

Control and Coordination



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NERVOUS SYSTEM IN ANIMALS

Imagine that bright light is focussed on our eyes or we touch a hot object. We are able to detect the change and respond to it with movement in order to protect ourselves. All this movement, in response to the environment, is carefully controlled as the movement to be made depends upon the event that triggers it. All living organisms must use systems providing control and coordination and they must have specialised tissues to provide these control and coordination activities.

In animals, control and coordination are provided by nervous and muscular tissues. All information from our environment is detected by the specialised tips of some nerve cells. These receptors are usually located in our sense organs, such as the inner ear, the nose, the tongue, and so on.

The nervous system includes the brain, spinal cord and nerves. It controls and coordinates various functions in the body. Its functions are:

- (1) It receives information from the surroundings, processes and interprets it, and responds accordingly.
- (2) It passes information from one internal system to another.

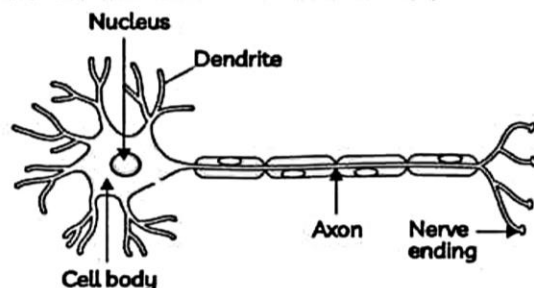
Sense organs: Sense organs or the receptors are specialized structures through which animals receive a variety of external information. These are:

- (1) Photoreceptors for light
- (2) Phonoreceptors for sound
- (3) Olfactory receptors for smell
- (4) Gustatory receptors for taste

Sensory neurons: These are the special type of nerve cells through which the receptors pass information to the brain.

Neuron

A neuron is the structural and functional unit of nervous system and is the largest cell found in the body. A neuron has three components:



Structure of a neuron

Structure of a Neuron

- (1) **Cell body or Cyton:** The cell body is like a typical

cell containing nucleus and granular cytoplasm. Stimulus is changed into impulse in the cyton.

- (2) **Dendrites:** Dendrites are short and branched processes connected to the cyton. They receive sensation or stimulus, which may be physical, chemical, mechanical or electrical. The stimulus is passed onto cyton.
- (3) **Axon:** Axon is the longest part of the neuron. It is a single, elongated fibre arising from one side of cyton. It conducts impulses away from the cell body. The plasma membrane of an axon is covered by a protective sheath of lipid and protein called myelin sheath, formed by the Schwann cells.

Synapse: It is the functional junction between two adjacent neurons or nerve cells, i.e., between the axon ending of one neuron and the dendrites of the next.

Nerve Impulse

Nerve impulse is the information in the form of chemical and electrical signals passing through neurons. These impulses are carried by dendrites towards the cell body.

Nerve Impulse Travelling Through the Body

- (1) The information, acquired at the end of the dendritic tip of a nerve cell, sets off a chemical reaction that creates an electrical impulse.
- (2) This impulse travels from the dendrite to the cell body, and then along the axon to its end.
- (3) At the end of the axon, the electrical impulse sets off the release of some chemicals.
- (4) These chemicals cross the gap, or synapse, and start a similar electrical impulse in a dendrite of the next neuron.

Example 1. What is the need for a system of control and coordination in an organism? [NCERT]

Ans. All living organisms respond to changes in their environment for which they need a well organized system of control and coordination. At times we have controlled movement that must be connected to the recognition of various events in the environment, followed by only the correct movement in response to the stimulus. Specialised tissues are used to provide these control and coordination activities in multicellular organisms.

Example 2. How do we detect the smell of an agarbatti (incense stick)? [NCERT]

Ans. The smell of an agarbatti is detected by the olfactory receptors present in our nose

which generate nerve impulses that reach the olfactory lobes present in the forebrain which produce the sensation of smell.

Example 3. Case Based:

Put some sugar in your mouth. How does it taste? Block your nose by pressing it between your thumb and index finger. Now eat sugar again. Is there any difference in its taste? While eating lunch, block your nose in the same way and notice if you can fully appreciate the taste of the food you are eating.

[NCERT Activity 1]

(A) Identify the correct statements:

- (I) Taste of sugar is sweet.
- (II) Gustatory receptors in our tongue are responsible for taste.
- (III) Olfactory receptors in our tongue are responsible for smell.
- (IV) Receptors communicate information to the mouth so that we are able to taste things.
- (a) Only (I)
- (b) Both (I) and (II)
- (c) (I), (II) and (III)
- (d) (I), (III) and (IV)

(B) When we block our nose by pressing it between our thumb and index finger, then:

- (a) There is no change in taste of sugar
- (b) We do not get the taste of sugar
- (c) There is a change in the taste of sugar
- (d) Sugar tastes salty

(C) Can you fully appreciate the taste of the food you are eating if you block your nose while eating lunch?

(D) Loss of smell and taste is one of the early symptoms of COVID-19. Justify.

(E) Assertion (A): The taste of food changes when we have blocked nose due to common cold.

Reason (R): Gustatory receptors are responsible for taste

- (a) Both (A) and (R) are true and (R) is the correct explanation of the (A).
- (b) Both (A) and (R) are true, but (R) is not the correct explanation of the (A).
- (c) (A) is true, but (R) is false.
- (d) (A) is false, but (R) is true.

Ans. (A) (b) Both (I) and (II)

Explanation: The taste of sugar is sweet. The taste is because of the combined perception of our sensory organs tongue and nose. Gustatory receptors in tongue and olfactory

receptors in nose are responsible for taste and smell respectively. Both sensations are communicated to the brain, which integrates the information so that flavors can be recognized and appreciated.

(B) (c) There is a change in the taste of sugar

Explanation: Smell and taste are closely linked. The taste buds of the tongue identify taste, and the nerves in the nose identify smell. Gustatory receptors in tongue and olfactory receptors in nose are responsible for taste and smell respectively. Both sensations are communicated to the brain, which integrates the information so that flavors can be recognized and appreciated.

(C) No, we cannot fully appreciate the taste of the food we are eating if we block our nose while eating as the general perception of taste, which we have for any particular eatable substance, is jointly created by our sense organs tongue and nose through receptors. Gustatory receptors in tongue will detect taste while olfactory receptors in nasal cavity will detect smell.

(D) Smell receptors can be temporarily damaged by the influenza (flu) virus or the Corona Virus. Some people cannot smell or taste for several days or even weeks after the virus attacks our body. Sudden loss of smell also may be an early symptom of corona virus disease 2019 (COVID-19), an acute respiratory illness that has taken so many lives in 2020-21.

(E) (b) Both (A) and (R) are true, but (R) is not the correct explanation of the (A).

Explanation: When we have a blocked nose due to common cold, our ability to taste food changes due to the blockage of olfactory bulb which are the series of nerve endings in the nose, that not only allows to smell, but to taste at the same time. Gustatory receptors in tongue will detect taste while olfactory receptors in nasal cavity will detect smell.

The ability to smell can be affected by changes in the nose, in the nerves leading from the nose to the brain, or in the brain. For example, if nasal passages are blocked due to common cold, the ability to smell may be reduced because odors are prevented from reaching the smell receptors (specialized nerve cells in the mucous membrane lining the nose). Because the ability to smell affects taste, food often does not taste right to people with a cold.

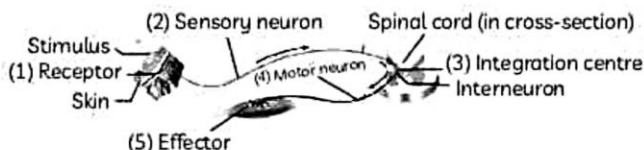
Reflex Action

Reflex action is defined as an unconscious and involuntary response of effectors (muscles and glands) to

a stimulus. For example, knee-jerk reflex, coughing, sneezing, yawning, and blinking of eyes, movement of the diaphragm, etc.

Reflex Arc

- (1) Reflex arc is the pathway taken by the nerve impulses and responses in a reflex action, i.e., from the receptor organs to the spinal cord by sensory nerves and from the spinal cord to the effector organs via motor nerves.



- (2) Nerves from all over the body meet in a bundle in the spinal cord on their way to the brain.
- (3) Reflex arcs are formed in this spinal cord itself, although the information input also goes on to reach the brain.
- (4) Reflex arcs have evolved in animals because the thinking process of the brain is not fast enough.

Example 4. What is the role of the brain in reflex action? [NCERT]

Ans. The spinal cord is the main coordinating centre in reflex actions and the brain has no role to play except that the information is also conveyed to the brain for memory.

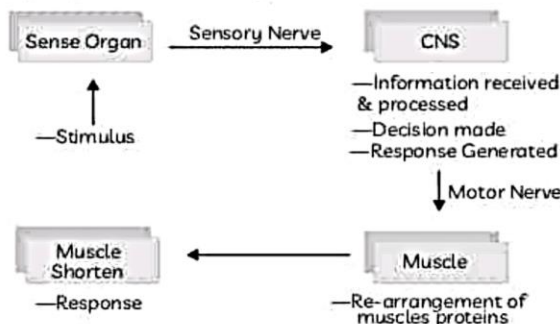
Human Brain

Brain is the highest coordinating centre of the body. The brain and spinal cord constitute the central nervous system. They receive information from all parts of the body and integrate it.

Brain is protected by the cranium, a bony box in the skull and is covered by three membranes called meninges. The space between membranes is filled by cerebrospinal fluid which protects the brain from mechanical shocks.

Coordination between Nervous and Muscular Tissue

The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system.



The vertebrate nervous system is highly evolved and consists of:

- (1) **Central Nervous System** includes brain and spinal cord

Spinal cord: Spinal cord is a cylindrical structure and begins in continuation with the medulla oblongata and extends downward. A total of thirty one pairs of spinal nerves arise from the spinal cord.

Functions of spinal cord:

- It is the main centre of reflex action.
- It is concerned with the conduction of nerve impulses to and from the brain.

- (2) **Peripheral Nervous System** consists of cranial and spinal nerves. The cranial nerves arise from the brain and spinal nerves arise from the spinal cord.

Example 5. Which signals will get disrupted in case of a spinal cord injury? [NCERT]

Ans. All the signals and responses within the Central Nervous System, which are exchanged between brain and different body parts through the spinal cord may get disturbed causing impaired functioning of different body parts like in paralysis.

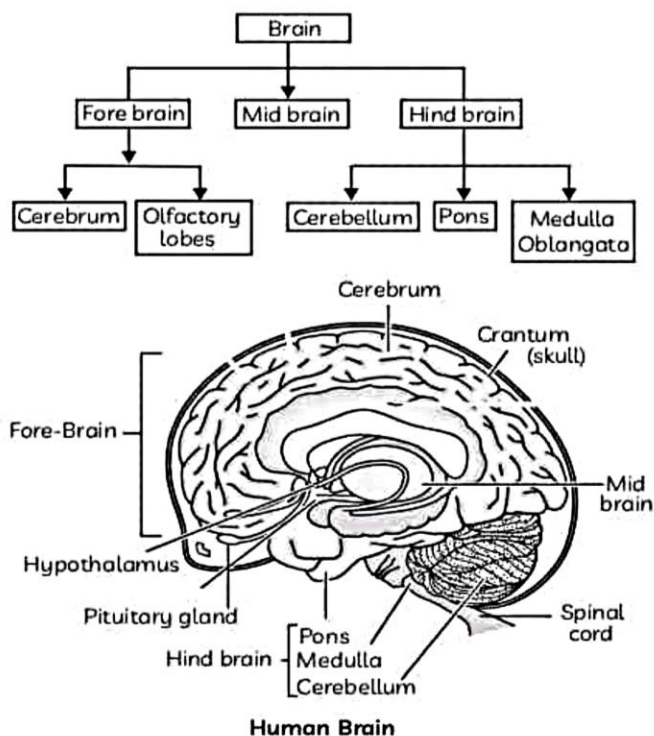
Also, signals for reflex actions and involuntary actions will get disrupted in case of a spinal cord injury.

