



AMBITION INSTITUTE

CLASS 10TH

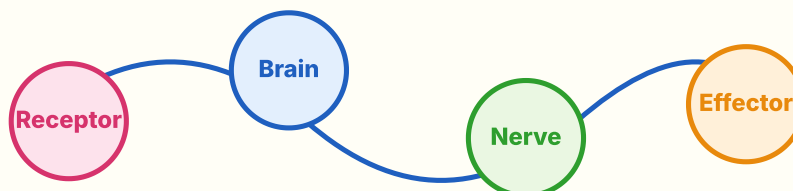
CHAPTER 6

CONTROL AND COORDINATION

Let's Sense, Think and Respond – The Language of Life!

Every response starts with a stimulus... Let's trace the journey together!

Sense · Send · Think ·
Respond · Grow!



**Stimulus → Receptor → Brain →
Effector → Response**

Observe · Think · Respond · Understand



CONTROL & COORDINATION



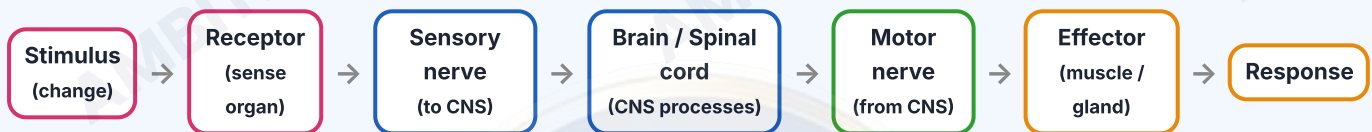
IN SHORT

- Living organisms **respond to changes** around them.
- Change in the environment = **Stimulus** (light, heat, sound, smell, touch...).
- Reaction to the stimulus = **Response**.
- Working together of organs to give a proper response = **Coordination**.

Note

- Control and coordination in **animals** is done by the **nervous system** and **hormones** (endocrine system).
- In **plants** it is done only by **chemical (hormonal)** coordination – plants have no nervous system.
- Science Class - 10 ☺

PATH OF A RESPONSE



Receptors are specialised tissues in sense organs that detect information. **Effectors** are muscles or glands that carry out the response. The **CNS** (Central Nervous System = brain + spinal cord) receives and processes information.

RECEPTORS IN SENSE ORGANS

Sense organ	Receptor detects	Sense organ	Receptor detects
Eye (photoreceptors)	Light – vision	Nose (olfactory receptors)	Smell – chemicals in air
Ear (phonoreceptors)	Sound and balance	Tongue (gustatory receptors)	Taste – chemicals in food
Skin (thermo / touch receptors)	Heat, cold, touch, pain, pressure	Ear (inner)	Body balance (posture)

WHY IS COORDINATION NEEDED?

- To respond quickly to danger (e.g. pulling the hand from a hot object).
- To keep the internal conditions steady (**homeostasis**).
- To make different organs work as one team – walking, eating, thinking.

NERVOUS VS CHEMICAL COORDINATION

Nervous	Hormonal
Electrical impulses	Chemical messengers
Very fast	Slower
Short-lived effect	Long-lasting effect
Travels along nerves	Travels in blood

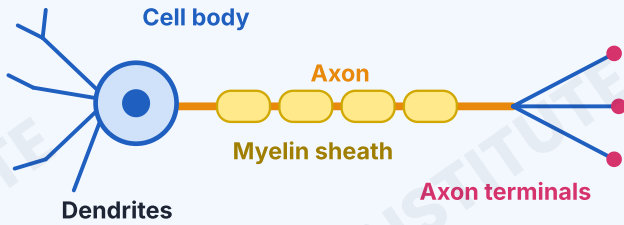
Tip!

Say it in order: **Stimulus → Receptor → Sensory neuron → CNS → Motor neuron → Effector → Response**. It is the base of every question in this chapter.

EXAMPLES

- Mouth watering on seeing food
- Closing eyes in bright light
- Pulling hand from a hot object
- Shivering in cold

NEURON – THE UNIT OF THE NERVOUS SYSTEM



- **Dendrite** – receives information, converts it to an **electrical impulse**.
- **Cell body** – impulse travels through it to the axon.
- **Axon** – long fibre that carries the impulse away from the cell body.
- **Axon end** – converts the impulse into a **chemical signal** to cross the gap.

