Holy faith presentation school

CLASS: 10TH

SUBJECT: BIOLOGY

SESSION :-2024-25

UNIT-2ND

Contents:-

TOPIC: CONTROL AND COORDINATION

Coordination: -

Coordination is the process through which two or more organs interact and complement the functions of each other.

OR

Coordination is the working together of various organs (parts) of the body of an organism in a proper manner to produce proper reaction to a stimulus.

The coordination is under some control and for proper control and coordination i.e.

1. Neural (nervous) control and coordination.
2. Hormonal (endocrine) control and coordination.

Plants have only Hormonal control and coordination while as animals have both.

CONTROL AND COORDINATION IN ANIMALS:

1) ● Neural control and coordination: -

The neural control system of highly specialized called neurons. The neurons detect and receive information from different sense organs (receptors) in the form of stimuli and transmit the stimuli to central neural system (CNS) through sensory nerve fibres.

Neuron: - (Nerve cell). A neuron is a structural and functional unit of neural tissue and hence the neural system. Human neural system has about 100 billion neurons. Majority of neurons occur in brain. Fully formed neurons never divide.

Structure of neuron: - A neuron consists of main cell body and cytoplasmic processes arising from it. We can simply divide neuron into three prominent parts:

(i) Cell body: (= cyton or soma). It varies in size and form. It may be up to 13.5 um in diameter and may be irregular, spherical, oval, rounded, star-shaped or pyramidal. Like a typical cell it consists of cytoplasm, called neuroplasm, nucleus and cell membrane. The cytoplasm has mitochondria, Golgi apparatus, RER, ribosomes, lysosomes, fat globules, pigment granules, neurofibrils, neurotubules and Nissil' s granules. Neurofibrils play a role in the transmission of impulses. Neuro- tubules are in fact, microtubules which maintain shape of neuron and the nissl' s granules probably synthesize proteins for the cell.

(ii) Dendrites: Dendrites and axon are basically the processes of neurons and are called neuritis.

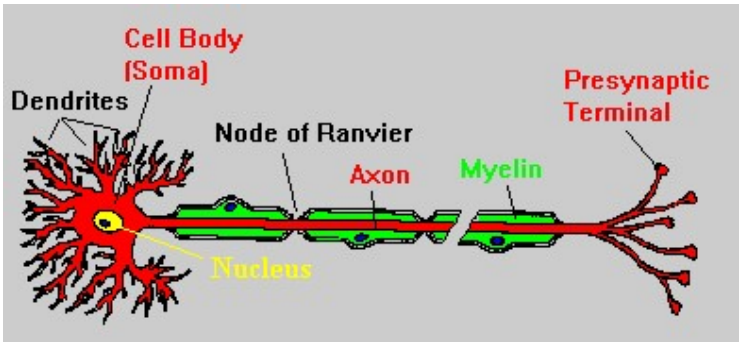
The dendrites are usually shorter, tapering and much branched processes. They may be one to several. The dendrites contain neurofibrils, neurotubules and nissl' s granules. They conduct nerve impulse towards the cell body and are called afferent processes (=receiving processes).

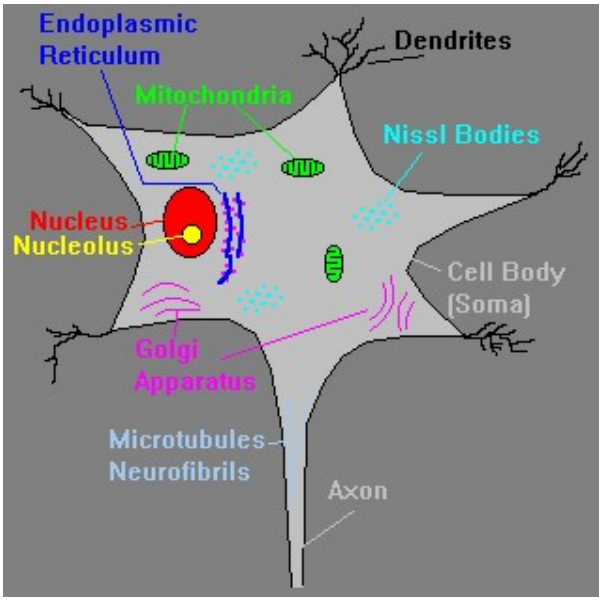
(iii) Axon: Axon is a single, long process of uniform thickness. The part of cyton from where the axon arises is called Axon Hillock. Most sensitive part of neuron is axon hillock. The axon contains neurofibrils; neurotubules but doesnot have nissl' s granules, the axon depends on cell body for the supply of proteins. The axon ends in a group of branches, the terminal arborizations.

