CLASS 10TH NOTES ON CONTROL AND CO-ORDINATION NERVOUS SYSTEM

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

(I) NERVOUS SYSTEM

→ Nervous or the nerve tissue is the main tissue of our nervous system. It monitors and regulates the functions of the body.
→ Nervous tissue consists of two cells: nerve cells or neurons and glial cells, which helps transmit nerve impulses and also provides nutrients to neurons.
→ Brain, Spinal Cord, and nerves are composed of nervous tissue, they are specialized for being stimulated to transmit stimulus from one to another part of the body rapidly.

FUNCTIONS:

→ They transmit information from body parts to brain.
→ They transmit orders from brain to body parts.
→ Nervous and muscular tissue together control body movement in all animals.
→ The main function of nervous tissue is to receive stimuli and send signals to the brain and spinal cord.
→ These signals are sent to the muscles via the nerves.

STIMULUS:

It is observable or detectable change in the external or internal environment to which an organism reacts.

HOW DO WE REACT TO STIMULI?

→ This is because of the nervous tissues present in our body. They are capable of transmitting information quickly from the brain to different parts of the body and vice-versa.
→ Therefore, nervous tissues are found in nerves, brain, and spinal cord.
→ The Nervous tissue is made up of cells called the Nerve Cells or Neurons.
→ These neurons connect together to form the nerves of our body.

RECEPTORS

→ These are specialized tips of some nerve cells that detect the information from the environment.
→ These are located in our sense organs
→ Receptors are the specialized tips of the nerve fibres that collect the information to be conducted by the nerves.
→ Receptors are in the sense organs of the animals.
→ The five sense organs in our body, eyes, ears, nose, tongue and skin are called receptors and these organs functions by receiving information from the environment around us.
→ Therefore, the response and coordination in both humans and animals involve the sense organs, the nervous system and hormones.
→ These are classified as follows :

(I) PHONO-RECEPTORS:

These are present in inner ear.

FUNCTIONS:

The main functions are hearing and balance of the body.

(II) PHOTO-RECEPTORS:

→ These are present in the eye.
FUNCTION: These are responsible for visual stimulus.

(III) THERMO-RECEPTORS:

→ These are present in skin.
FUNCTIONS: These receptors are responsible for pain, touch and heat stimuli. These receptors are also known as thermoreceptors.

(IV) OLFACTORY-RECEPTORS:

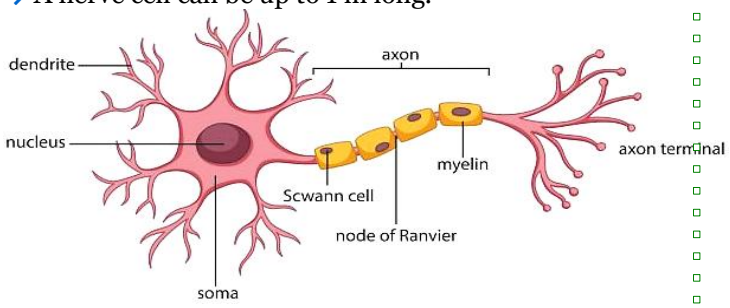
→ These are present in nose.
FUNCTIONS These receptors receive smell.
(V) GUSTATORY-RECEPTORS: These are present in the tongue.
FUNCTIONS: These helps in taste detection.

NEURON: -

→ Neuron is a highly specialized cell which is responsible for the transmission of nerve impulses.
→ It is the structural and functional unit of nervous system.

STRUCTURE OF A NEURON

→ It is an elongated cell with a Cell Body that consists of some branch-like structure called Dendrites.
→ There is a Nucleus present in the center of the cell body.
→ The Nerve Endings of the cell are connected with the cell body via Axon.
→ A nerve cell can be up to 1 m long.



1. DENDRITES

→ They are tree-like extensions (highly-branched) at the beginning of a neuron.
→ They increase the surface area of the neuron.
→ They receive chemical signals from different neurons of the body.
→ They then convert these chemical signals into electrical signals and pass them to the neuron cell body.
→ A neuron can have a single dendrite or multiple dendrites

2. CELL BODY

→ Also called **Soma.**

→ The main function of the cell body and nucleus of the neuron is to maintain the functionality of the cell.

