

CONTROL AND COORDINATION

The **working together** of the various organs of an organism to **adjust vital activities** of life is called coordination.

Coordination is mainly of two types :-

1. Nervous coordination.
2. Chemical coordination.

NERVOUS COORDINATION IN ANIMALS

There are two systems to control and coordinate various activities in animals –

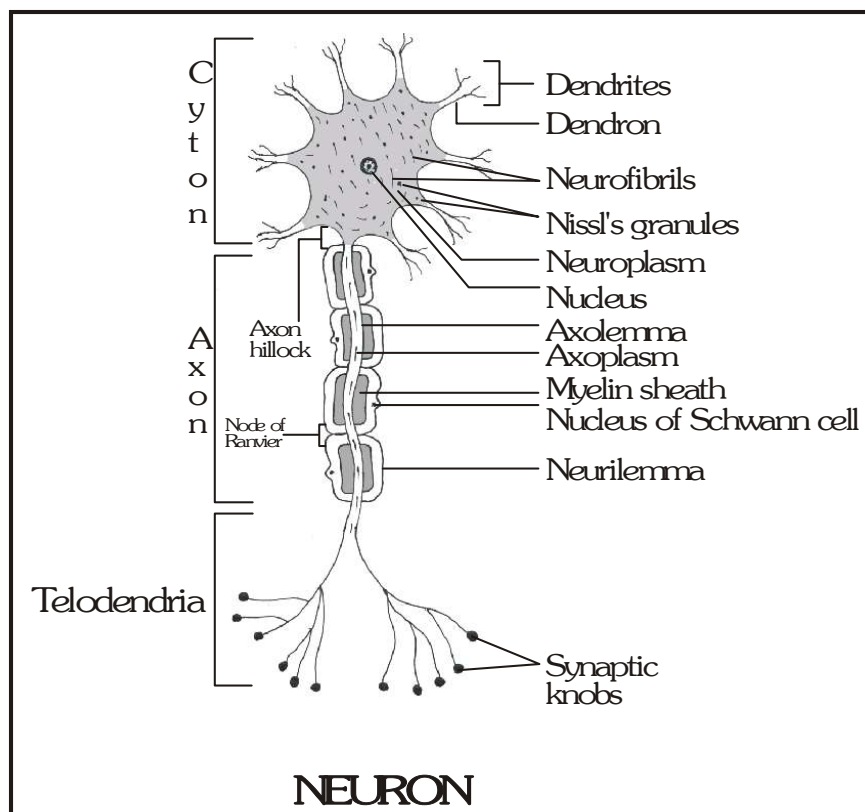
(A) Nervous system (B) Endocrine system

NERVOUS SYSTEM

NEURON

- The structural and functional unit of nervous system.
- Neuron (nerve cell) is the longest cell of human body (up to 100 cm)
- Neuron is made up of –
 - (i) Cell body
 - (ii) Cell processes (axon and dendron)
- (i) **Cell body :- or Cyton or Soma or Perikaryon**
 - It contains granular cytoplasm which is called **neuroplasm**.
 - Many small fibrils are present in the neuroplasm called **neurofibrils** for the conduction of nerve impulses.
 - Rough endoplasmic reticulum coils around the ribosome and form a granule like structure called as **Nissl's granule** or **Tigroid body**.
 - Nissl's granule is the centre of protein synthesis.
 - Energy for conduction of nerve impulses is provided by numerous mitochondria.
 - **Except centriole**, all other cell organelles are found in neuroplasm.
- (ii) **Cell process :-**
 - (a) **Axon :-**
 - It is longest cell process of cyton, its diameter is uniform and it contains **axoplasm**.
 - Axoplasm of axon contains only neurofibrils and mitochondria.
 - **Nissl's granules are absent**.
 - Axon is covered by **axolemma**.
 - Axolemma may be covered by a layer of phospholipids which is called as **medulla** or **myelin sheath**.
 - Myelin sheath acts as insulator and prevents leakage of ions.
 - Myelin sheath is discontinuous around the axon. These interruptions where axon is uncovered by myelin sheath are called **nodes of Ranvier**.
 - Axon produces centrifugal conduction i.e. nerve impulse travels away from the cell body.
 - The terminal ends of axon are branched which are called **telodendria**.
 - Each telodendron ends in a swollen knob called **synaptic knob**.
 - Nerve fibres in which myelin sheath is present, are called **medullated** or **myelinated nerve fibres** and nerve fibres without myelin sheath, are called **non-medullated** or **non-myelinated nerve fibres**.

Axon is functional part of nerve cell, therefore term "nerve fibre" usually refer to axon.



(b) Dendron :-

- It is small cell process.
- It's fine branches are called 'dendrites'
- Dendron receive the stimuli and produce **centripetal conduction** i.e. nerve impulse travels towards the cell body.
- It is not covered by myelin sheath.

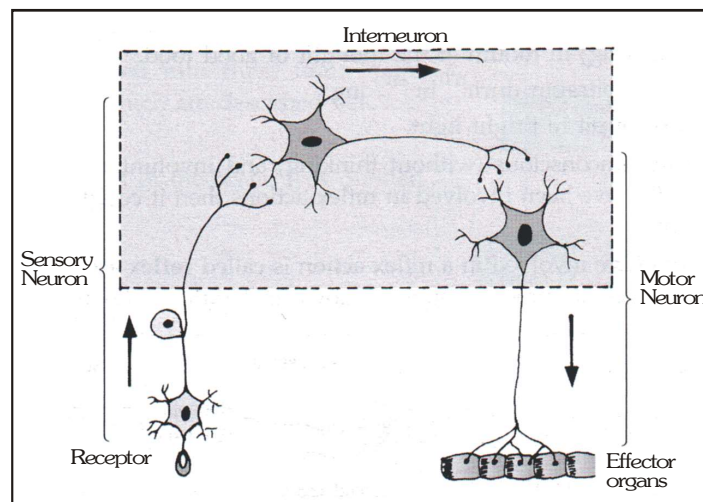
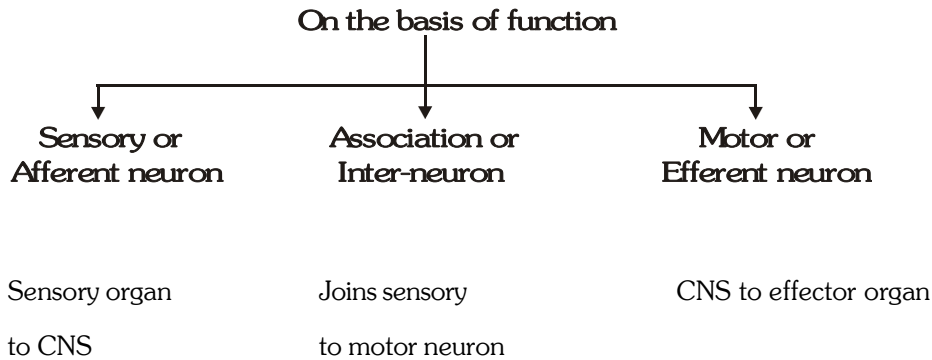
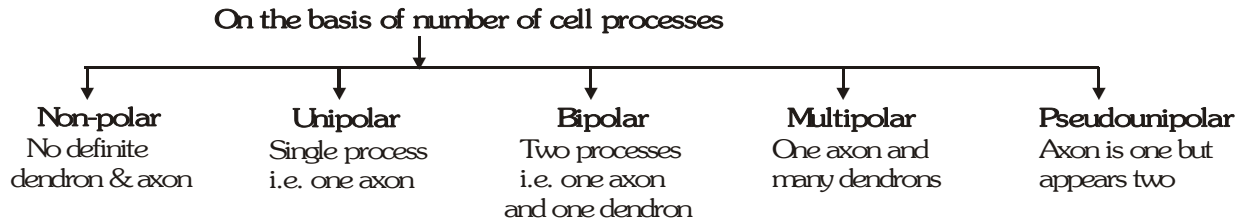
Differences between Axon and Dendron –

S.No.	Features	Axon	Dendron
1	Size	Long	Small
2	Number	Either absent or one	Either absent or one, mostly many.
3	Diameter	Uniform	Non-uniform
4	Branching	Generally unbranched	Branched
5	Terminal knobs (Telodendria)	Present	Absent
6	Nissl's granule	Absent	Present
7	Myelin sheath	Present	Absent
8	Direction of nerve impulse	Away from cyton	Towards cyton

Differences between medullated and non-medullated nerve fibre.

S.No.	Features	Medullated nerve fibre	Non-medullated nerve fibre
1	Occurrence	White matter	Grey matter
2	Sheath	Two: inner medullary, outer neurilemma	Only neurilemma
3	Node of Ranvier	Present	Absent
4	Speed of nerve impulse	Faster	Slower

Type of Neurons –



REVIEW QUESTIONS

1. What are the structural and functional units of nervous system ?
2. Which cell organelle does not present in neuron ?
3. What are Nissl's granules? Give their function.
4. Classify neurons on the basis of function.
5. State differences between medullated and non-medullated nerve fibres.

SYNAPSE : The junction between two adjacent neurons i.e.

between the axon ending of one neuron and dendrites of the next.

Nerve impulse :- It is an electro-chemical information (signal) passing through neuron.

Neurotransmitters or Neurohormones – Chemical substances which either transmit or inhibit the message from one neuron to another.