The Main Functions of Brain

- (1) The brain receives information carrying impulses from all the sensory organs of the body.
- (2) The brain responds to the impulses brought in by sensory organs by sending its own instructions to the muscles and glands causing them to function accordingly.
- (3) The brain correlates the various stimuli from different sense organs and produces the most appropriate and intelligent response.
- (4) The brain coordinates the activities of the body so that the mechanisms and chemical reactions of the body work together efficiently.
- (5) The brain stores 'information' so that behaviour can be modified according to the past experience. This function makes brain the organ of thought and intelligence.

Parts of Brain

The brain has three such major parts or regions, namely the fore-brain, mid-brain and hind-brain.



Fore brain

- (1) Fore brain includes cerebrum and olfactory lobes.
- (2) The forebrain is the main thinking part of the brain.
- (3) It has regions which receive sensory impulses from various receptors.
- (4) Separate areas of the fore-brain are specialized for hearing, smell, sight and so on.
- (5) The sensation that we have eaten enough is because of a centre associated with hunger, which is in separate part of the fore-brain.

Cerebrum

- (1) Cerebrum is the most complex and specialized part of the brain.
- (2) It consists of two cerebral hemispheres.
- (3) It has a sensory areas where information is received from sense organs and a motor area from where impulses are sent to effector organs.
- (4) There are specific regions for each kind of stimulus and its response.
- (5) Olfactory lobes: It lies below the cerebrum and contain olfactory receptors which are the organs of smell.

Region	Stimulus
Olfactory Lobe	Visual reception
Temporal Lobe	Auditory reception
Frontal Lobe	Muscular activities
Parietal Lobe	Touch, smell, taste, temperature and conscious association

Example 6. What is the function of receptors in our body? Think of situations where receptors do not work properly. What problems are likely to arise? [NCERT]

Ans. The main function of receptors in our body is to detect information from our environment. These receptors are usually located in our sense organs, such as tongue, nose, inner ear, skin etc. The information collected by the receptors is transferred to brain through an organised network of nerve cells for processing.

There may be situations, where receptors do not work properly. For example, gustatory receptors in tongue detect taste while olfactory receptors in nasal cavity detect smell. In case they do not work properly, the food will have no taste or may taste differently. Also, in the absence of smell, we may end up eating spoiled food or rotten fruits.

Mid brain

Mid brain connects the fore brain to the hind brain. Its functions are:

- (1) It controls reflex movements of the head, neck and trunk in response to visual and auditory stimuli.
- (2) It also controls the reflex movements of the eye muscles, change in pupil size and shape of the eye lens.

Hind brain

Hind brain consists of three centres which are Cerebellum, Pons and Medulla oblongata.

- (1) **Cerebellum:** Cerebellum lies at the roof of the hind brain and controls the coordination and adjustments of movement and postures of the body.
- (2) **Pons:** Pons lies just above the medulla and takes part in regulating respiration.
- (3) **Medulla oblongata:** Medulla oblongata lies at the floor of the hind brain and continues into the spinal cord. It is the regulating centre for swallowing, coughing, sneezing and vomiting. It is also the seat of involuntary activities which controls heart beat, breathing and blood pressure.

Many of the involuntary actions are controlled by the mid brain and the hind brain.

Example 7. How are involuntary actions and reflex actions different from each other? [NCERT]

Ans. Involuntary action and reflex action are different in the following ways:

Involuntary Action	Reflex Action
These are muscle movements over which we do not have any thinking control	These are quick automatic responses carried out by muscles without any thought processes under taken by brain
These actions are regulated by the brain	These actions are regulated by the spinal cord
These actions are performed throughout one's life	These actions produced in response to an event of an emergency

This action may be quick or slow	This action is always quick
Example: Beating of the heart	Example: Immediate withdrawal of hands upon touching a hot cup of tea

Nervous Tissue in Action

Muscle cells have special proteins that change both their shape and their arrangement in the cell in response to nervous electrical impulses.

When a nerve impulse reaches the muscle, the muscle fibre moves due to which new arrangements of these proteins give the muscle cells a shorter form.

TOPIC 2

COORDINATION IN PLANTS

Plants show two types of movement one dependent on growth and the other independent of growth. Some common observations are:

- (1) The leaves of touch-me-not plant begin to fold up and droop on being touched. There is no growth involved in this movement.
- (2) When a seed germinates, first the root goes down and the stem comes up into the air. The directional movement of a seedling is caused by growth.

Plants respond to various stimuli like light, gravity, chemicals, water, and touch etc due to the effect of hormones. However, since plants do not have a nervous system, they do not respond as quickly as compared to animals. It usually takes a considerable time to observe the effect of a stimuli as plants respond to various stimuli very slowly.

If we touch a plant movement happens at a point different from the point of touch. So, information that a touch has occurred must be communicated.

Immediate Response to Stimulus

Nastic Movements

Nastic movement is the movement of plant organs in response to external stimulus which is independent of the direction of stimulus. For ex, the leaves of 'touch-me-not' plant bend and droop on touching.

- (1) Plants use electrical-chemical means to convey any information from one cell to another. However, there is no specialized tissue in plants for the conduction of information, unlike the nervous tissue in animals.
- (2) Plants cells change their shape in response to an external stimulus by changing the amount of water in them which results in swelling or shrinking, unlike in animals, where specialized proteins

are found in muscle cells due to which muscle cells change their shape and movement occurs.

Example 8. What is the difference between the manner in which movement takes place in a sensitive plant and the movement in our legs?

[NCERT]

Ans. Differences between the manner in which movement takes place in a sensitive plant and the movement in our legs are given below:

Movement in a Sensitive Plant	Movement in Our Legs
It is response to stimuli (touch) which is an involuntary action	It is a voluntary action
There are no specialized tissues for conduction of information	There is specialized nervous tissue for conduction of information
Plant cells change their shape and size by changing the amount of water in their cells	Muscles cells have specialized proteins that help in contraction and relaxation of muscles.

Movement due to Growth (Thigmotropism)

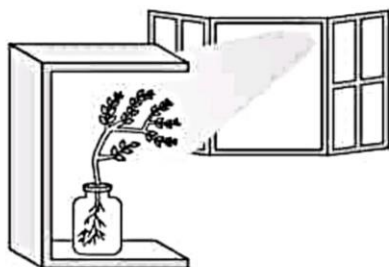
- (1) Some plants like the pea plant have tendrils, which are thin, thread-like growths on the stem or leaves of climbing plants.
- (2) These tendrils are sensitive to touch.
- (3) When a tendril touches an object like a bamboo stick, the part of tendril in contact with the object does not grow as rapidly as the part of the tendril which is away from the object.

- (4) This causes the tendril to bend towards the object by growing towards it and circling around the object.
- (5) This type of winding movement of the tendril of a climbing plant is an example of thigmotropism.

Example 9. Case Based:

Shreya performed an activity to understand tropism in plants. She filled a conical flask with water and covered the neck of the flask with a wire mesh. She kept two or three freshly germinated bean seeds on the wire mesh.

Case I: She then took a cardboard box which is open from one side and kept the flask in the box in such a manner that the open side of the box faced light coming from a window (Figure). She noted her observations after two or three days.



Case II: She then turned the flask so that the shoots were away from light and the roots towards light. She left the flask undisturbed in this condition for a few days and noted her observations again.

[NCERT Activity 7.2]

- (A) Shreya recorded her observations as given below:

	Direction of Root and Shoot at (I)	Direction of Old Root and Shoot at (II)
(a)	Both roots and shoot bend towards light	Both root and shoot bend towards light
(b)	Roots bend towards light and shoot bends away from light	Not much change in direction of old roots and shoot
(c)	Shoot bends towards light and roots bend away from light	Not much change in direction of old roots and shoot
(d)	Both root and shoot bend away from light	Both root and shoot bend away from light

- (B) Select the correct statement:

- (a) Both roots and shoot show positive phototropism.

- (b) Roots show negative phototropism whereas shoot show positive phototropism.

- (c) Roots show positive phototropism whereas shoot show negative phototropism.

- (d) Both roots and shoot show negative phototropism.

- (C) Do you observe change in direction of the old parts of the shoot and root when direction of flask is changed?

- (D) Are there differences in the direction of the new growth?

- (E) Assertion (A) : Direction of old parts of the root and shoot change on changing the direction of flask.

Reason (R) : Roots show negative phototropism and shoot shows positive phototropism.

- (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion.

- (b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion.

- (c) (A) is true, but (R) is false.

- (d) (A) is false, but (R) is true.

Ans. (A) (c) (A) is true, but (R) is false.

Explanation: We observe in Case I, that shoot bends towards light whereas roots bend away from light. However, after 2 to 3 days we observe that there is not much change in the direction of old roots and shoot.

- (B) (b) Roots show negative phototropism whereas shoot show positive phototropism.

Explanation: Roots bend away from light whereas shoot bends towards light. Roots show negative phototropism whereas shoots show positive phototropism.

- (C) The change in direction of the old parts of the shoot and root, change in direction is less and not much noticeable, however there is marked and noticeable change in case of new parts of the shoot and root.

- (D) Yes, new growth of parts of the shoot and root is visibly more noticeable. Shoots are found bending towards light while roots are found bending away from it.

- (E) (d) (A) is false, but (R) is true.

Explanation: When the direction of flask is changed in Case II, the old parts of roots and shoot do not change direction much whereas new parts change their direction.

Example 10. How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light? [NCERT]

Ans. The movement of leaves of the sensitive plant is independent of growth whereas the movement of a shoot towards light is dependent on growth.

Movement of Leaves of Sensitive Plants	Movement of a Shoot Towards Lights
(1) It is a nastic movement which does not depend on the direction of stimulus applied.	(1) It is a tropic movement which depends upon the direction of applied stimulus.
(2) The stimulus is 'touch'	(2) The stimulus is light.
(3) It is caused due to change in amount of water in them resulting in swelling or shrinking.	(3) It is caused due to the unequal growth on the two sides of the shoot.
(4) It is not a growth movement.	(4) It is a growth movement.

Tropism

The movement of a plant in the direction of an external stimulus is known as tropism. Environmental triggers such as light or gravity will change the directions in which plant parts grow. The growth of a plant part in response to a stimulus can be of two types:

- (1) **Positive tropism:** If the growth or movement of a plant part is towards the stimulus, it is called positive tropism.
- (2) **Negative tropism:** If the growth of a plant part is away from the stimulus, it is called negative tropism.

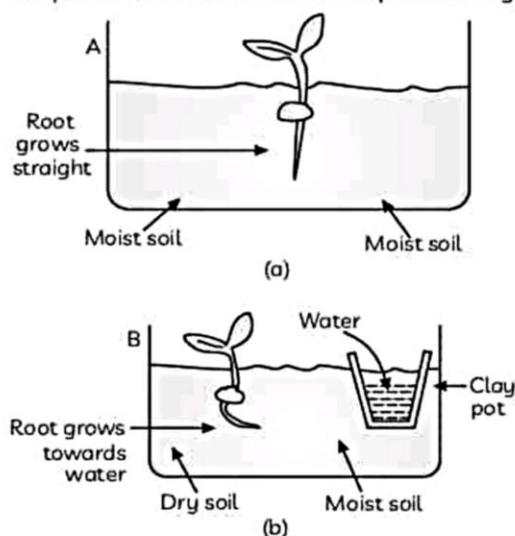
Types of Tropisms

There are five types of tropisms depending on the type of stimuli. These are:

- (1) **Phototropism:** It is the movement of a plant part in response to light. For e.g., growth of shoot in the direction of light.
- (2) **Geotropism:** It is the movement of a plant part in response to gravitational forces. For ex, downward movement of roots.
- (3) **Chemotropism:** It is the movement of plant parts in response to chemical stimulus. For ex, the growth of pollen tube towards a chemical produced by the ovule during fertilization.
- (4) **Hydrotropism:** The movement of a plant part in response to water is called hydrotropism. For ex, the movement of roots of a plant towards water.
- (5) **Thigmotropism:** The directional movement of a plant part in response to the touch of an object is called thigmotropism. For ex, coiling of tendrils around a support.