→ It does not play an active role in the transmission of the signal.

→ It produces proteins that are required by different parts of the neuron to work properly.

→ It contains different cell organelles such as mitochondria, Golgi apparatus etc that perform various functions of the cell.

3. AXON

→ Neurons have one axon in general.

→ It is a long structure that connects the cell body to the terminals and it also connects with other neurons, cells and organs of the body through nerve terminals.

→ It allows in fast transmission of signals. The larger the diameter of the axon the faster it will transmit signals.

→ It is covered with a special insulating substance called myelin. It helps in rapid transmission of signals.

4. SCHWANN CELLS

→ The Myelin sheath that covers the axon is produced by Schwann cells.

→ The Myelin sheath keeps the signal intact

TYPES OF NERVES

01. MOTOR NERVES

→ Motor neurons or motor nerves are responsible to send signals or impulses all the way from spinal cord and brain to all the muscles of the body.

→ The impulse enables humans to carry out basic activities such as talking, walking, drinking water, blinking eyes, sitting, sleeping, etc.

→ Damage to the motor neurons can cause muscle weakness or shrinking of the muscles.

→ The nerve that passes from the lower back to the buttocks is known as the sciatic nerve.

02. SENSORY NERVES

→ The sensory nerves or sensory neurons are responsible to generate impulses or signals in the contrasting directions from another type of nerves known as the motor neurons.

→ The sense neurons gather information such as pressure, pain, temperature, etc from the sensors that are present in the muscles, skin and other internal organs which in turn redirect it back to the brain and spinal cord.

→ Damage to the sensory nerves can cause numbness, pain, tingling sensation and hypersensitivity.

03. AUTONOMIC NERVES

→ The autonomic nerves system controls the actions of the muscles of the heart, such smooth muscles located in the stomach and in the interlining of glands and other organs.

→ The autonomic nerves regulate the functions that are not under control, i.e., involuntary.

→ There are two functional divisions in the autonomic nervous system, namely:

01. The sympathetic nervous system –

Responsible for the heart rate to speed up and related flight or fight responses

02. The parasympathetic nervous system –

Controls activities such as excretion, digestion, and related metabolic actions.

04. 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.

05. 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.

06. 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.

REFLEX ACTION: -

→ Reflex action is quick, sudden and immediate response of the body to a stimulus. Example: Knee jerk, withdrawal of hand on touching hot object.

→ A reflex action, also known as a reflex, is an involuntary and nearly instantaneous movement in response to a stimulus. A true reflex is a behavior, which is mediated via the reflex arc.

→ In animals, reaction time to visual stimuli is typically 150 to 300 milliseconds

REFLEX ARC:

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

→ A reflex arc is a neural pathway that controls an action reflex. In higher animals, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord.

→ This characteristic allows reflex actions to occur relatively quickly by activating spinal motor neurons, without the delay of routing signals through the brain.

→ Although the brain receives sensory input while the reflex action occurs.

→ There are **two types of reflex arc -** autonomic reflex arc affecting inner organs and somatic reflex arc affecting muscles.

→ When a reflex arc consists of only two neurons in an animal i.e. one sensory neuron, and one motor neuron. It is defined as **monosynaptic.**

→ **Monosynaptic** refers to the presence of a single chemical **synapse.**

→ In the case of **peripheral muscle reflexes,** brief stimulation to the muscle spindle results in contraction of the agonist or effector muscle.

→ By contrast, in polysynaptic reflex pathways, one or more interneuron's connect afferent (sensory) and efferent (motor) signals.