SYNAPSE

- Tiny gap between the axon end of one neuron and the dendrite of the next.
- Electrical impulse → **chemical (neurotransmitter)** → electrical impulse again.
- Ensures the impulse moves in **one direction** only.

TYPES OF NEURONS

- **Sensory** – receptor → CNS
- **Relay (inter)** – inside CNS, connects
- **Motor** – CNS → muscle / gland

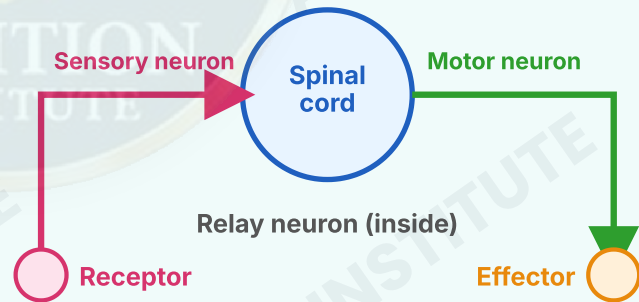
REFLEX ACTION

WHAT IS IT?

- A **sudden, automatic, involuntary** response to a stimulus.
- Does not need thinking – the **spinal cord** (not the brain) takes the decision.
- Saves time and protects from harm.
- **Examples:** knee-jerk, blinking, sneezing, withdrawing hand from a flame, coughing, salivation.

Voluntary action (writing, walking) is controlled by the **fore-brain**; **involuntary action** (heartbeat, digestion) by the **hind-brain (medulla)**.

REFLEX ARC



Reflex arc = the pathway followed by impulses in a reflex: **Receptor → Sensory neuron → Spinal cord → Motor neuron → Effector**.

GOOD TO KNOW

- Impulse speed can reach about **100 m/s** in myelinated nerves.
- Nerves are bundles of long nerve fibres.

NERVOUS TISSUE

- Made of **neurons** – the longest cells of the body.
- Impulses are electrical + chemical.

Tip!

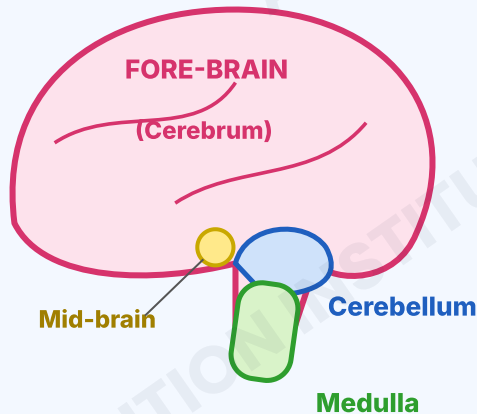
Reflex ≠ Brain action. In a reflex the brain is told afterwards.



THE HUMAN BRAIN



PARTS OF THE BRAIN



Brain = **fore-brain** + **mid-brain** + **hind-brain**.
Hind-brain = cerebellum + pons + medulla.

HOW IS THE BRAIN PROTECTED?

- Enclosed in a bony box – the **cranium (skull)**.
- Covered by 3 membranes – **meninges**.
- Space between meninges is filled with **cerebro-spinal fluid** that acts as a shock absorber.
- The spinal cord is protected by the **vertebral column** (backbone).

SPINAL CORD

- Made of nerves that run from the brain down the back.
- Controls **reflex actions** and carries impulses to and from the brain.

FUNCTIONS OF EACH PART

Part	Location	Main functions
Cerebrum	Fore-brain – largest part	Thinking, memory, intelligence, learning, will-power; receives sensory impulses from all receptors; controls voluntary muscles; has centres for hearing, smell, sight, taste, touch ; hunger centre.
Cerebellum	Hind-brain (back, below cerebrum)	Maintains posture and balance ; coordinates and fine-tunes voluntary movements (e.g. picking up a pencil, riding a bicycle).
Medulla oblongata	Hind-brain, joins the spinal cord	Controls involuntary actions – blood pressure, salivation, vomiting, heartbeat, breathing.
Pons	Hind-brain	Connects different parts of the brain; helps regulate breathing.
Mid-brain	Between fore- and hind-brain	Controls reflex movements of head, neck and eyes in response to sight and sound.

