Control & Coordination

PRASHANT KIRAD

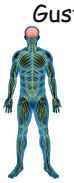
Coordination: working together of the various organs of an organism to adjust various activities of life.

Stimuli: change in the environment that can cause a physical or behavioral change in a living organism.

Response: the reaction of an organism to an internal or external stimulus.

Receptors: Cells or groups of cells in sense organs that detect stimuli and convert them into impulses.

Effectors: Parts of the body that respond to impulses sent by the nervous system, converting them into actions. e.g. muscles and glands.



COORDINATION IN ANIMALS:

Nervous system → Central **Brain**: Fore - Brain, Mid - Brain, Hind- Brain

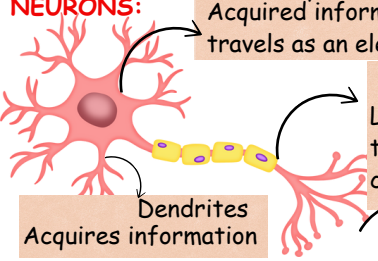
Nervous system → **Spinal cord**

Endocrine system: Hormones

Endocrine system → **Peripheral**

- **Spinal nerve**: Arise from the brain
- **Cranial nerves**: Arise from spinal cord

NEURONS:



Cell body
Acquired information travels as an electrical impulse

IMPORTANT

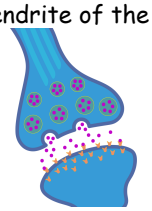
Axon
Longest fibre on the cell body. It transmits electrical impulse from cell body to dendrite of next neuron.

Dendrites
Acquires information

Nerve ending

Synapse

Gap between the nerve ending of one neuron and dendrite of the other neuron.
Electrical signal to Chemical signals



Neuromuscular junction (NMJ):
a synaptic connection between the terminal end of a motor nerve and a muscle.

Dendrites → Cell body → Axon → Nerve ending → Synapse

Types of Neuron:

Sensory Neurons Transmit impulses from sense organs to brain
Motor Neurons Transmit impulses from Brain and spinal cord to body
Relay Neurons Allow sensory and motor neuron to communicate

Aspect	Voluntary Actions	Involuntary Actions	Reflex Actions
Definition	Actions under conscious control	Actions occurring without conscious control	Sudden, automatic responses to stimuli
Control	Involves the brain's thinking and decision-making	Controlled by the autonomic nervous system or lower brain centers	Controlled by the spinal cord via reflex arc
Examples	Walking, writing, speaking	Heartbeat, digestion, breathing	Pulling hand away from a hot object, blinking

Reflex action: spontaneous automatic and involuntary response.

Monitored through the spinal cord.

the pathway taken by nerve impulses in a reflex action is called reflex arc.

IMPORTANT

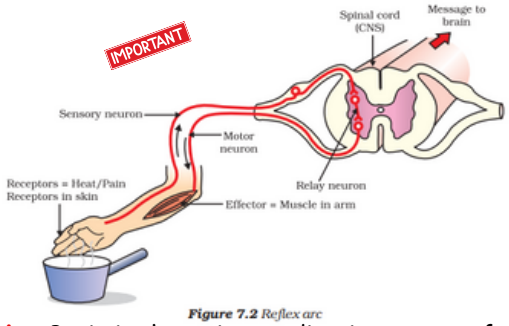
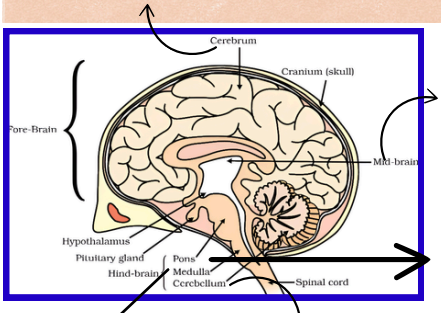


Figure 7.2 Reflex arc

Human brain: Brain is the main coordinating centre of the body.

Most complex or specialized part of brain (largest also).
Consists of cerebrum, Thalamus, Hypothalamus.
Functions: Thinking part of the brain Control the voluntary actions. Store information. Receives sensory impulse
Centre associated with hunger.



Controls involuntary actions such as:
Changing pupil size.
reflex movement of head, neck and trunk

Control involuntary actions, regulation of respiration

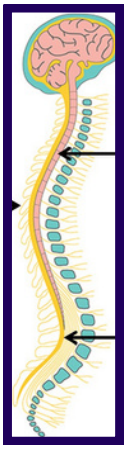
controls voluntary act. Eg: blood pressure, salivation, vomiting.

controls posture and balance. Precision of voluntary act.

Protection of nervous system

Brain

- Brain in cranium (bone box, part of skull).
- Covered by 3 membrane layers (meninges).
- Fluid protects brain from injuries.



Spinal cord

- Spinal cord wrapped in meninges.
- Protected by vertebral column (backbone).
- Vertebral column made of 33 bones (vertebrae).

