

CONTROL AND COORDINATION

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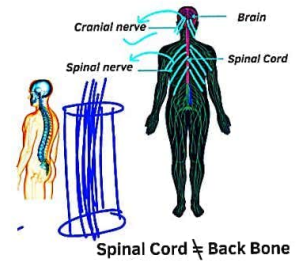
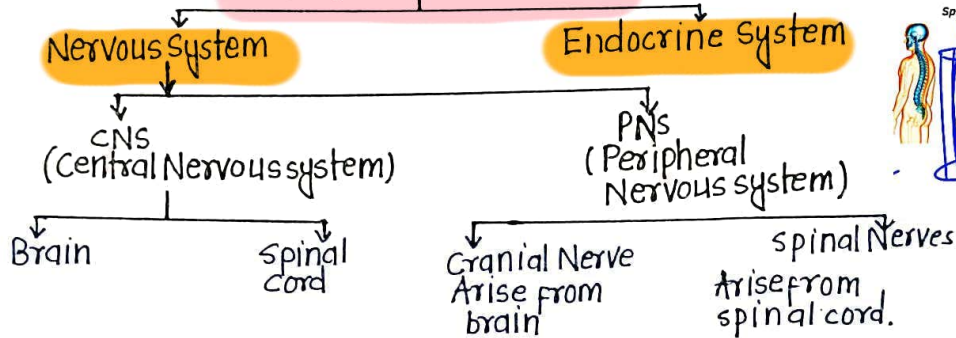
stimuli :- change in the environment to which an organism responds.

Response :- Reaction of an organism to a stimulus.

Coordination :- Working together of various body parts to respond to a stimuli.



Coordination in Animals

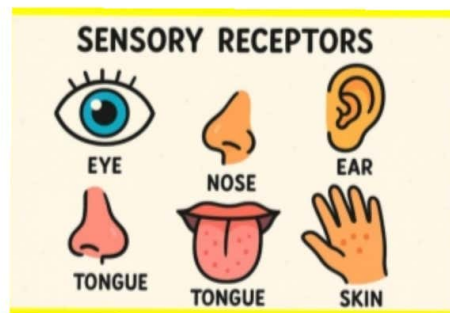


Receptors and Effectors :-

Receptors :- Cells, tissue or organs that receive the stimulus.

Effectors :- muscles/tissue/glands which act in response to a stimuli.

Receptors	Sense Organ	Stimuli
Photo receptors	Eyes	Light
Olfactory receptors	Nose	Smell
Gustatory receptors	Tongue	Taste
Phono receptors	Ear	Sound
Thermo receptors	Skin	Heat / Cold
Nociceptors	Skin	Pain

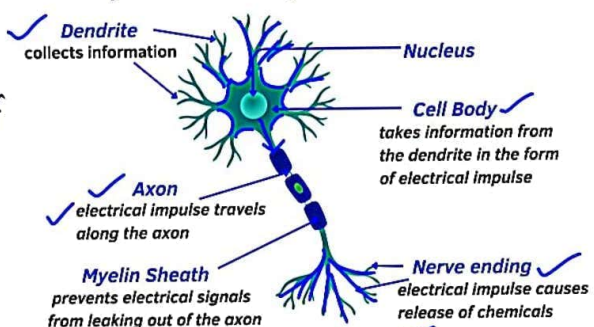


Nerve Cells or Neuron :-

Nerve - A nerve is a bundle of fibres that carries signals between the brain and other parts of the body, enabling sensation, movement and other bodily functions.

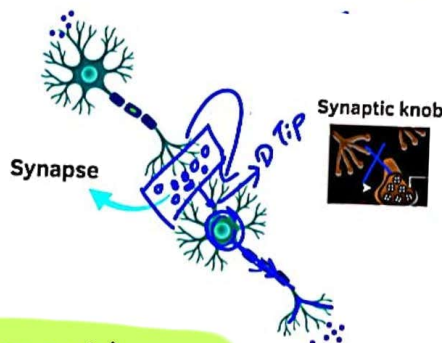
Neuron :-

- structural and functional unit of nervous system.
- longest cell in the body.
- carry message in the form of electrical impulses/ signals.



Synapse :-

Microscopic gap between two neurons. The role of the synapse is to transmit the electrical impulse from one neuron to another. As a synapse, the electrical impulse causes the release of chemicals (neurotransmitters) from the nerve ending of one neuron. These chemicals cross the synaptic gap and reach dendritic tip of next neuron, generating a new electrical impulse in that neuron.



