Control and Coordination

Movement and Life:

- We often associate movement with life.
- Some movement is due to growth, like a plant pushing through soil.
- Other movement is not growth-related, like animals running or eating.
- We see this movement as a response to the environment, often to the organism's advantage.

Controlled Movement:

- Movement in response to the environment is controlled.
- Different environmental changes trigger specific responses.
- This control requires recognizing events and reacting with the right movement.
- Specialized tissues, like nerves and muscles, provide this control and coordination.

Nervous System:

- Detects and responds to environmental information.
- Receptors in sense organs gather information.
- This triggers a chemical reaction, creating an electrical impulse.
- The impulse travels through the neuron (dendrite to cell body to axon).
- At the axon's end, chemicals are released, crossing a gap (synapse) to the next neuron.
- This continues until the impulse reaches muscles or glands.

Reflex Actions:

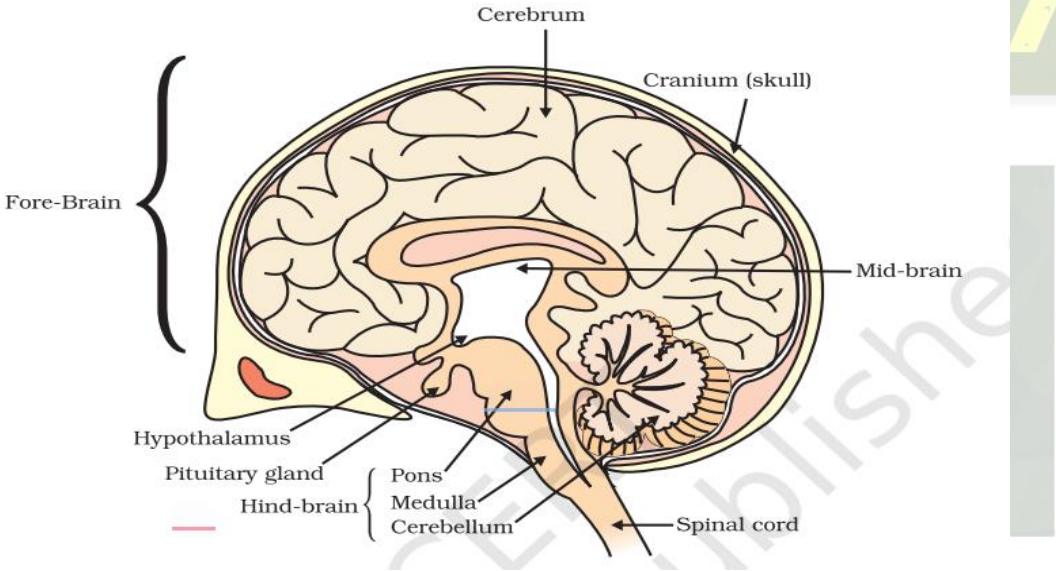
- Reflexes are quick, automatic actions.
- They happen without conscious thought.
- This is important for survival in urgent situations.
- Thinking takes time, as it involves many nerve impulses.
- Reflex arcs provide a faster connection between sensory nerves and motor nerves.
- These arcs are mainly in the spinal cord.
- Reflexes are efficient for quick responses, even in organisms with complex brains.

Key Concepts:

- **Neuron:** The basic unit of the nervous system, transmitting information.
- **Synapse:** The gap between neurons where chemical signals are transmitted.
- **Reflex Arc:** A direct connection between sensory and motor nerves for quick reactions.

Human Brain

- **Central Nervous System (CNS):**
  - The brain and spinal cord make up the CNS.
  - It receives and integrates information from the entire body.
- **Brain:**



  - The main coordinator of the body.
  - It allows us to think and act based on our thoughts.
  - Divided into three major parts:
    - **Fore-brain:** Responsible for thinking, sensory perception, and voluntary actions.
    - **Mid-brain:** Controls some involuntary actions.
    - **Hind-brain:** Controls many involuntary actions and coordination.
- **Peripheral Nervous System (PNS):**
  - Connects the CNS to the rest of the body.
  - Includes cranial nerves (from the brain) and spinal nerves (from the spinal cord).
- **Voluntary Actions:**
  - Actions we consciously decide to take (e.g., writing, talking).
  - Controlled by the brain.
- **Involuntary Actions:**
  - Actions we don't consciously control (e.g., heartbeat, breathing).
  - Controlled by the mid-brain and hind-brain.
- **Medulla (in the hind-brain):**
  - Controls involuntary actions like blood pressure, salivation, and vomiting.
- **Cerebellum (in the hind-brain):**
  - Responsible for precision of voluntary actions, posture, and balance.
- **Protection:**

    - The brain is protected by the skull and a fluid-filled layer.
    - The spinal cord is protected by the vertebral column (backbone).
- **Muscle Movement:**
    - Nerves send impulses to muscles, causing them to move.
    - Muscle cells change shape (shorten) due to special proteins that rearrange in response to nerve impulses.

Types of Muscles:

- **Voluntary Muscles:**
    - Under conscious control (e.g., skeletal muscles).
- **Involuntary Muscles:**
    - Not under conscious control (e.g., heart muscle, muscles in the digestive system).