When terminal arborizations meet the dendrites of another neuron to form a synapse they form synaptic knob (=end plates).

The axon conducts nerve impulse away from the cell body, therefore, called an efferent process.

The cell membrane of axon is called axolemma and its cytoplasm as axoplasm. Axon is covered with sheaths called nerve fibres. Nerve fibres may be myelinated or non-myelinated fibres. Myelinated fibres conduct impulse more efficiently than non-myelinated. At intervals, myelinated fibres possess unmyelinated areas called node of Ranvier.





TYPES OF NEURONS

The neurons are of three types: -

(i) Sensory (receptor) neuron. These often occur in sense organs and receive stimuli by their dendrites. The sensory neuron transmits stimuli or impulse towards CNS (brain and spinal cord) through their axons.

(ii) Motor (effector) neurons. The dendrites of these neurons synapse with axons of sensory neutrons in CNS. They transmit impulses from CNS towards muscles or glands.

(iii) Relaying (connector) neuron. These occur in CNS. These serve links between sensory and motor neurons for distant transmission of nerve impulses.

REFLEX ACTIONS;

It may be defined as a spontaneous, automatic and mechanical response to a stimulus, acting on a specific receptor without the will of an animal.

Examples: - Blinking of eyes, movement of diaphragm during respiration, with drawl of hand or foot every time it suddenly prickled with a needle or touched by a hot object.

Reflex actions generally involve spinal cord for quick response to specific stimulus. However, information input also goes on to reach the brain where thinking process occurs.

INVOLUNTARY ACTIONS;

Involuntary muscular actions are performed by the animal without its will. These occur automatically and the animal has no choice in it.

Examples: - Regular beating of heart, blood pressure, salivation, vomiting etc.

VOLUNTARY;

Voluntary muscular actions are performed by the animal with its will.

Examples: - Walking, riding a bicycle, writing, reading etc.

HUMAN NERVOUS SYSTEM

Human nervous system is the most complex and is divided into two main parts.
(i) Central nervous system and
(ii) Peripheral nervous system.

(I) CENTRAL NERVOUS SYSTEM;

It comprises of brain and spinal cord.

(A) BRAIN (ENCEPHALON)

Brain is the anterior most part of the central nervous system (CNS) which is lodged in the cranial cavity (cranium) of the skull. The human brain weighs from 1200-1400 grams. The human neural system has about 100 billion neurons and majority, 98%, of them occur in brain.

The brain is covered by three membranes. The innermost membrane, the piameter is thin; the middle membrane is arachnoid membrane and the outermost membrane is called durameter [PAD-‘ P’ stands for piameter; ‘ A’ stands for arachnoid and ‘ D’ stands for durameter]. Between the piameter and arachnoid membrane is a space known as sub-arachnoid space. The space between the arachnoid and durameter is called subdural space. The sub-arachnoid space is filled with cerebro-spinal fluid (CSF). This fluid serves as a pad to cushion the central nervous system from shocks.

The human brain is divided into three parts.

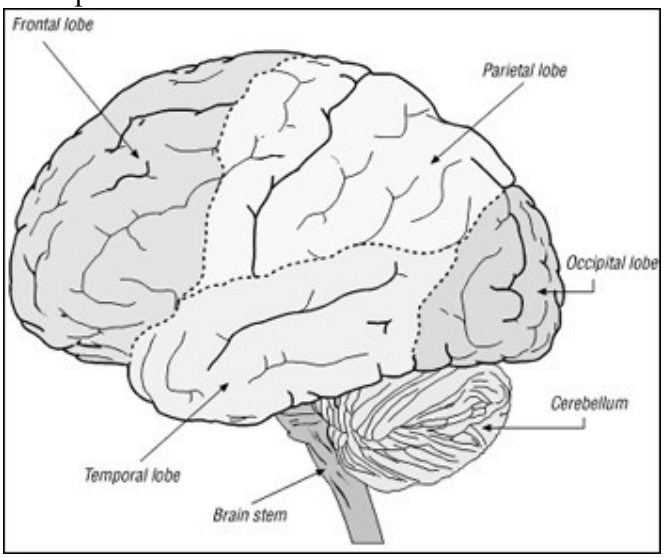
1. Fore Brain: - It is also called Prosencephalon and includes olfactory lobes, cerebrum and diencephalons.

