

## Introduction

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

## Systems for Control and Coordination in Animals

- Nervous system
- Endocrine system

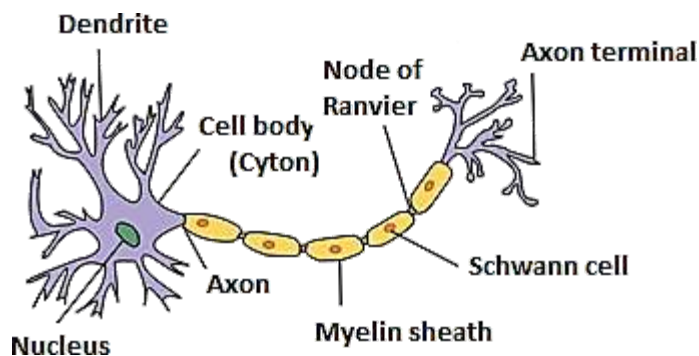
## Nervous system

Nervous tissue is made up of **nerve cells or neurons** (specialized cells for conducting information via electrical impulses from one part of the body to another).

## Receptors

1. Ear: phonoreceptors (receiving sound). Also, maintain the balance of the body.
2. Eyes: photoreceptors (receiving light). It helps in vision.
3. Skin: thermoreceptors (feels temperature) heat or cold.
4. Nose: olfactory receptors (sense of smell). It helps in the detection of the smell.
5. Tongue: Gustatory receptors (sense of taste).

**Neuron:** structural and functional unit of the nervous system.



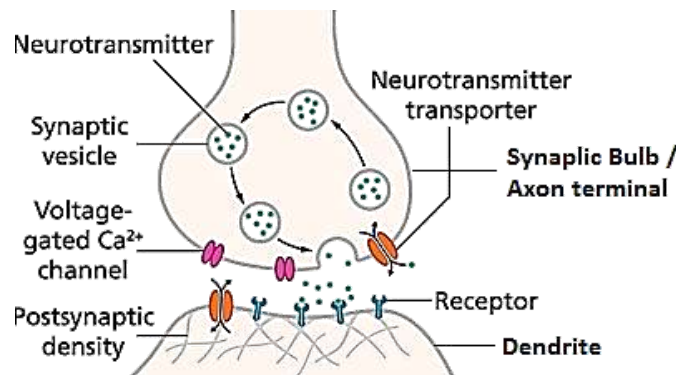
## Functioning of Neuron

- Stimuli from receptors reach up to the dendritic tip of a nerve cell and create an electrical impulse.
- This impulse travels from the dendrite to the cell body and then at the end of the axon.
- Impulse through synapse transmitted by chemicals.

- The chemical is again converted into an electrical impulse in the next neuron's dendrite.

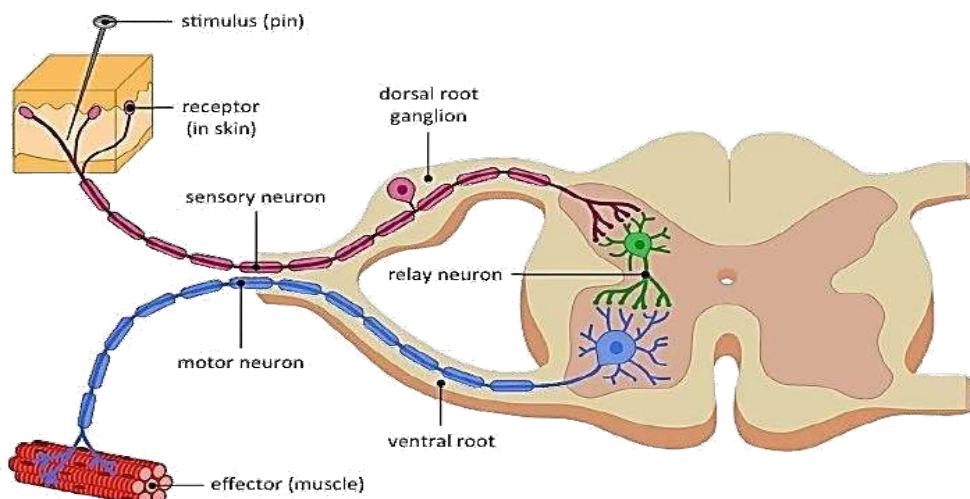
## Parts of Neuron

1. **Dendrite:** cytoplasmic extensions of the cell body that acquire information.
  2. **Cell body:** contains all cell organelle and a nucleus.
  3. **Axon:** It transmits an electrical impulse from the cell body to the dendrite of the next neuron.
- Synapse:** It is the gap between the nerve ending of one neuron and the dendrite of the other neuron. Here, an electrical signal is converted into a chemical signal for onward transmission.



