relation to gravity such as lifting, leaning or lying down. These organs contain small crystals that are displaced during these movement to stimulates tiny hairs, which transmit the message via the vestibular or balance nerve to the cerebellum. The vestibular system works with the visual system to stop objects blurring when the head moves. It also helps us maintain awareness of positioning when for examples walking, running or riding in a vehicle. In addition, sensors in the skin, joints and muscles provide information of the brain on movement, the position of parts of the body in relation to each other and the position of the body in relation to the environment . the brain sends messages to instruct muscles to move and make the adjustments to body position that will maintain balance and



coordination.