Stimulatory Neurotransmitters

Stimulate impulse at synapse

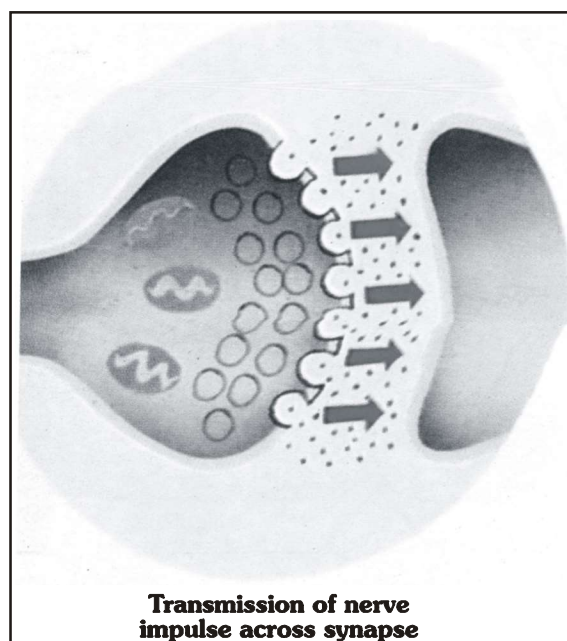
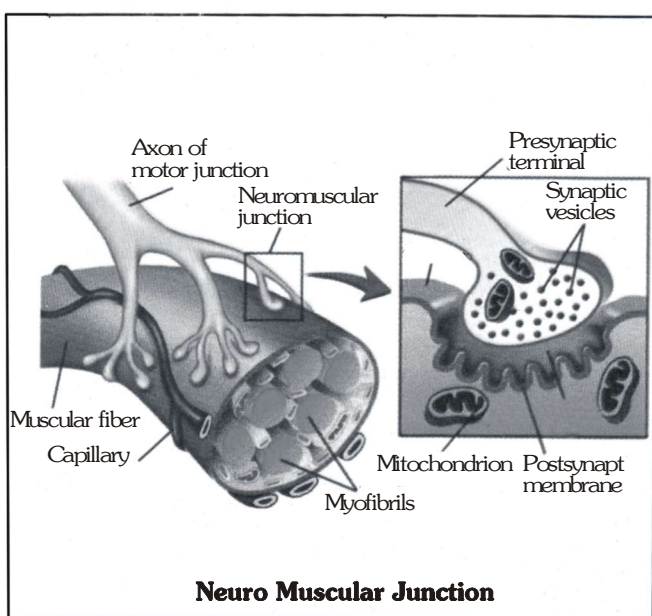
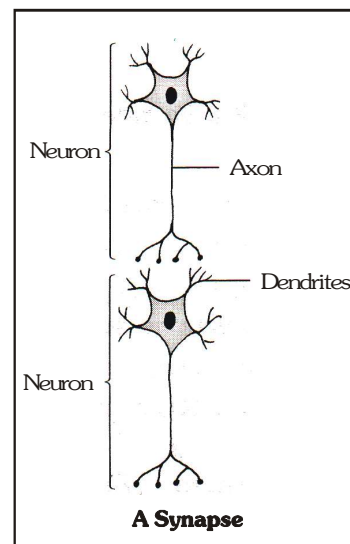
e.g. – Acetyl choline (Ach)

Inhibitory Neurotransmitters

Inhibit impulse at synapse

e.g. – GABA

(Gamma Amino Butyric Acid)



WORKING OF NEURON OR TRANSMISSION OF NERVE IMPULSE :-

- Stimuli are detected by dendrites of receptor nerve cells located at our sense organs i.e. ear, eyes, nose, tongue and skin.
- A chemical reaction occurs and creates **electric impulse**.
- Impulse travels from dendrites and finally reaches axon endings (synaptic knobs)
- Impulse releases some chemicals like **acetylcholine** from synaptic knob.
- By these chemicals, impulse transmits across synapse.
- This initiates similar electric impulse in a dendrite of next neuron and thus impulse is transferred from one nerve cell to another.
- Message is sent to CNS (brain & spinal cord) via sensory nerves.
- CNS sends message to muscles via motor nerves
- Muscles of effector organ show response.

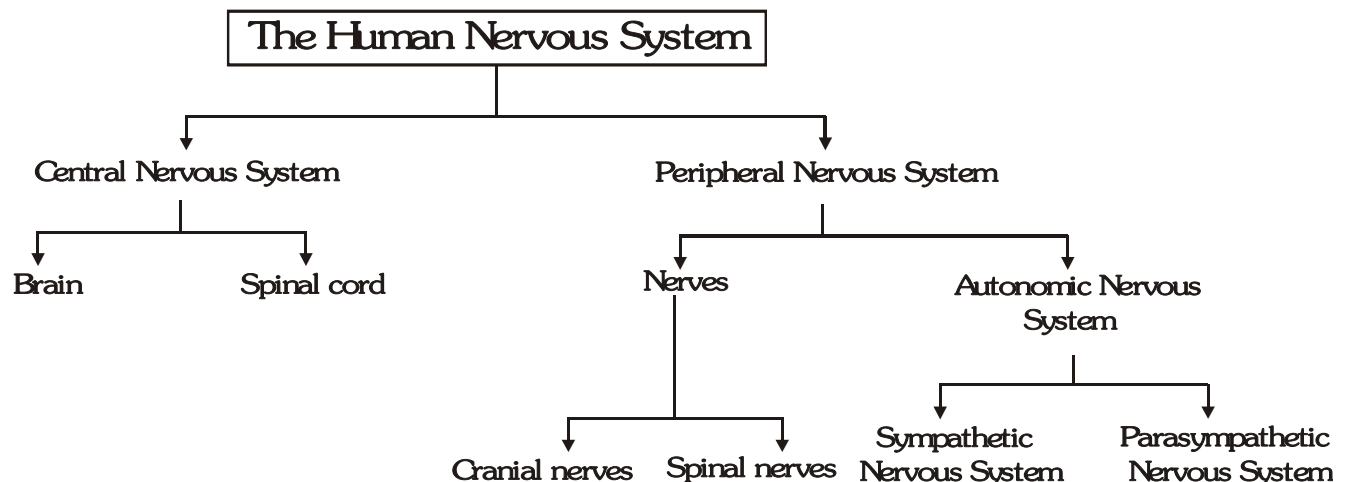
Receptors	Stimuli	Location
Photoreceptors	light	eyes
Phonoreceptors	sound	internal ear
Olfactoreceptors	smell	nasal chamber
Gustatoreceptors	taste	taste buds on tongue
Tangoreceptors	touch	skin
Thermoreceptors	temperature	skin
Algesireceptors	pain	skin

Physiology of Nerve Impulse

- At resting stage : in this stage, anions (negative ions) are present on inner surface of neuron membrane and cations (positive ions) are present on outer surface of neuron.
- This neuron membrane is said to be **polarised**.
- At exciting stage : As the neuron receive external stimuli, undergoes **depolarisation**.
- The anions are now on outer surface and cations on inner surface.
- At this point, nerve impulse is **initiated**.
- **Repolarisation** : As the impulse conducts forward, repolarisation occurs at previous point.
- As the impulse reaches the nerve synapses acetyl choline is secreted by terminal end. Through this, impulse is transmitted to dendrites of the next nerve. Thus, the impulses are transmitted.

REVIEW QUESTIONS

1. What are neurotransmitters?
2. How will you define "synapse"?
3. What are receptors? List any four types of receptor with their function and position.



CENTRAL NERVOUS SYSTEM (CNS) :-

- CNS consists of the brain and the spinal cord.

(A) BRAIN

- Brain is the most important part of human body.
- Brain is situated in a cranial box (cranium) which is made of bones.
- **Meninges(Meninx) :-** Brain is covered by three membranes of connective tissue, termed as meninges.
 - (i) **Dura Mater :-** It is the first and the outermost membrane which is thick, very strong and nonelastic.
 - (ii) **Arachnoid Mater :-** It is middle, thin, delicate and non-vascular membrane found only in mammals.
 - (iii) **Pia Mater :-** It is innermost, most vascular, thin and transparent membrane.

- The space between the arachnoid and pia mater is filled with a fluid called cerebrospinal fluid (CSF). It protects the brain from mechanical shocks.

Meningitis :- Any inflammation of meninges is called meningitis.

Weight of brain :- In adult male 1400 gm, female 1250 gm.

Parts of Brain:(1) Fore brain

(2) Mid brain

(3) Hind brain

(a) Cerebrum

(a) Crura cerebri

(a) Cerebellum

(b) Diencephalon

(b) Corpora quadrigemina

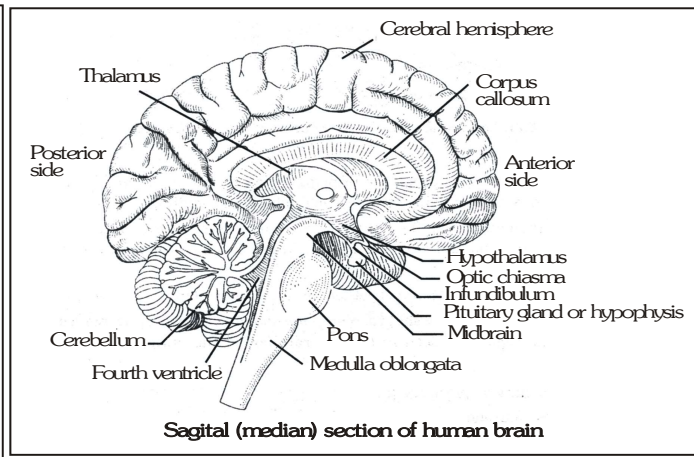
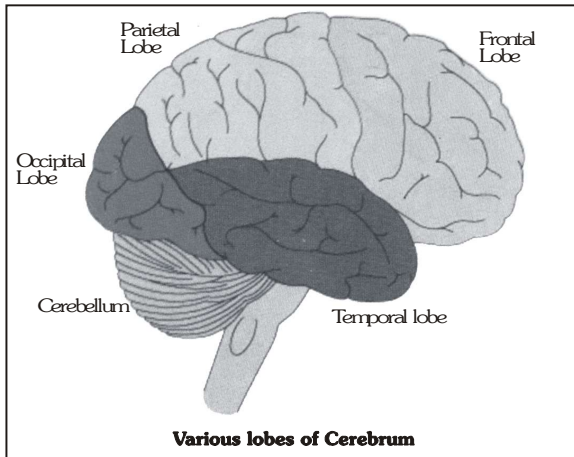
(b) Pons

(c) Medulla oblongata

(1) Forebrain (Prosencephalon) :-

(a) Cerebrum (Telencephalon) :-

- It is the most developed and the most complex part of brain.
- It makes 2/3 part of total brain.
- Cerebrum consists of two cerebral hemispheres. (Left and right cerebral hemispheres)
- Outer part of cerebral hemispheres is known as **cerebral cortex**.
- Both cerebral hemispheres are connected by a thick nerve band called **corpus callosum**.
- Many ridges and grooves are found on dorsal surface of cerebral hemisphere.
- Ridges are known as **gyri**, whereas grooves are known as **sulci**.
- These gyri and sulci increase the surface area of brain.
- Each cerebral hemisphere is divided into 4 lobes :-
 - (i) **Anterior :- Frontal lobe** for intelligence, knowledge, abstract, reasoning, creative ideas and memory.
 - (ii) **Middle :- Parietal lobe** for taste, writing, pain, touch and pressure.
 - (iii) **Lateral :- Temporal lobe** for language, hearing and smell.
 - (iv) **Posterior :- Occipital lobe** meant for vision.



(b) Diencephalon :-

- It is small and posterior part of fore brain.
- It is covered by cerebrum.

(i) Thalamus :-

- They act as **relay station**.
- They receive all sensory impulse from all parts of body and these impulses are send to the cerebral hemispheres.

(ii) Hypothalamus :-

- It forms lower lateral wall of diencephalon.
- A cross like structure is found on anterior surface of hypothalamus called as **optic chiasma**.
- Pituitary body is attached to middle part of hypothalamus by infundibulum.
- **Functions :** (i) Thermoregulation (ii) Behaviour and emotion (iii) Endocrine control
(iv) Biological clock system
(v) The centres of feeling pain, hunger and thirst are present in it.

(iii) Epithalamus :-

- It forms the roof of diencephalon.
- Pineal body is attached to it.

(2) Mid brain (Mesencephalon) :-

- It is small and contracted part of brain.

(a) Cerebral peduncles (Crura cerebri) :-

- Anterior part of mid brain contains two longitudinal myelinated thick nerve fibres, called **crura cerebri**.
- They connect the medulla oblongata of hindbrain to cerebrum of fore brain.
- It controls the limb muscle movement.

(b) Optic lobes (Corpora Quadrigemina) :-

- On the posterior part of mid brain, four spherical projections are found, called **optic lobes**.
- Four optic lobes are collectively called **corpora quadrigemina**.
- These mainly control vision.

(3) Hind Brain (Rhombencephalon) :-**(a) Pons :-**

- It is small, spherical projection, which is situated below the mid brain and upper side of medulla oblongata.
- It regulates the breathing action.

(b) Cerebellum :-

- It is made up of 3 lobes (2 lateral lobes and 1 vermis).
- Lateral lobes are also called **cerebellar hemisphere**.
- **Function :** To maintain body balance & posture. It is responsible for percision of voluntary actions.

(c) Medulla oblongata :-

- It is the posterior-most, tubular and cylindrical part of brain.
- The lower end medulla extends in the from of spinal cord.
- **Functions:**
 - (i) It controls all the involuntary activities of the body. **e.g.** – heart beats, respiration, blood pressure salivation.
 - (ii) It also concerned with some reflexes- sneezing reflex, coughing reflex, vomiting reflex, yawning reflex.

REVIEW QUESTIONS

1. What does the central nervous system in human consist of ?
2. Write the names of the regions in hindbrain.
3. Name the most important part of the human brain.
4. Which part of brain maintains the posture and balance of the body?
5. Any inflammation of meninges is known as..... .

Difference between cerebrum and cerebellum

S.No.	Features	Cerebrum	Cerebellum
1	Part of	Forebrain	Hindbrain
2	Size	Largest part of brain	Second largest part of brain
3	Function	Associated with intelligence, memory	Associated with body balance and posture

(B) SPINAL CORD

- It is a downward continuation of the medulla oblongata, which lies in the vertebral column.

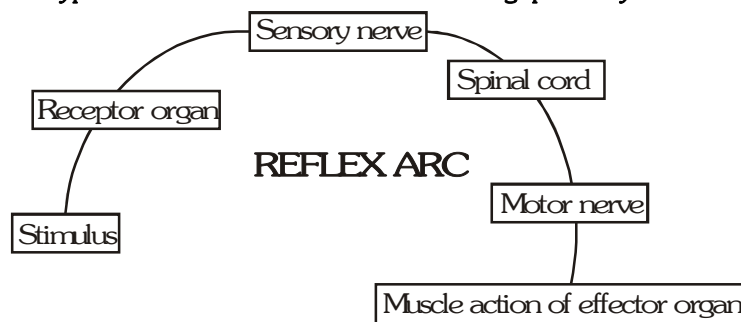
Functions of spinal cord –

- (i) Spinal cord regulates and conducts the reflex actions.
- (ii) It acts as bridge between brain & organs of the body.
- (iii) It also provides relay path for the impulses coming from brain.

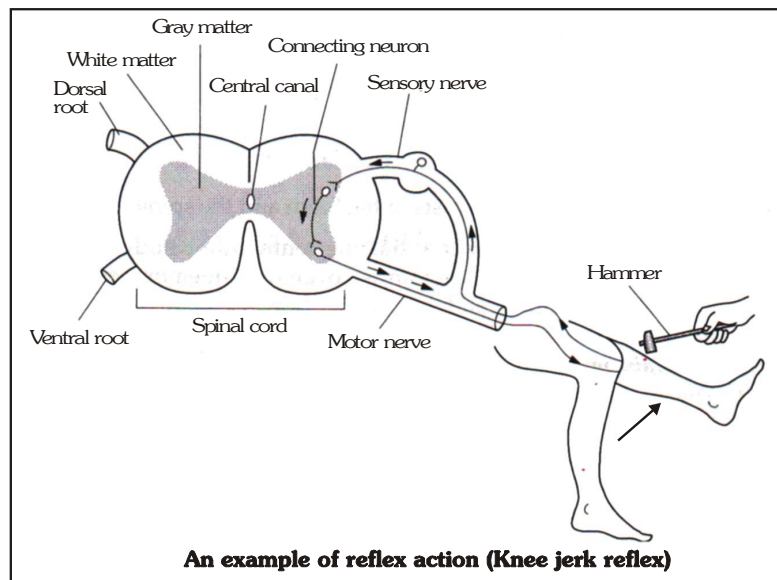
REFLEX ACTIONS

- "**Marshal Hall**" first observed the reflex actions.
- Reflex actions are spontaneous, automatic, involuntary, mechanical responses produced by specific stimulating receptors.
- Reflex actions are completed very quickly as compared to normal action
- The path of completion of reflex action is called "**reflex arc**".

A typical reflex action has the following pathway –



- Examples :-**
- (i) Watering in mouth on sight of food
 - (ii) Closing of eyes when flashed with strong light.
 - (iii) Withdrawal of hand when pinched with a needle.
 - (iv) Blinking of eyelids, gut peristalsis, yawning sneezing, coughing.



REVIEW QUESTIONS

1. Define reflex arc.
2. Give two examples of reflex actions.
3. Which type of nervous action is associated with the spinal cord ?
4. What is the position of spinal cord ?

PERIPHERAL NERVOUS SYSTEM :-

- All the nervous arising from brain and spinal cord are included in peripheral nervous system.
- PNS consists of two sets of nerves :-

(A) Cranial Nerves :-

- Nerves arising from brain are called cranial nerves.
- Nerves may be sensory, motor or mixed.
 - 12 pairs of cranial nerves are found in reptiles birds and mammals but amphibians and fishes have only 10 pairs.

(B) Spinal Nerves :-

- Nerves arising from spinal cord.
- Each spinal nerve is mixed type and arises from the roots of the horns of grey matter of the spinal cord.
- In human only 31 pairs of spinal nerves are found.

REVIEW QUESTIONS

1. What are the two sets of nerves which consists of peripheral nervous system?
2. Give the number of cranial and spinal nerves found in man.

AUTONOMIC NERVOUS SYSTEM (ANS)

- The autonomic nervous system is that part of the peripheral nervous system which controls activities inside the body that are normally involuntary.
- ANS plays an important role in maintaining the constant environment. (Homeostasis)
- There are the two divisions of the ANS :-

(a) Sympathetic nervous system

(b) Parasympathetic Nervous system.

(a) Sympathetic Nervous System :-

- SNS is related with such visceral reactions, which increase the protection of body in adverse atmospheric conditions.

(b) Para sympathetic Nervous System :-

- PNS is related with those reactions in which energy is conversed.
- In this way, ANS controls the activities of visceral organs double side i.e. **antagonistic** to each other.

REVIEW QUESTIONS

1. Which nervous system maintains homeostasis inside the body ?
2. Write the parts of autonomous nervous system.

Effects of sympathetic and parasympathetic nervous system			
S.No.	Organs involved	Sympathetic effect	Parasympathetic effect
1	Eyes	Dilation of pupil	Constriction of pupil
2	Bronchi	Dilates	Constricts
3	Heartbeat rate	Increases	Decreases
4	Blood pressure	Increases	Decreases
5	Blood vessels	Constricts	Dilates
6	Gastric secretion	Inhibits	Stimulates
7	Urinary bladder	Relaxes	Contracts

SPECIAL POINTS

- **Cerebrospinal Fluid (C.S.F) :-** This fluid is clear and alkaline in nature just like lymph. C.S.F is present in ventricle of brain, subarachnoid space between arachnoid and piamater and spinal cord. It acts as shock absorbing medium.
- **Broca's area :** It is motor speech area, present in frontal lobe of cerebrum. If it get destroyed the animal becomes unable to speak.
- In human brain more than 100 billion neurons are present.
- In mammals the speed of nerve impulse is 100-130 m/sec.
- **Grey matter :** It is composed of cytons and non-medullated nerve fibres.
- **White matter :** It is composed of medullated nerve fibres.
- **Electroencephalograph :** is an instrument which records the electrical activity of the brain in the form of a graph of electric potentials generated with time. Such a record is called electroencephalogram (EEG). The electroencephalogram (EEG) of a patient is done by placing two electrodes of electroencephalograph instrument on the scalp of the patient. Then a record of four different types of waves (α , β , δ and θ) is produced on the graph paper. These waves vary in their frequency. These wave give the characteristic activity of the brain of a person. The EEG of a patient is useful to diagnose brain ailment

EXERCISE # 1**FOR SCHOOL / BOARD EXAMS.**

1. Which one of the endocrine glands is known as master gland ?
(1) Pituitary (2) Adrenal (3) Thyroid (4) Parathyroid
2. Cerebral hemispheres are the centres of :-
(1) Balance (2) Smell (3) Taste (4) Thinking
3. The cerebellum is concerned with :-
(1) Preception (2) Vision
(3) Coordinate and movement (4) Memory
4. Learning (intelligence) is related to :-
(1) Medulla oblongata (2) Hypothalamus (3) Cerebellum (4) Cerebrum
5. Junction of two neurons is called :-
(1) Synapse (2) Synapsis (3) Joint (4) Junction
6. The reflex arc in the reflex action is formed by :-
(1) Brain-Spinal Cord-Muscles (2) Muscles-Spinal Cord-Receptor
(3) Receptor-Spinal Cord-muscles (4) Muscles-Receptor-Brain
7. Olfactoreceptors help to respond to :-
(1) Sound (2) Touch
(3) Smell (4) Taste
8. Brain is a part of :-
(1) Peripheral nervous system (2) Central nervous system
(3) Autonomous nervous system (4) Cranial nerves
9. Cerebrum is a part of :-
(1) Forebrain (2) Hindbrain
(3) Midbrain (4) Neurons
10. The neurons that carry nerve impulse from spinal cord to effectors are called :-
(1) Sensory neurons (2) Motor neurons
(3) Interneurons (4) Spinal neurons

TURE OR FALSE :

1. All the voluntary actions of the body are coordinated by the cerebrum.
2. Axon endings of a neuron receive the stimuli.
3. Neuron has an insulating and protective sheath of myelin around it.
4. Coelenterates have a primitive type of nervous system, called *diffused* nervous system.
5. Human brain is covered by two meninges.
6. Sympathetic and parasympathetic nervous systems are antagonistic to each other in their functions.
7. Cranial nerves arise from brain and they are 12 in number.
8. Tangoreceptors detect touch.
9. Speed of nerve impulse depends on the diameter of axon.
10. Medulla oblongata controls involuntary functions.

FILL IN THE BLANKS :-

1. Cavities of brain are called
2. All information from our environment is detected by the specialized cells.
3. receptors detect taste while receptors detect smell.
4. tissue is made up of an organised network of neurons.
5. is the part of a neuron where information is acquired.
6. Through the neuron, information travels as an
7. Peripheral nervous system consisting of nerves arising from brain and spinal nerves arising from
8. is the main thinking part of the brain.
9. is a part of hind brain which maintain the posture and balance of body.
10. coordination is seen in both plants and animals.
11. Part of brain acting as relay centre is
12. Largest part of brain is
13. is the reaction of an organism to stimulus.
14. is the functional and structural unit of nervous system.
15. Main parts of a neuron are and
16. A close relation between axon endings of a neuron and dendrites of next neuron is known as
17. Cyton of a neuron contains granules which are made up of and endoplasmic reticulum.
18. are places on axon where myelin sheath is absent.
19. fluid is found in ventricles of brain.
20. Central nervous system is consist of and

MATCH THE COLUMN :-

Column A		Column B	
(i)	Cerebellum	(a)	Neuron
(ii)	Spinal cord	(b)	Acetylcholine
(iii)	Phonoreceptors	(c)	Thinking part of brain
(iv)	Functional and structural unit of nervous system	(d)	Close relation between two neuron
(v)	Neurotransmitter	(e)	Flatworms
(vi)	Cerebrum	(f)	Detect sound
(vii)	Synapse	(g)	Dendron
(viii)	Algesireceptors	(h)	Detect pain
(ix)	Small cell process of neuron	(i)	Reflex actions
(x)	Ladder type nervous system	(j)	Maintain balance and posture

CONTROL & COORDINATION

ANSWER KEY

EXERCISE # 1

OBJECTIVE QUESTION

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	1	4	3	4	1	3	3	2	1	2

TRUE OR FALSE :

- | | | | | |
|------|------|------|------|-------|
| 1. T | 2. F | 3. F | 4. T | 5. F |
| 6. T | 7. F | 8. T | 9. T | 10. T |

FILL IN THE BLANKS :

- | | | |
|--------------------------|-------------------------|----------------------------|
| 1. Ventricles | 2. Nerve | 3. Gustatory ; Olfactory |
| 4. Nervous | 5. Dendrite | 6. Electric impulse |
| 7. Cranial ; Spinal cord | 8. Cerebrum | 9. Cerebellum |
| 10. Chemical | 11. Response | 12. Thalamus |
| 13. Cerebrum | 14. Neuron | 15. Cyton ; Cell processes |
| 16. Synapse | 17. Nissl's ; Ribosomes | 18. Nodes of Ranvier |
| 19. Cerebrospinal | 20. Brain ; Spinal cord | |

MATCH THE COLUMN :

Ans. (i) - j, (ii) - i, (iii) - f, (iv) - a, (v) - b, (vi) - c, (vii) - d, (viii) - h, (ix) - g, (x) - e

VERY SHORT ANSWER TYPE QUESTIONS :

1. What is neuron ?
2. Name the part of hind-brain which takes part in regulation of respiration.
3. We suddenly withdraw our hand when a pin pricks. Name the type of response involved in this action.
4. Which part of the brain contains respiratory centre ?
5. Name the two systems that control and coordinate all other systems in human body.
6. Name the specialised cell of multicellular animals that perceive external stimuli.
7. Which group of multicellular animals do not possess neurons ?
8. Where are Nissl's granules found and what is their components ?
9. What happens when an impulse travel through a neuron ?
10. What is the function of medulla oblongata ?
11. How many cranial nerves are present in a mammal ?
12. What is the basic function of a receptor ?
13. Mention the function of fore-brain.
14. Name the largest and second largest part of the brain.
15. Name the reflex centre of the brain.
16. Name the structural and functional unit of nervous system.
17. Mention the various components of hind-brain ?
18. State one main function of cerebrum.
19. What is the function of cerebrospinal fluid ?
20. What is the singnificance of reflex action ?

SHORT ANSWER TYPE QUESTIONS :

1. Where does cerebrospinal fluid occur in our body ? Mention any two of its funcitons.
2. Name the four regions of the fore-brain and mention any one function per region.
3. Write the difference between cerebellum and cerebrum.
4. Write the difference between motor nerve and mixed nerve.
5. Define nerve impulse. Which structure in a neuron helps to conduct a nerve impluse.
 - (i) towards the cell body
 - (ii) away from the cell body
6. Which parts of human brain are responsible for auditory reception and sensation of smell ?
7. Write the functions of pons, cerebellum and medulla oblongata.

8. Explain how nerve impulse travel in the body.
9. Define reflex arc. Give a flow chart of a spinal reflex arc.
10. What is the cerebrum ? State the functions of cerebrum.
11. Give an account of the structure of hind brain in brain.
12. What are voluntary and involuntary actions ? Give examples.
13. Enumerate the three main parts of nervous system in man.
14. Draw a diagram of a neuron.
15. How is the brain protected against shock ?
16. Differentiate between medullated and non-medullated nerve fibres.
17. List the specific functions of four lobes a cerebral hemispheres.
18. Give the technical names for the following receptors in the animals :-

(i) Receptors for light	(ii) Receptors for temperature
(iii) Receptors for sound	(iv) Receptors for smell
19. What is the ganglion ?
20. What is the autonomic nervous system ?

LONG ANSWER TYPE QUESTIONS :

1. Describe the central nervous system in human beings.
2. What are the three major components of nervous system in animals ? How are nerves classified ? What are the three major types of nervous system and how is one different from the other ?
3. What is the peripheral nervous system ?
4. Autonomic Nervous System plays an important role in maintaining the constant environment, how ?
5. What are reflex actions ? Define reflex arc. Draw a neat and labelled diagram of the components in a reflex arc.

NCERT QUESTIONS :

1. What happens at the synapse between two neurons ?
2. Which part of the brain maintains posture and equilibrium of the body ?
3. How do we detect the smell of an agarbatti (incense sticks) ?
4. Which signals will get disrupted in case of spinal cord injury ?
5. What is difference between a reflex action and walking ?
6. What is the role of the brain in reflex action ?
7. How are involuntary actions and reflex actions different from each other ?
8. What is the function of receptors in our body ? Think of situation where receptors do not work properly. What problems likely to arise ?
9. Draw the structure of a neuron and explain its function.

EXERCISE # 3**(FOR COMPETITIVE EXAMS)**

1. Chemical transmission of nerve impulses from one neuron to another at a synapse is by :-
(1) Cholesterol (2) Acetylcholine (3) Cholecystokinin (4) ATP
2. "Nodes of Ranvier" are found in :-
(1) Brain (2) Heart (3) Axon (4) Eye
3. Afferent nerve fiber conducts impulse from :-
(1) C.N.S. to effector (2) Receptor to C.N.S. (3) Receptor to effector (4) Effector to receptor
4. Saltatory conduction occurs in :-
(1) Non-myelinated fibers (2) Myelinated fibers
(3) Both of them (4) None of them
5. Power of regeneration is lowest in :-
(1) Brain cell (2) Liver cell (3) Bone cell (4) Muscle cell
6. The Schwann sheath is :-
(1) A non myelinated nerve fibre
(2) Associated with myelin sheath
(3) A connective tissue cell
(4) Associated with myelinated & non myelinated nerve fibre
7. Non Myelinated axons differ from myelinated in that they :-
(1) Are more excitable (2) Lack nodes of Ranvier
(3) Are not capable of regeneration (4) Are not associated with Schwann cells
8. Meninges surrounding the brain of human from outside to inside are :-
(1) Duramater, arachnoid, piamater
(2) Piamater, arachnoid, duramater
(3) Duramater, piamater, arachnoid
(4) Piamater, duramater, arachnoid
9. Corpus callosum connects :-
(1) Two cerebral hemispheres (2) Two optic lobes
(3) Two olfactory lobes (4) Optic chiasma
10. Cerebellum is concerned with :-
(1) Co-ordination of muscular movement (2) Memory
(3) Vision (4) Reflex action

11. How many lobes are present in cerebellum :-
 (1) 1 (2) 3 (3) 5 (4) 7
12. The box like bony structure which encloses the brain is called :-
 (1) Cranium (2) Pericardium (3) Peritoneum (4) Periosteum
13. The function of cerebrospinal fluid surrounding CNS is to :-
 (1) Protect the brain from external jerks (2) Provide nourishment and O₂ to the brain
 (3) Take away unwanted substance from the brain (4) All of the above
14. Largest cavity in brain is called :-
 (1) Diocoel (2) Paracoel (3) Metacoel (4) Rhinocoel
15. Voluntary activities of body are controlled by :-
 (1) Diencephalon (2) Cerebrum (3) Crura cerebri (4) Cerebellum
16. Number of cranial nerves in human :-
 (1) 12 (2) 24 (3) 11 (4) 29
17. Reflex action is controlled by :-
 (1) Muscles (2) Limbs
 (3) Central nervous system (4) Autonomic nervous system
18. Find out the correct sequence of a simple reflex are :-
 (1) Brain-spinal cord - nerves - effector (2) Effector - CNS - sensory nerves - receptor
 (3) Muscles - spinal cord - brain - receptor (4) Receptor - sensory nerves - CNS - effector
19. Most of the involuntary actions are controlled by :-
 (1) Medulla oblongata (2) Cerebrum (3) Cerebellum (4) Diencephalon
20. If cerebellum of man gets damaged, his movement becomes :-
 (1) Shaky & speech becomes defective
 (2) Unbalanced, walk uncontrolled, defective speech & intention tremor
 (3) Jerky & defective speech
 (4) Jerky & walked uncontrolled

COMPETITIVE QUESTIONS :

						ANSWER KEY									
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	2	2	1	4	2	1	1	1	2	1	4	2	2
Que.	16	17	18	19	20										
Ans.	2	3	4	1	2										

CHEMICAL COORDINATION IN ANIMALS (ENDOCRINE SYSTEM)

- The branch of biology which deals with study of endocrine system and its physiology is known as "*endocrinology*".
- "*Thomas Addison*" is known as *Father of Endocrinology*.
- The glands which pour their secretion directly in the blood are called **endocrine glands**. These glands lack ducts, so these glands are called **ductless glands**. **e.g.**– Thyroid gland, parathyroid gland.
- Whereas the glands with duct are called **exocrine glands**. **e.g.** – Sweat gland, salivary gland.

Pancreas has both **exocrine** and **endocrine** part, so it is also called **mixed gland** or **common gland** or **heterocrine gland**.

HORMONES

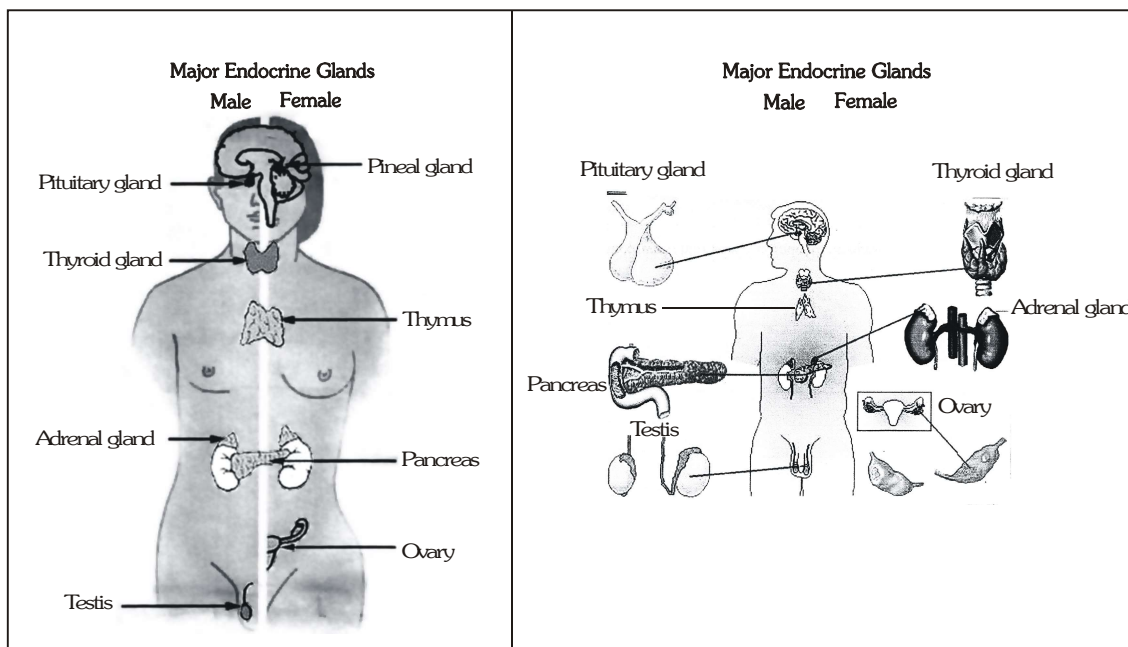
- Chemicals secreted by endocrine glands are called "**hormones**".
- The term hormone was coined by *Starling*.
- Hormones are also called "primary messengers" or "chemical messengers".

Discovery :-

- First discovered hormone was **secretin**.
- It was discovered by *Bayliss* and *Starling*.

Physical & chemical properties of hormones :-

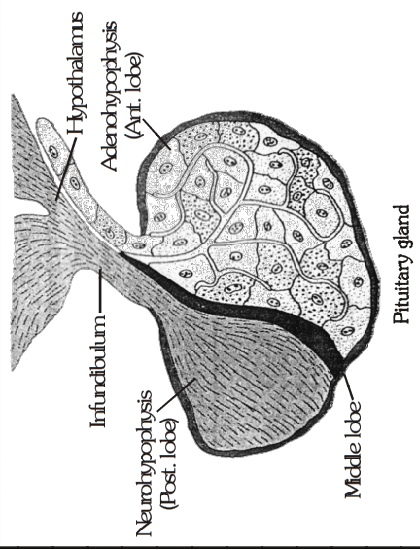
- These are secreted by endocrine glands.
- Hormones are secreted only when required.
- Their secretion is regulated by feedback mechanisms.
- These are generally released in the blood stream.
- The molecules of most of the hormones are small
- Their molecular weight is low.
- The secretion of hormone is always in very small quantity.
- Hormones are destroyed after use **i.e.** hormones can not be stored in the body. **Thyroxine** is an exception.



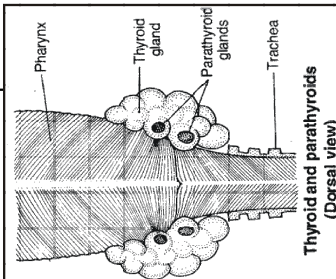
REVIEW QUESTIONS

1. What are hormones?
2. What are endocrine glands?
3. List four important characteristic features of hormones.
4. Why are endocrine glands called ductless glands?
5. Distinguish between exocrine and endocrine glands.
6. First discovered hormone is ?

Difference between Nervous and Hormonal Coordination		
S.No.	Nervous Coordination	Hormonal Coordination
1	It is sent as an electrical impulse along axons, and as a chemical across synapse	It is sent as a chemical messenger via blood stream.
2	Information travels rapidly, in milliseconds	Information travels slowly
3	Information is directed to specific receptors—one or a few nerve fibres, gland cells or other neurons.	Information is spread throughout the body by blood from which the target cells or organs pick it up.
4	It gets response immediately	It get response usually slowly
5	Its effects are short-lived	Its effects are generally more prolonged

S.NO.	Name of Endocrine gland	Position in body	Hormone(s)	Chemical nature of Hormone(s)	Function(s)	Hypo/Hypersecretion causes	Special Points
1	Hypothalamus	Below thalamus in brain	Releasing and inhibiting hormones	Protein	Regulate the secretion of pituitary hormones		Ectodermal in origin
2	Pituitary	Below hypothalamus attached to it with a stalk called infundibulum	GH (Growth Hormone)	Protein	- Body growth - Growth of muscles and bones	- Hyposecretion in children causes dwarfism - Hypersecretion in children causes gigantism and in adults causes acromegaly	- Ectodermal in origin - Also called master gland of the body
	Anterior lobe		TSH (Thyroid Stimulating Hormone)	Protein	Regulate the secretion of hormones from thyroid		
			ACTH (Adrenocortico Tropic Hormone)	Protein	Secretion of hormones from adrenal cortex		
			FSH (Follicle Stimulating Hormone)	Protein	Stimulate spermatogenesis and oogenesis		LH in males is called ICSH
			LH (Luteinising Hormone)	Protein	It causes ovulation and formation of corpus luteum		Also Known as Prolactin.
	Middle lobe		ILTH (Luteotrophic Hormone)	Protein	Stimulate growth of mammary glands during pregnancy and promotes lactation after parturition (delivery).		
			MSH (Melanocyte Stimulating Hormone)	Protein	Metachrosis (colour change) in poikilothermals (cold blooded animals)		In human MSH is secreted by anterior lobe is merged in anterior lobe
	Posterior lobe		Oxytocin	Protein	- Function in human is not known. - Contraction of uterine muscles during pregnancy - Causes release of milk after delivery		Also called birth hormone
			Vasopressin	Protein	Reabsorption of water from DCT of nephron and collecting duct	Hyposecretion causes Diabetes insipidus	Also called ADH (Antidiuretic hormone)

3	Thyroid	Located in the neck between the trachea and larynx	Thyroxine – Calcitonin	Amine Protein	Regulate BMR of body – Decreases the level of calcium in blood	– Hyposecretion in children causes cretinism – Hyposecretion in adults causes myxoedema – Generally say hyposecretion of thyroxine causes simple goiter – Hypersecretion of thyroxine causes exophthalmic goiter	– Thyroxine is the only hormone stored in our body – Element in thyroxine is iodine
4	Parathyroid	Attached to thyroid	Parathormone (PTH)	Protein	– Increases the level of calcium in blood	– Hypersecretion of PTH causes osteoporosis – Hyposecretion causes tetany	– Also called Collip's Hormone
5	Pineal gland	Attached to epithalamus in brain	Melatonin	Amine	– Metachrosis in poikilothermals – Control sexual behaviour in mammals		– Also called epiphysis cerebri – Also called as third eye in frog – Ectodermal in origin
6	Pancreas	In the loop of duodenum	Insulin Glucagon	Protein Protein	– Decreases the level of glucose in blood – Increases the level of glucose in blood	– Hyposecretion of insulin causes Diabetes mellitus	– World Diabetes Day 14 November – Endocrine part of pancreas is called Islets of Langerhans . – Endodermal in origin
7	Adrenal gland Adrenal cortex Adrenal Medulla	Above kidney	Corticoids Mineralo corticoids Glucocorticoids Sex corticoids Adrenaline	Steroid Amine	– Maintain the level of Na^+ , K^+ and Cl^- in body – Carbohydrate metabolism – Secrete androgens and estrogens – Increases heart beat, blood pressure and blood glucose level	– Hyposecretion of corticoids causes Addison's disease – Hypersecretion of corticoids causes Cushing's and Conn's disease	– Ectomesodermal in origin – Also called 3-F gland , Life saving gland , 4-S gland , Emergency gland



8	Testes	Outside the abdominal cavity	– Testosterone	Steroid	– Stimulate spermatogenesis – Promote secondary sexual characters in males.		
9	Ovaries	Inside the abdominal cavity	– Estrogen – Progesterone	– Steroid – Steroid	– Stimulate oogenesis – Promote secondary sexual characters in females – Maintain pregnancy	– Progesterone is also called anti abortion hormone	
10	Thymus	Near heart	– Thymosin	Protein	– Increases immunity of body	– Endodermal in origin – Also called Throne of Immunity or training School of T-lymphocytes	

EXERCISE # 1**FOR SCHOOL / BOARD EXAMS.**

- The term 'hormone' was coined by :-
 (1) Yabuta (2) Went (3) Starling (4) Wilson
- Which of the following hormone known as anti-abortion hormone ?
 (1) Oxytocin (2) Estrogen (3) Progesterone (4) Testosterone
- Hyposecretion of thyroxine in children causes :-
 (1) Dwarfism (2) Gigantism (3) Acromegly (4) Cretinism
- Olfactoreceptors are related to :-
 (1) sense of sight (2) sense of touch (3) sense of smell (4) sense of hearing
- Name the hormone which controls basal metabolic rate in animals :-
 (1) Adrenaline (2) Thymosin (3) Oxytocin (4) Thyroxine
- Which hormones regulate calcium and phosphorus levels in the body :-
 (1) Calcitonin and parathormone (2) Insulin an gulcagon
 (3) Oxytocin and vasopessin (4) Thyroxine and thymosin
- The fight, flight and fright hormone is :-
 (1) Glucagon (2) Insulin (3) Oxytocin (4) Adrenaline
- Which of the following hormone controls appearance of secondary sexual characters in human male :-
 (1) Testosterone (2) Progesterone (3) Thyroxine (4) Estrogen
- Which of the following gland has both exocrine and endocrine parts :-
 (1) Thyroid (2) Pituitary (3) Adrenal (4) None of these
- Hyposecretion of in children causes dwarfism :-
 (1) Thyroxine hormone (2) Growth hormone
 (3) Adrenaline hormone (4) Vasopression hormone

TURE OR FALSE :

- Thyroid gland is the largest endocrine gland of the body.
- Endocrine part of pancreas is called islets of Langerhans.
- Progesterone is also known as birth hormone.
- Follicle stimulating hormone stimulates formation of corpus luteum.
- Function of Melanocyte Stimulating Hormone in human is not known.
- Neurohypophysis is associated with Growth Hormone (GH)
- ADH helps in reabsorption of water from nephron.
- Thyroid gland regulates the BMR of body.
- Secretion of exocrine glands is known as hormone.
- Hypothalamus regulates the secretion of pituitary hormones.

FILL IN THE BLANKS :-

1. Element is essential for the synthesis of thyroxine.
2. A mechanism regulates the action of the hormones.
3. Secretion of ductless gland is called
4. Deficiency of insulin hormone causes
5. Deficiency of causes cretinism in children.
6. Parathormone is also called
7. Pancreas is the type of gland.
8. hormone regulates growth and development of the body.
9. is the only hormone which stored in our body.
10. Spermatogenesis in males and oogenesis in females are stimulated by hormone.
11. Hyposecretion of causes diabetes insipidus.
12. hormone causes ovulation.
13. Insulin is secreted by and the glucagon by the of islets of Langerhans.
14. Secretion of milk is stimulated by while ejection of milk is stimulated by
15. The hormone which controls secondary sexual characters in male is
16. Oxytocin hormone is released by and help in
17. Anterior lobe of pituitary is also called while posterior lobe is also termed
18. Hyposecretion of thyroid hormones causes in infants and in adults.
19. The master gland in human body is
20. Hormones are substances secreted in quantities by

MATCH THE COLUMN :-

Column A		Column B	
(i)	Ovary	(a)	Anti-abortion hormone
(ii)	Vasopressin	(b)	Testosterone
(iii)	Master gland	(c)	Throne of Immunity
(iv)	Emergency hormone	(d)	Diabetes mellitus
(v)	Insulin	(e)	Diabetes insipidus
(vi)	Testes	(f)	Pituitary
(vii)	Oxytocin	(g)	Adrenaline
(viii)	Parathormone	(h)	Birth hormone
(ix)	Progesterone	(i)	Collip's hormone
(x)	Thymosin	(j)	Estrogen

OBJECTIVE QUESTION

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	3	3	4	3	4	1	4	1	4	2

TRUE OR FALSE :

- | | | | | |
|------|------|------|------|-------|
| 1. T | 2. T | 3. F | 4. F | 5. T |
| 6. F | 7. T | 8. T | 9. F | 10. T |

FILL IN THE BLANKS :

- | | | | |
|---------------------------------------|--------------------------|---------------------------------------|----------------------|
| 1. Iodine | 2. Feed back | 3. Hormone | 4. Diabetes mellitus |
| 5. Thyroxine | 6. Collip's hormone | 7. Heterocrine | 8. Growth |
| 9. Thyroxine | 10. Follicle stimulating | 11. Vasopressin | 12. Luteinising |
| 13. β -cells ; α -cells | 14. Prolactin, oxytocin | 15. Testosterone | |
| 16. Posterior pituitary ; Child birth | | 17. Adenohypophysis ; Neurohypophysis | |
| 18. Cretinism ; myxoedema | | 19. Pituitary | |
| 20. Chemical ; small; endocrine gland | | | |

MATCH THE COLUMN :

Ans. (i) - j, (ii) - e, (iii) - f, (iv) - g, (v) - d, (vi) - b, (vii) - h, (viii) - i, (ix) - a, (x) - c

VERY SHORT ANSWER TYPE QUESTIONS :

1. List two functions performed by ovaries in human female.
2. Write the function of hormone 'thyroxine' in our bodies.
3. Which hormone helps in lowering the level of blood glucose in human beings ?
4. Which hormone is responsible for the development of moustache and beard in men ?
5. Which type of glands in human body secrete hormones ? State any one location for them.
6. Why is oxytocin called as 'birth hormone' ?
7. Deficiency of which hormone leads to diabetes mellitus ?
8. Which gland secretes glucagon ?
9. Name the hormone that promotes motility of sperms.
10. What is the chemical nature of hormone ?
11. Name the hormone that controls the water and electrolyte balance in the body and its source glands.
12. Name the source glands of prolactin and estrogen.
13. Name one gland in human body which secretes digestive enzymes as well as hormones.
14. Name the organ which secretes progesterone.
15. Name the hormone and its source, which produces changes in secondary sex organs in human females to prepare for anticipated pregnancy.
16. Name the hormone secreted by thymus gland.
17. Which two endocrine glands perform dual functions ?
18. Name the endocrine gland which is present just above the heart.
19. What is the study of hormones called ?
20. Name the two systems that control and coordinate all other systems in human body.

SHORT ANSWER TYPE QUESTIONS :

1. Name the two hormones secreted by pancreas. Write one function of each hormone named.
2. Name the hormone responsible for regulation of :
 - (i) metabolism of carbohydrates, fats and proteins.
 - (ii) balance of calcium and phosphate
 - (iii) blood pressure.
 - (iv) water and electrolyte balance.
3. State the main function of 'pituitary gland'. Write the effect of :
 - (i) excessive and
 - (ii) sluggish activity of this gland on the growth of a child.
4. Name the ovarian hormones and given the function of any one of them.

5. Justify that the pancreas and the gonads perform dual functions.
6. Glucagon and insulin are antagonistic to each other. Justify the statements.
7. Bring out any two differences between enzymes and hormones.
8. Why is oxytocin called a female hormone ?
9. "There is close coordination between nerves and hormones". Explain with an example.
10. What is thymus gland and state its location.
11. Why pancreas is called a mixed gland ? Write the names of its hormones.
12. Give the source and biological significance of following hormones :
 (i) oxytocin (ii) Testosterone (iii) FSH
13. What are 'releasing hormones' ? Where are they released from ?
14. Justify that the pancreas and the gonads perform dual functions.
15. Name the hormones secreted from pituitary.
16. Out of all the pituitary hormones, which two are exclusively female ? What function do they serve ?
17. Where is hypothalamus gland located ? What does it produce ? State the function of hypothalamus.
18. How do you support the statement that 'pancreas is the overall controller of the blood glucose level' ?
19. What are the male and female gonads in human beings ? State any two functions of each of them.
20. Give the full form of GH. Name the gland that secretes it. Mention its any two functions. Name the hormone that inhibits the secretion of GH. Name the disorder that is caused due to the failure of secretion of GH.

LONG ANSWER TYPE QUESTIONS :

1. Show in a tabular form the names of endocrine glands, hormones secreted by them and their functions.
2. Name five hormones secreted by pituitary gland and mention their functions.
3. What is endocrine system ? What are its functions ? Name the important endocrine glands present in human body. Draw a labelled diagram to show the positions of these endocrine glands in the human body.
4. Name the source gland and give one main action of the following hormones :
 (i) Prolactin (ii) Calcitonin (iii) Insulin (iv) Vasopressin
 (v) Oxytocin (vi) Parathormone (vii) Testosterone (viii) Progesterone

NCERT QUESTIONS :

1. Why is the use of iodised salt advisable ?
2. How does our body respond when adrenaline is secreted into blood ?
3. Why are some patients of diabetes treated by giving injections of insulin ?
4. What is the need for a system of control and coordination in an organism ?
5. How does chemical coordination take place in animals ?
6. Compare and contrast nervous and hormonal mechanisms for control and coordination in animals.

1. Which gland is lost as age advances ?
 (1) Thyroid (2) Thymus (3) Adrenal (4) Pituitary
1. Addison's disease is caused by :-
 (1) hyposecretion of parathormone (2) hypersecretion of corticoids
 (3) hyposecretion of corticoids (4) hypersecretion of insulin
3. Sweat glands, salivary glands and gastric glands are the examples of :-
 (1) Heterocrine glands (2) Endocrine glands
 (3) Both Endocrine and exocrine glands (4) Exocrine glands
4. Secretion of pituitary hormones is regulated by :-
 (1) Thyroid (2) Thymus (3) Adrenal (4) Hypothalamus
5. Which hormone is responsible for metamorphosis in frog ?
 (1) Thymosin (2) Thyroxine (3) Melatonin (4) Glucagon
6. Injecting a tadpole with thyroxine would lead to :-
 (A) giant but normal tadpoles (B) precocious metamorphosis
 (C) stoppage of metamorphosis (D) atrophy of gonads
7. A very high level of calcium in the blood suggests malfunction of the :-
 (A) parathyroid (B) thyroid (C) thymus (D) adrenal gland
8. Cortisone is used for the treatment of inflammation, allergy and arthritis. Which of the following endocrine glands produces cortisone :-
 (A) Thyroid (B) Pancreas (C) Adrenal (D) Gonads
9. Proprioceptors are :-
 (A) meant for detecting pressure in the skin
 (B) for magnifying sound in the internal ear
 (C) internal sense organs which occur most frequently in muscles
 (D) for the detection of direction of waves in fishes
10. Production of ADH, monitor of temperature and blood pressure, is mainly controlled by :-
 (A) cerebellum (B) cerebrum (C) hypothalamus (D) medulla

ANSWER KEY COMPETITIVE QUESTIONS

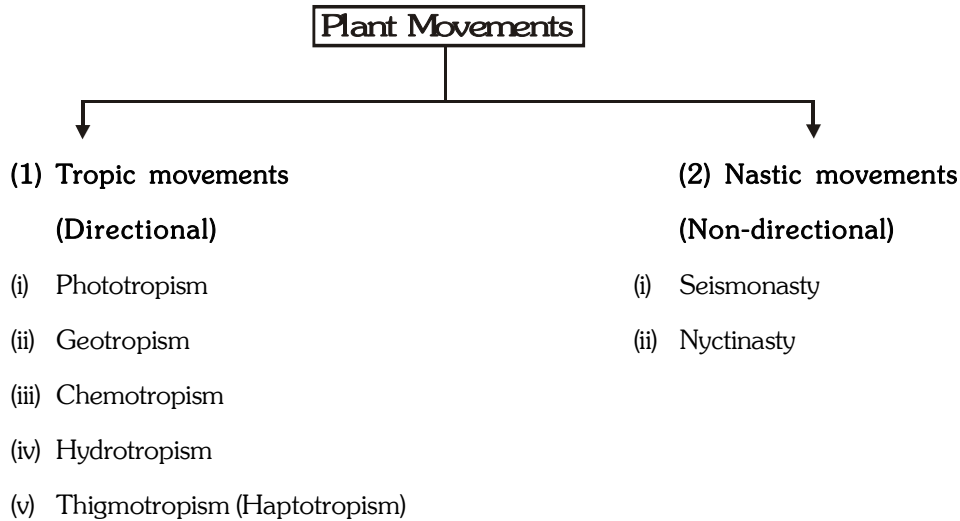
Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	2	3	4	4	2	2	1	3	3	3

PLANT MOVEMENTS & PLANT HORMONES

PLANT MOVEMENT : The movements in plants are not as apparent as in case of animals. Plants generally show movements at a very slow rate. The higher plants are fixed to the substratum by means of roots. They can not move from one place to another. They, therefore show movement of their organs only.