THREE TYPES OF RESPONSES:

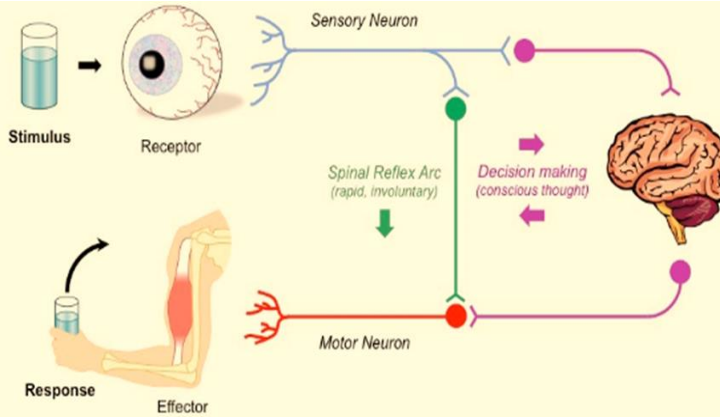
(I) VOLUNTARY:

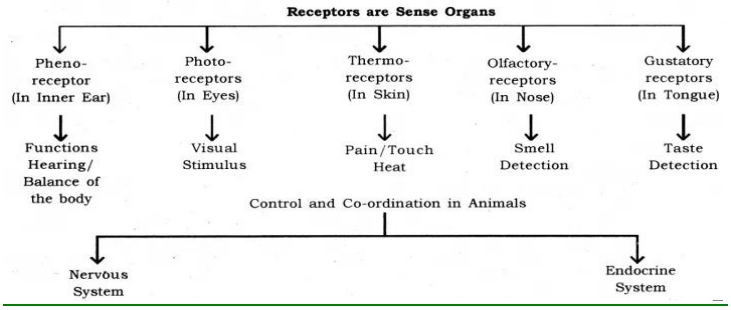
Controlled by fore brain. Example: talking, writing.

(II) INVOLUNTARY:

Controlled by mid and hind brain. Example: heart beat, vomiting, respiration.

(III) REFLEX ACTION: Controlled by spinal cord. Example: withdrawal of hand on to touching a hot object.





NEED FOR 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. In this way, time for taking action is reduced which save us from injury.

HOW NERVOUS TISSUE CAUSES ACTION?

→ Information is received by nervous tissue, then it passes to brain muscles and then it causes the action.

→ The junction between the two neurons is known as synapse. Information are passed from one neuron to another neuron via electrical or chemical transmission.

Electrical transmission	Chemical transmission
No need of neurotransmitter is needed	Neurotransmitter is needed
Fast mode of nerve impulse transmission	Slow mode of nerve impulse transmission
Impulse are directly transmitted from one neuron to another neuron	Impulse are not directly transmitted from one neuron to another neuron

COORDINATION IN PLANTS

→ Plants though do not have nervous system or muscles but they also respond towards the **stimulus.**

→ For example, when we touch **Mimosa pudica** (touch-me-not plant), its leaves fold up and droop.

→ There are **two types** of movements in plants - dependent on growth and independent of growth.

→ When we touch the Mimosa pudica, its leaves fold up but no growth occurs, so it does not involve any growth.

→ But movement of seedling is due to growth. Plants convey information from cell to cell through electrical-chemical means.

01. TROPIC MOVEMENT

→ The movement of organism towards or away from the stimulus is called **tropic movement.**

→ If the movement is towards the stimulus then it is called **positive stimulus**

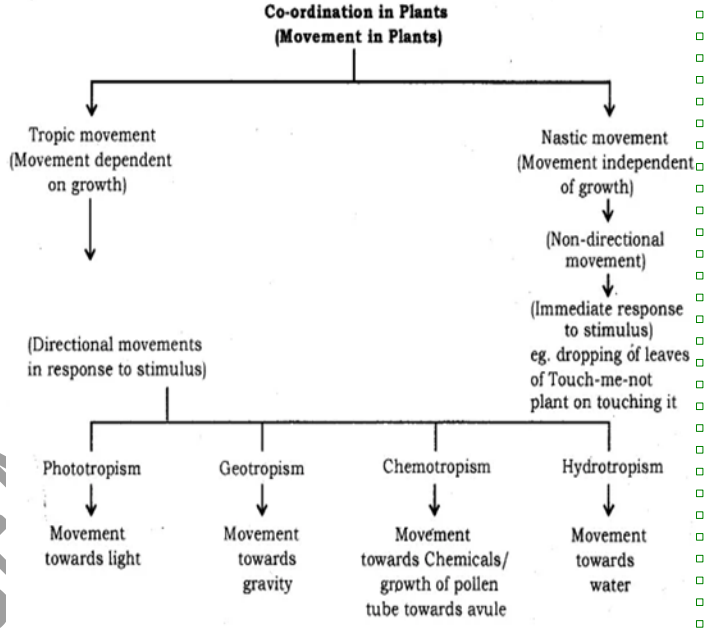
→ If it is away from the stimulus then it is called **negative stimulus.**