Plant Movement

- **Two types of movement:**
    - **Growth-dependent:** Like a seedling growing towards light.
    - **Growth-independent:** Like a sensitive plant folding its leaves when touched.
- **Immediate Response to Stimulus:**
    - Plants lack nervous and muscle tissue.
    - They use electrical-chemical signals to communicate information, but not through specialized tissues like nerves.
    - Plant cells change shape by changing their water content (swelling or shrinking).
- **Movement Due to Growth:**
    - **Tendrils:**
        - Sensitive to touch.
        - Coil around supports by growing faster on one side.
    - **Tropism:**
        - Directional growth in response to a stimulus.
        - **Phototropism:** Growth towards or away from light (shoots towards, roots away).
        - **Geotropism:** Growth towards or away from gravity (roots towards, shoots away).
        - **Hydrotropism:** Growth towards or away from water.
        - **Chemotropism:** Growth towards or away from chemicals (e.g., pollen tubes towards ovules).

Information Transfer in Plants

- **Speed of Response:**
    - Varies from quick (sensitive plant) to slow (growth-related movements).
- **Electrical Impulses:**

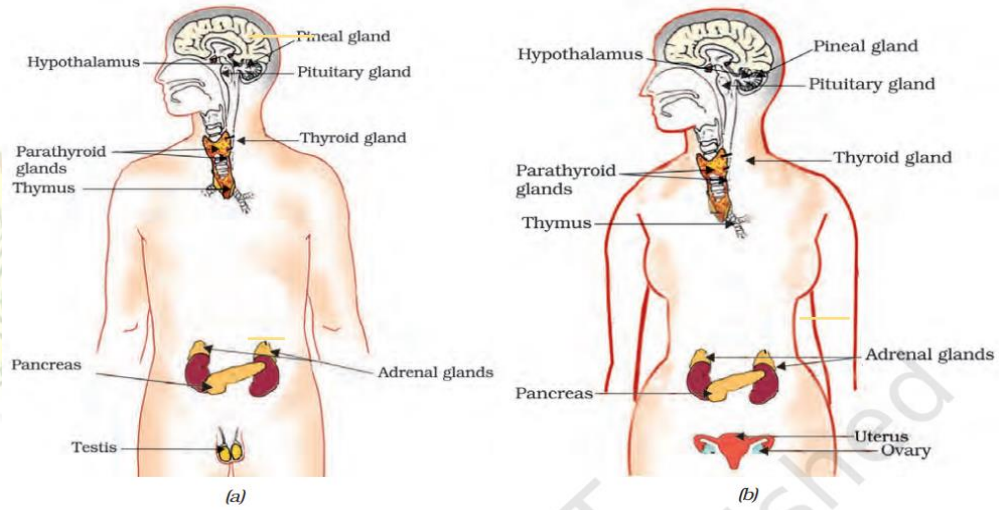
    - Fast but limited to cells connected by nervous tissue (which plants don't have).
    - Cells need time to reset before sending another impulse.
- **Chemical Communication (Hormones):**
    - Slower but can reach all cells.
    - Allows for steady and persistent signaling.

Plant Hormones

- **Auxin:**
    - Promotes cell elongation.
    - Involved in phototropism (bending towards light).
- **Gibberellins:**
    - Promote stem growth.
- **Cytokinins:**
    - Promote cell division.
    - Found in areas of rapid growth like fruits and seeds.
- **Abscisic Acid:**
    - Inhibits growth.
    - Can cause wilting of leaves.

Hormones in Animals

- **Chemical Communication:**
    - Hormones are chemical messengers that travel through the bloodstream.
    - They allow for widespread communication throughout the body.
    - Important for coordinating complex activities involving multiple tissues.
- **Adrenaline (Example):**
    - Released by the adrenal glands in response to stress (fight-or-flight situations).
    - Causes a range of effects:
        - Increased heart rate (more oxygen to muscles).
        - Reduced blood flow to digestion and skin (diverts blood to muscles).
        - Increased breathing rate.
- **Endocrine System:**
- The system of glands that produce and release hormones.
    - Works with the nervous system for control and coordination in animals.
- **Hormones and Growth:**
    - While not directional like in plants, animal hormones still regulate growth.
    - They ensure that growth and development happen in the right places and at the right times.



- **Examples of Animal Hormones:**
  - **Thyroxin (from the thyroid gland):**
    - Regulates metabolism (carbohydrate, protein, and fat use).
    - Requires iodine for production.
    - Iodine deficiency can lead to goiter (swollen neck).
  - **Growth Hormone (from the pituitary gland):**
    - Regulates overall growth and development.
    - Deficiency can cause dwarfism.
  - **Testosterone (in males) and Oestrogen (in females):**
    - Drive changes associated with puberty.
  - **Insulin (from the pancreas):**
    - Regulates blood sugar levels.
    - Problems with insulin production can lead to diabetes.
- **Feedback Mechanisms:**
  - Control the timing and amount of hormone release.
  - For example, blood sugar levels influence insulin secretion.

S.No.	Hormone	Endocrine Gland	Functions
1.	Growth hormone	Pituitary gland	Stimulates growth in all organs
2.		Thyroid gland	Regulates metabolism for body growth
3.	Insulin		Regulates blood sugar level
4.	Testosterone	Testes	
5.		Ovaries	Development of female sex organs, regulates menstrual cycle, etc.
6.	Adrenaline	Adrenal gland	
7.	Releasing hormones		Stimulates pituitary gland to release hormones

Some important hormones and their functions

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