## Reflex Action

- Reflex action is the quick, sudden, and immediate response of the body to a stimulus.  
Example: Knee jerk, withdrawal of hand on touching a hot object.
- **Stimulus:** It is a detectable change in the external or internal environment to which an organism reacts.
- **Reflex arc:** The pathway through which nerve impulses pass during reflex action is called a reflex arc.
- **Response:** It is the final reaction after the reflex action



## Three types of responses:

1. **Voluntary:** Controlled by the forebrain. E.g.: talking, writing.
2. **Involuntary:** Controlled by the mid and hindbrain. Eg: heartbeat, vomiting, respiration.
3. **Reflex action:** Controlled by the spinal cord. Eg: withdrawal of hand on touching a hot object.

## Human Nervous System

- The human nervous system consists of two parts, the **Central nervous system (CNS)** and **Peripheral nervous system (PNS)**.
- **CNS** consists of the **Brain** and **Spinal Cord**.
- **PNS** consists of the **Cranial** (from the brain) and **Spinal Nerves** (from the Spinal cord).

## Human Brain

1. Fore-brain
2. Mid-brain
3. Hind-brain

**Fore-brain** (cerebrum).

### Functions:

1. Thinking part of the brain.
2. Control the voluntary actions.
3. Store information (Memory).
4. Receives sensory impulses from various parts of the body and integrates them.
5. Centre associated with hunger.

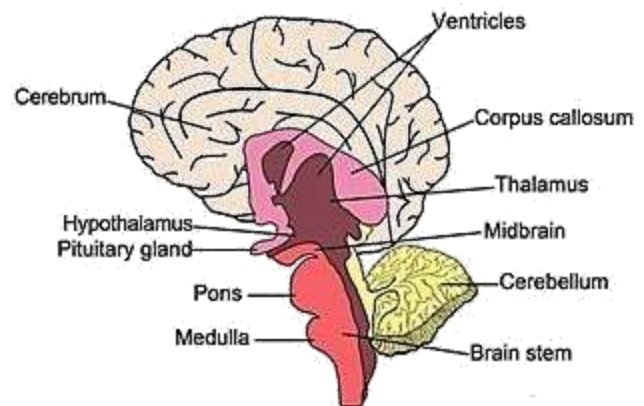
## Mid-brain

Controls involuntary actions such as a change in pupil size and reflex movements of head, neck, and trunk.

## Hind-brain

1. **Cerebellum:** Controls posture by coordinating the muscles and maintaining a balanced body. The precision of voluntary actions. E.g.: picking
2. **Medulla:** Oblongata controls involuntary actions. Example: blood pressure, salivation, vomiting.
3. **Pons:** Controls Involuntary actions, regulation of respiration.

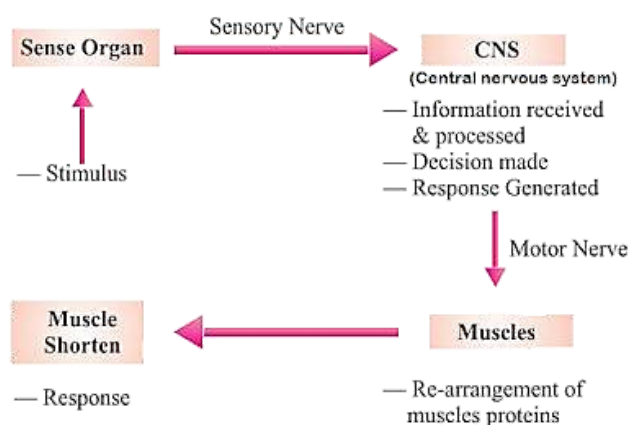
## Protection of Brain and Spinal Cord



The brain is enclosed in the **cranium** (skull or brain box). The spinal cord is enclosed in the **vertebral column**.

## Coordination between Nervous and Muscular Tissue

- The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system.
- The brain thus allows us to think and take actions based on that thinking. This is accomplished through a complex design, with different parts of the brain responsible for integrating different inputs and outputs.



## Limitations of Nervous system

1. Electric impulse will reach only to those cells that are connected by nervous tissue.
2. After the 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 the impulse.
3. Plants do not have any nervous system.

