

Chapter- 7

Control And Coordination

- All the living organisms respond and react to changes in the environment around them.
- The changes in the environment to which the organisms respond and react are called stimuli such as light, heat, cold, sound, smell, touch etc.
- Both plants and animals respond to stimuli but in a different manner.

Control and Coordination in Animals

It is brought about in all animals with the help of two main systems :

- (a) Nervous system
- (b) Endocrine system

NERVOUS SYSTEM

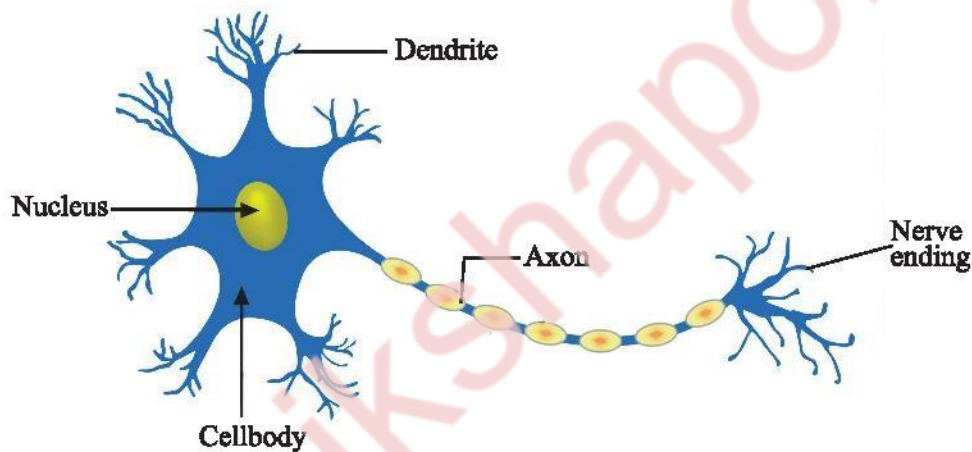
- Control and coordination are provided by nervous and muscular tissues.
- Nervous tissue is made up of an organized network of nerve cells or neurons, and is specialized for conducting information via electrical impulses from one part of the body to another.

Receptors: Are specialized tips of some nerve cells that detect the information from the environment. These receptors are located in our sense organs.

- (a) **Ear :**
 - Phonoreceptors
 - Hearing
 - Balance of the body

- (b) **Eyes :**
 - Photoreceptors
 - Seeing
- (c) **Skin :**
 - Thermoreceptors
 - Heat or cold
 - Touch
- (d) **Nose :**
 - Olfactory receptors
 - Smell detection
- (e) **Tongue :**
 - Gustatory receptors
 - Taste detection

Neuron : It is the structural and functional unit of nervous system.



Parts of Neuron :

- (a) **Dendrite :** Acquires information.
- (b) **Cell body :** Acquired information travels as an electrical impulse.
- (c) **Axon :** Longest fibre on the cell body is called axon. It transmits electrical impulse from cell body to dendrite of next neuron.

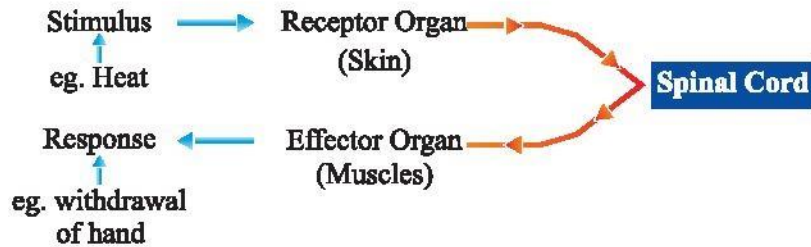
Synapse : It is the gap between the nerve ending of one neuron and dendrite of the other neuron. Here electrical signal is converted into chemical signal for onward transmission.

REFLEX ACTION

Reflex action is quick, sudden and immediate response of the body to a stimulus.

E.g., Knee jerk, withdrawal of hand on touching hot object.