- Spinal cord: cylindrical extension of brain, starts from medulla.
- Surrounded by meninges.
- 31 pairs of nerves arise.
- Handles spinal reflexes.
- Conducts nerve impulses to/from brain.

more about Spinal cord

CHEMICAL COORDINATION IN PLANTS :

NASTIC

Thigmonasty
Non-directional movement in response to touch (e.g., Mimosa pudica).

Photonasty
Non-directional movement in response to light (e.g., dandelion, moonflower)

TROPIC

Phototropism: Growth towards or away from light.

Hydrotropism: Growth in response to water.

Chemotrpism: Growth towards or away from chemicals.

Geotropism: Growth in response to gravity.

Thigmotropism : Growth in response to touch.

Nastic Movement	Tropic Movement
Non-directional response to stimuli.	Directional response to stimuli.
Fast movement.	Slow movement.
Involves flat organs (leaves, petals).	Involves all plant parts.

COORDINATION IN PLANTS:

HORMONES (PHYTOHORMONES)

Growth of a plant can be divided into three stages:

1.Cell division

2.Cell enlargement

3.Cell differentiation (or cell specialization

- **Auxin** → Promotes cell elongation, helps in phototropism (bending towards light), and root development.
- **Gibberellins** → Stimulates stem elongation, seed germination, and flowering.
- **Cytokinins** → Promotes cell division, delays aging of leaves, and helps in fruit and seed development.
- **Abscisic Acid (ABA)** → Inhibits growth, induces dormancy in seeds, and helps in closing stomata during water stress.
- **Ethylene** → Promotes fruit ripening and helps in leaf and flower shedding.

CHEMICAL COORDINATION IN ANIMALS:

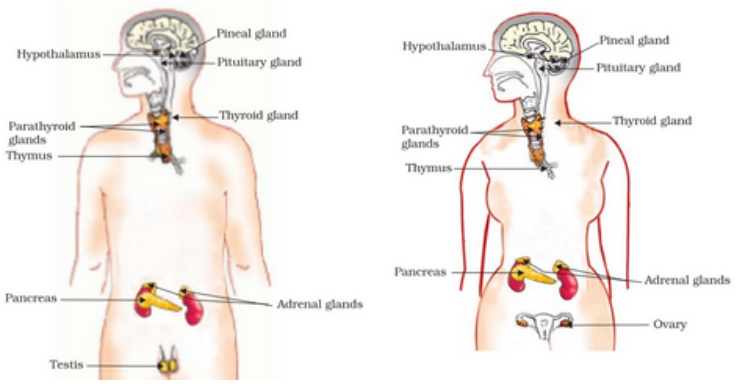
GLANDS → structure made of cells or tissue that secretes specific substances in the body.

ENDOCRINE GLANDS

- Secrete substances directly into the bloodstream (ductless).
- Substances are hormones.
- Secretion occurs throughout the body via blood.
- Examples: Pituitary gland, thyroid gland, adrenal glands.
- Part of the endocrine system.

EXOCRINE GLANDS

- Secrete substances through ducts onto body surfaces.
- Substances include enzymes, sweat, saliva, etc.
- Secretion occurs on external body surfaces or into body cavities.
- Examples: Sweat glands, salivary glands, digestive glands.
- Not part of the endocrine system.



HORMONES: Chemical messengers in the bloodstream that regulate and control the activity of organs and tissues.

Feedback Mechanism: A process that maintains hormonal balance by adjusting hormone secretion in response to changes in hormone levels.

Endocrine Glands, Their Hormones, and Functions

- **Hypothalamus (Brain)** → Hormone: Releasing & Inhibitory → Function: Regulates pituitary gland hormones
- **Pituitary Gland (Below the brain)** → Hormone: Growth Hormone → Function: Controls body growth (bones, muscles) - master gland → Condition: Dwarfism, Gigantism
- **Thyroid Gland (Attached to windpipe)** → Hormone: Thyroxine → Function: Regulates metabolism of carbs, fats, and proteins → Condition: Goitre (iodine deficiency)
- **Parathyroid Gland (Embedded in thyroid gland)** → Hormone: Parathormone → Function: Regulates calcium and phosphate levels in blood
- **Thymus Gland (Lower neck/upper chest)** → Hormone: Thymus Hormone → Function: Develops immune system; large in children, shrinks after puberty
- **Pancreas (Below the stomach)** → Hormones: Insulin & Glucagon → Function: Regulates blood sugar levels; insulin helps glucose uptake → Condition: Diabetes
- **Adrenal Glands (On top of kidneys)** → Hormone: Adrenaline → Function: Prepares body for 'fight or flight' response (increases heart rate, breathing, energy mobilization)
- **Testes (Male reproductive organs)** → Hormone: Testosterone → Function: Controls male puberty (voice, hair growth)
- **Ovaries (Female reproductive organs)** → Hormones: Estrogen & Progesterone → Function: Controls female puberty (voice, skin, breasts); progesterone supports menstrual cycle and pregnancy

Chapter ka KAZAANA:

- **Neuron (Function + Diagram)**
- **Reflex arc (Diagram)**
- **Hormone Topic is very important**
- **Function of Brain (MCQ)**