## Chemical coordination (By Hormones)

It helps in overcoming the limitations of electric communication.

## Coordination in Plants (plant coordinate by hormones.)

There are three types of movements in plants.

- a. **Nastic movement:** non-directional movement, Independent of growth.
- b. **Tropic movement:** directional movement, Dependent on growth.

## Nastic movement

- Independent of growth and has an immediate response to the 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.
- Example: **Drooping of leaves of 'Touch-me-not' plant on touching it.**

## Trophic movement

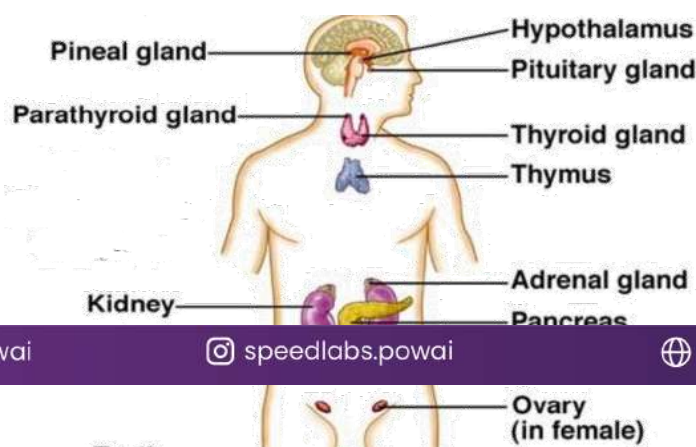
1. Directional movements in response to a stimulus.
2. **Thigmotropism:** The part of the tendril that moves away from the object grows more rapidly as compared to the part near the object. This causes the circulating of a tendril around the object movement in response to touch.
3. **Phototropism:** Movement towards the light.
4. **Geotropism:** Movement towards/away from gravity.
5. **Chemotropism:** Growth of pollen tube towards ovule.
6. **Hydrotropism:** Movement towards the water.

## Plant Hormones

- **Auxin:** Synthesized at shoot tip. It helps the cells to grow longer and be involved in phototropism (response towards light).
- **Gibberellin:** It helps in the growth of the stem.
- **Cytokinins:** It promotes cell division. This is present in greater concentration in fruits and seeds
- **Abscisic Acid:** It inhibits growth. It also causes wilting of leaves and is also known as the stress hormone.

## Hormones in Animals

- **Hormones** are chemical substances that coordinate the activities of living organisms and also their growth.
- **Endocrine glands:** These glands secrete their product (hormone) directly into the blood and the main organ for releasing the hormones.



- a. **Thyroxine:** This hormone is secreted by the **Thyroid gland**. The Thyroid gland is located in the Neck/Throat region. It **regulates the metabolism of carbohydrates, fats, and proteins**.
- b. **Growth hormones:** This is secreted by the **pituitary** (master gland). This gland is located in Mid-brain. It regulates **growth and development**.
- c. **Adrenaline:** This hormone is secreted by the **Adrenal gland**. The adrenal gland is located above both kidneys. It regulates **blood pressure (increasing), heartbeat, carbohydrate** metabolism (during an emergency).
- d. **Insulin:** This hormone is secreted by Pancreas. The pancreas is located below the stomach. It **regulates blood sugar levels**.
- e. **Sex hormones:**
- 1. Testosterone in males:** Secreted by the testis. Associated with puberty (sexual maturity).
  - 2. Estrogen in females:** Secreted by Ovaries. Associated with puberty (sexual maturity).

### Importance of iodine

- Iodised salt is necessary because iodine mineral is an essential part of the thyroxine hormone secreted by the thyroid gland. Thyroxine regulates the metabolism of carbohydrates, fats, and proteins. So, we must consume iodized salt which is necessary for the proper working of the thyroid gland.
- Its deficiency causes a disease called **goitre**. (Swollen neck)

### Diabetes

Diabetes is a disease in which blood sugar level increases.

#### Cause of Diabetes

Caused due to the deficiency of insulin hormone secreted by the pancreas that is responsible to control blood sugar levels.

#### Treatment of Diabetes

Injections of insulin hormones can help in the treatment of diabetes.

#### Feedback Mechanism

- The excess or deficiency of hormones has a harmful effect on our bodies. The feedback mechanism makes sure that hormones should be secreted in precise

quantity and at right time.

- Example: Feedback mechanism to control the sugar level in blood is as follows:

