

# Control and Coordination- Class 10

## Science Detailed Notes

**Control and coordination** are fundamental processes that enable living organisms to regulate their bodily functions and respond to environmental changes, crucial for survival, growth, and maintaining balance in their internal environment.

### Introduction

All activities in animals are controlled and coordinated by the **nervous and endocrine systems**. These systems work together to help organisms:

- Control body activities
- Respond to environmental changes
- Maintain internal balance (homeostasis)
- Ensure survival and growth

### Nervous System

#### Structure and Function

The nervous system serves as the body's **command center**, orchestrating both voluntary and involuntary actions using specialized cells called **neurons**.

#### Main Components:

1. **Central Nervous System (CNS):** Brain and spinal cord
2. **Peripheral Nervous System (PNS):** All nerves outside the CNS

### Neuron Structure

Neurons have **three main parts**:

1. **Dendrites:** Receive impulses from other neurons
2. **Cell Body (Cyton):** Processes the impulses received by dendrites
3. **Axon:** Transfers processed impulses to another neuron, muscle, or glands

#### Types of Axons:

- **Myelinated:** Faster impulse transmission
- **Unmyelinated:** Slower impulse transmission

### Synapse

The **synapse** is the junction between two neurons where electrical signals are converted into chemicals that cross the gap and pass the chemical messenger to the next neuron, where it's converted back to electrical signals.

## **Human Brain**

### **Main Parts and Functions**

#### **1. Cerebrum (Forebrain):**

- Controls thinking, memory, and voluntary actions
- Largest part of the brain

#### **2. Cerebellum:**

- Maintains posture and equilibrium of the body
- Controls motor functioning and balance

#### **3. Medulla Oblongata (Hindbrain):**

- Controls involuntary actions like breathing, heartbeat
- Regulates vital life processes

## **Brain Protection**

The brain is protected by:

- **Skull bones:** Provide physical protection
- **Cerebrospinal fluid:** Absorbs shocks and provides additional cushioning

## **Types of Actions**

### **1. Reflex Actions**

**Reflex actions** are involuntary, immediate responses to stimuli that occur without involvement of conscious areas of the brain.

#### **Characteristics:**

- Unconscious and automatic
- Very fast response
- Protective in nature
- Example: Withdrawing hand from hot objects

## **Reflex Arc Pathway**

**Stimulus → Receptor → Sensory Neuron → Spinal Cord → Motor Neuron → Effector (muscle/gland) → Response**

## **2. Voluntary Actions**

- Controlled by the **cerebrum** of the brain
- Conscious decisions (like walking, writing)
- Learnt behaviors that require thinking

## **3. Involuntary Actions**

- Controlled by **medulla oblongata**
- Automatic body functions (heartbeat, breathing, digestion)
- Do not require conscious thought

## **Receptors and Senses**

**Receptors** are specialized tips of nerve cells that detect information from the environment:

1. **Eyes:** Photoreceptors for vision
2. **Ears:** For hearing and body balance
3. **Nose:** Olfactory receptors for smell
4. **Tongue:** Gustatory receptors for taste
5. **Skin:** Thermoreceptors for temperature and touch

## **Plant Coordination**

Plants don't have a nervous system but coordinate their activities using **hormones and movement responses**.

## **Plant Movements (Tropisms)**

**Tropic movements** are directional growth movements in response to stimuli:

1. **Phototropism:** Growth response to light
  - Shoots show **positive phototropism** (grow towards light)
  - Roots show **negative phototropism** (grow away from light)
2. **Geotropism/Gravitropism:** Growth response to gravity
  - Shoots show **negative geotropism** (grow away from earth)
  - Roots show **positive geotropism** (grow towards earth)
3. **Hydrotropism:** Growth response to water

- Roots grow towards water sources
- 4. **Chemotropism:** Growth response to chemicals
  - Pollen tubes grow towards ovules

### **Plant Hormone Functions**

#### **1. Auxins:**

- Promote cell elongation
- Help in root formation
- Control apical dominance

#### **2. Gibberellins:**

- Promote stem elongation
- Break seed dormancy
- Promote flowering

#### **3. Cytokinins:**

- Promote cell division
- Delay senescence (aging)
- Promote lateral bud growth

#### **4. Absciscic Acid:**

- Promotes dormancy
- Closes stomata during stress
- Inhibits growth

### **Endocrine System (Chemical Coordination)**

#### **Important Glands and Hormones**

##### **1. Pituitary Gland:**

- **Growth Hormone:** Controls body growth and development
- Called "master gland"

##### **2. Thyroid Gland:**

- **Thyroxine:** Regulates metabolism
- Controls rate of cellular activities

### 3. Adrenal Glands:

- **Adrenaline:** Prepares body for emergency situations
- "Fight or flight" hormone

### 4. Pancreas:

- **Insulin:** Regulates blood sugar levels
- Maintains glucose homeostasis

### 5. Reproductive Glands:

- **Testosterone:** Male hormone
- **Estrogen:** Female hormone

### Comparison: Nervous vs Hormonal Control

Nervous Control	Hormonal Control
Very fast response	Slow response
Uses electrical impulses	Uses chemical messengers
Short-term effects	Long-term effects
Localized action	Widespread action
Involves neurons	Involves hormones
Example: Reflex action	Example: Growth regulation

### Key Differences: Animal vs Plant Movement

Animal Movement	Plant Movement
Voluntary action	Response to stimulus (involuntary)
Complete nervous system (CNS & PNS)	No specialized tissue for information transfer
Specialized proteins for muscle contraction	No specialized proteins for movement
Fast movement	Slow growth-based movement

### Important Points for Exams

1. **Control and coordination** are achieved by nervous system and hormones in animals, only by hormones in plants
2. **Reflex arc** is the pathway for rapid, unconscious reactions

3. **Cerebellum** maintains posture and balance
4. Plant coordination involves **tropic movements** and **hormones**
5. **Synapse** converts electrical signals to chemical signals
6. **Hormones** are produced at one place but act at distant locations

### **Summary**

The nervous system provides **quick, precise control** through electrical impulses, while the endocrine system provides **slower but sustained control** through hormones. Plants use only chemical coordination through hormones to respond to environmental stimuli and coordinate growth. Understanding these mechanisms is crucial for comprehending how living organisms maintain internal balance and respond to their environment.