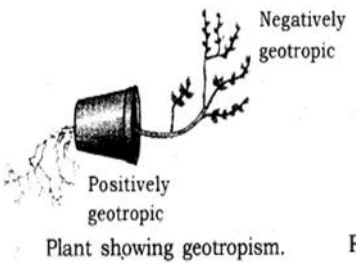
→ The most common example of movement of growth are tendrils. Tendrils are sensitive to touch.

→ When they come in contact with some object, the part of tendril away from the object will grow fast compare to the part of tendril which is in contact with the object.

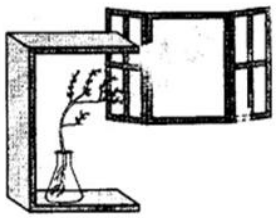
→ So, it is a directional movement and it appears as if the plant is moving.

THE VARIOUS TYPES OF TROPIC MOVEMENTS ARE:





Plant showing geotropism.


Plant showing phototropism

PHOTOTROPISM: -

→ The response of organism towards the light is called **phototropism. For example,** a money plant kept in a pot in a room grows more towards the direction from which the light is coming, as compared to the other direction.

GEOTROPISM: -

Response of organism towards the gravity is called **geotropism.** The root of the plant grows deep into the earth is an example of geotropism.

HYDROTROPISM: -

The growth of plants parts towards the water is called hydrotropism.

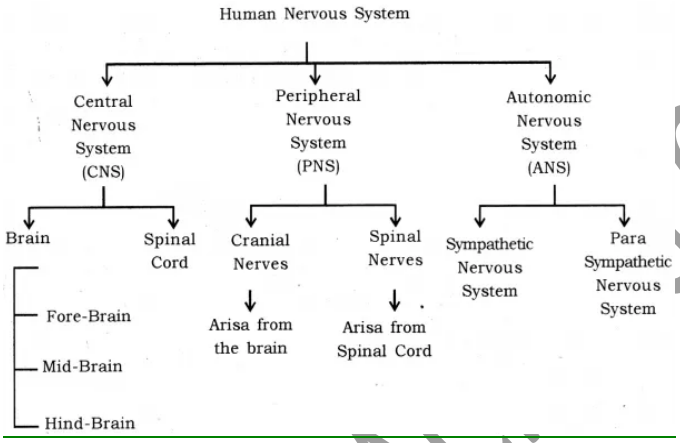
CHEMOTROPISM: -

The growth of plant parts towards the chemicals is called chemotropism. **For example** roots, of plants grows more towards the chemical fertilizers.

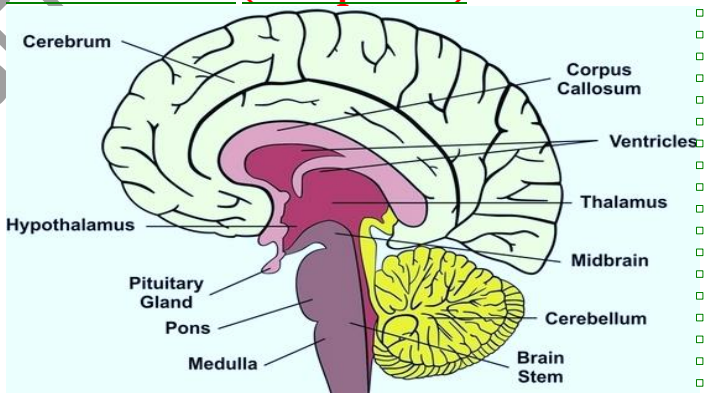
THIGMOTROPISM: -

The response of organism towards the touch or contacts is called **thigmotropism. example**, touch me not plant.

02. 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.
HORMONES PRODUCED BY THE PLANT
•AUXIN: This hormones synthesized at shoot tip. It helps the cells to grow longer and involved in phototropism (response towards light).
•PHOTOTROPISM: more growth of cells towards the 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 cause wilting of leaves and also known as stress hormone.
HUMAN NERVOUS SYSTEM:



→ The nervous system in humans can be divided into three main parts
01. CENTRAL NERVOUS SYSTEM:
In all the vertebrates including man, CNS is dorsal, hollow and non-ganglionated while in invertebrates when present, it is ventral, solid and ganglionated.
→ The central nervous system is composed of the
A. Brain – Upper and broader part lying in the head.
→ The brain controls all the functions in the human body.
B. Spinal cord – Lower, long and narrow part running from beginning of neck to trunk.
→ The spinal cord works as the relay channel for signals between the brain and the peripheral nervous system.
2. PERIPHERAL NERVOUS SYSTEM:
→ It is formed of long, thin, whitish threads called **nerves** which extend between CNS and body parts (muscles, glands and sense organs).
→ It controls the voluntary functions of the body.
→ The peripheral nervous system is composed of the cranial nerves and spinal nerves.
→ There are **12 pairs of cranial nerves.**
→ The cranial nerves come out 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 like heartbeat, peristalsis etc.
→ The autonomous nervous system can be divided into two parts :
01. 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.
02. 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.
HUMAN BRAIN: (Encephalon)



→ The brain is covered by a three-layered system of membranes, called **meninges.** Cerebrospinal fluid is filled between the meninges.
→ The Cerebrospinal Fluid (CSF) providers cushion the brain against mechanical shocks.
→ The human brain can be divided into three regions, viz. forebrain, midbrain and hindbrain.
→ On average, an adult brain weighs between **1.0 kg – 1.5 kg.** It is mainly composed of neurons – the fundamental unit of the brain and nervous system.
→ the brain contains anywhere between **86 billion to 100** billion neurons.
→ The brain, along with the spinal cord, constitutes the central nervous system. It is responsible for thoughts, interpretation and origin of control for body movements.
WHERE IS THE BRAIN LOCATED?
→ The brain is enclosed within the skull, which provides frontal, lateral and dorsal protection.

→ The skull consists of **22 bones, 14** of which form the facial bones and the remaining **8 forms** the cranial bones.
→ The **Cerebrospinal Fluid (CSF)** is a fluid that circulates within the skull and spinal cord, filling up hollow spaces on the surface of the brain.
→ Every day, the specialised ependymal cells produce **around 500mL** of cerebrospinal fluid.
→ The primary function of the CSF is to act as a buffer for the brain, cushioning mechanical shocks and dampening minor jolts.
→ It also provides basic immunological protection to the brain.
→ Brain is divided into three parts

01. FOREBRAIN

→ forebrain consists of cerebrum, hypothalamus and thalamus. forebrain is specialized in hearing, sight, smell
→ It also controls voluntary movements in our body such as movement of leg muscles.
→ Centre for hunger is also located in the separate part of forebrain.
→ cerebrum or the cerebral cortex consists of 4 lobes- parietal lobe, temporal lobe, occipital lobe and frontal lobes.

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.
controls the reproductive functions, body temperature, emotions, hunger and sleep.
NOTE: the largest among the forebrain parts is the cerebrum. it is also the largest part of all vertebrate brains.

02. MIDBRAIN:

→ Smallest and central part of the brain
→ The midbrain consists of:

(i) TECTUM

→ The tectum is a small portion of the brain, specifically the dorsal part of the midbrain.
→ It serves as a relay Centre for the sensory information from the ears to the cerebrum.
→ It also controls the reflex movements of the head, eye and neck muscles.
→ It provides a passage for the different neurons moving in and out of the cerebrum.

(ii) TEGMENTUM

→ The tegmentum is a region within the brainstem.
→ It is a complex structure with various components, which is mainly involved in body movements, sleep, arousal, attention, and different necessary reflexes.
→ It forms the platform for the midbrain and connects with the thalamus, cerebral cortex, and the spinal cord.

