

Chapter 6: Control and Coordination

Control and coordination are essential for all living organisms to respond and adapt to their environment in a proper and timely manner.

6.1 CONTROL AND COORDINATION IN ANIMALS

Control – The ability to direct or regulate body activities.

Coordination – The process by which different parts of the body work together in a synchronized manner.

In animals, control and coordination are achieved by:

- The nervous system (brain, spinal cord, nerves)
- The endocrine system (hormones)

Nervous System

Neuron – A neuron is the structural and functional unit of the nervous system. It conducts electrical impulses.

Structure of Neuron:

- **Dendrites** – Receive information
- **Cell Body** – Processes the information
- **Axon** – Transfers the impulse to next cell

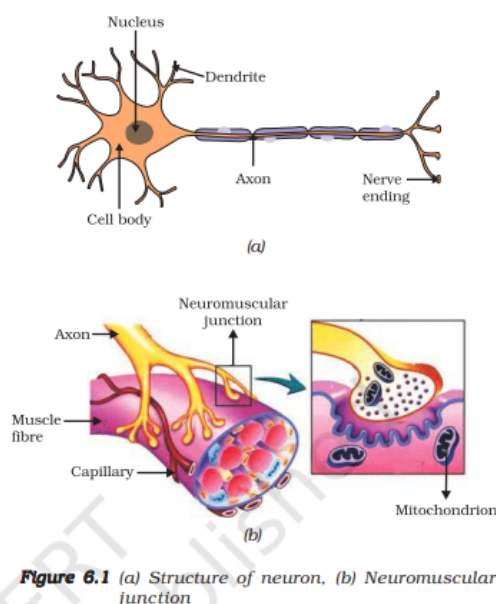


Figure 6.1 (a) Structure of neuron, (b) Neuromuscular junction

Synapse – The tiny gap between two neurons where chemical signals help transfer the impulse from one neuron to another.

Activity 6.1 – Taste and Smell Connection

Steps:

- Taste some sugar normally.
- Now block your nose and taste it again.
- Block nose while eating lunch and compare.

Observation:

- Blocking the nose reduces the sense of taste because smell and taste are closely linked.

Reflex Action

Reflex Action – An automatic, quick response to a stimulus without conscious thought.

Reflex Arc – The path followed by nerve impulses in a reflex action. It includes:

Stimulus → Receptor → Sensory Neuron → Spinal Cord → Motor Neuron → Effector (muscle)

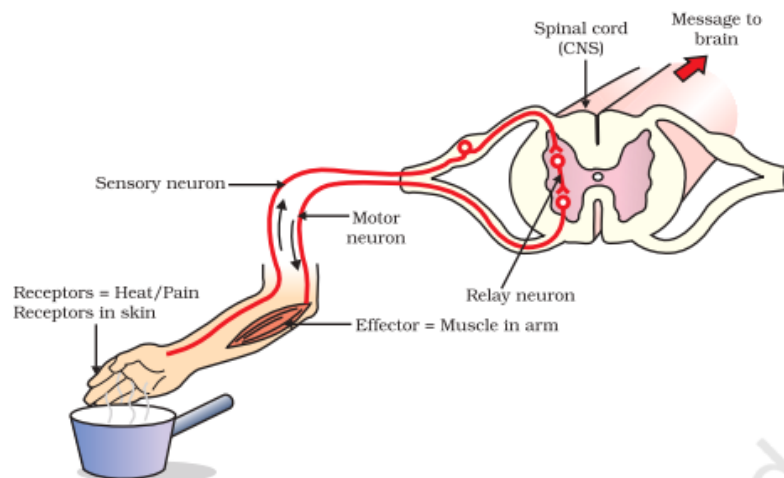


Figure 6.2 Reflex arc

Example: Pulling your hand away from a hot object.

Difference Between Reflex Action and Walking:

- Reflex is involuntary and immediate.
- Walking is a voluntary action controlled by the brain.

Human Brain

Brain – Main control center of the nervous system. It interprets information and controls body functions.