Example 11. Design an experiment to demonstrate hydrotropism. [NCERT]

Ans. Take two beakers A and B. Add moist soil in beaker A and sow the seeds. In beaker B add dry soil in one part and moist soil in another part and sow the seeds. Also, place a small porous pot filled with water just adjacent to it. Keep it for some time so that the plants can grow.



It is observed the roots of the plant in beaker A grow straight whereas the roots in beaker B bend and grow towards moist soil. This activity demonstrates hydrotropism, or movement of plant part towards water.

Comparison between Electrical Impulse and Chemicals

Electrical impulses reach only those cells of the body which are connected by nervous tissue, not each and every cell in the animal body. Chemical compounds are secreted by stimulated cells which diffuse all around the original cell and if other cells would have the means to detect this compound, they would be able to recognize this information.

Once an electrical impulse is generated in a cell and transmitted, the cell will take some time to reset its mechanism before it can generate a new impulse.

Phytohormones

These are chemical substances known as plant hormones which perform the function of control and coordination in plants. The different types of plant hormones are:

Auxins, Gibberellin, Cytokinin, Absciscic Acid and Ethylene.

Stimulated plant cells release a chemical compound which diffuse all around the cell.

The cells around have the means to detect this compound using special molecules on their surfaces and are able to recognize information and also transmit it.

This information potentially reaches all cells of the body steadily and persistently.

The plant hormones are synthesized at places away from where they act and simply diffuse to the area of action.

Functions of Phytohormones: The plant hormones regulate many functions in plants which are described below:

Plant Hormone	Functions
Auxins	(1) Synthesized at the shoot and root tip.
	(2) Help the cells to grow longer as they promote cell enlargement and cell differentiation in plants.
	(3) Promote fruit growth.
Gibberellins	(1) Promote cell enlargement and cell differentiation in plants in the absence of Auxins.
	(2) Help in breaking dormancy in seeds and buds.
	(3) Promote growth in fruits.
Cytokinin	(1) Promote cell division in plants.
	(2) Help in breaking dormancy of seeds and buds.
	(3) Delay ageing in leaves.
	(4) Promote the opening of stomata.
	(5) Promote fruit growth.
Absciscic Acid	(1) Functions mainly as a growth inhibitor.
	(2) Promotes the dormancy in seeds and buds.

	(3) Promotes the closing of stomata.
	(4) Promotes the wilting and falling of leaves.

Role of auxins in phototropism:

Bending of stem towards light:

- (1) When sunlight falls from top, the auxin hormone present in the shoot tip spreads uniformly down the stem and both the sides of the stem grow uniformly.
- (2) When the light falls only on side (say, right side), then the auxin hormone collects in the left side away from light.
- (3) Due to the presence of more auxin hormone on the left side, this side grows faster as compared to the right side.
- (4) The stem therefore bends towards the right side.

Bending of root away from light:

- (1) The effect of auxin hormone on the growth of root is opposite to the effect of auxin on the shoot.
- (2) The side of a root which is away from light will have greater concentration of auxins.
- (3) Due to this, this side will grow slowly than the side which is facing the light.
- (4) The root bends away from light.

Photoperiodism: The response of plant activities to the duration of light is known as photoperiodism. Flowering and germination of seeds is regulated by duration of light.

Example 12. What are plant hormones? [NCERT]

Ans. The organic substances that are produced naturally in plants and which control growth and other physiological functions in plants are known as plant hormones. Examples are auxins, gibberellins, etc.

TOPIC 3

HORMONES IN ANIMALS

Hormones are chemical substances secreted in trace amounts by specialized tissues called endocrine glands.

Characteristics of Hormones

- (1) They are specific chemical messengers.
- (2) They are secreted by endocrine glands.
- (3) They are poured directly into the blood and carried by blood circulation.

- (4) They act on specific tissue/organ called target organ.
- (5) Hormones are involved in the regulation of several functions.

Example: Adrenaline is secreted directly into the blood and carried to different parts of the body. The target organs or the specific tissues on which it acts include the heart. As a result, the heart beats faster, resulting in supply of more oxygen to our muscles.

The blood to the digestive system and skin is reduced due to contraction of muscles around small arteries in these organs. This diverts the blood to our skeletal muscles. The breathing rate also increases because of the contractions of the diaphragm and the rib muscles. All these responses together enable the animal body to be ready to deal with the situation.

Endocrine or Hormonal System

This is another organ system which controls and coordinates various life processes.

Endocrine glands: The endocrine glands are also called ductless glands as they do not have ducts to pass their hormones. These glands are located in different parts of our body. Some endocrine glands perform dual functions.

- (1) Pancreas secretes digestive enzymes and produce hormones insulin and glucagons.
- (2) Testes and ovary produce gametes and also hormones Testosterone and oestrogen respectively.

A brief summary of Endocrine glands, their hormones and their functions is given below:

Endocrine Glands	Hormones	Functions
Hypothalamus	Releasing hormones	Regulation of the secretion of hormones from pituitary gland.
Pituitary (hypophysis)	Growth hormone	Development of bones and muscles.
	Trophic hormone	Regulation of the secretion of hormones from endocrine gland.
	Prolactin	Regulation of the function of mammary gland.
	Vasopressin	Regulation of water and electrolyte balance.
	Oxytocin	Regulation of the ejection of milk during lactation
Thyroid	Thyroxine	Regulation of metabolism of carbohydrate, fat and protein.
Parathyroid	Calcitonin	Regulation of blood calcium and phosphate
Adrenal	Adrenalin and Corticoids	Regulation of blood pressure, heart rate, carbohydrate metabolism and mineral balance
Pancreas	Insulin	Lowering of blood glucose.
	Glucagon	Increase of blood glucose

Testes	Testosterone	Regulation of male sex organs and secondary sexual characters like moustache, beard and voice.
Ovary	Oestrogen and Progesterone	Regulation of female sex organs and secondary sexual characters like mammary gland, hair pattern and voice.
		Maintenance of pregnancy.

Comparison of Nervous System and Endocrine system

Nervous System	Endocrine System
(1) It is made of neurons or nerve cells	(1) Made of glands or secretory cells.
(2) Messages are transmitted in the form of electrical impulses	(2) Messages are transmitted in the form of chemicals called hormones
(3) Messages are transmitted along nerve fibres.	(3) Messages are transmitted through blood stream.
(4) Messages travel very fast.	(4) Messages travel more slowly
(5) The effect of message usually lasts for a very short while.	(5) The effect of message usually lasts longer.
(6) Nerve impulses are not specific in their action.	(6) Action of hormones is highly specific.

Role of Iodine

Iodine is necessary for the thyroid gland to make thyroxine hormone. Thyroxine regulates carbohydrate, protein and fat metabolism in the body so as to provide the best balance for growth. Iodine is essential for the synthesis of thyroxine. In case iodine is deficient in our diet, there is a possibility that we might suffer from goitre.

Role of Growth Hormone

Growth hormone is one of the hormones secreted by the pituitary. As its name indicates, growth hormone regulates growth and development of the body. If there is a deficiency of this hormone in childhood, it leads to dwarfism.

Role of Insulin

Insulin is a hormone which is produced by the pancreas and helps in regulating blood sugar levels. If it is not secreted in proper amounts, the sugar level in the blood rises causing many harmful effects.

Feedback Mechanism

If it is so important that hormones should be secreted in precise quantities, we need a mechanism through which this is done. The timing and amount of hormone released are regulated by feedback mechanisms. For example, if the sugar levels in blood rise, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

Example 13. Compare and contrast nervous and hormonal mechanisms for control and coordination in animals. [NCERT]

Ans. The differences between nervous and hormonal mechanisms for control and coordination in animals are listed below:

Nervous System	Hormonal System
Consists of nerves, brain and spinal cord	Consists of endocrine glands and hormones
Consists of impulses which travel along the nerve cells	Consists of chemicals secreted by endocrine glands directly into the blood stream
Effect is observed immediately	Effect is slow and delayed
Does not affect growth	May affect growth
Response is short lived	Response usually lasts longer

OBJECTIVE Type Questions

[1 mark]

Multiple Choice Questions

- Electrical impulse travels in a neuron from:
 - Dendrite → Axon → Axonal end → Cell body
 - Cell body → Dendrite → Axon → Axonal end
 - Dendrite → Cell body → Axon → Axonal end
 - Axonal end → Axon → Cell body → Dendrite

[CBSE 2019, 18, NCERT Exemplar]

Ans. (c) Dendrite → Cell body → Axon → Axonal end

Explanation: The electrical impulse travels from the dendrite to the cell body, and then along the axon to its axonal end. At the end of the axon, the electrical impulse sets off the release of some chemicals. These chemicals cross the gap, or synapse, and start a similar electrical impulse in a dendrite of the next neuron.

- In a synapse, chemical signal is transmitted from:
 - The dendritic end of one neuron to the axonal end of another neuron.
 - Axon to cell body of the same neuron.

- Cell body to the axonal end of the same neuron.
- The axonal end of one neuron to the dendritic end of another neuron.

[CBSE 2019, NCERT Exemplar]

Ans. (d) The axonal end of one neuron to the dendritic end of another neuron.

Explanation: The chemical signal is transmitted from axonal end of one neuron to the dendritic end of another neuron. This microscopic gap is called synapse.

- In a neuron, the conversion of electrical signal to a chemical signal occurs at/in:
 - Cell body
 - Axonal end
 - Dendritic end
 - Axon

[NCERT Exemplar]

- Which is the correct sequence of the components of a reflex arc?
 - Receptors → Muscles → Sensory neuron → Motor neuron → Spinal cord

- (b) Receptors → Motor neuron → Spinal cord
→ Sensory neuron → Muscle
- (c) Receptors → Spinal cord → Sensory
neuron → Motor neuron → Muscle
- (d) Receptors → Sensory neuron → Spinal
cord → Motor neuron → Muscle

[CBSE 2019, 16, NCERT Exemplar]

Ans. (d) Receptors → Sensory neuron → Spinal cord
→ Motor neuron → Muscle

Explanation: A stimulus received by the
receptors present on skin, is transmitted to the
sensory neuron, which carries it to the central
nervous system (the spinal cord and brain).

A motor neuron carries the message from the
central nervous system to the effector which
could be a muscle, a gland or both.



Related Theory

→ Nerve based pathway performed by an impulse
from the receptor of stimulus to the effector organ
is called the reflex arc. A reflex action is a nerve
mediated automatic and spontaneous response to
a certain stimulus without consulting the will of the
individual coughing, sneezing, etc.

5. Which of the following statements are true?

- (I) Sudden action in response to something
in the environment is called a reflex action.
- (II) Sensory neurons carry signals from the
spinal cord to muscles.
- (III) Motor neurons carry signals from
receptors to the spinal cord.
- (IV) The path through which signals are
transmitted from a receptor to muscle or
a gland is called reflex arc.

- (a) (I) and (II) (b) (I) and (III)
(c) (I) and (IV) (d) (I) (II) and (III)

[CBSE 2019, NCERT Exemplar]

Ans. (c) (I) and (IV)

Explanation: Reflex action is a sudden action
in response to some stimuli in the environment.
Reflex arc is the path through which signals are
transmitted from a receptor to a muscle or a
gland.

6. Which of the following statements are
true about the brain?

- (I) The main thinking part of brain is the
hind brain.
- (II) Centres of hearing, smell, memory, sight,
etc. are located in the fore-brain.
- (III) Involuntary actions like salivation,
vomiting and blood pressure are
controlled by the medulla in the hind
brain.

(IV) Cerebellum does not control posture and
balance of the body.

- (a) (I) and (II) (b) (I) (II) and (III)
(c) (II) and (III) (d) (III) and (IV)

[CBSE 2014, NCERT Exemplar]

7. The spinal cord originates from:

- (a) Cerebrum (b) Medulla
(c) Pons (d) Cerebellum

[CBSE 2010, NCERT Exemplar]

8. The movement of shoot towards light is:

- (a) Geotropism (b) Hydrotropism
(c) Chemotropism (d) Phototropism

[CBSE 2020, 16 NCERT Exemplar]

9. The main function of abscisic acid in plants
is to:

- (a) Increase the length of cells
(b) Promote cell division
(c) Inhibit growth
(d) Promote growth of stem

[CBSE 2019, NCERT Exemplar]

Ans. (c) Inhibit growth

Explanation: Absciscic acid (ABA) is one
example of a hormone which inhibits growth.
Its effects include wilting of leaves.



Related Theory

- **Auxin** is synthesized at the 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.
- **Gibberellin** helps in the growth of the stem.
- **Cytokinin** promotes cell division, and it is natural
then that they are present in greater concentration
in areas of rapid cell division, as in fruits and seeds.
- **Absciscic acid** inhibits growth. Its effects include
wilting of leaves. It is also responsible for falling of
senescent leaves.

10. Iodine is necessary for the synthesis of which
hormone?

- (a) Adrenaline (b) Thyroxine
(c) Auxin (d) Insulin

[CBSE 2015, NCERT Exemplar]

Ans. (b) Thyroxine

Explanation: Iodine is necessary for the
thyroid gland to make thyroxine hormone.
Thyroxine regulates carbohydrate, protein and
fat metabolism in the body so as to provide
the best balance for growth. Iodine is essential
for the synthesis of thyroxine. In case iodine
is deficient in our diet, there is a possibility

that we might suffer from goitre. One of the symptoms in this disease is a swollen neck.

11. Choose the incorrect statement about insulin:
- It is produced from pancreas.
 - It regulates growth and development of the body.
 - It regulates blood sugar levels.
 - Insufficient secretion of insulin will cause diabetes. [CBSE 2015, NCERT Exemplar]

12. Select the mismatched pair:

- Adrenaline - Pituitary gland
- Testosterone - Testes
- Oestrogen - Ovary
- Thyroxin - Thyroid gland

[CBSE 2018, NCERT Exemplar]

Ans. (a) Adrenaline - Pituitary gland

Explanation: Adrenaline is secreted by the adrenal gland, whereas growth hormone is secreted by the pituitary gland.

13. The growth of tendril in pea plants is due to:
- The effect of light.
 - The effect of gravity.
 - Rapid cell divisions in tendrillar cells that are away from the support.
 - Rapid cell divisions in tendrillar cells in contact with the support.

[NCERT Exemplar]

14. The growth of pollen tubes towards ovules is due to:

- Hydrotropism
- Chemotropism
- Geotropism
- Phototropism

[CBSE 2020, 15, NCERT Exemplar]

15. The movement of sunflower in accordance with the path of the sun is due to:

- Phototropism
- Geotropism
- Chemotropism
- Hydrotropism

[CBSE 2016, Exemplar]

16. Involuntary actions in the body are controlled by:

- Medulla in the fore brain
- Medulla in the mid brain
- Medulla in the hind brain
- Medulla in the spinal cord

[CBSE 2014, NCERT Exemplar]

Ans. (c) Medulla in the hind brain

Explanation: Medulla is a part of the hind brain and controls involuntary action.

17. Which of the following is not an involuntary action?

- Vomiting
- Salivation
- Heart beat
- Chewing

[NCERT Exemplar]

Ans. (d) Chewing

Explanation: The actions that are not under our direct control are known as involuntary actions. Vomiting, salivation and heart beat are examples of involuntary action. These involuntary actions are controlled by the medulla in the hind brain.

18. A doctor advised a person to take an injection of insulin because:

- His blood pressure was low.
- His heart was beating slowly.
- He was suffering from goitre.
- His sugar level in blood was high.

[NCERT Exemplar]

Ans. (d) His sugar level in blood was high.

Explanation: A person taking injections of insulin is suffering from diabetes. Insulin is a hormone which is produced by the pancreas. It helps in regulating blood sugar levels. If not secreted in proper amounts, the sugar level in the blood rises, causing many harmful effects.

19. The hormone which increase fertility in males is called:

- Oestrogen
- Testosterone
- Insulin
- Growth hormone

[CBSE 2014, NCERT Exemplar]

Ans. (b) Testosterone

Explanation: Testosterone is the male sex hormone necessary for sperm production. In addition to regulating the formation of sperms, testosterone brings changes in appearance seen in boys, at the time of puberty.

20. Which of the following endocrine glands is unpaired?

- Adrenal
- Testes
- Pituitary
- Ovary

[CBSE 2018, NCERT Exemplar]

21. Junction between two neurons is called:

- Cell junction
- Neuromuscular junction
- Neural joint
- Synapse

[NCERT Exemplar]

Ans. (d) Synapse



Related Theory

- **Synapse** is the junction between two neurons.
- **Cell junction** is junction between neighbouring cells.
- **Neuromuscular junction** allows delivery of impulses from neurons to other cells, like muscles cells/gland.

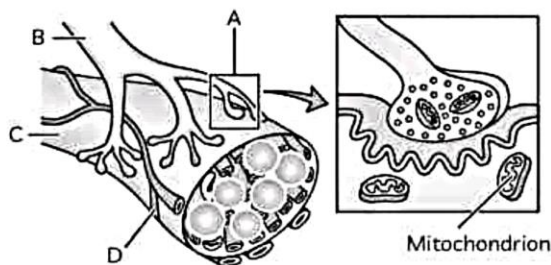
22. In humans, life processes are controlled and regulated by:
- Reproductive and endocrine systems.
 - Respiratory and nervous systems.
 - Endocrine and digestive systems.
 - Nervous and endocrine systems.

23. Select the row containing incorrect information:

	Endocrine Gland	Function of hormone secreted
(a)	Thyroid	Regulates carbohydrate, protein and fat metabolism
(b)	Pituitary	Regulates growth and development of the body
(c)	Pancreas	Increasing blood sugar levels
(d)	Adrenal	Increasing heart rate

Ans. (c) Endocrine Gland: Pancreas; Function of hormone - Increasing blood sugar levels

24. Look at the figure below and identify the structure labelled incorrectly:



(a)	A	Neuromuscular junction
(b)	B	Axon
(c)	C	Muscle fibre
(d)	D	Dendrite

Ans. (d) D-Dendrite

Explanation: Part labelled D is capillary and not dendrite, as dendrites receive nerve impulses.

25. Given below are four statements regarding endocrine glands and hormones. Select the correct statements:

- Hormones are secreted by the endocrine glands.
 - Some endocrine glands secrete hormones in response to other hormones.
 - Hormones are required in large quantities.
 - Many hormones are controlled by some form of a feedback mechanism.
- Both (I) and (II)
 - Both (I) and (III)
 - (I), (II) and (III)
 - (I), (II) and (IV)

Ans. (d) (I), (II) and (IV)

Explanation: Hormones are very potent substances, which means that very small amounts of a hormone may have profound effects on metabolic processes. Some endocrine glands secrete hormones in response to other hormones. The hormones that cause secretion of other hormones are called tropic hormones. A hormone from gland A causes gland B to secrete its hormone. Many hormones are controlled by some form of a negative feedback mechanism. In this type of system, a gland is sensitive to the concentration of a substance that it regulates. A negative feedback system causes a reversal of increases and decreases in body conditions in order to maintain a state of stability.

26. Given below are four statements regarding movement in plants.

Select the incorrect statements.

- Movement in plants happens at a point as the point of touch.
 - The plants use electrical-chemical means to convey information from cell to cell.
 - There are specialised tissues in plants for the conduction of information.
 - Plant cells change shape by changing the amount of water in them
- Both (I) and (III)
 - Both (I) and (IV)
 - Both (II) and (III)
 - Both (II) and (IV)

27. The junction between two nerves is known as:

- Synapse
- Axon
- Dendrite
- Capillary

Ans. (a) Synapse

Explanation: The junction between two neurons is known as synapse. It is the site of transmission of nerve impulses between two nerve cells (neurons) or between a neuron and a gland or muscle cell (effector). A synaptic connection between a neuron and a muscle cell is called a neuromuscular junction.

28. The plant hormone that promotes dormancy in seeds and buds is:

- (a) Auxin (b) Gibberellin
(c) Cytokinin (d) Absciscic acid

Ans. (d) Absciscic acid

Explanation: Absciscic acid is one example of a hormone which inhibits growth. Its effects include wilting of leaves and promoting dormancy in seeds and buds.

29. ② The secretion of which hormone leads to physical changes in the body when you are 10-12 years of age?

- (a) Oestrogen from testes and testosterone from ovary.
(b) Oestrogen from adrenal gland and testosterone from pituitary gland.
(c) Testosterone from testes and Oestrogen from ovary.
(d) Testosterone from thyroid gland and Oestrogen from pituitary gland.

Assertion-Reason Questions

For the following questions, two statements are given: one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

- (a) Both (A) and (R) are true and (R) is the correct explanation of the assertion.
(b) Both (A) and (R) are true, but (R) is not the correct explanation of the assertion.
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

30. Assertion (A) : A growing plant appears to bend towards the direction of light.

Reason (R) : The plant hormone auxin diffuses towards the shady side of the shoot.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of the (A).

31. ④ Assertion (A) : Plants convey the acquired information from cell to cell.

Reason (R) : Plants have specialized tissues for conduction of information.

Select the correct answer to the above question from the codes (a), (b), (c) and (d) as given below:

32. Assertion (A) : In animals, the brain is the main controlling centre for responding to changes in their environment.

Reason (R) : The thinking process of the brain is not fast enough in animals.

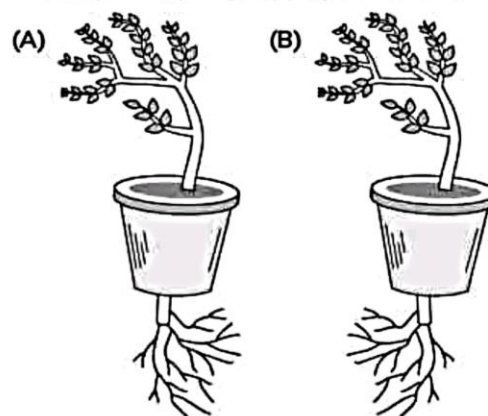
Ans. (d) (A) is false, but (R) is true.

Explanation: Reflex arcs have evolved in animals as the thinking process of the brain is not fast enough. Reflex action is any spontaneous, involuntary and automatic response to a stimulus due to a change in our environment. For e.g. when a person touches a hot plate a sudden action leading to withdrawal of hand occurs in a certain manner, this path of manner determines the reflex arc.

Reflex arcs have evolved in animals in order to take sudden and involuntary actions which are required in certain circumstances where emergency response is required to save body from situations which may lead to danger.

Very Short Answer Type Questions

33. Which one appears more accurate and why?





[NCERT Exemplar]

Ans. (A) is more appropriate as shoots are negatively geotropic and roots are positively geotropic. Hence, shoots grow upwards and roots grow downwards.



Related Theory

→ The roots of a plant always grow downwards while the shoots usually grow upwards and away from the earth. This upward and downward growth in response to the gravity pull is known as geotropism.

34. ② Name the two components of central nervous systems in humans.

35. How is the spinal cord protected in the human body?

Ans. Spinal cord is enclosed in a bony cage called vertebral column.

36. ② A potted plant is made to lie horizontally on the ground. Which part of the plant will show (a) positive geotropism?

37. Name any two types of tropism.

Ans. Phototropism and geotropism.

38. Name the hormone that helps in regulating level of sugar in our blood. Name the gland that secretes it.

Ans. Insulin helps in regulating blood sugar level. This hormone is secreted by pancreas gland.

39. ② Give an example of a plant hormone that promotes its growth. Where is it synthesized?
 [CBSE 2014]

40. Mention the function of adrenaline hormone.

Ans. The function of adrenaline hormone is to regulate blood pressure, heartbeat, breathing rate, carbohydrate metabolism and mineral balance in the body.

41. ② State the function of:
 (A) gustatory receptors, and
 (B) olfactory receptors

42. Mention the part of the body where gustatory and olfactory receptors are located.

Ans. Gustatory receptors are located in Cerebrum of fore-brain. Olfactory receptors are located in Olfactory lobe of fore-brain.

COMPETENCY BASED Questions (CBQs)

[1, 4 & 5 marks]

43. Thyroid gland is a bilobed structure situated in our neck region. It secretes a hormone called thyroxine. Iodine is necessary for the thyroid gland to make thyroxine. Thyroxine regulates carbohydrate, protein and fat metabolism in the body. It promotes growth of body tissues also. When there is an excess of thyroxine in the body, a person suffers from hyperthyroidism and if this gland is underactive it results in hypothyroidism. Hyperthyroidism is diagnosed by blood tests that measure the levels of thyroxine and Thyroid Stimulating Hormone (TSH). Hypothyroidism is caused due to the deficiency of iodine in our diet resulting in a disease called goitre. Iodised salt can be included in our diet to control it.

- ② Where is thyroid gland situated in our body?
- State the function of thyroxine in human body.
- What is hyperthyroidism?
- How can we control hypothyroidism?

[CBSE 2020]

Ans. (B) Thyroxine hormone is secreted by thyroid glands. Thyroxine plays vital roles in:
 increasing the basal metabolic rate
 regulating long bone growth. Increasing body's sensitivity to hormone adrenaline, digestive function.
 (C) Hyperthyroidism occurs when the thyroid gland produces excessive amount of hormone thyroxine.



Related Theory

Hyperthyroidism means the thyroid gland is overactive and Overactive thyroid can sized up metabolism nervousness, anxiety, loss of mood swings etc.

(D) We can control hypothyroidism by including iodised salt in our diet. Deficiency of iodine in our diet reduces the levels of TSH and a disease called goitre

44. While watching the TV show Master Chef Australia, Rima observed that the contestants were blindfolded and then asked to identify cubes of different fruits or food items by smelling and then by tasting them.



Which of the following statements is correct about receptors?

- (a) Gustatory receptors detect taste while olfactory receptors detect smell.
- (b) Both gustatory and olfactory receptors detect smell.
- (c) Auditory receptors detect smell and olfactory receptors detect taste.
- (d) Olfactory receptors detect taste and gustatory receptors detect smell.

[CBSE 2018, NCERT Exemplar]

45. Thyroid Stimulating Hormone (TSH) stimulates thyroid gland to produce thyroxine. Study the table given below.

Table: TSH Levels During Pregnancy

Stage of pregnancy	Normal (mU/L)	Low (mU/L)	High (mU/L)
First trimester	0.2-2.5	<0.2	2.5-10
Second trimester	0.3-3.0	<0.3	3.01-4.5
Third trimester	0.8-5.2	<0.8	>5.3

It is important to monitor TSH levels during pregnancy. High TSH levels and hypothyroidism can especially affect chances of miscarriage. Therefore, proper medication in consultation with a doctor is required to regulate/control the proper functioning of the thyroid gland.

- (A) Give the full form of TSH.
- (B) State the main function of TSH.
- (C) Why do TSH levels in pregnant women need to be monitored?
- (D) A pregnant woman has TSH level of 8.95 mU/L. What care is needed for her?

[CBSE 2020]

Ans. (A) Full form of TSH: Thyroid Stimulating Hormone.

(B) Thyroid stimulating hormone is produced by pituitary gland. Its main function is to regulate the production of hormones by the thyroid gland.)



Related Theory

A TSH test is a blood test that measures TSH i.e. how much of this hormone is present in blood. Thyroid gland is the largest gland endocrine gland, which is H-shaped present in the neck region. Thyroxine produced by thyroid gland regulates the metabolism of carbohydrates, proteins and fats.

(D) A pregnant woman has TSH levels 8.95 mU/L which is very high in any of the three trimesters. A care is needed for her on regular basis to reduce the levels of TSH. A regular test of TSH levels every 6-8 weeks should be done. Proper medication in consultation with a doctor is required to regulate/control the proper functioning of the thyroid gland

46. Veer accidentally touched a thorn but quickly withdrew his hand. He later realized that he did this without even thinking about it! So, his reflexes were quite quick.



Reflex action is controlled by:

- (a) Brain
- (b) Spinal cord
- (c) Peripheral Nervous System
- (d) Autonomic Nervous System

Ans. (b) Spinal cord

Explanation: Reflex action is an involuntary and nearly instantaneous movement in response to a stimulus. A reflex action involves a very simple nervous pathway called a reflex

arc. A reflex arc starts off with receptors being excited on sensing a stimulus. They then send signals along a sensory neuron to the spinal cord, where the signals are passed on to a motor neuron. Invertebrates, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. The spinal cord acts as the main centre for reflex actions. The spinal cord acts as a link between spinal nerves and the brain.

47. When Sanket went to a nearby farm with his friend, he found lots of mature fruits and leaves lying on the ground. He tried to find out the reason behind this.



The substance that triggers the fall of mature leaves and fruits from plants is:

- (a) Auxin (b) Gibberellins
(c) Absciscic acid (d) Cytokinin

[CBSE 2020, 19, NCERT Exemplar]

Ans. (c) Absciscic acid

Explanation: Absciscic acid is one example of a hormone which inhibits growth. Its effects include wilting of leaves and fall of mature leaves and fruits from plants.

48. Study the table in which the levels of Thyroid Stimulating Hormone (TSH) in men are given and answer the questions that follow on the basis of understanding of the following paragraph and the related studied concepts.

Age Range	Normal (mU/L)	Low (mU/L)
18-29 years	0.4-2.34 mU/L	< 0.4 mU/L
30-49 years	0.4-4.0 mU/L	< 0.4 mU/L
50-79 years	0.46-4.68 mU/L	< 0.46 mU/L

men are at greater risk for developing abnormal TSH levels during instruction, while giving birth and after going through menopause. Found 5% of women in the United States have some kind of thyroid problem compared to 3% of men. Despite claims that high TSH increases risk for heart disease, a 2013 study found no link

between high TSH heart diseases. But a 2017 study showed that older women are specially at risk for developing thyroid cancer if they have high TSH calls along with thyroid nodules.

- (A) A 35 year old woman has TSH level 6.03 mU/L. What change should she bring in her diet to control this level?
(B) When do women face a greater risk of abnormal TSH level?
(C) State the consequence of low TSH level.
(D) Name the mineral that is responsible for synthesis of hormone secreted by thyroid gland. [CBSE 2020]

Ans. (A) The normal range of TSH level falls between 0.4 -4.0 m U/L A 35 year old woman has TSH level 6.03 m U/L. It means she has higher level of TSH. Chance are that she may have an underactive thyroid. She should follow iodine rich diet.

Explanation: The deficiency of iodine in the diet of a person produces less thyroxine hormone. When a person will start taking iodine rich diet like iodised salt, the thyroid gland will work actively to produce more thyroxine hormone.

- (B) Women face a greater risk of abnormal TSH level during menstruation, while giving birth and after going through menopause.
(C) The consequences of low TSH level:
(1) Body metabolism slows down
(2) Weight gain
(3) Forgetfulness
(4) Lack of concentration
(5) Fatigue
(6) Depression etc. (Any two)

49. Pranay's father was suffering from diabetes since a long time. Apart from several dietary restrictions, he was given injections of insulin regularly.



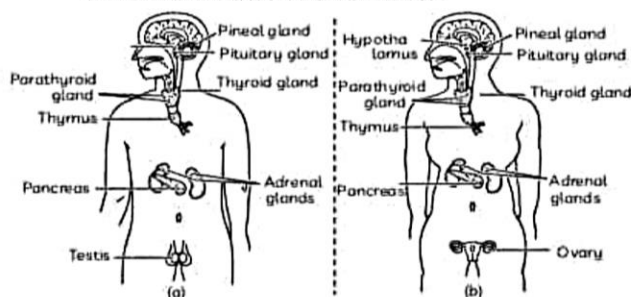
Why are some patients of diabetes treated by giving injections of insulin?

[NCERT Exemplar]

Ans. Patients of diabetes have insufficient levels of insulin produced by pancreas and are therefore treated by giving injections of insulin. Insulin is a hormone which is produced by the pancreas

and helps in regulating blood sugar levels. If it is not secreted in proper amounts, the sugar level in the blood rises causing many harmful effects.

50. A student was interested in knowing about various endocrine glands in human body, the hormones secreted by them and their functions. The figure below shows the endocrine glands in human males and females.



- (A) The table below gives the names of some endocrine glands and their functions. Identify the row containing incorrect information:

	Name of Endocrine Gland	Function
(a)	Thyroid	Regulates carbohydrate, protein and fat metabolism in the body
(b)	Pituitary	Regulates growth and development of the body
(c)	Pancreas	Regulates levels of uric acid in blood
(d)	Testis	Changes associated with puberty in males

- (B) 2. The endocrine gland known as the master gland in human beings is:
 (a) Pituitary gland
 (b) Hypothalamus gland
 (c) Pineal gland
 (d) Thymus glands
- (C) 2. Identify which of the following statements about thyroid gland is incorrect?
 (I) Thyroid gland requires iodine to synthesize thyroxine.
 (II) Deficiency of iodine in our diet may cause dwarfism.
 (III) Thyroxine regulates protein, carbohydrates and fat metabolism in the body.

(IV) Iron is essential for the synthesis of thyroxine.

- (a) Both (I) and (II) (b) Both (II) and (III)
 (c) Both (I) and (III) (d) Both (II) and (IV)
- (D) Name the gland which secretes the growth hormone:
 (a) Thyroid (b) Pituitary gland
 (c) Hypothalamus (d) Adrenal
- (E) The dramatic changes in body features associated with puberty are mainly because of the secretions of:
 (a) Oestrogen from testes and testosterone from ovary
 (b) Oestrogen from adrenal gland and testosterone from pituitary gland
 (c) Testosterone from testes and oestrogen from ovary
 (d) Testosterone from thyroid gland and oestrogen from pituitary gland

Ans. (A) (c) Name of Endocrine Gland : Pancreas; Function : Regulates levels of uric acid in blood.

Explanation: Insulin is a hormone which is produced by the pancreas and helps in regulating blood sugar levels.

- (D) (b) Pituitary gland
 Explanation: Growth hormone is one of the hormones secreted by the pituitary and it regulates growth and development of the body. If there is a deficiency of this hormone in childhood, it leads to dwarfism.
- (E) (c) Testosterone from testes and oestrogen from ovary

51. Akriti's grandfather complained of giddiness since past several days. Her father took her to the physician who checked his blood pressure and immediately prescribed medicines for hypertension.