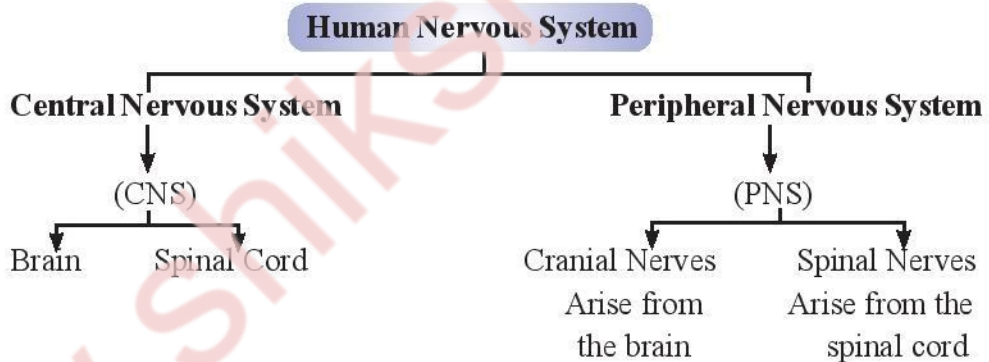
Reflex arc : The pathway through which nerve impulses pass during reflex action is called reflex arc.



Response : Responses are of three main types :

- (a) **Voluntary :** Controlled by fore brain. *E.g.*, talking, writing.
- (b) **Involuntary :** Controlled by mid and hind brain. *E.g.*, heart beat, vomiting, respiration.
- (c) **Reflex action :** Controlled by spinal cord. *E.g.*, withdrawal of hand on touching a hot object.

Need of Reflex Actions : In some situations such as touching a hot object, pinching etc. we need to act quickly, otherwise our body would be harmed. Here response is generated from spinal cord instead of brain.



HUMAN BRAIN

Brain is the main coordinating centre of the body. It has three major parts :

- (a) Fore-brain
- (b) Mid-brain
- (c) Hind-brain

(a) **Fore-brain :** It is the most complex or specialized part of the brain. It consists of cerebrum.

Functions :

- (i) Thinking part of the brain.

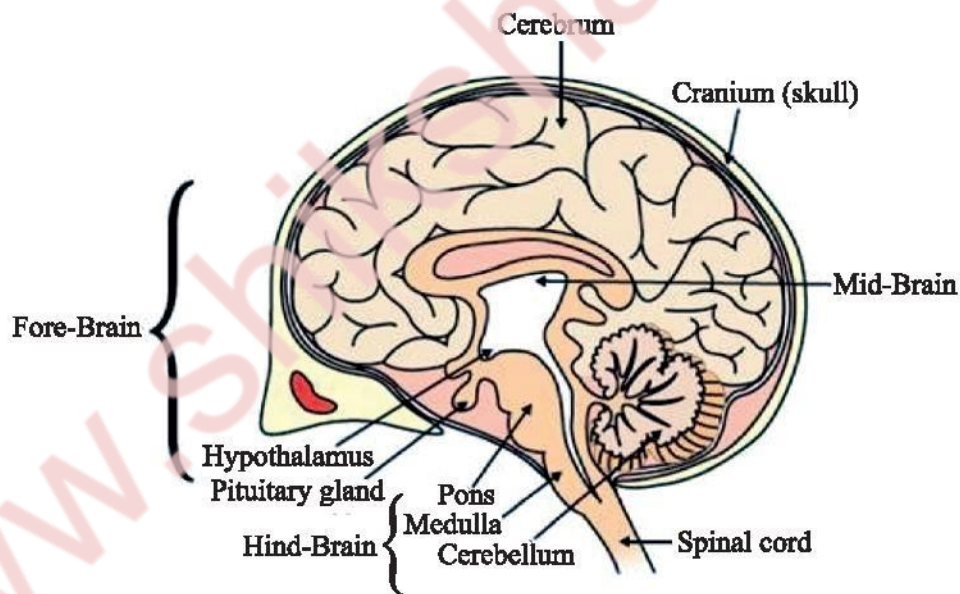
- (ii) Control the voluntary actions.
- (iii) Store information (Memory).
- (iv) Receives sensory impulses from various parts of the body and integrate it.
- (v) Centre associated with hunger.

