THE RADIANT EDUCATION POINT
(MRITUNJAY MISHRA)
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Introduction

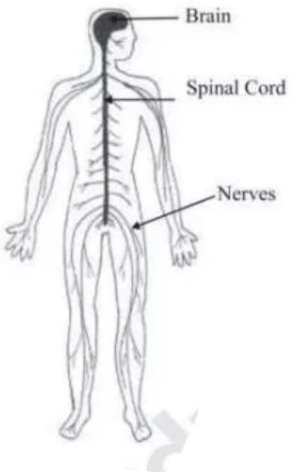
→ All the living organisms respond and react to changes in the environment around them.
→ The changes in the environment to which the organisms respond and react are called stimuli such as light, heat, cold, sound, smell, touch etc.
→ Both plants and animals respond to stimuli but in a different manner.

Systems for Control and Coordination in Animals

→ Control and Coordination in animals is done with the help of two main systems:
(i) Nervous system
(ii) Endocrine system

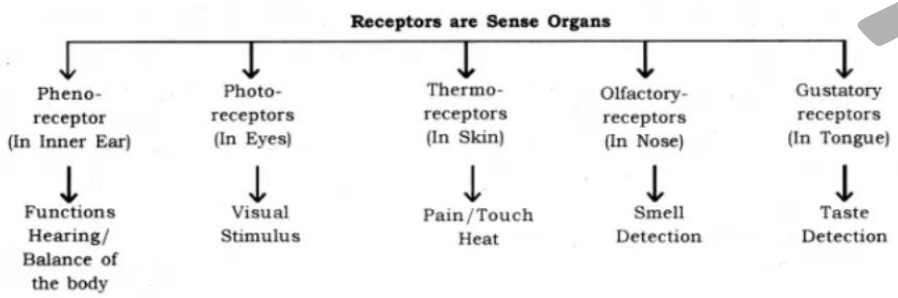
Nervous System

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



Receptors

→ These are specialized tips of some nerve cells that detect the information from the environment. `These are located in our sense organs.
(i) Ear: It acts as phonoreceptors (receiving sound). It helps in hearing and maintaining the balance of body.
(ii) Eyes: It acts as photoreceptors (receiving light). It helps in seeing
(iii) Skin: It acts as thermoreceptors (feels temperature). It helps in feeling heat or cold and touch.
(iv) Nose: It acts as olfactory receptors (sense of smell). It helps in the detection of the smell.
(v) Tongue: It acts as Gustatory receptors (sense of test). It helps in the detection of taste.



Nervous system is mainly composed of brain, spinal cord and nerves. Though five sense organs (nose, eyes. ears, tongue and skin) are also a part of nervous system and play a very important role in nervous system.
Functions of Nervous System
• Receive the information from environment by sense organs.
• Transportation of information to brain through spinal cord and nerves.
• After analyzing the information, it reacts accordingly through muscles and glands.
For example when we touch a hot object, our skin helps us to sense the heat, the nerves carry the impulse to the brain through spinal cord, and then the brain sends impulse to the muscles to contract and take off the hands.

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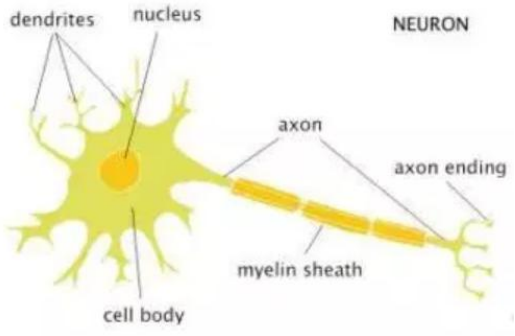
Neuron



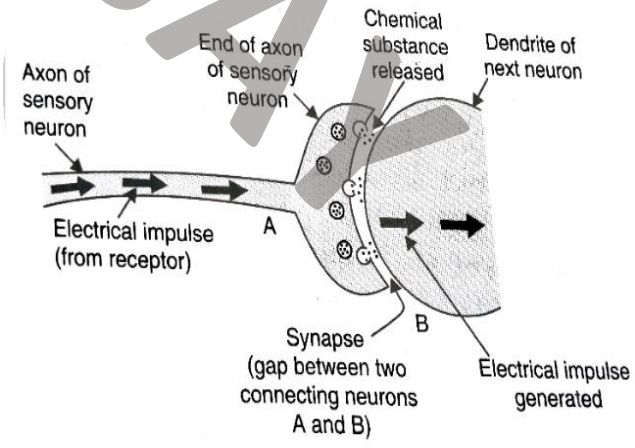
Neurons are specialized cells which are combined to form nerves of the nervous system. As nerves are emerged from brain and spinal cord and branch out to almost all parts of the body, so neuron is also called unit of nervous system.