(i) Olfactory lobes: - The anterior part of the brain is formed by a pair of short club-shaped structures, the olfactory lobes. Each lobe consists of two parts, an anterior olfactory bulb and a posterior olfactory tract.

Olfactory lobes are concerned with the sense of smell.

(ii) Cerebrum: - It is the largest part of the brain. It consists of right and left hemispheres connected by a large bundle of myelinated fibres corpus callosum and other smaller fibres bundles. Anteriorly the corpus callosum curves ventrally to form splenium.

A very deep fissure, the longitudinal fissure, separates the two cerebral hemispheres. Each cerebral hemisphere of cerebrum is divided into four lobes:



(a) Frontal lobe: - Major functions are: - inner monitoring of complex thoughts and actions, creative idea, speech, facial muscular activities as well ability to abstract etc.

(b) Parietal lobe: - perception of touch, pain, heat and cold. It is the region of conscious association.

(c) Temporal lobe: - It is concerned with language comprehension, smell, memory or it is the region for auditory reception.

(d) Occipital lobe: - decoding of visual information, shape and color. It is the region of visual reception (sight).

(iii) Diencephalon: - Its main parts are epithalamus (roof), thalamus (sides) and hypothalamus (floor). Hypophysis (pituitary gland0 is directly attached to the hypothalamus by a stalk the infundibulum.

2. Mid Brain: - It is also called Mesencephalon and includes corpora quadrigemia and crura cerebri (cerebral peduncles).

(i) Corpora quadrigemia: - The upper or superior surface of the mid brain has two pairs of rounded protrusions called the corpora quadrigemia. One pair is called superior colliculi (concerned with sense of sight) and the other is called inferior colliculi (concerned with sense of hearing).

(ii) Cerebral peduncles: - These are two bundles of fibres which lie on the lower or inferior surface of mid brain; they relay impulse between the cerebrum, cerebellum, pons varolii and medulla.

3. Hind Brain: - It is also called Rhombencephalon and consists of cerebellum, pons varolii and medulla oblongata.

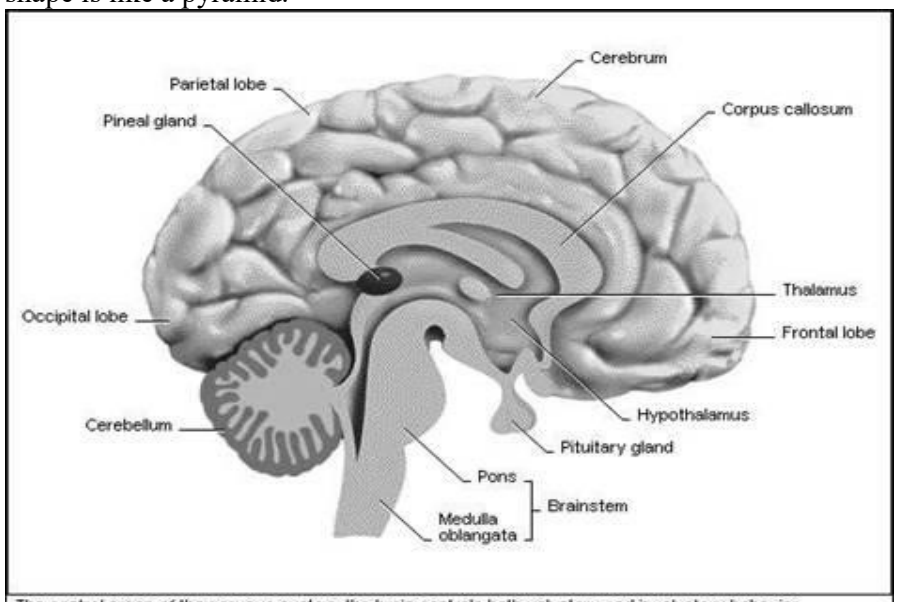
(i) Cerebellum: - The second largest part of the brain is the cerebellum (little cerebrum). It consists of lateral cerebellar hemispheres and central worm-shaped part, the vermis.

The cerebellum controls rapid muscular activities, such as running, typing and even talking. All activities of the cerebellum are involuntary, but may involve learning in their early stages.

(ii) Pons varolii: - It is situated in front of the cerebellum below the mid brain and above the medulla oblongata.