(b) Mid-brain : Controls involuntary actions such as :

- Change in pupil size.
- Reflex movements of head, neck and trunk.

(c) Hind-brain : It has three parts :

- (i) **Cerebellum :** Controls posture and balance. Precision of voluntary actions *e.g.*, picking pen.
- (ii) **Medulla :** Controls involuntary actions *e.g.*, blood pressure, salivation, vomiting.
- (iii) **Pons :** Involuntary actions, regulation of respiration.



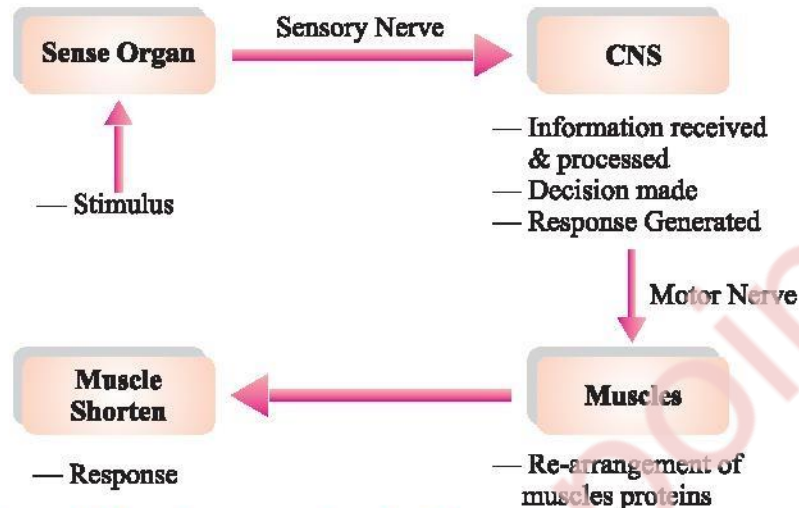
Human Brain

Protection of Brain and Spinal Cord

- (a) **Brain :** Brain is protected by a fluid filled balloon which acts as shock absorber and is enclosed in cranium (skull or brain box).

(b) **Spinal Cord** : Spinal cord is enclosed in vertebral column.

Coordination between Nervous and Muscular Tissue



Limitations of Electric communication/Nervous system :

- Electric impulse will reach only to those cells that are connected by nervous tissue.
- After generation and transmission of an electrical impulse, the cell takes some time to reset its mechanism before transmitting another impulse. So cells cannot continually create and transmit impulse.
- Plants do not have any nervous system.

Chemical communication : To overcome the limitations of electric communication.

COORDINATION IN PLANTS

Movements in plants :

- Independent of growth
- Dependent on growth

(i) **Independent of growth** : Immediate response to stimulus.

- Plants use electrical-chemical means to convey information from cell to cell.
- For movement to happen, cells change their shape by changing the amount of water in them, resulting in swelling or shrinking of cells.

E.g., Drooping of leaves of 'Touch-me-not' plant on touching it.

(ii) Dependent on growth : These movements are tropic movements i.e., directional movements in response to stimulus.

- **Tendrils :** The part of tendril away from the object grows more rapidly as compared to the part near the object. This causes circulating of tendril around the object.
- **Phototropism :** Movement towards light.
- **Geotropism :** Movement towards/away from gravity.
- **Chemotropism :** Growth of pollen tube towards ovule.
- **Hydrotropism :** Movement towards water.

Plant Hormones : Are chemical compounds which help to coordinate growth, development and responses to the environment.