CLASSIFICATION OF PLANT MOVEMENTS :

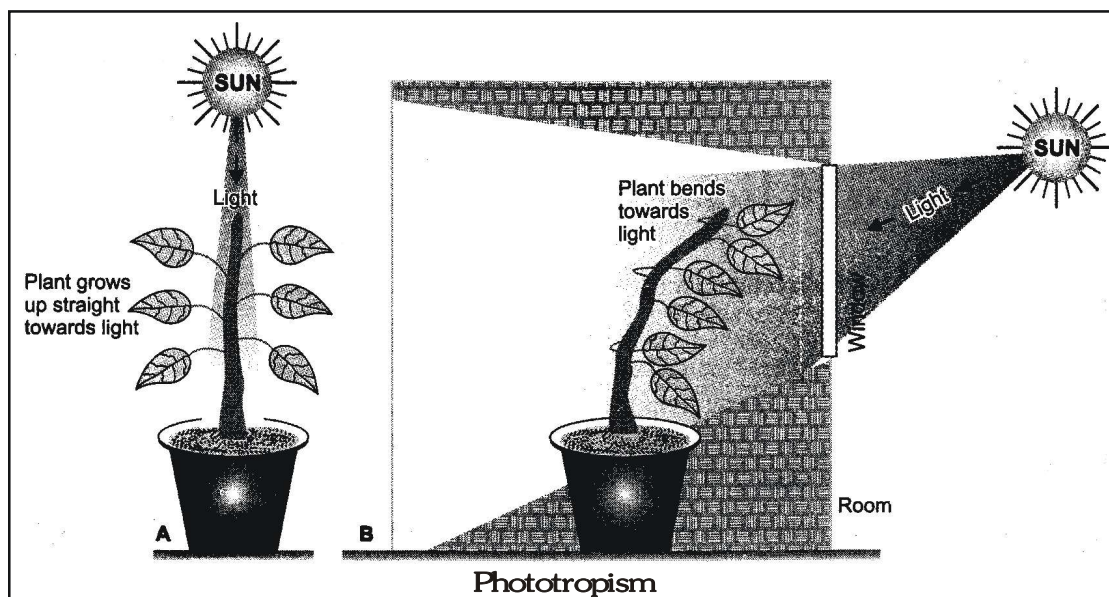
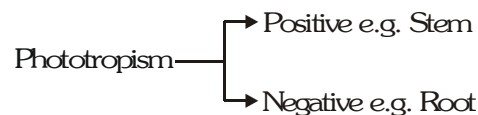
Plant movements are broadly classified into two types :



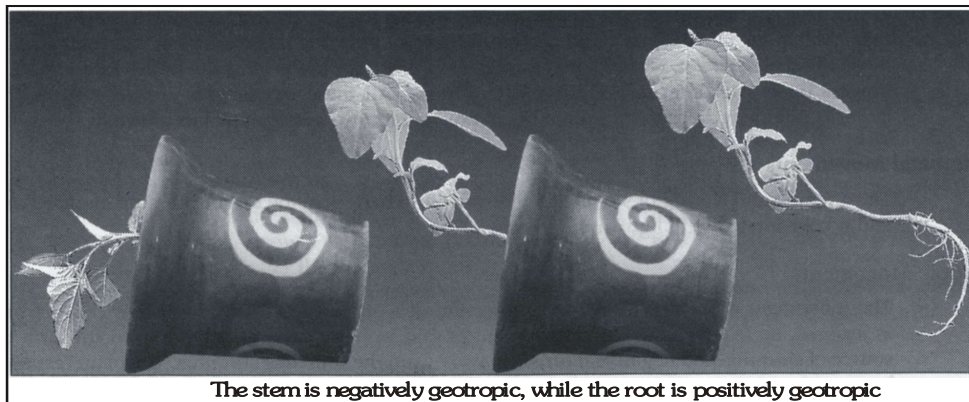
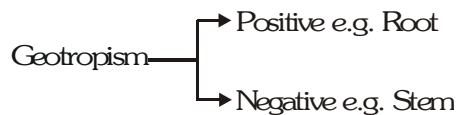
1. Tropic movements :- Directional movements or orientations of specific part of a plant in response to external stimuli such as light, force of gravity, chemicals, water are called tropisms or tropic movements.

Tropic movements are very slow. The movement of the plant part can be either towards the stimulus (positive tropism) or away from the stimulus (negative tropism).

(i) Phototropism :- Definite direction movement in relation to light.



(ii) **Geotropism** :- Definite direction movement in relation to gravity.

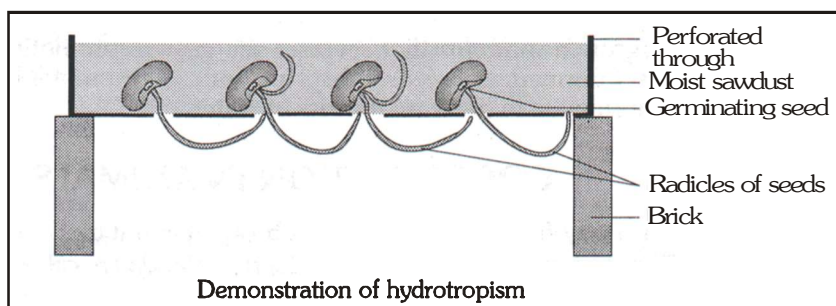


(iii) **Chemotropism** :- Definite direction movement in relation to chemicals.

e.g. – Movement of pollen tubes and fungal hyphae.

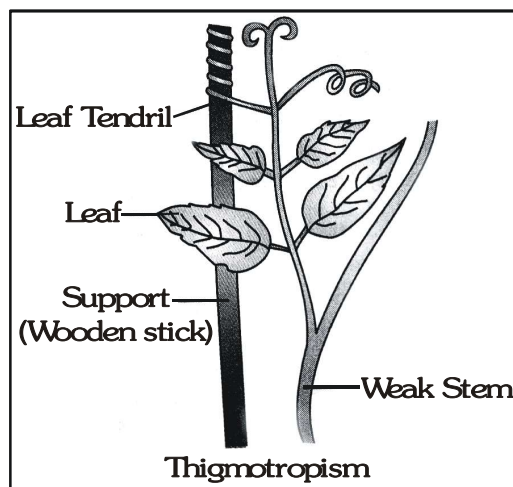
(iv) **Hydrotropism** :- Definite direction movement in relation to water.

e.g. – Roots of seedlings.



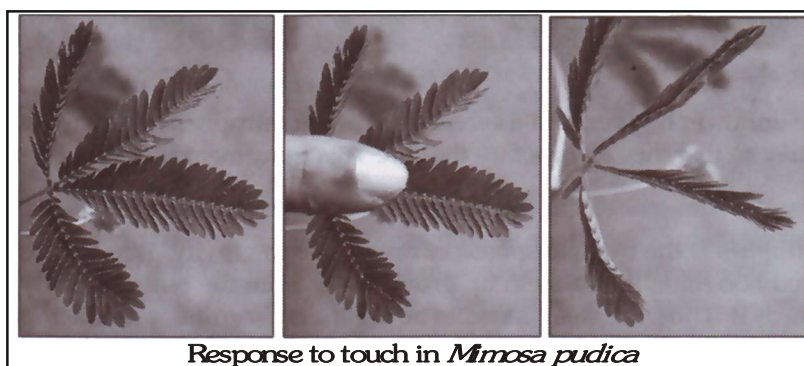
(v) **Thigmotropism (Haptotropism)** :- Definite direction movement in relation to contact or support. The pea plant develops tendrils which help it to climb up other plants or fences or some other support. These tendrils are sensitive to touch.

e.g. – Tendrils, haustoria of *Cuscuta*.



(2) Nastic movements :- Induced by external stimuli such as light, temperature, touch. However, these are not directional movements. Here, the part of the plant does not respond towards or away from the stimulus. Nastic movements include :-

(i) Seismonasty :- The turgor changes occur in thin-walled cells of pulvinus, causing folding and drooping of the compound leaves. Such movements occur in response to touch (shock). These movements are very quick and are best seen in 'touch-me-not' plant (*Mimosa pudica*), also called '*Chhui-mui*' or '*Lajwanti*' or '*sensitive plant*'. If we touch the leaves of the chhui-mui plant with our finger, we find that all its leaves immediately fold up and droop. After sometime, the leaves regain their original status. Here, no growth is involved. Instead, plant cell change shape by changing the amount of water in them (turgor changes), resulting in folding up and drooping of leaves.



(ii) Nyctinasty :- Sleep movements – Due to day and night.

e.g. –Daily movement of flowers, leaves, stomata.

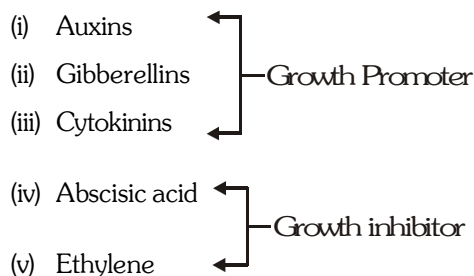
Tropic movements	Nastic movements
(i) Direction of movement is in the direction of the stimulus.	(i) Direction of movement is not determined by the direction of stimulus.
(ii) Growth takes place	(ii) Growth does not take place.
(iii) Movements are slow.	(iii) Movements are fast
(iv) e.g. Growth movement of shoot towards light	(iv) e.g. The folding up and drooping of leaves in the sensitive plants.

REVIEW QUESTIONS

1. Name any two types of tropism.
2. Define seismonasty.
3. Fill in the following blanks :-
 - (a) A plant's response to light is called.....
 - (b) A plant's response to gravity is called.....
 - (c) A plant's response to contact is called.....

CHEMICAL COORDINATION IN PLANTS

- ☐ A phytohormone can be defined as a chemical substance which is produced naturally in plants and is capable of translocation and regulating one or more physiological processes.
- ☐ Different plant hormones help to coordinate growth development and responses to the environment. They are synthesised at places away from where they act and simply diffuse to the area of action.
- ☐ First plant hormone, discovered by **Went** was **auxin**.
- ☐ Main phytohormones are –



(i) Auxins :-

- ☐ When growing plants detect light, a hormone called auxin, synthesised at shoot tip, helps the cells to grow longer.
- ☐ When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.
- ☐ This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light.