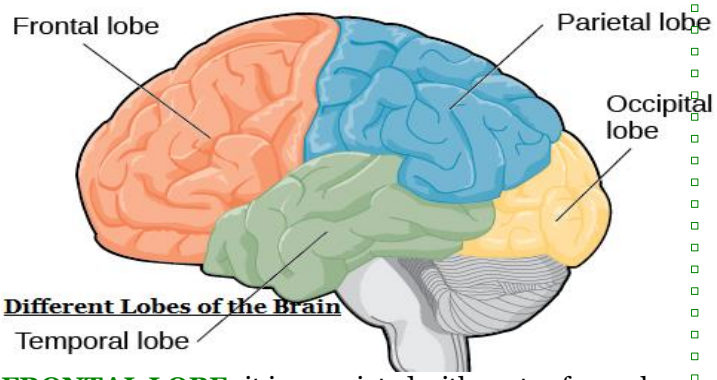
03. HINDBRAIN:

→ The central region of the brain
→ The hindbrain is composed of:

A. Cerebellum B. **Medulla** C. **Pons**

CEREBRUM

→ The cerebrum is the largest part of the brain. it consists of the cerebral cortex and other subcortical structures.
→ It is composed of two cerebral hemispheres that are joined together by heavy, dense bands of fibre called the corpus callosum.
→ The cerebrum is further divided into **four lobes:**



Different Lobes of the Brain

FRONTAL LOBE: it is associated with parts of speech, planning, reasoning, problem-solving and movements.
PARIETAL LOBE: help in movements, the perception of stimuli and orientation.
OCCIPITAL LOBE: it is related to visual processing.
TEMPORAL LOBE: this region is related to perception and recognition of memory, auditory stimuli, and speech.
→ The brain consists of two types of tissues:
01. GREY MATTER:- grey matter mainly consists of various types of cells, which make up the bulk of the brain.
02. WHITE MATTER:- white matter is primarily composed of axons, which connect various grey matter areas of the brain with each other.
→ The exterior portion of the cerebrum is called the **cortex or the cerebral mantle.**
→ The cortex is extremely convoluted, due to which, it has a large surface area.
→ The cerebrum also includes:
Sensory areas: to receive the messages.
Association areas: these areas integrate the incoming sensory information. it also forms a connection between sensory and motor areas.
Motor areas: this area is responsible for the action of the voluntary muscles.

FUNCTIONS OF CEREBRUM

→ The cerebrum controls voluntary motor actions.
→ It is the site of sensory perceptions, like tactile and auditory perceptions.
→ It is the seat of learning and memory.

CEREBELLUM

→ The cerebellum is the second largest part of the brain, located in the posterior portion of the medulla and pons.
→ The cerebellum and cerebrum are separated by tentorium cerebelli and transverse fissure.
→ Cortex is the outer surface of the cerebellum, and its parallel ridges are called the foila.
→ The cerebellum consists of two hemispheres, the outer grey cortex and the inner white medulla.

→ It is mainly responsible for coordinating and maintaining the body balance during walking, running, riding, swimming, and voluntary movements.
→ The main functions of the cerebellum include:

1. It senses equilibrium.
2. Transfers information.
3. Coordinates eye movement.
4. It enables precision control of the voluntary body movements.
5. Predicts the future position of the body during a particular movement.
6. Both anterior and posterior lobes are concerned with the skeletal movements.
7. The cerebellum is also essential for making fine adjustments to motor actions.
8. Coordinates and maintains body balance and posture during walking, running, riding, swimming.

Cerebrum	Cerebellum
(1) It is the largest part of the brain, forming four-fifths of its weight.	(1) It is the second largest part of the brain, forming one-eighth of its mass.
(2) It covers the rest of the brain.	(2) It covers the medulla oblongata only.
(3) It is a part of the forebrain.	(3) It is a part of the hindbrain.
(4) It consists of 2 cerebral hemispheres each comprising 4 lobes : frontal, occipital, parietal, temporal.	(4) It consists of two cerebellar hemispheres and a median vermis.
(5) It encloses 2 lateral ventricles.	(5) It is solid.
(6) White matter does not form arbor vitae.	(6) White matter form arbor vitae.
(7) It initiates voluntary movements, and is a seat of will, intelligence, memory *etc.*	(7) It maintains posture and equilibrium.