Main plant hormones are :

- (a) **Auxin :**
 - Synthesized at shoot tip
 - Helps the cells to grow longer
 - Involved in phototropism
- (b) **Gibberellin :**
 - Helps in the growth of the stem
- (c) **Cytokinins :**
 - Promotes cell division
 - Present in greater concentration in fruits and seeds
- (d) **Abscissic Acid :**
 - Inhibits growth
 - Cause wilting of leaves
 - Stress hormone

Hormones in Animals :

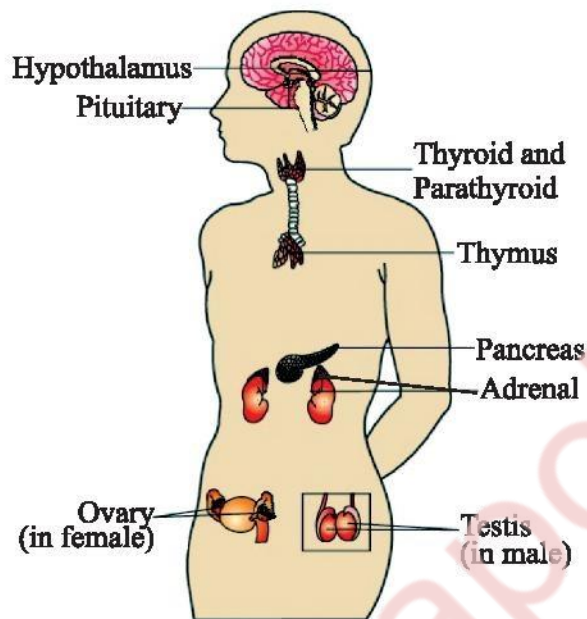
Hormones : Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.

Endocrine glands : These glands secrete their product (hormone) into the blood.

Endocrine Gland, Hormones and their Functions

S. No.	Hormone	Endocrine Gland	Location	Functions
1.	Thyroxine	Thyroid	Neck/Throat region	Regulation of metabolism of carbohydrates, fats and proteins.
2.	Growth hormone	Pituitary (master gland)	Mid brain	Regulates growth and development.
3.	Adrenaline	Adrenal	Above both kidneys	Regulation (increasing) of blood pressure, heart beat, carbohydrate metabolism (during emergency)
4.	Insulin	Pancreas	Below stomach	Reduces and regulates blood sugar level
5.	(a)Testosterone in males (b)Estrogen in females	Testis Ovaries	Genital/lower abdomen area	Changes associated with puberty (Sexual maturity)

Human Endocrine Glands



Iodised salt is necessary because iodine mineral is essential part of thyroxine hormone secreted by thyroid gland. Thyroxine regulates metabolism of carbohydrates, fats and proteins. So, we must consume iodised salt which is necessary for proper working of thyroid gland. It's deficiency causes a disease called goiter (Swollen neck).

Diabetes

Disease in which blood sugar level increase.

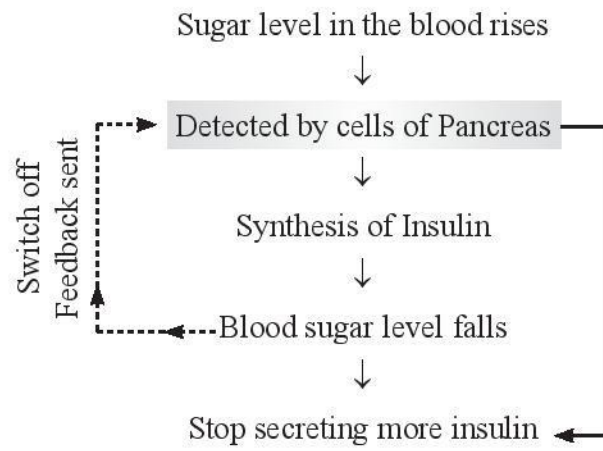
Cause : Due to the deficiency of insulin hormone secreted by pancreas that is responsible to control blood sugar levels.

Treatment : Injections of insulin hormone.

Feedback Mechanism

The excess or deficiency of hormones has a harmful effect on our body. Feedback mechanism makes sure that hormones should be secreted in precise quantity and at right time.

E.g., Feedback mechanism to control the sugar level in blood is as follows :



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