CNS VS PNS

- **CNS** = brain + spinal cord.
- **PNS** = cranial nerves (12 pairs from the brain) + spinal nerves (31 pairs).

WHICH CONTROLS WHAT?

- Thinking → **cerebrum**
- Balance → **cerebellum**
- Heartbeat → **medulla**
- Reflex → **spinal cord**

Remember!

Cerebellum = balance. Medulla = must-do (involuntary) actions.
Cerebrum = cognition.

ACTIONS AND THE BRAIN – QUICK CHECK

Voluntary

Writing, talking, picking a pencil → controlled by fore-brain

Involuntary

Blood pressure, vomiting, salivation → medulla

Reflex

Sneezing, blinking, withdrawing hand → spinal cord



COORDINATION IN PLANTS



TWO KINDS OF MOVEMENT

- **Growth-independent (nastic):** not related to growth, direction is not decided by the stimulus. e.g. **touch-me-not (*Mimosa pudica*)** folds leaves on touch.
- **Growth-dependent (tropic):** directional growth movement towards or away from the stimulus.

TOUCH-ME-NOT – HOW?

- Leaves fold and droop when touched.
- Plant cells change shape by **changing the amount of water** in them – they swell or shrink.
- Information travels by electrical-chemical means from cell to cell (no nerves).

TROPIC MOVEMENTS (TROPISM)

Tropism	Stimulus	Example
Phototropism	Light	Shoots bend towards light (+ve); roots bend away (-ve).
Geotropism	Gravity	Roots grow down (+ve); shoots grow up (-ve).
Hydrotropism	Water	Roots grow towards water.
Chemotropism	Chemicals	Pollen tube grows towards the ovule.
Thigmotropism	Touch	Tendrils coil around a support.

PHOTOTROPISM – HOW DOES THE SHOOT BEND?



Note

- When growing plants detect light, **auxin** synthesised at the shoot tip moves to the side **away from light**.
- This makes cells on the shady side **elongate more**, so the shoot bends **towards the light**.

PLANT HORMONES (PHYTOHORMONES)

Hormone	Made in	Function
Auxin	Shoot tip	Promotes cell elongation; helps shoots bend towards light.
Gibberellin	Young leaves, seeds	Stem growth (elongation); seed germination.
Cytokinin	Areas of rapid cell division (fruits, seeds)	Promotes cell division; opposes ageing; delays leaf fall.
Abscisic acid (ABA)	Wilting leaves	Growth inhibitor ; wilting of leaves; closing of stomata; seed dormancy.
Ethylene	Ripening fruits	Gaseous hormone – fruit ripening.

Tip!

Growth **promoters**: auxin, gibberellin, cytokinin.
Growth **inhibitor**: abscisic acid.

KEY IDEA

- Plant cell moves = change in **turgor** (water pressure).
- No nerves – only chemicals and cell-to-cell signals.



HORMONES IN ANIMALS



WHAT ARE HORMONES?

- **Chemical messengers** secreted by **endocrine (ductless) glands**.
- Poured directly into **blood**, which carries them to the **target organ**.
- Needed in **tiny amounts**; control growth, metabolism, reproduction.
- Slower than nerves but longer lasting.

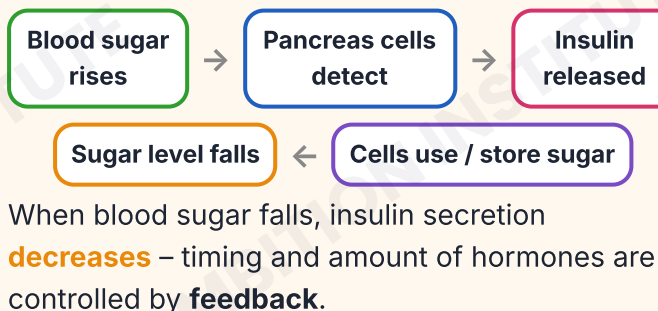
WHY USE HORMONES AS WELL AS NERVES?