The neuron consists of the following parts:
Cell Body: This main part has all of the necessary components of the cell, such as the nucleus, endoplasmic reticulum, ribosome and mitochondria. If the cell body dies, the neuron dies.
Axon: This is a long cable like projection of the cell along the length of the cell. It ends in several hair-like structures; called axon terminals or axon endings. The axon terminals relay nerve impulses.
Dendrites: These small branch-like projections of the cell make connections to other neuron and receive the nerve impulses
Synapse: The point of contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse.

Neuromuscular Junction (NMJ): NMJ is the point where a muscle fibre comes in contact with a motor neuron carrying nerve impulse from the control nervous system.

Functioning of Neuron

→ The information from receptors is acquired at the dendritic tip of a nerve cell as chemical reaction that creates an electrical impulse.
→ This impulse travels from the dendrite to the cell body and then at the end of the axon.
→ Chemicals are released at the end of the axon by the effect of electrical impulse.
→ These chemicals cross the gap (synapse) and start a similar electrical impulse in a dendrite of the next neuron.
→ The similar synapse finally allows delivery of such impulses from neurons to other cells, such as muscles cells or gland.



Transmission of nerve impulse: Nerve impulses travel in the following manner from one neutron to the next :
Dendrites → cell body → axon → nerve endings at the tip of axon → synapse → dendrite of next neuron.
Chemical released from axon tip of one neuron, cross the synapse or neuromuscular junction to reach the next cell

Types of Neuron:
a. Sensory Neurons- These neurons transmit message from body parts to central nervous system (which is composed of the brain and the spinal cord).
b. Motor Neurons- These neurons transmit message from central nervous system to body parts.
c. Relay Neurons -These neurons relay the signals within the central nervous system.

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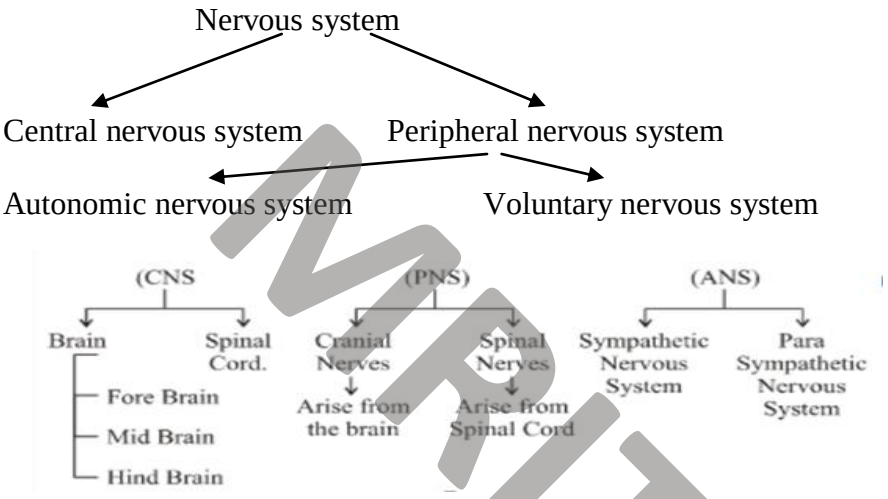
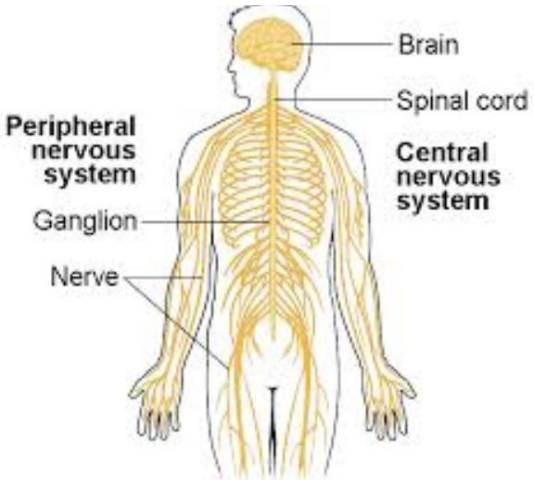
Human Nervous System: The nervous system in humans can be divided into three main parts