It relays impulses between the medulla oblongata and more superior part of brain, between the hemispheres of the cerebellum and between the cerebrum and cerebellum.

(iii) Medulla oblongata: - Medulla oblongata receives and integrates signals from spinal cord and sends it to cerebellum. It extends from pons varolii above and is continuous with the spinal cord below. Its shape is like a pyramid.



The central organ of the nervous system, the brain controls both voluntary and involuntary behavior.
Alexander and Turner Illustration

(B) SPINAL CORD

It is a posterior part of CNS which runs mid-dorsally within the vertebral column. It lies in the neural canal of vertebral column. It is a cylindrical structure and is about 45cm long. It begins in continuation with the medulla oblongata of brain and extends down wards upto early part of lumbar region. It ends as the conus medullaris and is enclosed within vertebral column. It is surrounded by the three protective membranes (meninges) as found in brain, viz. a thin innermost piameter, the middle webby arachnoid membrane and outer tough durameter. The sub arachnoid space is filled with CSF. There is an additional space, the epidural space above the durameter. The epidural space contains fatty and connective tissues and veins.

Spinal cord performs two main functions;
(i) The stimuli are passed from and to the brain through the spinal cord.
(ii) It is the centre of spinal reflex action.

(II) PERIPHERAL NEURAL SYSTEM;

It connects CNS with different parts of body.
-Voluntary peripheral nervous system is concerned with the actions which are under the control of will. The nerves of voluntary peripheral nervous system arise directly from CNS connecting different body parts for voluntary control of brain.
-Involuntary peripheral nervous system (it is also called autonomic nervous system. It is not under the control cranial and spinal nerves.
The spinal nerves are the nerves arising from spinal cord and the nerves arising from brain are called cranial nerves. The cranial nerves are 12 pairs and spinal nerves are 31 pairs. The spinal nerves are collectively called cauda equine or horse' s tail.
The visceral nerves are those nerves which control the activities of internal organs such as heart, kidney, lungs, urinary bladder etc. So, it forms the autonomic nervous system.
[For names of cranial nerves refer to class lecture].
Cranial nerves I, II and VIII are sensory nerves; cranial III, IV, VI, XI and XII are motor nerves and cranial nerves V, VII, IX and X are mixed nerves (containing both sensory and motor nerve fibres).
All spinal nerves are mixed nerves
[For autonomic nervous system i.e. sympathetic and parasympathetic refer to class lecture]

2) ● Chemical control and coordination:

In the chemical coordination the chemicals are released by some stimulated cells into the blood and these chemicals are called hormones. The hormones are secreted by various endocrine glands (ductless glands). The term hormone was introduced by William M. Baylis and Ernest H Starling in 1902. The tissues or organs secreting hormones are called endocrine tissues and endocrine organs. Hormones have low molecular weight and are effective in low concentration.
The secretion of hormones is controlled by the anterior lobe of pituitary gland located at the base of brain.
Hormones are chemical messengers secreted by ductless endocrine glands that regulate biological processes in living organisms.
Hormones are released in blood and action on specific organ that becomes its target organ/target cell/ target site.

HUMAN ENDOCRINE SYSTEM

The father of endocrinology is Thomas Addison.

1. HYPOTHALAMUS:

It is situated at the base of brain and is composed of nervous tissue, lies below the thalamus. It is known as ' control centre' / ' supreme commander' of endocrine regulation.
The hormones of the hypothalamus influence the functioning of pituitary gland.
It secretes releasing and inhibiting factors which in turn affect the releasing and inhibiting of pituitary hormones.

2. PITUITARY GLAND:

It is located below the brain i.e. below hypothalamus. It is known as Master endocrine gland. It has three lobes: Anterior lobe, Intermediate lobe and Posterior lobe.

(A) Hormones of anterior lobe of pituitary gland:

(i) Growth hormone (GH)/ (somatotropin; STH):
It increases rate of protein synthesis and cell division thus stimulates growth and development of tissues. Its deficiency leads to dwarfism and deficiency in child leads to midget.

The excess secretion of growth hormone from childhood leads to gigantism and after adolescence it leads to acromegaly.
Target cells: - cells undergoing growth.

(ii) Prolactin hormone (PH) or leuteotrophic hormone (LTH) or mammotropin hormone (MTH):
It stimulates the growth of milk glands during pregnancy and secretion of milk after delivery of child.
Target cells: - cells of mammary glands.
(iii) Thyroid stimulating hormone (TSH) or Thyrotropin:
This hormone controls the growth and activity of thyroid gland. It influences the uptake of iodine, the synthesis of the hormones: T_3 and T_4 by the thyroid gland.
Target cells: - cells of thyroid.

