

Chapter 9: Nervous System

1. Introduction:

The nervous system coordinates and controls various functions of the body through electrical signals. It is divided into:

- **Central Nervous System (CNS)**
 - **Peripheral Nervous System (PNS)**
 - **Autonomic Nervous System (ANS)**
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2. Structure of a Neuron:

- **Neuron:** The basic structural and functional unit of the nervous system.
 - **Parts of a Neuron:**
 - **Cell Body (Soma):** Contains the nucleus.
 - **Dendrites:** Receive signals.
 - **Axon:** Transmits impulses.
 - **Myelin Sheath:** Insulating layer.
 - **Axon Terminals:** Transfer signals to the next neuron.
 - **Function:** Transmits nerve impulses throughout the body.
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3. Central Nervous System (CNS):

- Composed of the **Brain and Spinal Cord**.

Brain:

- **Cerebrum:** Largest part, controls voluntary actions, intelligence, memory.
- **Cerebellum:** Maintains balance and coordination.
- **Medulla Oblongata:** Controls involuntary actions (breathing, heartbeat).
- **Thalamus:** Sensory relay center.
- **Hypothalamus:** Regulates body temperature, hunger, and hormones.
- **Pons:** Connects cerebrum to the cerebellum.

Spinal Cord:

- Extends from the brainstem down the vertebral column.

- Composed of **gray matter (inner region)** and **white matter (outer region)**.
 - Conducts signals between the brain and the rest of the body.
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4. Peripheral Nervous System (PNS):

- Comprises **nerves** outside the CNS.
 - Divided into:
 - **Somatic Nervous System:** Controls voluntary actions.
 - **Autonomic Nervous System (ANS):** Controls involuntary actions, further divided into:
 - **Sympathetic Nervous System:** Prepares the body for 'fight or flight'.
 - **Parasympathetic Nervous System:** Restores the body to a calm state.
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5. Reflex Action:

- **Definition:** An automatic, quick response to a stimulus.
 - **Reflex Arc:** Pathway followed by nerve impulses during a reflex.
 - **Components:** Receptor → Sensory Neuron → Spinal Cord → Motor Neuron → Effector.
 - **Types of Reflexes:**
 - **Natural Reflex:** Inborn (e.g., blinking).
 - **Acquired Reflex:** Learned (e.g., cycling).
 - **Difference from Voluntary Actions:** Reflex actions are involuntary and do not involve conscious thought.
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6. Sense Organs:

Eye:

- **Structure:**
 - **Cornea:** Transparent front part.
 - **Iris:** Colored part controlling pupil size.
 - **Lens:** Focuses light on the retina.
 - **Retina:** Contains photoreceptors (rods and cones).
 - **Optic Nerve:** Transmits visual signals to the brain.
- **Functions:** Vision, focusing, and image formation.
- **Vision Mechanisms:**
 - **Stereoscopic Vision:** 3D perception due to both eyes working together.
 - **Accommodation:** Adjusting lens shape for focusing.

- **Adaptation:** Adjusting to varying light intensities.
 - **Defects of the Eye:**
 - **Myopia (Nearsightedness):** Corrected with concave lenses.
 - **Hyperopia (Farsightedness):** Corrected with convex lenses.
 - **Presbyopia:** Age-related farsightedness.
 - **Astigmatism:** Blurred vision due to irregular cornea shape.
 - **Cataract:** Clouding of the lens.
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Ear:

- **Parts:**
 - **Outer Ear:** Pinna, auditory canal.
 - **Middle Ear:** Eardrum, ossicles (malleus, incus, stapes).
 - **Inner Ear:** Cochlea (hearing), semicircular canals (balance).
 - **Functions:**
 - **Hearing:** Sound waves → Eardrum vibrations → Cochlea.
 - **Balance:** Maintained by semicircular canals.
 - **Sound Perception:**
 - Sound waves travel through the auditory canal, vibrate the eardrum, and are processed in the cochlea.
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7. Summary:

- The nervous system ensures coordination and response to stimuli.
- Reflex actions are quick and involuntary, unlike voluntary actions.
- The eye and ear are crucial sense organs responsible for vision and hearing, respectively.
- Understanding eye defects and their corrections helps maintain clear vision.