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CHAPTER NOTES

Control and Coordination Class 10 Notes | CBSE Chapter 6 Science

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Control and Coordination Class 10 Notes | CBSE

Chapter 6 Science

Control and Coordination is Chapter 6 of CBSE Class 10 Science — and one of the most important chapters for your board exam. It explains how living organisms detect changes in their environment and respond to them. In animals, this is done by the nervous system and endocrine system. In plants, it is done through hormones and movements.

Expect 5–8 marks from this chapter every year. The nervous system, reflex arc, brain structure, and plant hormones are the most frequently tested topics.

Key Concepts

1. What is Control and Coordination?

Control means regulating and managing body functions. **Coordination** means making different parts of the body work together smoothly.

In multicellular organisms, specialised systems handle this:

- **Animals:** Nervous system (fast, electrical signals) + Endocrine system (slow, chemical signals)
- **Plants:** Chemical signals called phytohormones + Tropic and nastic movements

2. Control and Coordination in Plants

Movements in Plants

Plants cannot move from place to place, but parts of a plant can move in response to stimuli. These are called **tropic movements** — directional movements caused by external stimuli.

Type	Stimulus	Example
Phototropism	Light	Stem grows towards light (positive); roots grow away (negative)
Geotropism	Gravity	Roots grow downward (positive); shoots grow upward (negative)
Hydrotropism	Water	Roots grow towards water (positive)
Chemotropism	Chemicals	Pollen tube grows towards ovule
Thigmotropism	Touch/Contact	Tendrils of a pea plant coil around a support

Nastic movements are non-directional — they don't depend on the direction of the stimulus. Example: *Mimosa pudica* (touch-me-not plant) — leaves fold when touched.

Plant Hormones (Phytohormones)

Plants coordinate their activities using chemical messengers called **phytohormones**. They are produced in one part and transported to another.

Hormone	Where produced	Function
Auxin	Shoot tips	Promotes cell elongation; causes bending towards light in phototropism. Inhibits lateral bud growth.
Gibberellin	Young leaves, seeds	Promotes stem elongation, seed germination, and flowering
Cytokinin	Areas of rapid cell division (roots, fruits)	Promotes cell division; delays ageing (senescence) of leaves
Absciscic Acid (ABA)	Leaves, stems, roots	Inhibits growth; causes wilting of leaves; promotes seed dormancy. Called the "stress hormone."
Ethylene	Ripening fruits	Promotes fruit ripening; causes leaf and fruit fall (abscission)

How phototropism works (Auxin explanation):

When light falls on one side of a shoot, auxin moves to the shaded side. The shaded side gets more auxin → more cell elongation → shoot bends towards the light.

3. Control and Coordination in Animals — The Nervous System

The Neuron — Basic Unit of the Nervous System

A **neuron** (nerve cell) is the structural and functional unit of the nervous system. It is specialised to receive, process, and transmit information as electrical impulses.

Structure of a neuron:

- **Cell body (Soma):** Contains the nucleus and cytoplasm; the metabolic centre of the neuron
- **Dendrites:** Short, branched projections that receive impulses from other neurons and carry them towards the cell body
- **Axon:** Long fibre that carries impulse away from the cell body to the next neuron or effector organ. Can be very long (up to 1 metre in humans).
- **Myelin sheath:** Fatty covering around the axon in many neurons; speeds up impulse transmission and provides insulation
- **Axon terminals (synaptic knobs):** The end of the axon; releases neurotransmitters into the synapse

Types of Neurons

- **Sensory (afferent) neurons:** Carry impulses from sense organs to the CNS
- **Motor (efferent) neurons:** Carry impulses from the CNS to muscles/glands (effectors)
- **Relay (interneurons):** Connect sensory and motor neurons within the CNS

The Synapse

A **synapse** is the tiny gap between the axon terminal of one neuron and the dendrite of the next. The electrical impulse cannot jump across — instead, chemicals called **neurotransmitters** (e.g., acetylcholine) are released, cross the gap, and trigger a new impulse in the next neuron.

How a Nerve Impulse Travels

Stimulus → Sense organ → Sensory neuron → CNS (brain/spinal cord) → Motor neuron → Effector (muscle/gland) → Response

4. Reflex Action and Reflex Arc

A **reflex action** is a sudden, automatic, involuntary response to a stimulus — it does not involve conscious thought. It is controlled by the spinal cord, not the brain.

Examples: Withdrawing your hand from a hot object; knee-jerk reflex; blinking; sneezing; salivating.

The pathway of a reflex action is called the **reflex arc**:

Receptor → Sensory neuron → Spinal cord (relay neuron) → Motor neuron → Effector (muscle)

Why does reflex action bypass the brain?

Because the brain takes time to process information. In emergencies (like touching a hot flame), waiting for the brain would cause more damage. The spinal cord provides a faster, direct route.