(iv) Adrenocorticotrophic hormone (ACTH): - This hormone stimulates the cortex of the adrenal gland to produce its hormones. The amount of ACTH secreted depends upon the concentration of the hormones in the blood from the adrenal cortex and on stimulation of the pituitary gland by the hypothalamus.
In mammals its action is limited to the areas called Zona reticularis and Zona fasciculata of the adrenal cortex.
Target cells: - cells of adrenal cortex.

(v) Follicle stimulating hormone (FSH): - It stimulates growth of ovarian follicles and their secretion of oestrogens in the female and spermatogenesis (formation of sperms) in the male.
Target cells: - cells of gonads (testes and ovaries).

(vi) Leutinising hormone (LH)/ Interstitial cell stimulating hormone (ICSH):
In female it stimulates the corpus luteum of the ovary to secrete progesterone. In males it activates the leydig' s cells of the testes to secrete androgens.
Target cells: - cells of gonads.

(B) Hormones of the intermediate lobe: -

The intermediate lobe of the pituitary gland secretes a hormone named melanocyte stimulating hormone (MSH). This hormone stimulates the synthesis of black pigment melanin in the skin so helps in pigmentation.
Target cells: - Melanocytes in skin.

(C) Hormones of the posterior lobe: -

The secretion of the posterior lobe is called pituitrin and it contains two hormones: -
(i) Oxytocin (OT)/Birth hormone/ Milk ejecting hormone: -
Oxytocin promotes contraction of the uterine muscle and contraction of the cells of the lactating breasts, squeezing milk into the large ducts behind the nipple.
Target cells: - cells of mammary glands.

(ii) Vasopressin/ Pitressin/ Antidiuretic hormone (ADH): -
This hormone has two main functions (a) Antidiuretic effect. It increases the reabsorption of water in the distal convoluted tubule, collecting tubules and collecting ducts of the nephrons of the kidneys. (b) Pressure effect. Involuntary muscles in the walls of the walls of the intestine, gallbladder, urinary bladder and blood vessels are stimulated to contract by ADH. It regulates blood pressure.
Its deficiency leads to diabetes insipidus (Drinker' s disease). Deficiency of ADH reduces reabsorption of H_2O and increase urine output thus causing excessive thirst and is known as drinker' s disease.
Target cells: - cells of kidney.

3. THYROID GLAND:

It is the largest endocrine gland located anterior to the thyroid cartilage of the larynx in the neck. The gland is well supplied with blood vessels and is bilobed organ. The hormones of the thyroid gland are: -

(i) Thymine (T4) and Tri-iodothyronine (T3): -
T4 and T3 contain 4 and 3 iodine atoms respectively, therefore, they are named so. T3 is secreted in smaller amount but is more active.
The functions of T3 and T4 are: -
1. Stimulate protein synthesis.
2. Regulate development of mental faculties.
3. Maintain body temperature.
4. Increase action of adrenaline and non-adrenaline.
5. Regulate metabolic rate of body and thus maintain basal metabolic rate (BMR).

(ii) Calcitonin: - It is secreted when calcium level is high in the blood (hyper calcemia).
It lowers Ca level by suppressing release of calcium ions from the bones.

4. PARATHYROID GLAND:

The cells of parathyroid gland are of two types: - Chief cells or principal cells and large oxyphil cells (or eosinophils cells).
The chief cells are the secretory cells which produce or secrete **parathyroid hormone (PTH) or parathormone or collip' s hormone** after the name of the discoverer.
It metabolizes the release of calcium into the blood from the bones. It increases calcium absorption from the intestines and increases calcium reabsorption from the nephrons (and inhibits phosphate reabsorption) of the kidneys.
The PTH regulates the metabolism of calcium and phosphate.
The functions of oxyphil cells are unknown.
Deficiency of PTH leads to hypoparathyroidism which leads to parathyroid tetany (decrease in Ca level in blood plasma which increases phosphorus level)
Excess of PTH leads to hyperparathyroidism which leads Osteitis Fibrosa Cystica or Osteoporosis or also called as " hungry bone syndrome" (Excess of calcium from bones forming cavities in interior and bones become hungry for calcium), it leads to formation of stones in kidney and ureters causing renal insufficiency.