Functions of Auxins

- ☐ **Promote cell division and elongation**
- ☐ **Cause apical dominance (terminal or apical bud inhibits the development of lateral buds)**
- ☐ Used in parthenocarp (production of seedless fruits without pollination and fertilization).
- ☐ Help in root initiation in cutting or in callus differentiation.

(ii) Gibberellins (GA) :-

- **Yabuta and Sumiki (1938)** were the first to extract a substance from the *Gibberella* fungus, which they named as Gibberellin.

Functions of Gibberellins

- ☐ **Stimulate stem elongation.**
- ☐ Help in seed germination.
- ☐ Rossette plants show bolting effect when treated with gibberellins.

(iii) Cytokinins (CK) :-

- ☐ Cytokinins promote cell division, and it is natural then that they are present in greater concentration in areas of rapid cell division such as in fruits and seeds.

Functions of Cytokinins

⇒ **Promote cell division and elongation**

- ☐ Suppress apical dominance (promotes lateral branches in the presence of apical bud).
- ☐ Help in secondary growth (growth in thickness).
- ☐ Promote production of female flowers.
- ☐ It helps in breaking the dormancy of seeds and buds.

(iv) Absciscic Acid (ABA) :- It is also known **stress hormone** or **dormin**.

Functions of Absciscic Acid (ABA)

- ☐ **Inhibit growth hence called antiauxins or antigibberellins**
- ☐ **Reduce transpiration by closing stomata under water stress conditions, hence called stress hormone**
- ☐ **Stimulate the formation of abscission zone (zone of separation), causes wilting of leaves.**

(v) Ethylene (Gaseous hormone) :-

Functions of Ethylene (Gaseous hormone)

- ☐ **Promote fruit growth and ripening**
- ☐ **Cause ageing (senescence)**

REVIEW QUESTIONS

1. Name any four plant hormones.
2. From where gibberellins were isolated?
3. Name growth inhibitor in plants.
4. Name the gaseous hormones.

Do you know ?

Photoperiodism :- Effect or requirement of relative length of day (photoperiod) and night (dark phase) on flowering of plants is called as **photoperiodism**. The phenomenon was first discovered by **Garner and Allard** on *Maryland mammoth* (a mutant variety of tobacco) and they classified plants into following groups –

(i) SDP (Short Day Plants) :- They need short day length for flowering.

e.g. – Tobacco, Soybean, Strawberry, Dahlia, Sugarcane.

(ii) LDP (Long Day Plants) :- They need long day length for flowering.

e.g. – Potato, Radish, Carrot, Wheat, Spinach.

(iii) DNP (Day Neutral Plants) :- They do not need any specific light period for the flowering.

e.g. – Zea, Cotton, Tomato, Sunflowers, Cucumber.

Phytochrome :- It is light sensitive pigment responsible for flowering which discovered by **Borthwick and Hendricks..**

Vernalization (Yarovization) :- "Acceleration of ability to produce flower by chilling treatment is called vernalisation".

EXERCISE # 1**FOR SCHOOL / BOARD EXAMS.**

1. Avena coleoptile test to find out growth promoting hormones was performed by :-
(1) Went (2) Lysenko (3) Butler (4) Borthwick
2. Which of the following effects of auxins is of wide application :-
(1) Induction of fruit development (2) Induction of root initiation
(3) Prevention of abscission (4) All of the above
3. Stem elongation is affected by :-
(1) Gibberellin and florigen (2) Auxin and gibberellin
(3) Florigen and kinin (4) Kinin and auxin
4. Apical dominance means :-
(1) Suppression of growth of apical bud by axillary buds
(2) Suppression of growth of axillary buds by the presence of apical bud
(3) Stimulation of growth of axillary buds by removal of apical bud
(4) Inhibition of growth of axillary buds by removal apical bud
5. Which of the following is not natural occurring plant hormone :-
(1) 2, 4-D (2) Cytokinin (3) Gibberellin (4) I.A.A
6. Parthenocarpy is the production of :-
(1) Fruits with pollination (2) Fruits without fertilization
(3) Seeds with fertilization (4) Only seeds and no fruits
7. Clinostat is used in study for :-
(1) Photosynthesis (2) Respiration (3) Geotropism (4) Osmosis
8. Phytohormone term was coined by :-
(1) Gregory and Purvis (2) F.W.Went (3) Thimann (4) L.J.Audus
9. Cytokinin :-
(1) Is a hormone whose main function is to induce the cell division
(2) Is the process of cell division
(3) Retards cell division
(4) Causes dormancy
10. Gibberellin was first extracted from :-
(1) *Gibberella* (2) *Gelidium* (3) *Gracillaria* (4) *Aspergillus*
11. Which of the following breaks the dormancy of seeds :-
(1) IAA (2) GA (3) Ethylene (4) All the above
12. Absciscic acid induces :-
(1) Shoot elongation (2) Cell elongation and cell wall formation
(3) Cell division (4) Leaf fall and dormancy
13. Which of the following is a hypothetical hormone :-
(1) Gibberellin (2) Auxin (3) Cytokinin (4) florigen
14. Which of the following is a growth inhibitor hormone :-
(1) Cytokinin (2) Gibberellin (3) Auxin (4) Absciscic acid
15. *Mimosa* (touch me not plant) shows :-
(1) Thigmotropism movement (2) Chemotactic movement
(3) Thigmonasty (4) Seismonasty

TRUE OR FALSE

1. The movement of a plant part in response to water is called hydrotropism.
2. Auxin hormone increases the rate of growth in a stem but it decreases the rate of growth in a root.
3. Absciscic acid is the only gaseous plant hormone.
4. The phenomenon apical dominance is due to the plant hormone - gibberellins.
5. Ethylene induces ripening of fruits.
6. *Mimosa pudica* shows seismonastic movements.
7. Auxin initiates the root formation.
8. Cytokinins induce stem elongation in rosette plants.
9. Foolish seedling disease is associated with gibberellin.
10. First plant hormone was discovered by Went.

FILL IN THE BLANKS

1. When growing plants detect light, a hormone called synthesised at the shoot tip.
2. Plant hormone promotes cell division.
3. is the response to touch in plants.
4. A phenomenon in plants which is controlled by the duration of light is called
5. In plant, chemical control is brought about by
6. The different phytohormones are,, and
7. Phototropic movements take place due to the stimulus of
8. Touch-me-not plant shows movement.
9. Plant shoots grow upwards and show
10. Plant roots grow downwards and show
11. Phytohormone term is given by
12. Organic substances which regulate the growth of plant, are called
13. Apical bud dominates over the growth of lateral buds, this phenomenon is called
14. IAA and IBA are the example of

MATCH THE COLUMN

Column A		Column B	
(i)	Ethylene	(a)	Bolting effect
(ii)	Root	(b)	Positive phototropic
(iii)	Abscisic acid	(c)	Richmond Lang effect
(iv)	Stem	(d)	Positive geotropic
(v)	Cytokinin	(e)	Stress hormone
(vi)	<i>Mimosa pudica</i>	(f)	Ripening of fruits
(vii)	Went	(g)	Seismonasty
(viii)	Auxin	(h)	Auxin
(ix)	Gibberellin	(i)	Apical dominance

CONTROL & COORDINATION IN PLANT
ANSWER KEY
EXERCISE # 1
OBJECTIVE QUESTIONS

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	4	2	2	1	2	3	3	1	1	2	4	4	4	4

TRUE OR FALSE

1. T 2. T 3. F 4. F 5. T
6. T 7. T 8. F 9. T 10. T

FILL IN THE BLANKS

1. Auxin 2. Cytokinin 3. Thigmotropism 4. Photoperiodism
5. Phytohormones 6. auxin ; cytokinin ; gibberellin ; abscisic acid ; ethylene
7. Light 8. Seismonastic 9. Positive phototropic 10. Positive geotropic
11. Thimman 12. Plant hormones / phytohormones 13. Apical dominance
14. Natural auxins

MATCH THE COLUMN

Ans. (i) – f, (ii) – d, (iii) – e, (iv) – b, (v) – c, (vi) – g, (vii) – h, (viii) – i, (ix) – a

EXERCISE # 2**FOR SCHOOL / BOARD EXAMS.****VERY SHORT ANSWER TYPE QUESTIONS**

1. What are phytohormones ?
2. Which type of movement is shown by the leaves of "touch-me-not" when touched ?
3. Name the pigment in plant which perceives light stimulus.
4. Give the major role of cytokinin in plants.
5. Which growth regulator is found in the form of gas ?
6. Which growth hormone is present in the tip of a stem ?
7. Name the three stimuli which act on plants.
8. Which hormone is used for artificial ripening of fleshy fruits ?
9. Name the plant hormone which causes stem elongation and leaf elongation.
10. Which plant hormone brings parthenocarpy in plants ?
11. Name the stress hormone in plants.
12. Name the growth inhibitor in plants.
13. From where gibberellins were isolated ?
14. What are tropic movements ?
15. What are nastic movements ?

SHORT ANSWER TYPE QUESTIONS

1. Differentiate between tropic and nastic movements in plants, give one example of each.
2. Give terms for following :-
 - (i) The movement of plant in the direction of light,
 - (ii) The movement of plant towards chemical substances.
 - (iii) The movement of plant towards gravity.
 - (iv) The movement of plant towards water.
3. Define phytohormone. Name any four phytohormones.
4. Why do stem and root show growth towards light and gravity respectively ?
5. What are auxins and where are they synthesised in plant body ?
6. Define hydrotropism. Give one example of it.
7. What is geotropism ?

8. Classify the following movements as tropic or nastic.
(i) opening of flower (ii) roots moving downwards
(iii) shoots moving towards light (iv) twirling of a tendril
9. Define tropism. What are different types of tropism ?
10. Give the difference between auxins and gibberellins.
11. Differentiate the functions of auxins, gibberellins and cytokinins.
12. Explain nyctinasty with examples.
13. What is the thigmotropism ?
14. Define seismonasty.
15. What is bolting effect ?
16. Define apical dominance.
17. Write the characteristic functions of abscisic acid and ethylene.
18. Give the full forms of following :-
(i) IAA (ii) IBA (iii) NAA (iv) 2, 4-D (v) 2, 4, 5 - T

LONG ANSWER TYPE QUESTIONS

1. Explain the functions of auxins and cytokinins.
2. Write the effects of gibberellins on plant growth in detail.
3. How do abscisic acid and ethylene effect plant growth ?
4. Differentiate tropic and nastic movements. Write their different types with examples.

NCERT QUESTIONS

1. Design an experiment to demonstrate hydrotropism.
2. How does chemical coordination occur in plants ?
3. What is the difference movement in the sensitive plant and movement in our legs take place ?
4. How does phototropism occur in plants ?
5. How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light.
6. How do auxins promote the growth of a tendril around a support ?
7. What are plant hormones ?
8. Give an example of a plant hormone that produces growth.