1. Central Nervous System: The central nervous system is composed of the brain and the spinal cord. The brain controls all the functions in the human body. The spinal cord works as the relay channel for signals between the brain and the peripheral nervous system.
2. Peripheral Nervous System: The peripheral nervous system is composed of the cranial nerves and spinal nerves. There are 12 pairs of cranial nerves. The cranial nerves come our of the brain and go to the organs in the head region. There are 31 pairs of spinal nerves. The spinal nerves come out of the spinal cord and go to the organs which are below the head region.
3. Autonomous Nervous System: The autonomous nervous system is composed of a chain of nerve ganglion which runs along the spinal cord. It controls all the involuntary actions in the human body. The autonomous nervous system can be divided into two parts :

Sympathetic Nervous System: This part of the autonomous nervous system heightens the activity of an organ as per the need. For example, during running, there is an increased demand for oxygen by the body. This is fulfilled by an increased breathing rate and increased heart rate. The sympathetic nervous system works to increase the breathing rate the heart rate, in this case.

Parasympathetic Nervous System: This part of the autonomous nervous system slows the down the activity of an organ and thus has a calming effect. During sleep, the breathing rate slows down and so does the heart rate. This is facilitated by the parasympathetic nervous system. It can be said that the parasympathetic nervous system helps in the conservation of energy.

Peripheral Nervous System (PNS):

The Peripheral nervous system is composed of the Cranial nerves, Spinal nerves and Visceral nerves

Cranial Nerves -There are 12 pairs of cranial nerves. The cranial nerves come out of the brain and go to the sense organs and muscles in the head region.

Spinal Nerves- There are 31 pairs of spinal nerves. The spinal nerves come out of the spinal cord and go to the sense organs and muscles which are below the head region. These nerves carry message to brain through spinal cord.

Visceral Nerves- The visceral nerves come out of the brain and spinal cord and go to the internal organs (like heart, kidney etc.)

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Voluntary and Involuntary Actions

Voluntary actions are actions which we do in conscious control of brain. For example: speaking, walking, kicking a ball, lifting an object etc.

Involuntary actions are those which occur without the conscious control of organisms or we can say they are not under the control of will. For example: beating of heart, breathing, sweating, working of kidney, digestion of food.

REFLEX ACTION

Reflex action is an automatic response of the body to a stimulus. e.g. withdrawal of hand, knee jerk etc. on touching a hot plate.

Reflex arc : The pathway taken by nerve impulses in a reflex action is called reflex arc.