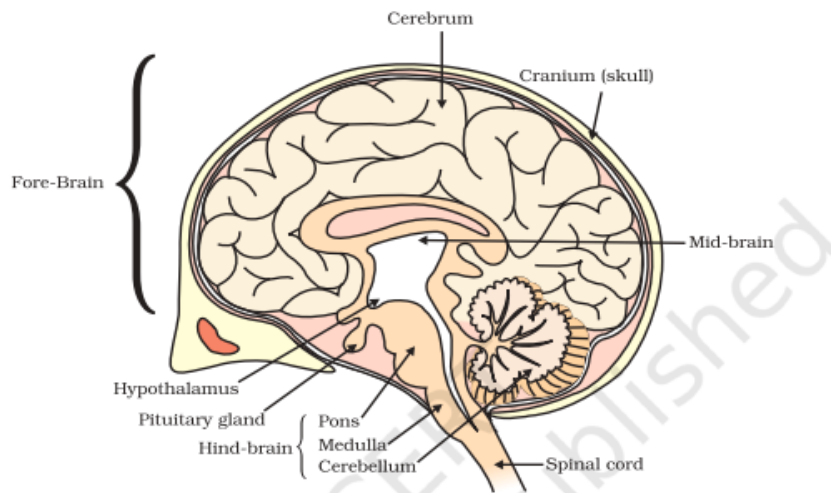


Figure 6.3 Human brain

Parts of the Brain:

1. Forebrain:

- Thinking part
- Controls voluntary actions
- Receives sensory information (sight, smell, hearing)

2. Midbrain:

- Controls some reflex movements like eye blinking

3. Hindbrain:

- **Cerebellum** – Maintains posture and balance
- **Medulla** – Controls involuntary actions like heartbeat, breathing

■ **Central Nervous System** = Brain + Spinal Cord

■ **Peripheral Nervous System** = Cranial + Spinal nerves

◆ Protection of Brain and Spinal Cord

- Brain is protected by a bony skull and a fluid-filled membrane (cerebrospinal fluid).
- Spinal cord is protected by the vertebral column (backbone).

◆ Muscle Action

■ When a nerve impulse reaches a muscle:

- Muscle contracts (shortens) to cause movement.
- This is due to special proteins in muscle cells.

■ **Voluntary muscles** – Controlled by us (e.g., hand movement)

■ **Involuntary muscles** – Not under our control (e.g., heart, breathing)

◆ 6.2 CONTROL AND COORDINATION IN PLANTS

Plants do not have a nervous system. They use chemical and cellular mechanisms for control.

◆ 6.2.1 Immediate Response to Stimulus

Example: *Mimosa pudica* (Touch-me-not) folds its leaves on touch.

■ This movement is:

- Quick
- Not related to growth
- Caused by changes in water pressure in plant cells



Figure 6.4 The sensitive plant

◆ 6.2.2 Movement Due to Growth (Tropic Movements)

■ **Tropism** – Movement or growth of a plant in response to an external stimulus.

Types:

- Phototropism → Light (e.g., shoot bends toward light)
- Geotropism → Gravity (e.g., roots grow downward)
- Hydrotropism → Water (roots grow toward water)
- Chemotropism → Chemicals (e.g., pollen tube toward ovule)

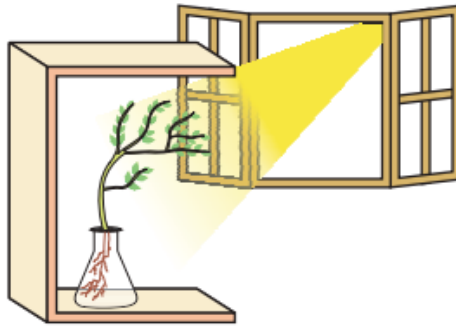


Figure 6.5
Response of the plant to the direction of light



Figure 6.6 Plant showing geotropism

Activity 6.2 – Observing Plant Growth Toward Light

Steps:

- Keep a plant in a box with one side open to light.
- Observe direction of shoot and root growth.
- Reverse the flask and see changes.