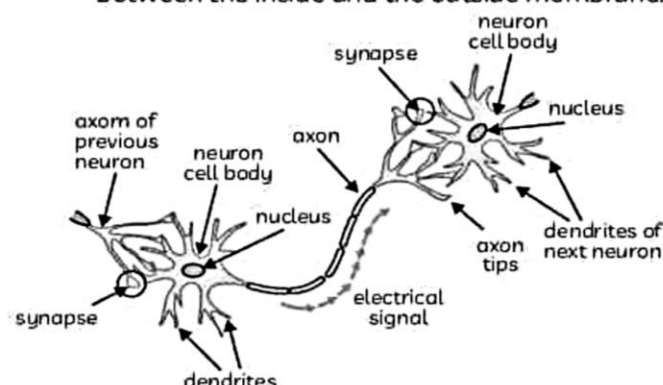


Which part of the brain is responsible for involuntary actions?

Ans. The involuntary actions such as blood pressure, vomiting and salivation are controlled by the medulla in the hind-brain.

52. The neurons are cells with some special abilities. These cells get excited, because of the membranes that are in a polarised state. Each neuron has a charged cellular membrane,

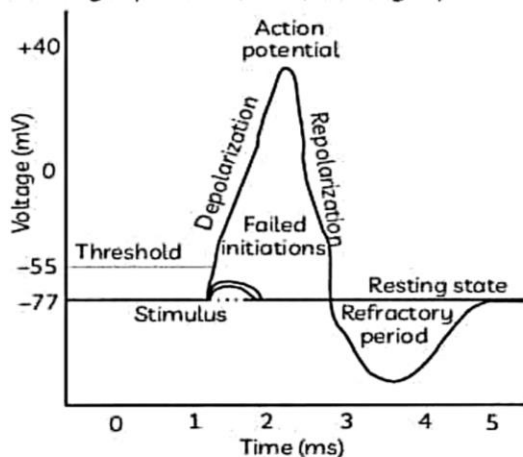
... which means there is a voltage difference between the inside and the outside membrane.



Membrane potential is the difference in the total charge between the inside of the cell and the outside of the cell. Action potential is a short-term change in the electrical potential that travels across the neuron cell.

A nerve impulse is generated when the stimulus is strong. This stimulus triggers the electrical and chemical changes in the neuron. When a nerve impulse is generated, there is a change in the permeability of the cell membrane. The sodium ions flow inside and potassium ions flow outside, causing a reversal of charges. The cell is now depolarised. This depolarization results in an action potential which causes the nerve impulse to move along the length of the axon. This depolarization of the membrane occurs along the nerve. A series of reactions occur where the potassium ions flow back into the cell and sodium ions move out of the cell. This whole process again results in the cell getting polarised, with the charges being restored.

When the nerve impulse reaches the end of the axon, there are some chemicals released from the neurotransmitters. They diffuse across the synaptic gap, which is the small space present between the axon and the receptors. Nerve impulses can be transmitted either by the electrical synapse or the chemical synapse.



(A) From the statements given below regarding polarization and depolarization of neurons, select the row containing the correct information.

	Polarization of Neuron	Depolarization of Neuron
(a)	The sodium ions flow into the cell and potassium ions move out of the cell.	The sodium ions flow inside and potassium ions flow outside
(b)	The potassium ions flow into the cell and sodium ions move out of the cell.	The sodium ions flow inside and potassium ions flow outside
(c)	The potassium ions flow into the cell and sodium ions move out of the cell.	The potassium ions flow inside and sodium ions flow outside
(d)	The potassium ions flow into the cell and sodium ions move out of the cell.	The potassium ions flow inside and sodium ions flow outside

(B) Four statements are given below. Select the incorrect statements.

- Nerve impulse is generated by the stimulus when a neuron is depolarized.
- Nerve impulse is generated by the stimulus when a neuron is polarized.
- The polarization of neuron results in an action potential.
- The action potential causes the nerve impulse to move along the axon.

- Both (I) and (III)
- Both (II) and (IV)
- Both (I) and (IV)
- Both (II) and (III)

(C) ② The part of a neuron which receives information from other neurons is/are :

- Cell body
- Axon

- (c) Dendrites
 (d) Myelin sheath
 (D) The part of the neuron through which the impulse travels is:
 (a) Axon (b) Soma
 (c) Dendrites (d) Nucleus
 (E) ④ Control and coordination in animals is provided by:
 (a) Nervous tissues only
 (b) Muscular tissues only
 (c) Receptors
 (d) Both nervous and muscular tissues

Ans. (A) (b) Polarization of Neuron: The potassium ions flow into the cell and sodium ions move out of the cell.

Depolarization of Neuron: The potassium ions flow inside and sodium ions flow outside.

Explanation: When a nerve impulse is generated, there is a change in the permeability of the cell membrane. The cell gets depolarized when the sodium ions flow inside and potassium ions flow outside, causing a reversal of charges. The cell gets polarized when the potassium ions flow back into the cell and sodium ions move out of the cell.

- (B) (d) Both (II) and (III)
 (D) (a) Axon

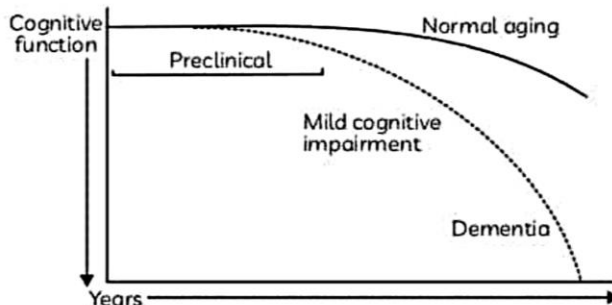
Explanation: Axon is a single prominent extension that emerges from the cell body and is responsible for conducting outgoing impulses away from the cell and towards other cells.

53. ④ Sujay was watching a program when he found that several people of a particular region had swollen neck. He tried to gather more information regarding the probable cause of this disease.



Identify the disease they were suffering from and a possible cause.

54. Alzheimer's disease is a progressive neurologic disorder that causes the brain to shrink (atrophy) and brain cells to die. Alzheimer's disease is the most common cause of dementia — a continuous decline in thinking, behavioral and social skills that affects a person's ability to function independently. The early signs of the disease include forgetting recent events or conversations. As the disease progresses, a person with Alzheimer's disease will develop severe memory impairment and lose the ability to carry out everyday tasks. Common symptoms of Alzheimer's disease include memory loss, language problems, and impulsive or unpredictable behavior. This happens because of a loss of connection between the nerve cells, or neurons, in the brain which means that information cannot pass easily between different areas of the brain or between the brain and the muscles or organs.



- (A) Select the incorrect statement:

- (a) Alzheimer's is a type of dementia that causes memory loss.
 (b) It occurs only in elderly people.
 (c) The early signs of the disease include forgetting recent events or conversations.
 (d) As the disease progresses, a person develops severe memory impairment and loses the ability to carry out everyday tasks.
 (B) In Alzheimer's disease there is a loss of connection between the nerve cells, or neurons, in the brain because of which:
 (I) Information cannot pass easily between different areas of the brain.
 (II) Information cannot pass easily between the brain and the muscles or organs.
 (III) Information cannot be acquired by the dendrite.

(IV) Gustatory and olfactory receptors stop working.

Select the correct statements:

- (a) Both (I) and (II)
 (b) Both (II) and (III)
 (c) Both (I) and (IV)
 (d) Both (II) and (IV)
- (C) Given below are some parts of the brain and their functions.

Select the row containing the correct information:

	Part of Human Brain	Function
(a)	Hind brain	Sensation of feeling full during eating a meal
(b)	Cerebrum	Controls involuntary actions such as salivation and vomiting
(c)	Medulla	Controls intelligence and memory
(d)	Cerebellum	Precision of voluntary actions

(D) ④ The part of human brain that is responsible for maintaining the posture and balance of the body is:

- (a) Cerebrum (b) Medulla
 (c) Cerebellum (d) Pons

(E) ④ The main thinking part of the human brain is:

- (a) Fore brain (b) Mid brain
 (c) Hind brain (d) Cerebellum

Ans. (A) (b) It occurs only in elderly people.

Explanation: Alzheimer's disease can affect people of any age group and does not occur only in the elderly.

(B) (a) Both (I) and (II)

Explanation: In Alzheimer's disease there is a loss of connection between the nerve cells, or neurons, in the brain because of which Information cannot pass easily between different areas of the brain and

between the brain and the muscles or organs.

(C) (d) Part of Human Brain: Cerebellum; Function: Precision of voluntary actions.

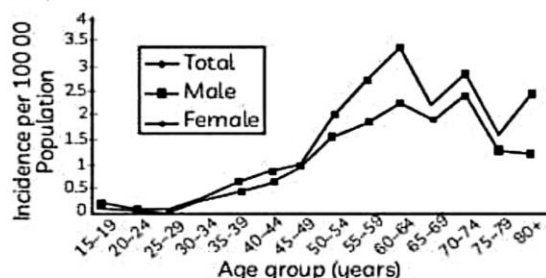
Explanation: Sensation of feeling full during eating a meal is due to fore brain.

Cerebrum controls intelligence and memory whereas medulla controls involuntary actions such as salivation and vomiting.

55. Motor neurone disease (MND) is the name for a group of diseases that affects particular nerves known as motor nerves, or motor neurons. In MND, those neurons generate and die and slowly the muscles become weaker. This eventually leads to paralysis. It is also known as Lou Gehrig's disease, amyotrophic lateral sclerosis or ALS. MND is a progressive disease that usually starts slowly and gets worse over time. Symptoms sometimes starting on one side of the body and then spreading. Usually, the first things people notice are:

- (1) weakness in the hands and grip
- (2) slurred speech
- (3) weakness in the legs, and a tendency to trip
- (4) weakness of the shoulder, making lifting difficult
- (5) cramps and muscles twitching

The graph below shows the age wise incidence of MND per 1 lakh of population for men and women.



This information, acquired at the end of the dendritic tip of a nerve cell, sets off a chemical reaction that creates an electrical impulse. This impulse travels from the dendrite to the cell body, and then along the axon to its end. At the end of the axon, the electrical impulse sets off the release of some chemicals. These chemicals cross the gap, or synapse, and start a similar electrical impulse in a dendrite of the next neuron. This is a general scheme of how nervous impulses travel in the body. A similar

synapse finally allows delivery of such impulses from neurons to other cells, such as muscles cells or glands.

(A) Based on the passage above, select the correct statements regarding Motor Neuron Diseases (MND):

- (I) MND incidence is higher in men than women.
- (II) MND affect sensory neurons.
- (III) MND is a progressive disease that usually starts slowly and gets worse over time.
- (IV) MND may eventually lead to paralysis as muscles become weaker.

- (a) Both (I) and (II)
- (b) Both (II) and (III)
- (c) (I), (III) and (IV)
- (d) (I), (III) and (IV)

(B) Select the row containing the incorrect information:

	Type or Part of Neuron	Function
(a)	Dendrites	These carry signals in the form of electrical impulses away from the cell body
(b)	Sensory Neuron	These are found in receptors such as the eyes, ears, tongue and skin, and carry nerve impulses to the spinal cord and brain.
(c)	Motor neuron	These are found in the central nervous system (CNS) and control muscle movements.
(d)	Relay neuron	Relay neurons are found in the brain and spinal cord and allow sensory and motor neurons to communicate.

(C) ② The motor neurons :

- (a) Are found in receptors

(b) Are found in the brain and spinal cord

(c) Are found in the Central nervous system

(d) Carry impulses to the spinal cord and brain

(D) ② In the diagram above, the parts marked A and B are:

(a) Sensory neuron and motor neuron respectively

(b) Sensory neuron and relay neuron respectively

(c) Motor neuron and relay neuron respectively

(d) Motor neuron and sensory neuron respectively

(E) In the diagram above, the motor neuron is labelled as:

- (a) A
- (b) B
- (c) C
- (d) D

Ans. (A) (d) (I), (III) and (IV)

Explanation: Motor Neuron Diseases (MND) affects motor neurons and not sensory neurons.