5. PANCREATIC HORMONES:

Group of cells secreting different hormones are called islets of langerhans or pancreatic islets. Pancreatic islets lie below the stomach in the loop of duodenum. It is a heterocrine gland.
Islets of langerhans are five types of cells that secrete hormones and are as under: -
(i) α- cells: - Produce Glucagon (anti-insulin hormone). It increases the concentration of glucose in blood stream thus promoting glyconeogenesis (formation of glucose from non-sugars) and glycogenolysis (formation of glucose from glycogen).

(ii) β-cells: - Secrete Insulin. Insulin promotes protein synthesis in tissue from amino acids. It increases the synthesis of fat in adipose tissue from fatty acids. It also reduces the catabolism of proteins, the breakdown and oxidation of fat.

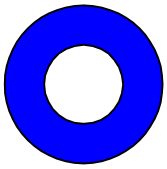
(iii) γ-cells: - Secrete Gastrin. Gastrin stimulates secretion of gastric acid (HCl) in stomach.

(iv) δ-cells: - Secrete Somatostatin. Somatostatin inhibits glucagons and somatotropin releases and suppresses the release of other hormones from pancreas.

(v) ғ-cells: - Produce Pancreatic polypeptide. It increases glycogenolysis (glycogen→ glucose) and regulates gastrointestinal activity.

6. ADRENAL GLANDS:

These are paired structures located on the top of the kidneys. Each adrenal gland has two parts external adrenal cortex and internal adrenal medulla.



The blue colored portion represents the adrenal cortex and the internal middle or interior portion represents the adrenal medulla.

(A) Adrenal medullary hormones: -

(i) Epinephrine (adrenaline): - It is secreted at the time of emergency. Hence it is also called emergency hormone and due to it the adrenal gland is also called emergency gland. Epinephrine is secreted at the time of fight, flight and fright. So, the adrenal gland is also known as Triple F gland.

(ii) Non epinephrine: - It regulates blood pressure under normal condition.

(B)Adrenal cortical hormones: -

The adrenal cortex is subdivided into three zones:

(i) Zona Glomerulosa: - This is the outer zone. It constitutes 15% of the gland. The cells of this zone secrete mainly " Mineralocorticoids" . They help in mineral metabolism and regulate salt and potassium ratio in the body. It includes the main hormone Aldosterone which is 90-95% of mineralocorticoid in humans.

(ii) Zona Fasciculata: - This is the middle zone and constitutes 50% of the gland. The cells of this zone secrete " glucocorticoids" .

Glucocorticoids affect metabolism of proteins and fats. They have anti-inflammatory and anti-allergic affects. It includes three main hormones cortisol (95%), corticosterone and cortisone.

(iii) Zona reticularis: - This is the inner zone that constitutes about 7% of the gland. The cells of this zone secrete gonadocorticoids (sex corticoids). Male hormones secreted by this are androgens female sex hormones are called oestrogens.

[For diseases of adrenal cortex i.e. Addison' s disease, refer class lecture]

7. PINEAL GLAND:

The pineal gland is located between the cerebral hemisphere, where it protrudes from the roof of the third ventricle. It secretes one hormone, melatonin, also called ' sleeping hormone' , because it promotes sleep.

Melatonin regulates working of gonads in certain animals.

8. THYMUS GLAND:

It is situated in the upper chest near the front side of the heart. It is soft, pinkish, bilobed structure and is a prominent gland in the young child. It secretes Thymosin hormone which stimulates the development and differentiation of lymphocytes and there by increasing resistance to infection.

9. HORMONES OF THE REPRODUCTIVE SYSTEM:

(a) Male sex hormones: - Hormone produced by testes is androgen. It is produced by leydig' s cells or interstitial cells of the testes. Two common hormones are: - Testosterone and androsterone.

Testosterone serves the following functions: -

(i) It stimulates the growth and development of male accessory glands, e.g. prostate, penis etc.

(ii) It stimulates formation of sperms.

(iii) It stimulates the development of secondary sexual characters in males at puberty e.g. moustache, beard, hair on the body, broadening of shoulders etc.

(b) Female sex hormones: - Hormones produced by ovaries. They secrete three female sex hormones.

(i) Estrogen: - Under influence of FSH, it is secreted by growing ovarian follicles. It serves following functions:

* It stimulates the formation of ova.

* It stimulates the development of accessory sex characters such as enlargement of breasts during puberty, broadening of pelvis, onset of menstrual cycle etc.