Note: The brain is still informed about the reflex — that's why you feel the pain a moment after you've already pulled your hand away.

5. The Human Brain

The brain is the main coordinating centre of the body. It is protected by the skull (cranium) and three membranes called **meninges**. It is cushioned by **cerebrospinal fluid (CSF)** which also acts as a shock absorber.

The brain has three main parts:

a) Forebrain

- **Cerebrum (largest part):** Controls thinking, memory, intelligence, voluntary movements, speech, hearing, vision, and all conscious actions. The outer layer (cerebral cortex) is highly folded to increase surface area.
- **Thalamus:** Relay station — routes sensory information to the appropriate areas of the cerebrum
- **Hypothalamus:** Controls body temperature, hunger, thirst, sleep, and emotional responses. Links the nervous system to the endocrine system by controlling the pituitary gland.

b) Midbrain

- Controls visual and auditory reflexes (e.g., turning your head towards a sound)
- Connects the forebrain to the hindbrain

c) Hindbrain

- **Cerebellum:** Controls balance, posture, and precision of voluntary movements. A person who is drunk has an impaired cerebellum — they lose balance and coordination.
- **Pons:** Involved in breathing regulation and connects the cerebellum to the rest of the brain
- **Medulla oblongata:** Controls involuntary actions — heart rate, breathing, blood pressure, swallowing, vomiting. It connects the brain to the spinal cord. Damage to the medulla is fatal.

Brain Summary Table

Part	Function	Memory trick
Cerebrum	Thinking, memory, voluntary movement	The “chief” — does everything conscious
Thalamus	Sensory relay station	“Traffic controller” for senses
Hypothalamus	Temperature, hunger, thirst, links to hormones	“Body’s thermostat + homeostasis hub”
Cerebellum	Balance, coordination, posture	“Coordination — think cycling/writing”
Medulla oblongata	Heart rate, breathing, blood pressure	“Life-support centre”

6. The Spinal Cord

The spinal cord runs from the base of the brain down the backbone (vertebral column). It has two roles:

- **Conducts impulses** between the brain and the rest of the body
- **Controls reflex actions** — the spinal cord processes reflex arcs directly without involving the brain

7. Chemical Coordination — The Endocrine System

While the nervous system sends fast, electrical signals, the **endocrine system** sends slow, chemical signals called **hormones** through the bloodstream.

Hormone: A chemical messenger secreted by an endocrine (ductless) gland directly into the blood, which travels to a target organ and produces a specific effect.

Key difference from nervous system:

Feature	Nervous System	Endocrine System
Signal type	Electrical impulse	Chemical (hormone)
Speed	Very fast	Slow
Effect duration	Short-lived	Long-lasting
Transmission	Along nerves	Through bloodstream

Major Endocrine Glands and Their Hormones

Gland	Hormone(s)	Function	Deficiency/Excess
Pituitary (master gland)	Growth Hormone (GH), TSH, FSH, LH, ADH, Oxytocin	Controls other glands; regulates growth, reproduction, water balance	GH deficiency → dwarfism; GH excess → gigantism
Thyroid	Thyroxine	Regulates body metabolism, physical and mental development. Requires iodine.	Deficiency → goitre (enlarged thyroid), cretinism in children; Excess → hyperthyroidism
Parathyroid	Parathormone (PTH)	Regulates calcium and phosphorus levels in blood	Deficiency → muscle cramps
Adrenal (on kidneys)	Adrenaline (epinephrine)	"Fight or flight" hormone — increases heart rate, breathing rate, blood sugar; diverts blood to muscles	Excess → high blood pressure, anxiety
Pancreas (Islets of Langerhans)	Insulin (beta cells), Glucagon (alpha cells)	Insulin lowers blood sugar; Glucagon raises blood sugar	Insulin deficiency → Diabetes mellitus (high blood sugar)
Testes (males)	Testosterone	Development of male secondary sexual characters — beard, deep voice, sperm production	—
Ovaries (females)	Oestrogen, Progesterone	Development of female secondary sexual characters; regulation of menstrual cycle	—

Feedback Mechanism

The endocrine system uses **negative feedback** to maintain hormone levels:

- When blood sugar rises → Pancreas secretes more insulin → Sugar level falls

- When blood sugar falls → Pancreas secretes glucagon → Sugar level rises
- This keeps blood sugar in a narrow, healthy range — this is called **homeostasis**

Adrenaline — Fight or Flight

When you are frightened or in danger, the adrenal glands release **adrenaline** immediately:

- Heart beats faster → more blood to muscles
- Breathing rate increases → more oxygen
- Blood sugar rises → more energy available
- Pupils dilate → better vision
- Digestion slows down → blood redirected to muscles

This prepares the body to either fight the danger or run away from it.