Observation:

- Shoots always grow toward light (positive phototropism)
- Roots grow away from light (negative phototropism)

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Plant Hormones (Phytohormones)

 **Definition:** Chemical substances in plants that control growth and response.


Important Plant Hormones:

Hormone	Function
Auxins	Promote stem elongation, phototropism
Gibberellins	Stimulate growth, stem elongation
Cytokinins	Promote cell division
Absciscic Acid	Inhibits growth, causes leaf fall

Example: Auxin moves to shady side of shoot, making it bend toward light.

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◆ 6.3 HORMONES IN ANIMALS

 **Hormones** – Chemical messengers secreted by endocrine glands directly into the blood to regulate body functions.

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◆ Important Human Hormones

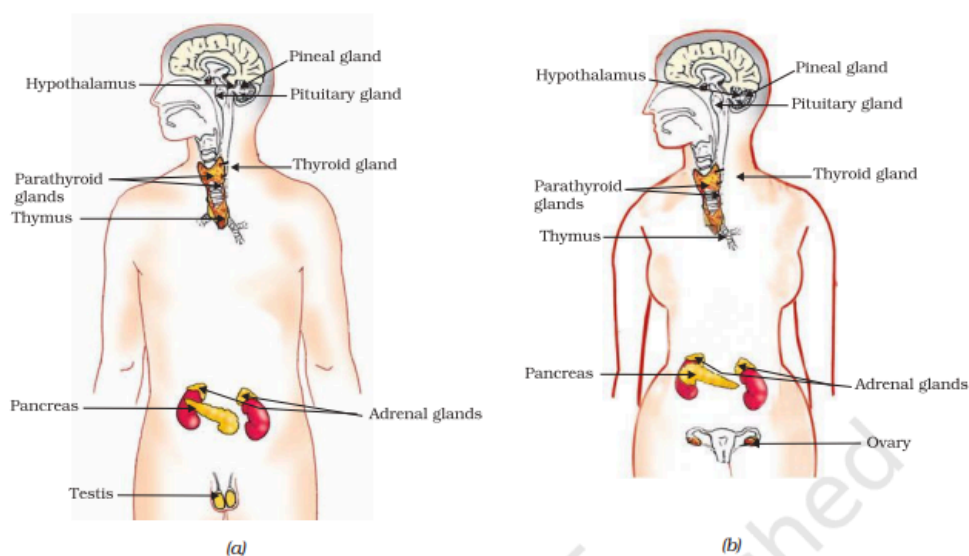


Figure 6.7 Endocrine glands in human beings (a) male, (b) female

 Table 6.1 – Hormones and their functions

Hormone	Gland	Function
Adrenaline	Adrenal	Increases heartbeat, emergency action
Thyroxin	Thyroid	Regulates metabolism
Insulin	Pancreas	Controls blood sugar
Growth Hormone	Pituitary	Stimulates body growth
Testosterone	Testes	Male secondary sexual traits
Estrogen	Ovaries	Female sexual development

Activity 6.3 – Study of Endocrine Glands

Steps:

- Observe endocrine glands in diagram
- Research more hormones and their functions

Important Notes:

- Iodine is required for thyroxin production. Deficiency causes goitre.
- Insulin controls blood sugar. Its deficiency causes diabetes.
- Adrenaline helps body prepare for emergency (fight or flight).
- Growth hormone controls body height; deficiency causes dwarfism.
- Feedback Mechanism – Keeps hormone levels balanced.

Activity 6.4 – Complete hormone table using your understanding of glands and their roles.

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Summary Points:

- Nervous system uses electrical impulses for fast communication.
- Hormones (chemical messengers) act more slowly but reach entire body.
- Reflex action = Quick automatic response
- Voluntary actions = Under conscious control
- Involuntary actions = Happen without our control

- Plant hormones control growth, movement, and responses to environment.
- Animal hormones regulate growth, metabolism, reproduction, and more.