Al-Mustaqbal University

College of Engineering & Technology

Biomedical Engineering Department

Subject Name: Medical Measurement lab 2

4 Class, Second Semester

Subject Code: [Insert Subject Code Here]

Academic Year: 2024-2025

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Lecture No.:-3

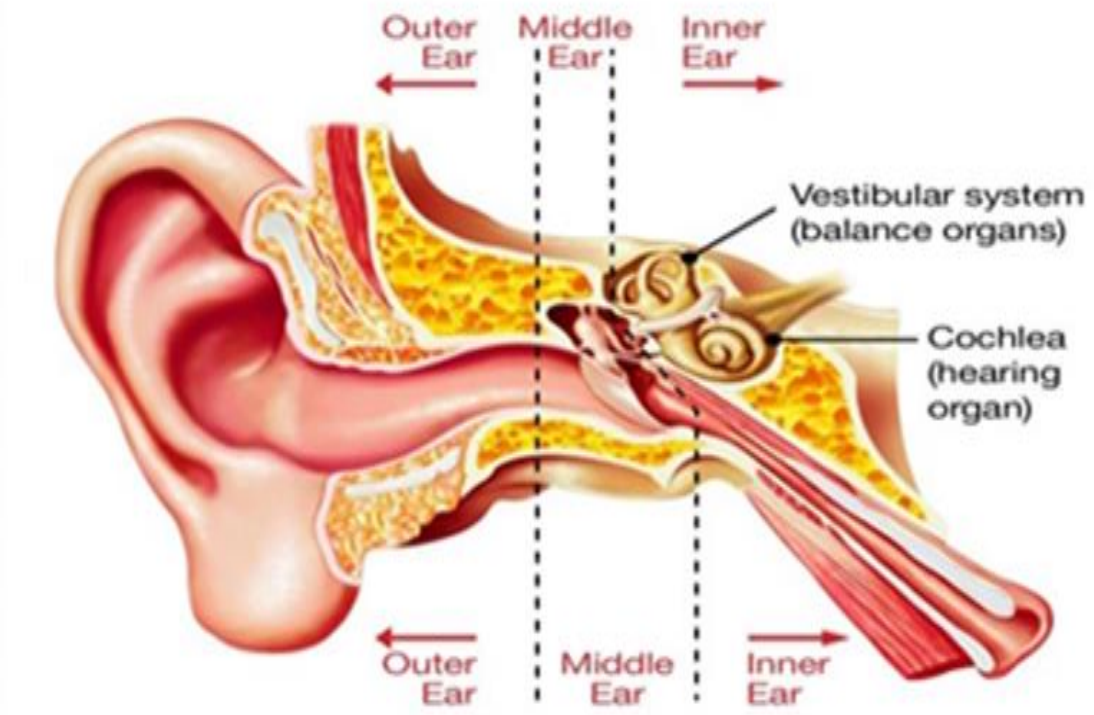
Lecture Title: [Balance]

Balance

Balance is the ability to distribute your weight in a way that lets you stand or move without falling, or recover if you trip. Good balance requires the coordination of several parts of the body: the central nervous system, inner ear, eyes, muscles, bones, and joints. Problems with any one of these can affect balance.