HYPOTHALAMUS:

→ The hypothalamus lies at the base of the cerebrum. It controls sleep and wake cycle **(circadian rhythm)** of the body. It also controls the urges for eating and drinking.
→ The hypothalamus is a small and essential part of the brain, located precisely below the thalamus.
→ It is considered the primary region of the brain, as it is involved in the following functions:

i. Receives impulses
ii. Regulates body temperature
iii. Controls the mood and emotions
iv. Controls the sense of taste and smell
v. Synthesises the body's essential hormones
vi. Coordinates the messages from the autonomous nervous system
vii. Controls appetite, peristalsis, the rate of heartbeat, and blood pressure

MEDULLA OBLONGATA

→ The medulla oblongata is a small structure present in the lowest region of the brain.
→ It mainly controls the body's autonomic functions such as heartbeat, breathing, and digestion vomiting.
→ It plays a primary role in connecting the spinal cord, pons and the cerebral cortex. Also, it helps us in maintaining our posture and controlling our reflexes.

PONS

→ The pons is the primary structure of the brain stem present between the midbrain and medulla oblongata.
→ It serves as a relay signals between the lower cerebellum, spinal cord, the midbrain, cerebrum also regulates respiration and other higher parts of the brain.
→ The main functions of the pons include:

i. Controlling sleep cycles.
ii. Regulating the magnitude and frequency of the respiration.
iii. Transfers information between the cerebellum and motor cortex.
iv. Pons is also involved in sensations, such as the sense of taste, hearing, and balance.

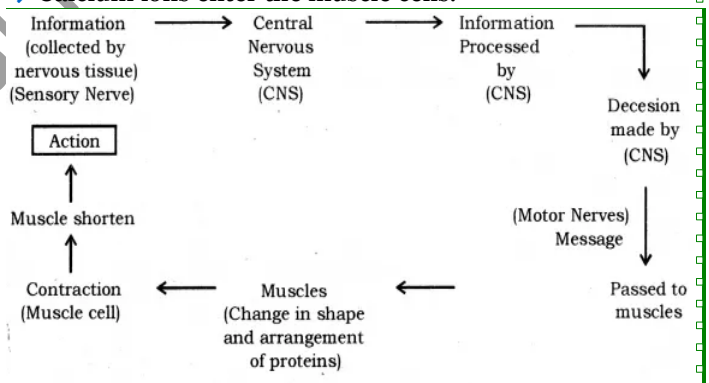
SPINAL CORD: Spinal cord controls the reflex actions and conducts massages between different parts of the body and brain.

PROTECTION OF BRAIN AND SPINAL CORD

Brain is protected by a fluid filled balloon which acts as shocks absorber and enclosed in cranium (Brain box) Spinal cord is enclosed in vertebral column.

MUSCULAR MOVEMENTS AND NERVOUS CONTROL:

→ Muscle tissues have special filaments, called actin and myosin. When a muscle receives a nerve signal, a series of events is triggered in the muscle.
→ Calcium ions enter the muscle cells.



Muscular movement and nervous control

→ It result in actin and myosin filaments sliding towards each other and that is how a muscle contracts. Contraction in a muscle brings movement in the related organ.

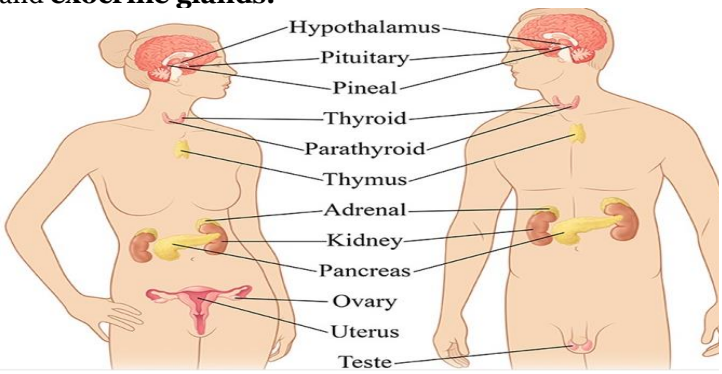
WHAT IS ENDOCRINE SYSTEM?