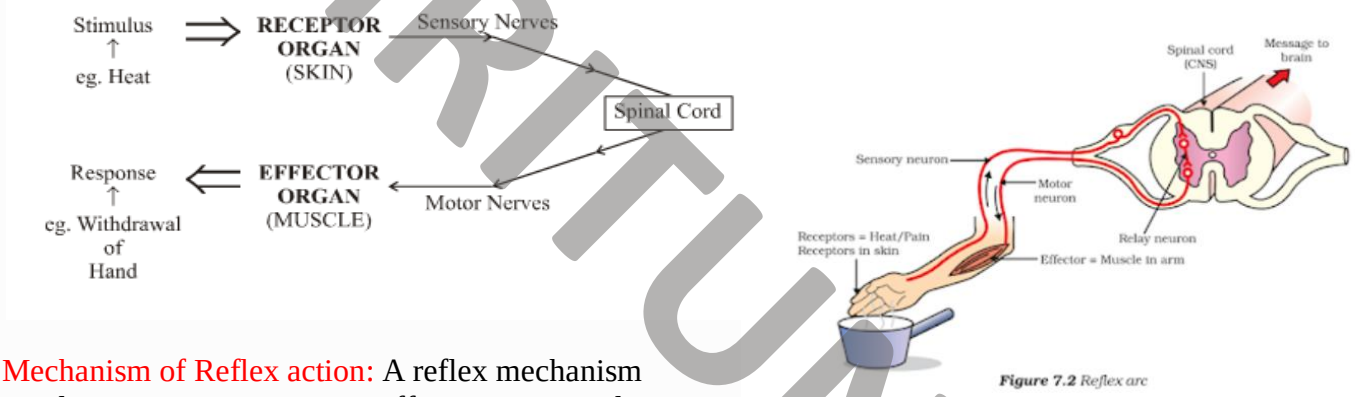

Figure 7.2 Reflex arc

Mechanism of Reflex action: A reflex mechanism involves a receptor organ, an effector organ, and some type of communication network. When a sensory receptor is stimulated, signals pass from it along a sensory neuron to the spinal cord. The message travels out of the spinal cord along a motor neuron to the effector organ (e.g., a muscle or a gland), which shows the response. Such a pathway is called a reflex arc. In most cases, however, the basic physiological mechanism behind a reflex is more complicated than the reflex arc theory would suggest. Additional nerve cells capable of communicating with other parts of the body (beyond the receptor and effector) are present in reflex circuits.

Types of Reflexes/Reflex actions

1. Cerebral Reflex: A cerebral / cranial reflex is one that is controlled by one of the cranial nerves and tends to take place in the facial or head area. For ex. Change In size of pupil in bright light etc.
2. Spinal Reflex: A spinal reflex is a reflex that involves only the spinal nerves and spinal cord and is not processed by the brain. For ex. take off the hand on touching a hot object.

How Muscles (Effectors) cause Movement?

Muscles are made up of muscle cells which have special proteins. These proteins can change their arrangement on receiving message from brain. When they do so, shape of muscle changes. They can contract or expand This contraction and expansion can cause movement in body parts.

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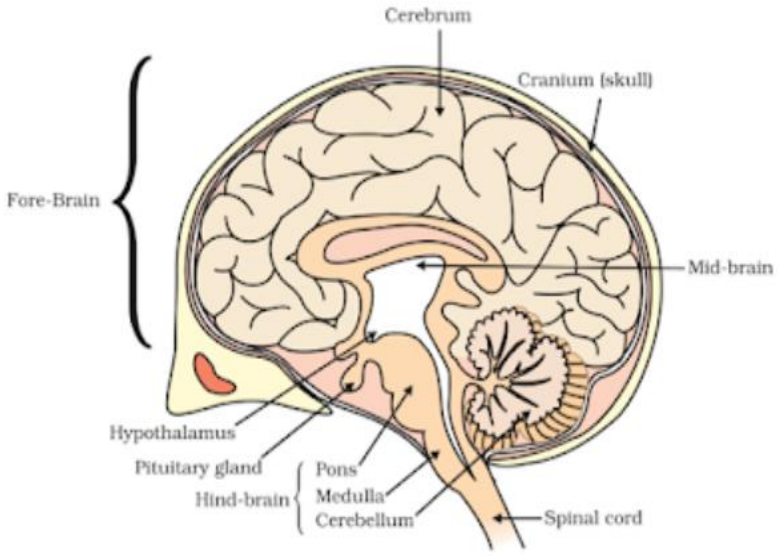
Central nervous system

Central nervous system consists of Brain and Spinal Cord.



Human Brain

→ Brain is the main coordinating centre of the body. It has three major parts:
(i) Fore-brain
(ii) Mid-brain
(iii) Hind-brain

Fore-brain

→ It is the most complex or specialised part of the brain. It consists of cerebrum.
→ Functions of Fore-brain:
(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.

Mid-brain

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

Hind-brain

It has three parts:
(i) Cerebellum : Controls posture and balance. Precision of voluntary actions. Example: picking pen.
(ii) Medulla : Controls involuntary actions. Example: blood pressure, salivation, vomiting.
(iii) Pons : Involuntary actions, regulation of respiration.

Protection of Brain and Spinal Cord

→ Protection of Brain: Brain is protected by a fluid filled balloon which acts as shock absorber and is enclosed in cranium (skull or brain box).
→ Protection of Spinal Cord: Spinal cord is enclosed in vertebral column.

Coordination between Nervous and Muscular Tissue

→ For taking place the voluntary actions, the brain has to send messages to muscles.
→ The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system consisting of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.
→ 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.