(ii) Progesterone: - Secreted by corpus luteum under influence of LH and HCG (Human Chorionic Gonadotropin). It plays the following roles:-
* Maintenance of pregnancy by suspending ovulation.
* Stimulates thickening of uterine epithelium during menstrual cycle.
(iii) Relaxin: - It is a proteinacious hormone secreted by corpus luteum towards the closure of gestation period for softening and relaxing of uterus for decreasing comfort of carriage and early child birth.

CONTROL AND COORDINATION IN PLANTS:

Control and coordination in plants is under hormones only or, in other words, plants coordinate their responses against environmental stimuli by using hormones. Plants thus possess only chemical coordination.

PLANT MOVEMENTS:

Plants movements are very slow. Plant movements are largely brought about by some definite internal and external stimuli. They are caused due the pigment known as **phytochrome.**

Classification of induced plant movement

Induced plant movements are broadly classified into two types: Nastic movements and Tropic movements.
Difference between tropic and nastic movements;

S.No.	Tropic movement	Nastic movement
1.	These are plant movements of curvature caused by unilateral growth i.e. one side of an organ grows faster than the other causing curvature.	These are also caused by more growth on one side and less growth on other side. But these movements can also be caused by reversible changes.
2.	Tropic movements are paratonic i.e. caused by external stimulus such as light, gravity, water and temperature.	Nastic movements may be autonomic or paratonic variation movements e.g. photonasty, seismonasty, chemonasty etc.
3.	Direction of response is related to the direction of stimulus e.g. stem apex bends towards the direction of light.	The direction of response is determined by the organ, not by stimulus. E.g. the opening and closing of flowers result with the changes of light intensity all round.

1) Nastic movements: - These are non-directional induced variation movements that occur due to turgor changes. These reveal immediate response to stimulus but do not involve growth. Nastic movements include: -
(i) Seismonastic movement/ Thigmonastic/ Haptonastic movements: - It is the shock movement in response to the stimulus of touch or it is a nastic movement due to touch. It is best seen in tentacles of drosera, leaf of Mimosa Pudica (touch me not).
(ii) Nyctinastic movements: - It is the movement of plant organs in response to day and light. It is also known as sleep movement. If the movement is induced by changes in light intensity, it is called photonastic e.g. dandelion and if by changes in temperature, it is called thermonastic movement.

2. Tropic movements: - It is also known as tropism. It is the movement of curvature brought about by more growth on one side and less growth on other (opposite) side of plant organ induced by external stimuli. They are of following types depending upon the nature of stimuli.
If the movement of the plant part is towards the stimulus, it is termed as positive (+ve) tropism. If the movement of the plant part is away from the stimulus, it is termed as negative (– ve) tropism

(i) Phototropism: - It refers to the movement of plant organs in response to the direction of light. E.g. shoot or stem of a growing plant towards light is positively phototropic while as roots growing away from light (in soil) is negatively phototropic.

(ii) Geotropism: - It is the movement of plant organs under the influence of gravity. It is also called Gravitotropism, e.g. Roots of a plant move downward in the soil in the direction of gravity, show positive geotropism while as stem shows movement away or against the gravity thus shows negative geotropism.

(iii) Chemotropism: - It is the direction of plant part in response to chemicals e.g. during the process of fertilization, growth of pollen tube towards the ovule in the ovary is positive chemotropism.

(iv) Hydrotropism: - It is the movement of plant organ in response to moisture or water example bending of roots of the plant towards water signifies positive hydrotropism.

(v) Thigmotropism: - It is the movement of the plant organ in response to the stimulus of touch. It is also known as haptotropism, example. The response is generally positive in stem of climbers and in tendrils causing them to twin round the support.

SOME IMPORTANT TERMS:

Apical dominance: - Auxin promotes cell elongation. If auxins are present in the shoot apex, there occurs suppression of lateral bud growth. This is called apical dominance.

Parthenocarpic: - If a fruit is developed without seed, without fertilization, it is called Parthenocarpic.

Seed dormancy: - The dormancy may be defined as the condition of viable seed when it fails to germinate even though the environmental conditions, usually considered favourable for active growth, are present.

Senescence: - As the young plant grows, it undergoes ageing and develops into mature plant in an orderly fashion. The later part of the development process which ultimately leads to death is called senescence.

Abscission layer: - shedding of mature leaves from the stem or ripe fruits from the stem is called abscission. Generally a layer of tissue is formed at the base of the organ. This layer of tissue is called abscission zone or abscission layer.