Important Definitions

Term	Definition
Stimulus	Any change in the environment that causes a response in an organism
Response	The reaction of an organism to a stimulus
Neuron	The structural and functional unit of the nervous system
Synapse	The gap between two neurons where neurotransmitters pass signals
Reflex action	Automatic, involuntary response to a stimulus; controlled by spinal cord
Reflex arc	The neural pathway of a reflex — receptor → sensory neuron → spinal cord → motor neuron → effector
Hormone	Chemical messenger secreted by endocrine glands, transported by blood
Tropic movement	Directional growth movement in plants in response to an external stimulus
Auxin	Plant hormone produced at shoot tips that promotes cell elongation
Insulin	Hormone secreted by the pancreas that lowers blood glucose levels
Adrenaline	“Fight or flight” hormone secreted by adrenal glands during stress or danger
Homeostasis	Maintenance of a stable internal environment in the body
Goitre	Enlargement of the thyroid gland due to iodine deficiency
Meninges	Three protective membranes covering the brain and spinal cord

Solved Examples (NCERT-Based)

Example 1

Why does a plant shoot bend towards light?

Answer: When light falls on one side of the shoot tip, auxin migrates to the shaded side. The cells on the shaded side receive more auxin and elongate more than the cells on the lit side. This unequal growth causes the shoot to bend towards the source of light — this is called phototropism.

Example 2

What is the difference between a reflex action and a voluntary action?

Answer: A reflex action is automatic, involuntary, and very fast — it is controlled by the spinal cord without involving the brain (e.g., withdrawing hand from a hot flame). A voluntary action is conscious and deliberate — it is controlled by the cerebrum of the brain (e.g., picking up a pencil).

Example 3

Why is the pituitary gland called the “master gland”?

Answer: The pituitary gland is called the master gland because it secretes hormones (like TSH, FSH, LH) that control and regulate the functioning of other endocrine glands — thyroid, adrenal, and gonads. It is itself controlled by the hypothalamus.

Example 4

A person has high blood sugar levels. Which hormone is deficient and which gland produces it?

Answer: Insulin is deficient. It is produced by the beta cells of the Islets of Langerhans in the pancreas. Insulin is responsible for lowering blood glucose. Its deficiency leads to Diabetes mellitus.

Important Questions for Board Exams

1-Mark Questions

1. Name the hormone responsible for the “fight or flight” response.
2. Which part of the brain controls balance and posture?
3. What is a synapse?
4. Name the plant hormone that promotes fruit ripening.
5. Which gland is called the master gland?

2-Mark Questions

1. Distinguish between tropic and nastic movements. Give one example each.
2. What is a reflex arc? Name its components in order.
3. What is the role of auxin in phototropism? Explain with the direction of auxin movement.
4. What is the difference between the nervous system and the endocrine system?
5. What is goitre? What causes it?

3-Mark Questions

1. Explain the structure of a neuron with a diagram. Name the three types of neurons.
2. What is a reflex action? Describe the pathway of a reflex arc with an example.

3. Name the parts of the hindbrain and state the function of each.
4. What are phytohormones? Name four plant hormones and state one function of each.
5. Explain the role of insulin and glucagon in maintaining blood sugar levels. What is this mechanism called?

5-Mark Questions

1. Draw a labelled diagram of the human brain and describe the functions of: cerebrum, cerebellum, hypothalamus, and medulla oblongata.
 2. Describe the endocrine glands in the human body. Give the name of each gland, the hormone it produces, and the effect of hormone deficiency.
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Quick Revision Points

- Nervous system = fast, electrical; Endocrine system = slow, chemical (hormones)
 - Neuron = dendrite (receives) + cell body + axon (sends) + synapse (gap between neurons)
 - 3 neuron types: sensory (to CNS), motor (from CNS), relay (within CNS)
 - Reflex arc: receptor → sensory neuron → spinal cord → motor neuron → effector
 - Cerebrum = thinking/memory; Cerebellum = balance; Medulla = heartbeat/breathing
 - Hypothalamus controls pituitary; pituitary controls other glands → "master gland"
 - Auxin → phototropism (more auxin on shaded side → more elongation → bending towards light)
 - Absciscic acid = inhibitor; Gibberellin = promotes growth; Cytokinin = cell division; Ethylene = ripening
 - Insulin (pancreas) → lowers blood sugar; Glucagon → raises blood sugar; Deficiency → diabetes
 - Adrenaline = fight or flight; Thyroxine needs iodine; iodine deficiency → goitre
 - Touch-me-not (Mimosa) = nastic movement; Pea tendril coiling = thigmotropism
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Previous Chapter: Chapter 5 — Life Processes

Next Chapter: Chapter 7 — How do Organisms Reproduce?



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