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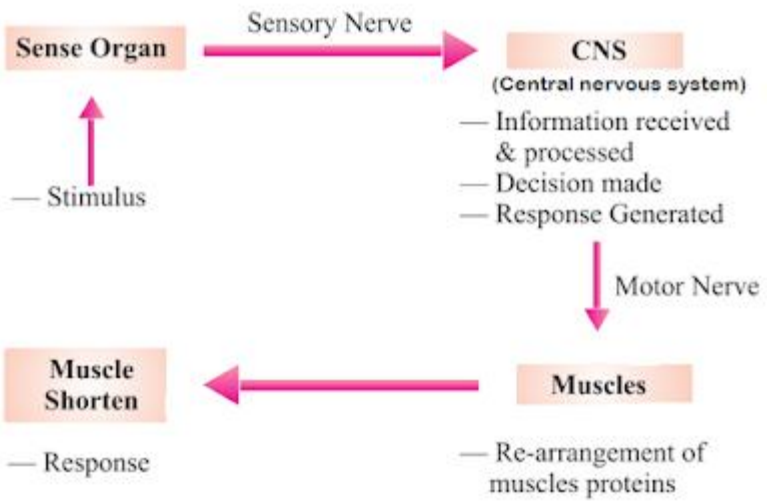
Limitations of Electric communication/Nervous system

(i) Electric impulse will reach only to those cells that are connected by nervous tissue.
(ii) 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.
(iii) Plants do not have any nervous system.



Chemical communication
→ It helps in overcoming the limitations of electric communication.

What are Glands?

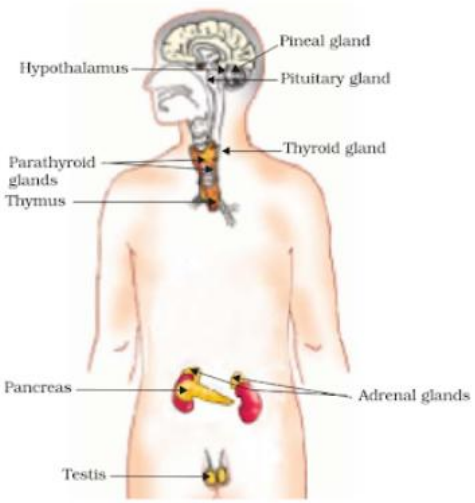
Glands are organs in our body which excrete a liquid substance (Hormones) having some different chemicals. Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.
Glands are of two types

Exocrine Glands

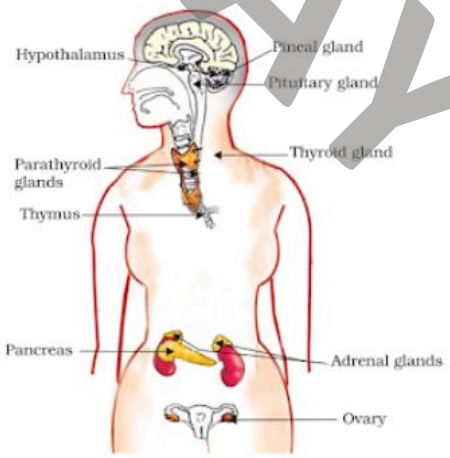
Glands that have ducts are called exocrine glands. The secretions of exocrine glands reach their target by travelling through a duct (tube). Some examples of exocrine glands are sweat glands and salivary glands.

Endocrine Glands

The endocrine glands do not have ducts to carry their product to a surface. They are called ductless glands. Hormones are the chemical substances produced by endocrine glands. These glands secrete their hormones directly into the blood vessels. Blood carries the secretion to different parts.
Thus Endocrine System Is the system of endocrine glands in our body which secretes chemical substances called **Hormones.** This system controls various activities of our body for example growth of body.



(a) Male



(b) Female

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Endocrine Gland	Hormone	Location	Function
Pineal Gland	Melatonin	Close to centre of brain	Regulates sleep cycle
Hypothalamus	Secrete many hormones	Below mid brain	-Controls pituitary gland. -Controls secretion of many other glands.
Pituitary Gland	Secrete many hormones for ex. Growth hormones, thyroid stimulating hormone etc.	Below hypothalamus in brain	-Growth hormones stimulate growth of muscles, bones. -Regulates secretion of many other glands.
Thyroid Gland	Thyroxine (Iodine is necessary for secretion of thyroxine).	Around wind pipe in neck	-Regulates metabolism of carbohydrates, fats & proteins.
Parathyroid Gland	Parathormone	On thyroid gland	Regulates the level of calcium & phosphate in body.
Thymus Gland	Thymus hormone	In upper part of chest between lungs.	Plays important role in development of immune system.
Adrenal Gland	Adrenaline	On top of kidneys.	-Secretes in small amount all the time. -But sometimes for extra energy, more adrenaline hormone is secreted by it. -It prepares the body for emergency situations, excitement and anger.
Pancreas	Insulin	Below stomach	Regulates the amount of sugar in blood.
Testes (in males)	Testosterone	In scrotum	Sperm production, development of sex organs during puberty.
Ovary (in females)	Oestrogen & Progesterone	In the pelvis	Egg production, development of sex organs during puberty.