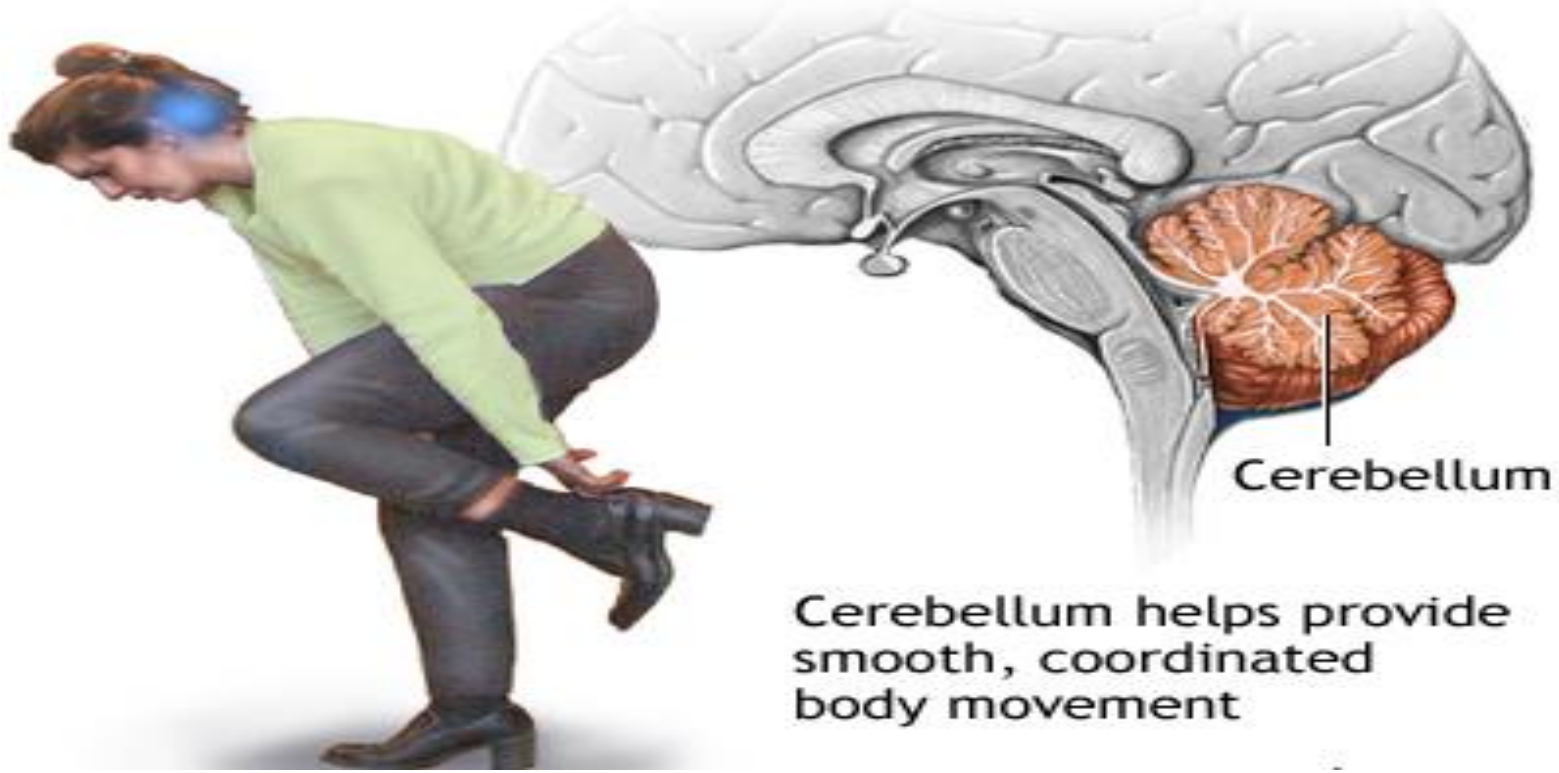
Physiological Basis of Balance

- **Vestibular System**: Located in the inner ear, it detects head movement and spatial orientation.
- **Proprioceptive System**: Sensory receptors in muscles, tendons, and joints provide feedback about limb position and movement.
- **Visual System**: The eyes provide crucial information about the body's position relative to the environment.



The brain’s movement control center

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, eyes, muscles and joints, and sends messages to the muscles to make any postural adjustments required to maintain balance.

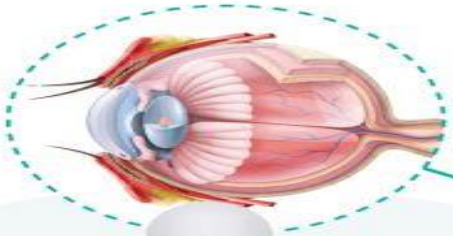


Balance

MECHANISMS

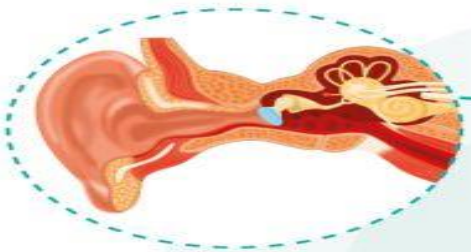
visual

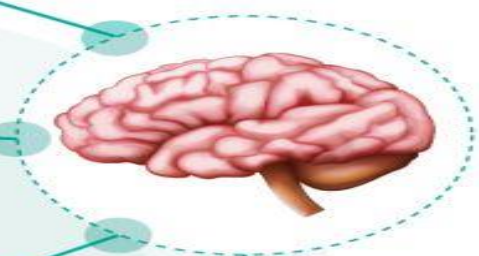
Spatial, motion and depth perception
Eye coordination
Stable Gaze
Clear Vision



brain

The brain receives the information processes it, sorts it, and integrates it.

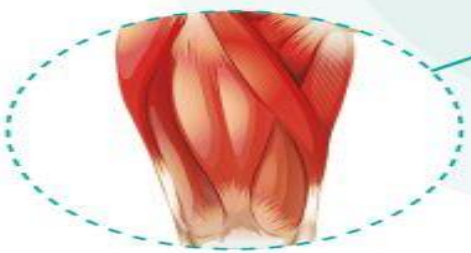


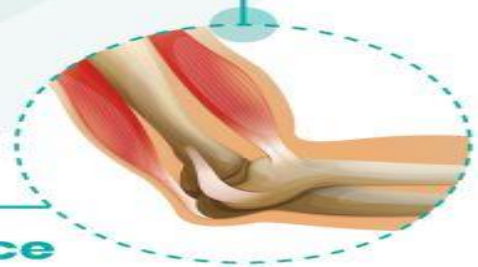


vestibular

Rotational movement
Linear movement
Equilibrium
Gravity

Brain sends impulses to the muscles that control movement, to coordinate posture and balance.





proprioception

Sense of body positioning
Joints
Muscles
Skin

balance

Balance is mantained by the complex system of sensory inputs and motor control.

Factors Affecting Balance

Several factors influence balance performance, including:

- **Age**: Balance tends to decline with age due to decreased sensory efficiency.
- **Neuromuscular Control**: Strength, flexibility, and reaction time affect postural stability.
- **Environmental Conditions**: Slippery surfaces, uneven terrain, and visual obstructions challenge balance.
- **Medical Conditions**: Neurological disorders (e.g., Parkinson’s disease, vestibular dysfunction) can impair balance.

Applications in Biomedical Engineering

Biomedical engineers develop technologies to assist individuals with balance impairments. Innovations include:

- **Wearable Sensors**: Devices that monitor postural sway and provide feedback for rehabilitation.
- **Exoskeletons**: Assistive devices that help patients with mobility disorders regain balance control.