(B) (a) Type or Part of Neuron: Dendrites; function: These are found in receptors such as the eyes, ears, tongue and skin and carry nerve impulses to the spinal cord and brain.

Explanation: The dendrites receive signals from other neurons or from sensory receptor cells. The dendrites are typically connected to the cell body, which is often referred to as the 'control centre' of the neuron, as it contains the nucleus. The axon is a long slender fibre that carries nerve impulses, in the form of an electrical signal known as action potential, away from the cell body towards the axon terminals, where the neuron ends. Most axons are surrounded by a myelin sheath (except for relay neurons) which insulates the axon so that the electrical impulses travel faster along the axon.

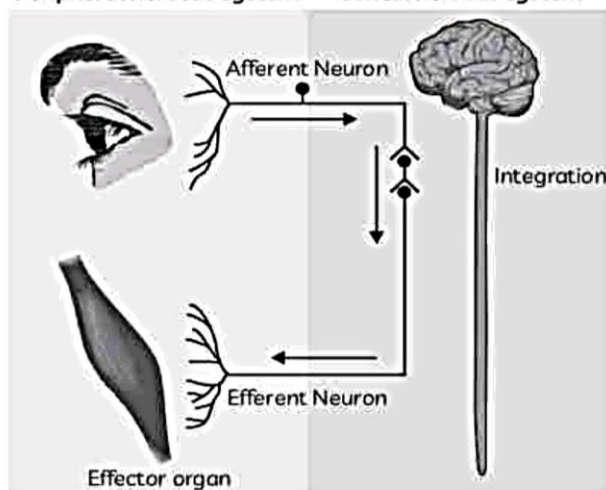
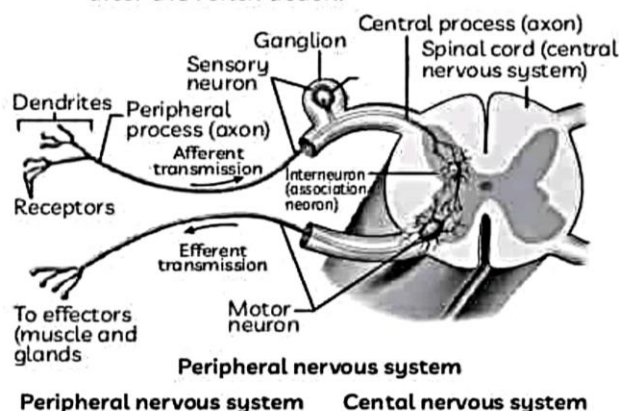
(E) (c) C

Explanation: The motor neuron carries response from the spinal cord to the effector organs.

56. The peripheral nervous system (PNS) is one of two components that make up the nervous system of bilateral animals, with the other part being the central nervous system (CNS). The PNS consists of the nerves and ganglia outside the brain and spinal cord. The main function of the PNS is to connect the CNS to the limbs and organs, essentially serving as a relay between the brain and spinal cord and the rest of the body.

In its simplest form, a reflex is viewed as a function of an idealized mechanism called the reflex arc. The primary components of the reflex arc are the sensory-nerve cells (or receptors) that receive stimulation, in turn connecting to other nerve cells that activate muscle cells (or effectors), which perform the reflex action.

A reflex arc is a neural pathway that controls a reflex. In vertebrates, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. This allows for faster reflex actions to occur by activating spinal motor neurons without the delay of routing signals through the brain. The brain will receive the sensory input while the reflex is being carried out and the analysis of the signal takes place after the reflex action.



- (A) Afferent neurons carry nerve impulses from
- CNS to muscles
 - CNS to receptors
 - receptors to CNS
 - effector organs to CNS
- (B) ☒ A neuron that carries information from the peripheral nervous system to the central nervous system is
- afferent neuron
 - efferent neuron
 - both
 - none
- (C) Which of these illustrate a reflex arc?
- Brain → Spinal cord → Muscles
 - Muscles → Receptor → Brain
 - Muscles → Spinal cord → Brain
 - Receptor → Spinal cord → Muscles
- (D) ☒ Given below are the parts of the nervous system and their functions. Identify the row containing incorrect information:

	Part	Function
(a)	Peripheral Nervous System	Consists of sensory organs
(b)	Central Nervous System	To organize and analyze information received
(c)	Afferent Neurons	Carry signals to the brain and spinal cord
(d)	Efferent Neurons	Carry neural impulses away from the central nervous system and toward muscles

- (E) Select the correct statements:
- The PNS facilitates communication between the CNS and other parts of the body.
 - The PNS consists of cranial nerves and spinal nerves
 - The cranial nerves arise from the spinal cord.

(IV) The CNS carries signals to the brain and spinal cord.

- (a) Both (I) and (II)
(b) Both (II) and (III)
(c) Both (I) and (IV)
(d) Both (III) and (IV)

Ans. (A) (c) receptors to CNS

Explanation: The afferent neurons carry nerve impulses from the receptors to the central nervous system, whereas the efferent neurons carry impulses from the CNS to the effector organs.

(C) (d) Receptor → Spinal cord → Muscles

Explanation: Reflex arc does not involve the brain. Infact it has evolved in higher animals as the thinking process of brain is not fast enough.

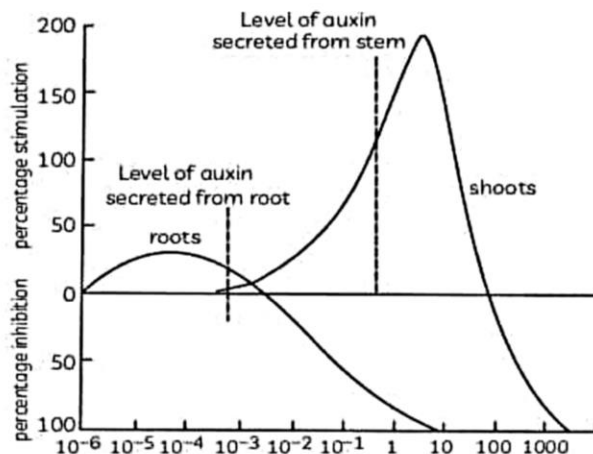
(E) (d) Both (III) and (IV)

Explanation: The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system consisting of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.

57. Plant hormones are among the most important biochemicals affecting plant growth and yield production under different conditions, including stress. Plant hormones include auxin, abscisic acid, ethylene, gibberellins, cytokinins, salicylic acid, strigolactones, brassinosteroids, and nitrous (nitric) oxide. Plant functioning under stress is affected by plant hormones, which can help the plant to tolerate the environmental stresses.

Tropism is the type of plant movement, that is achieved by growth and responsible to directional light. The movement is due to the action of auxin inside the plant part. Normally, phototropism, geotropism, hydrotropism and thigmotropism can be identified.

Within the above tropisms, the response of shoot tips are quite different from that of root tips. The basic difference is in the concentration they secrete. The level of auxin secreted from shoot tips is always on the ascending arm of the graph of response. But for the root tips, on the descending arm. Then, their responses become the opposite. The following graph shows the fact.



AUXIN CONCENTRATION (PARTS PER MILLION)
NB LOGARITHMIC SCALE FOR AUXIN CONCENTRATION

(A) Observe the graph above and select the correct statements.

- (I) Lower concentration of auxins decrease the growth of roots.
(II) Shoot growth requires greater concentrations of auxins as compared to growth of roots.
(III) The application of very high concentration of auxin inhibits the growth of shoots directly.
(IV) The response of roots to auxin can thus be represented by an optimum curve with the peak at very low concentration.

- (a) Both (I) and (II)
(b) Both (II) and (III)
(c) (I), (III) and (IV)
(d) (II), (III) and (IV)

(B) The table below lists few plant hormones and their functions. However, one row contains incorrect information. Select the row containing incorrect information.

	Name of plant hormone	Function
(a)	Auxin	Promotes cell elongation
(b)	Gibberellin	Promotes seed germination and stem growth
(c)	Cytokinin	Inhibits cell division
(d)	Absciscic acid	Maintains seed dormancy

- (C) ④ Plant roots exhibit:
(a) Positive geotropism
(b) Negative geotropism
(c) Positive chemotropism
(d) Negative hydrotropism
- (D) ④ Which of the following plant hormone is responsible for seed germination?
(a) Auxin (b) Gibberellin
(c) Ethylene (d) Absciscic acid
- (E) The hormone that is a growth inhibitor is:
(a) Auxin (b) Absciscic acid
(c) Cytokinin (d) Gibberellin

Ans. (A) (d) (II), (III) and (IV)

Explanation: Lower concentrations of auxins increases the growth of roots.

- (B) (c) Name of plant hormone: Cytokinin;
Function: Inhibits cell division

Explanation: Cytokinin is a plant hormone that promotes cell division, and they are present in greater concentration in areas of rapid cell division, such as in fruits and seeds.

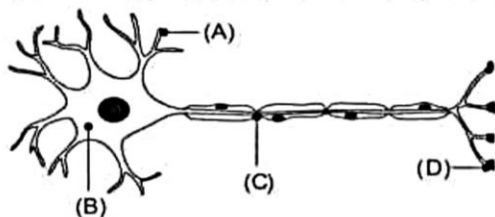
- (E) (b) Absciscic acid

Explanation: Absciscic acid is one example of a hormone which inhibits growth. Its effects include wilting of leaves.

SHORT ANSWER Type-I Questions (SA-I)

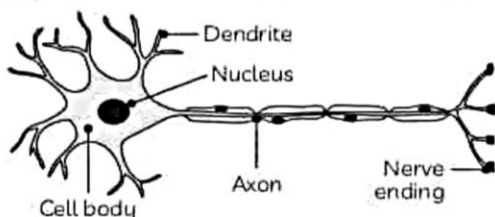
[2 marks]

58. Label the parts of neuron in the below figure:



[CBSE 2015, NCERT Exemplar]

- Ans.** (A) Dendrite (B) Cell body
(C) Axon (D) Nerve ending



59. What is tropic movement? Explain with an example. [CBSE 2020, 13, 10, NCERT Exemplar]

Ans. The movement of plant part in a particular direction in relation to the stimulus is called tropic movements. These directional or tropic movements can be either towards the stimulus or away from it.

For example, in case of phototropic movement, shoots respond by bending towards light while roots respond by bending away from it.

It is said to be positive if it is directed towards the source of stimulus and negative if directed away from the source stimulus.

The growth of a plant in the direction of the gravitational pull is known as geotropism. For example, roots of plants grow downwards and hence, show positive geotropism.

60. ④ Answer the following:

- (A) Which hormone is responsible for the changes noticed in females during puberty?
(B) Dwarfism results due to a deficiency of which hormone?
(C) Blood sugar level rises due to a deficiency of which hormone?
(D) Iodine is necessary for the synthesis of which hormone? [CBSE 2016, NCERT Exemplar]

61. ④ Answer the following:

- (A) Name the endocrine gland associated with the brain.
(B) Which gland secretes digestive enzymes as well as hormones?
(C) Name the endocrine gland associated with kidneys.
(D) Which endocrine gland is present in males but not in females? [NCERT Exemplar]

62. Why is chemical communication better than electrical impulses as a means of communication between cells in a multi-cellular organism? [CBSE 2020]

Ans. Chemical communication is better than electrical impulses as a means of communication between cells in a multi-cellular organism because

When stimulated cells release a chemical compound, this compound diffuses all around the original cell.