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Importance of iodine

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

Diabetes is a disease in which blood sugar level increases.

Cause of Diabetes

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

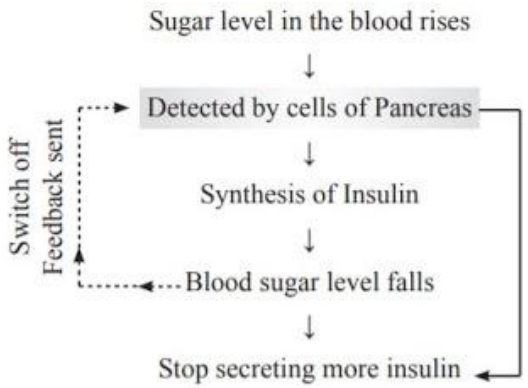
Treatment of Diabetes

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

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.

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



Control and Co-ordination in Plants: Movements in plants and plant harmones.

Co-ordination in Plants: Unlike animals, plants do not have a nervous system. Plants use chemical means for control and co-ordination. Many plant hormones are responsible for various kinds of movements in plants. Movements in plants can be divided into two main types :

1. Tropic movement
2. Nastic movement

1. Tropic Movement: The movements which are in a particular direction in relation to the stimulus are called tropic movements. Tropic movements happen as a result of growth of a plant part in a particular direction. There are four types of tropic movements.

(i) Geotropic movement: The growth in a plant part in response to the gravity is called geotropic movement. Roots usually show positive geotropic movement, i.e. they grow in the direction of the gravity. Stems usually show negative geotropic movement.

(ii) Phototropic Movement: The growth in a plant part in response to light is called phototropic movement. Stems usually show positive phototropic movement, while roots usually show negative phototropic movement. If a plant is kept in a container in which no sunlight reaches and a hole in the container allows some sunlight; the stem finally grows in the direction of the sunlight. This happens because of a higher rate of cell division in the part of stem which is away from the sunlight. As a result, the stem bends towards the light. The heightened

rate of cell division is attained by increased secretion of the plant hormone auxin in the which is away from sunlight.

(iii) Hydrotropic Movement: When roots grow in the soil, they usually grow towards the nearest source of water. This shows a positive hydrotropic movement.

(iv) Thigmotropic Movement: The growth in a plant part in response to touch is called thigmotropism movement. Such movements are seen in tendrils of climbers. The tendril grows in a way so as it can coil around a support. The differential rate of cell division in different parts of the tendril happens due to action of auxin.

(v) Chemotropism
Movement of plant or parts of plant in response to a chemical stimulus is called chemotropism. In positive chemotropism, movement is toward the chemical. In negative chemotropism, movement is away from the chemical.
Growth of pollen tube from pollen to ovary under the influence of chemical released by ovary is an example of chemotropism.

2. Nastic Movement: The movement which do not depend on the direction from the stimulus acts are called nastic movement. For example, when someone touches the leaves of mimosa, the leaves droop. The drooping is independent of the direction from which the leaves are touched. Such movements usually happen because of changing water balance in the cells. When leaves of mimosa are touched, the cells in the leaves lose- water and become flaccid, resulting in drooping of leaves.

Plant hormones: Plant hormones are chemical which help to co-ordinate growth, development and responses to the environment.
Type of plant hormones: Main plant hormones are

- Auxin: (Synthesized at shoot tip).
  Function: Helps in growth.
  Phototropism: more growth of cells towards the light.
- Gibberellin: Helps in the growth of the stem.
- Cytokinins: Promotes cell division.
- Abscisic acid: Inhibits growth, cause wilting of leaves. (Stress hormone)
- Ethylene hormone: ripening of fruits