→ Hormones are chemicals that affect a lot of the bodily functions ranging from hunger, reproduction and growth to much more complicated functions like human emotions and behavior.
→ These hormones are produced in our body through nine primary glands and these glands, along with other organs that provide auxiliary functions make up the endocrine system.
HORMONES: These are the chemical messengers secreted in very small amounts by specialized tissues called **ductless glands.**
→ They act on target tissues/organs usually away from their source. Endocrine System helps in control and

coordination through chemical compounds called hormones.

→ They are the chemical messengers that are secreted in small quantities.

→ There are two types of glands- **endocrine glands** and **exocrine glands.**



EXOCRINE GLANDS

Exocrine glands do have ducts to carry their secretion.

ENDOCRINE GLANDS

• Endocrine glands do not have ducts to carry the secretion and they produces the hormones.

• A ductless gland that secretes hormones directly into the bloodstream.

• The list of endocrine gland with the hormones names and their functions are given below:

(I) THYROXINE:

This hormone is secreted by Thyroid. The Thyroid is located in Neck/Throat region. It regulates the metabolism of carbohydrates, fats and proteins.

(II) GROWTH HORMONES:

This is secreted by Pituitary (master gland). This gland is located in **Mid-brain.** It regulates growth and development.

(III) ADRENALINE: This hormone is secreted by **Adrenal.** The adrenal gland is located above both kidneys. It regulates blood pressure (increasing), heart beat, carbohydrate metabolism (during emergency).

(IV) INSULIN: This hormone is secreted by **Pancreas.** The pancreas is located below stomach. It reduces and regulates blood sugar level.

(V) SEX HORMONES:

(A) TESTOSTERON IN MALES: This hormone is secreted by testis. The testis is located in genital area. Its changes associated with puberty (Sexual maturity).

(B) ESTROGEN IN FEMALES: This hormone is secreted by Ovaries. The ovaries are located in lower abdomen area. Its changes associated with puberty (Sexual maturity).

HORMONES IN ANIMALS

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

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.

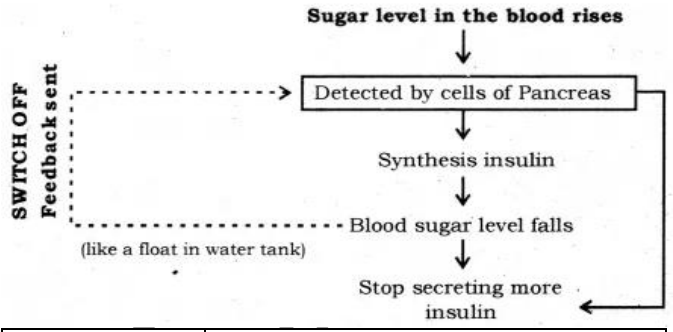
→ So, we must consume iodised salt which is necessary for proper working of thyroid gland. It's deficiency causes a disease called **goiter (Swollen neck).**

DIABETES: CAUSE: It is due to deficiency of insulin hormone secreted by pancreas that is responsible to lower/control the blood sugar levels.

TREATMENT: Patients have to internally administer injections of insulin hormone which helps in regulating blood-sugar level.

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.



Endocrine Gland	Function
Thyroid gland	Produces thyroxine that regulates carbohydrate, protein and fat metabolism
Adrenal gland	Produces adrenaline and it is secreted at the time of fear, fight or flight
Pancreas	Produces insulin and glucagon which regulate glucose metabolism in our body.
Testis	Produces male hormone known as testosterone required male secondary sexual characteristics such as beard and moustaches.
Pituitary gland	Secretes growth hormone that regulates the growth and development of an organism
Ovaries	Produces oestrogen needed for female sexual development