- Nerve impulses reach only the cells connected by nerves.
- Impulses are short-lived; cells cannot always conduct them.
- Chemical messages reach **all cells** through blood and give lasting control.

ENDOCRINE GLANDS AND THEIR HORMONES

Gland	Hormone	Function / disorder
Pituitary (master gland, at base of brain)	Growth hormone (GH)	Regulates growth and development. Too little → dwarfism ; too much → gigantism ; adult excess → acromegaly .
Thyroid (neck)	Thyroxine	Regulates carbohydrate, protein, fat metabolism for best growth. Needs iodine . Deficiency → goitre (swollen neck).
Pancreas	Insulin	Lowers blood sugar. Deficiency → diabetes .
Adrenal (above kidneys)	Adrenaline	"Fight or flight": heart beats faster, breathing faster, blood to muscles, skin and digestion less.
Testes (male)	Testosterone	Male secondary sexual characters at puberty.
Ovaries (female)	Oestrogen	Female secondary sexual characters at puberty.

FEEDBACK MECHANISM



REMEMBER

- Iodised salt prevents **goitre**.
- Diabetes patients may take **insulin injections**.
- Adrenaline prepares the body for an emergency.
- Pituitary is "master gland" – it controls other glands.

ANIMAL VS PLANT HORMONES

- Animal hormones travel through **blood**; plant hormones diffuse cell to cell.
- Animals have **specialised glands**; plants have none.

Tip!

Gland → Hormone → Disorder: Thyroid → thyroxine → goitre; Pancreas → insulin → diabetes; Pituitary → GH → dwarfism.



KEY POINTS IN ONE GLANCE

- Stimulus → Receptor → Sensory neuron → CNS → Motor neuron → Effector → Response.
- Neuron: dendrite → cell body → axon → synapse. Impulse: electrical → chemical → electrical.
- Reflex action is quick and involuntary, controlled by spinal cord; the pathway is the reflex arc.
- Brain: fore-brain (cerebrum), mid-brain, hind-brain (cerebellum, pons, medulla).
- Plants: no nerves; use hormones (auxin, gibberellin, cytokinin, ABA, ethylene) and tropic / nastic movements.
- Animals: endocrine glands secrete hormones directly into blood – regulated by feedback.

COMMON MISTAKES TO AVOID

- Calling the spinal cord a part of the brain – it is separate but part of CNS.
- Writing that cerebellum controls heartbeat – it is the **medulla**.
- Saying that auxin moves to the lit side – it moves to the **shady** side.
- Confusing nastic (not directional) with tropic (directional).
- Forgetting that thyroxine needs **iodine**.
- Drawing neurons without arrows or labels – always label dendrite, axon, nucleus.

PRACTICE QUESTIONS

1 MARK (MCQ / VSA)

- Which part of the brain maintains posture and balance?
- Name the hormone responsible for the fight-or-flight response.
- Which plant hormone promotes cell elongation?
- What is the gap between two neurons called?
- Name the gas that ripens fruits.
- Which gland is called the master gland?

2–3 MARKS

- What is a reflex arc? Draw a labelled diagram.
- How does the plant shoot bend towards light?
- Why is iodised salt recommended?
- Differentiate between nervous and hormonal coordination.
- How is the brain protected inside the body?
- Why do plants need chemical coordination only?

ANSWERS (1 MARK)

- | | | |
|---------------|---------------|--------------|
| 1. Cerebellum | 2. Adrenaline | 3. Auxin |
| 4. Synapse | 5. Ethylene | 6. Pituitary |

SELF-CHECK

- Can I name the parts of a neuron?
- Can I draw the reflex arc?
- Can I tell the 5 tropisms and examples?
- Can I match gland – hormone – disorder?

Exam tip!

Diagrams carry marks: neuron, reflex arc and phototropism are frequent. Label clearly with a pencil and ruled arrows.