Other cells around detect the chemical compound by using special molecules on their surfaces, recognise information and transmit it. Though this is slower, but it will potentially reach all cells of the body.

It is done steadily and persistently.

These compounds are hormones used by multi-cellular organisms for control and coordination. On the other hand electrical impulses reach only those cells that are connected by nervous tissue.

Once an electrical impulse is generated in a cell and transmitted, the cell will take some time to reset its mechanism before it generates and transmit a new impulse cells cannot continually create and transmit electrical impulses.

63. ② A cheetah, on seeing a prey, moves towards him at a very high speed. What causes the movement of his muscles? How does the chemistry of cellular components of muscles change during this event?
[CBSE 2020]

64. Define geotropism. Draw a labelled diagram of a plant showing geotropic movements of its parts.
[CBSE 2020]

Ans. The directional growth movement of a plant in response to force of gravity is called geotropism.

The upward growth of shoot against earth's gravitation represents negative geotropism.

The downward growth of roots towards earth's gravitational force shows positive geotropism. Experiment- Take a well-watered healthy potted plant growing in a transparent glass jar. Place the potted plant horizontally on its side on the ground.

Leave it for about a week but keep watering the pot daily.

After about a week, observe the potted plant. We will observe that the roots of the potted plant bend downwards towards the earth and the stem of the plant bends upwards, away from the earth.



65. ② Write in tabular form the location and function of the hormones secreted by each of the following glands present in the human body:
(A) Pituitary gland (B) Thyroid gland
(C) Pancreas [CBSE 2020]

66. Explain giving reasons the bending of the shoot tip of a plant towards light source coming from one side of the plant.

Ans. When growing plant shoot tip detects light a hormone called auxin is synthesised in the shoot tip which is sensitive to light.

Auxin diffuses towards the shady side of the stem.

It stimulates the growth of cells on the shady side of the plant which causes bending of the plant to the other side.

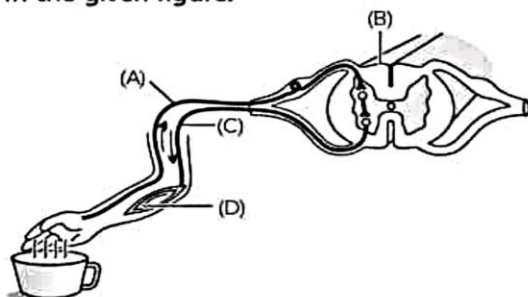
This gives the appearance that the stem of the plant bends in the direction of light.

[CBSE Marking Scheme 2019]

SHORT ANSWER Type-II Questions (SA-II)

[3 marks]

67. Label the parts (A), (B), (C) and (D) and show the direction of the flow of electrical signals in the given figure.

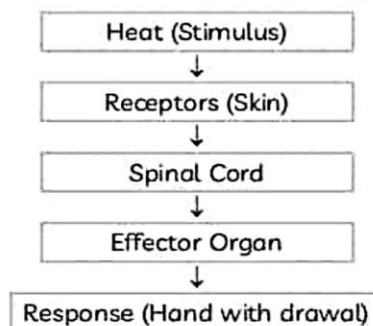


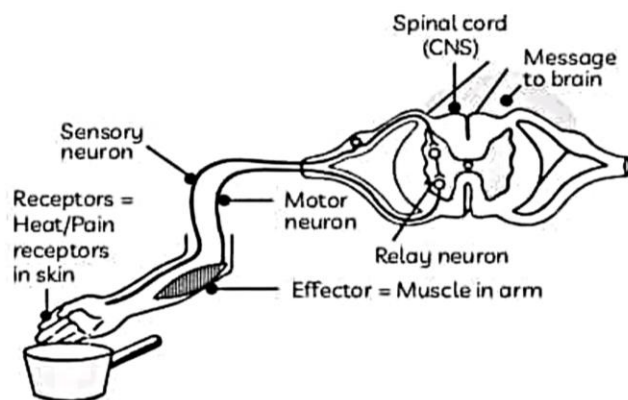
[NCERT Exemplar]

Ans. (A) Sensory neuron
(B) Spinal cord (CNS)

- (C) Motor neuron
(D) Effector (muscle in arm)

Direction of the flow of electric signals:

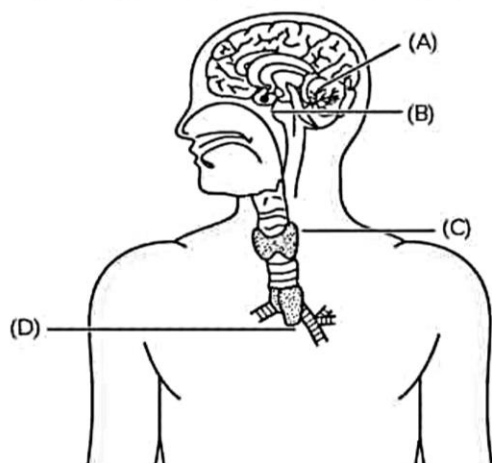




Related Theory

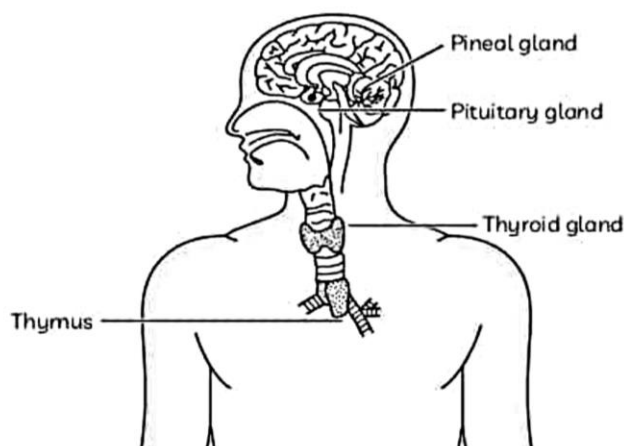
The stimulus (prick, heat, etc.) → receptor in the sensory organ → the afferent (sensory) nerve fibre bringing the impulse into the spinal cord → a (motor) neuron sending out the command through its efferent fibre in the ventral root of the spinal nerve → a muscle or the gland.

68. Label the endocrine gland in the figure:



[NCERT Exemplar]

Ans. (A) Pineal gland (B) Pituitary gland
(C) Thyroid gland (D) Thymus gland



69. Different parts of brain are associated with specific functions. Name the part of human brain which perform the following functions:

- (A) Sensation of feeling full
 - (B) Vomiting
 - (C) Picking up a pencil
 - (D) Riding a bicycle
- [CBSE 2018]

70. How do auxins promote the growth of a tendril around a support? [CBSE 2019]

- Ans. (1) When part of a tendril touches a support, the growth hormone auxins move to that side which is away from the support.
- (2) The side of tendril away from the support grows faster as it has more concentration of auxins.
- (3) This side becomes longer and makes the tendril curve and coil around the support.

71. How does chemical coordination take place in animals?

[CBSE 2017, NCERT Exemplar]

LONG ANSWER Type Questions (LA)

[5 marks]

72. What constitutes the central and peripheral nervous systems? How are the components of central nervous system protected?

[CBSE 2017, NCERT Exemplar]

Ans. The central nervous system is composed of the brain and the spinal cord. They receive information from all parts of the body and integrate it.

The peripheral nervous system is composed of cranial nerves arising from the brain and spinal nerves arising from the spinal cord. The communication between the central nervous system and other parts of the body is facilitated by the peripheral nervous system. Brain is the most important part of the body, which needs to be carefully protected. It is

lodged in the bony box or cranium which protects it. Inside the box, the brain is contained in a fluid-filled balloon which provides further shock absorption. The hard, bumpy structure at the back of our body is the vertebral column or backbone which protects the spinal cord.

Protection of brain: bony box (cranium).

73. Mention one function for each of these hormones:

- (A) Thyroxin (B) Insulin
(C) Adrenaline (D) Growth hormone
(E) Testosterone [NCERT Exemplar]

Ans.

Hormone	Function
(A) Thyroxin	Thyroxin controls the rate of metabolism of carbohydrate, protein and fat in the body to provide the best balance for growth.
(B) Insulin	Insulin helps in regulating blood sugar levels. If it is not secreted in proper amounts, the sugar level in the blood rises, causing many harmful effects.
(C) Adrenaline	Increases heart rate and supply of blood to various organs, thus preparing the body for short term stress responses.
(D) Growth hormone	It regulates growth and development in the body thus stimulating growth in all organs.
(E) Testosterone	It controls the changes of body features associated with puberty in males, the development of secondary sexual characters in males and sperm formation.

74. Ⓐ What are reflex actions? Give two examples. Explain a reflex arc.

[CBSE 2016, NCERT Exemplar]

75. Ⓐ Nervous and hormonal systems together perform the function of control and coordination in human beings. Justify the statement. [CBSE 2013, NCERT Exemplar]

76. Why do signals in a synapse flow from the axonal end of one neuron to the dendritic end of another neuron but not the other way around? [CBSE 2019, NCERT Exemplar]

Ans. Synapse is the junction between two adjacent neurons or nerve cells. When an electrical signal reaches the axonal end of a neuron, it releases a chemical substance. This chemical diffuses towards the dendrite end of the next neuron, where it generates an electrical impulse or signal. Hence, the electrical signal is converted into a chemical signal at the axonal end. Since these chemicals are absent at the dendrite end of the neuron, the electrical signal cannot be converted into chemical signal.

Hence, the flow of signals in a synapse happens from the axonal end of one neuron to the dendritic end of another neuron but not in the reverse direction.

77. Ⓐ What is geotropism? Draw a labelled diagram of a potted plant showing positive geotropism and negative geotropism.

[CBSE 2020]

78. Ⓐ Trace the sequence of events which occur when a bright light is focused on your eyes.

[CBSE 2019]

79. What are plant hormones? Name the plant hormones responsible for the following:

- (A) Growth of stem
(B) Promotion of cell division
(C) Inhibition of growth
(D) Elongation of cells

[CBSE 2019]

Ans. Plant hormones: These are chemical substances also known as Phytohormones which perform various functions of control and coordination in plants such as germination, growth, metabolism, or other physiological activities.

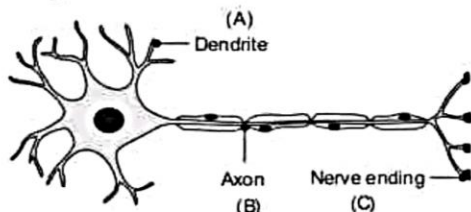
Plant hormones responsible for the following are given below:

- (1) Growth of stem: Auxins
(2) Promotion of cell division: Cytokinins
(3) Inhibition of growth: Abscissic Acid
(4) Elongation of cells: Auxins/Gibberellins in absence of Auxins

80. Draw a diagram of neuron and name and label the part:

- (A) where information is acquired,
(B) through which information travels as an electric impulse, and
(C) where the electric impulse must be converted into a chemical signal for onward transmission.

Ans. Diagram: Structure of a neuron



(A) End of the dendritic tip

(B) Axon

(C) Nerve ending

81. State the function of each of the following plant hormones:

(A) Gibberellins

(B) Auxins

(C) Absciscic acid

Ans. (A) Gibberellins help in the growth of the stem.

(B) Auxins help the cells to grow longer.

(C) Absciscic acid inhibits growth.

[CBSE Marking Scheme 2019]

82. ② List in tabular form three distinguishing features between cerebrum and cerebellum.

[CBSE 2019]

83. ② (A) Plants do not have any nervous system but yet, if we touch a sensitive plant, some observable changes take place in its leaves.

Explain how could this plant respond to the external stimuli and how it is communicated.

(B) Name the hormone that needs to be administered to

(i) increase the height of a dwarf plant.

(ii) cause rapid cell division in fruits and seeds.

[CBSE 2019]