PLANT HORMONES / PHYTO HORMONES

They are also known as growth hormones or growth regulators. Growth hormones are defined as organic substances which are synthesized in minute quantities in one part of the plant body and transported to another part where they influence specific physiological processes (Went and Thiemann 1937). A group of plant hormones including auxins, gibberellins, cytokinins, ethylene and abscissic acid are presently known to regulate growth.

Growth promoting phyto hormones or growth promoters: -

1. Auxin: - The existence of first growth hormone came from the work of Darwin (1881). Darwin and his son while working on canary grass observed auxins responsible for phototropism of plant shoot/ stem.

Functions:

* Auxins are well known to promote elongation of stem and longitudinal growth.
* Auxin is responsible for initiation and promotion of cell division in cambium.
* Promote root growth only at low concentration (extremely low concentration). At higher concentrations, they always inhibit root growth.
* Auxin promotes apical dominance.
* It prevents abscission layer.
* Auxins are well known to induce parthenocarpy.
* Many synthetic auxins, such as 2, 4-D (2,4- trichlorophenoxy acetic acid) etc are used as selective herbicides.
* Auxins generally inhibit the flowering but in pine apple, spraying of certain auxins initiates uniform flowering in the whole crop.
* Auxin regulates some of the important plant growth movements' viz. phototropism and geotropism.

2. Gibberellins: - Gibberellins were discovered by a Japanese plant pathologist Kurosawa in 1926, while working in the rice fields, Kurosawa observed that some rice seedlings grew much taller than the others and such plants were found to be infected by a fungus " Gibberella Fujikuroi" . The disease was

known as " Bakanae disease" (Bakanae in Japanese means foolish). The seedlings grew foolishly so tall that they ultimately resulted into death of the plants.
Later Yabuta and Sumiki isolated the crystalline form of fungi and named it gibberellic acid.

Functions:

* Gibberellins produce extra ordinary elongation of stems and leaf sheaths in intact plants.
* One of the most striking effect of the gibberellins is the reversal of dwarfism in many genetically dwarf plants.
* Induces parthenocarpy.
* Stimulates cell division in cambium.
* some of the light sensitive seeds (barley etc) can germinate with the treatment of gibberellic acid.
* They also have been shown to break the dormancy.
* Formation of male flowers on genetically female plants, example, Cannabis.

3. Cytokinins: - The cytokinins are plant growth substances which act primarily on cell division and have little or no effect on extension growth.

It was first isolated by Miller, Skoog and their collaborators at Wisconsin university, USA in 1995 while working on tobacco pith culture and wanted to grow it indefinitely.

Functions:

* Promotes cell division.
* Causes the enlargement of cells.
* Counteraction of apical dominance i.e. cytokinins promote the growth of lateral buds even if the apical bud is intact.
* Cytokinins can break dormancy of many seeds and also promotes their germination.
* Delay senescence.

Growth inhibiting phyto hormones or growth inhibitors:

4. Ethylene: - Ethylene ($CH_2=CH_2$) is a natural product of ripening of fruits (Gane, 1934).

Functions:

* Prevents elongation of stem and roots in longitudinal direction.
* Chadwick and Burg (1967) proposed that inhibition of elongation growth due to ethylene is responsible for positive geotropic bending of roots.
* Inhibits the growth of lateral buds thus causes apical dominance.
* Fruit growth and ripening is stimulated by ethylene in some plants.
* Stimulates abscission.
* Induces flowering in pine apple, mango etc.
* Stimulates rooting of cuttings, initiation of lateral roots and growth of root hair.
* Breaks seed dormancy.
* Promote senescence.
* Plays a major role in determining sex of monoecious flowers.
* Inhibits auxin synthesis and transport.

5. Abscisic Acid: - (ABA) Carns and Addicott (1963), while working on the physiological studies of the shedding of cotton balls, found that the chemical substance Abscisin II is responsible for their shedding.

Functions:

* Abscisic acid acts as a growth inhibitor and induces bud dormancy in a variety of plants.
* ABA also inhibits gibberellin stimulated growth.
* ABA inhibits seed development and germination.
* ABA is responsible for abscission.
* ABA stimulates positive geotropic responses by acting as inhibitor.
* Causes closure of stomata.
* ABA promotes senescence in leaves by causing loss of chlorophyll.
* It initiates resistance of plants to cold.