Types of Neurons

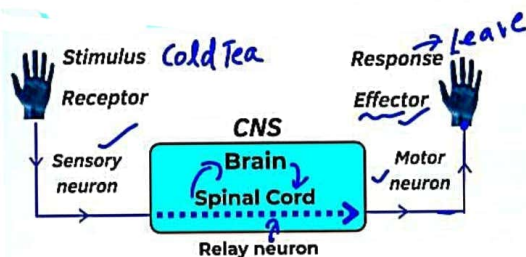
Sensory Neurons

Transmit impulse from receptors to CNS

Motor Neurons

Transmit impulse from CNS to effectors (muscle or gland)

Relay Neurons / Interneurons connects sensory and Motor neurons



Voluntary Action

controlled by will

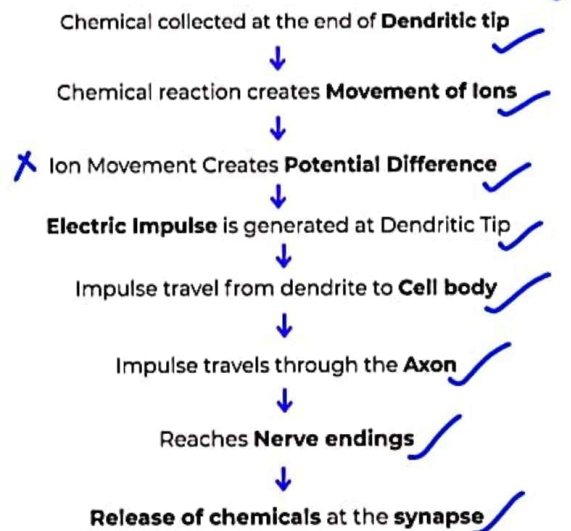
Thinking involved
Brain involved
walking, writing,
Dancing, Talking
etc

Involuntary Actions

Thinking Not involved ✓
Brain involved ✓

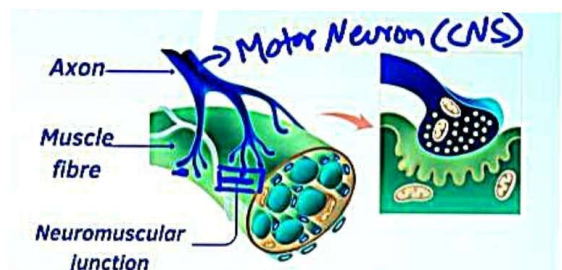
Blood pumping by
Heart, peristalsis,
Digestion ✓

Transmission of impulse between 2 Neurons



Neuromuscular Junction (NMJ)

point of contact between nerve ending of a motor neuron and a muscle



imp. How do muscles move ?

- Muscles cells have specialised proteins that change their shape & arrangements in the cell in response to nervous electrical impulses ✓
- Muscle cells move by changing their shape so that they shorten ✓

Reflex Actions

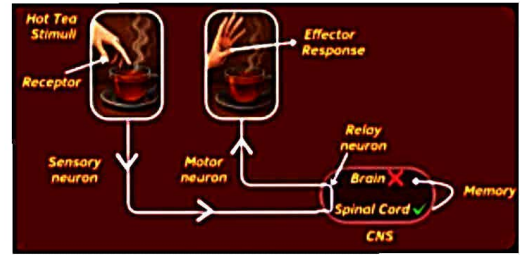
Thinking Not involved x
Brain directly Not involved. x

withdrawing a hand from a hot object, ✓
blinking when something comes close to the eye, ✓
sneezing ✓

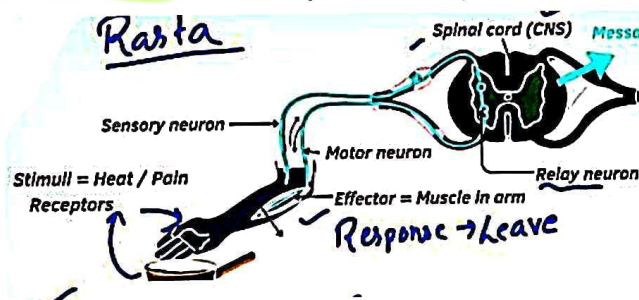
Reflex Actions (Reflex Movement)

A Reflex action is a sudden, Quick and involuntary movement in which thinking is not involved.

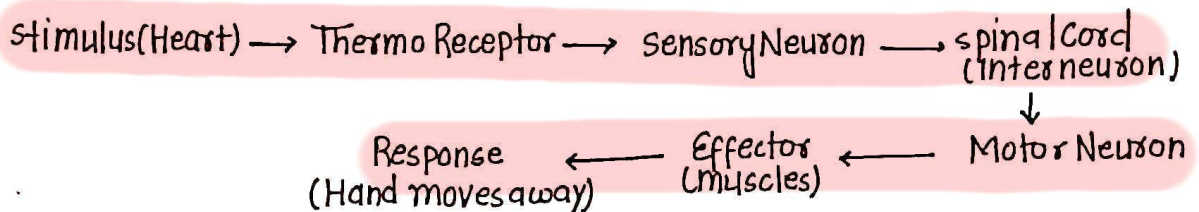
Reflex actions are controlled by spinal cord. it helps protect the body by producing a Quick reaction.



Reflex Arc:- path followed by nerve impulses in a reflex action.



Reflex arcs are evolved in animals to enable rapid, involuntary responses to harmful stimuli, providing a survival advantage. These pathways, located in the spinal cord, skip the brain's complex processing, allowing for quicker reactions to potentially harmful situations.

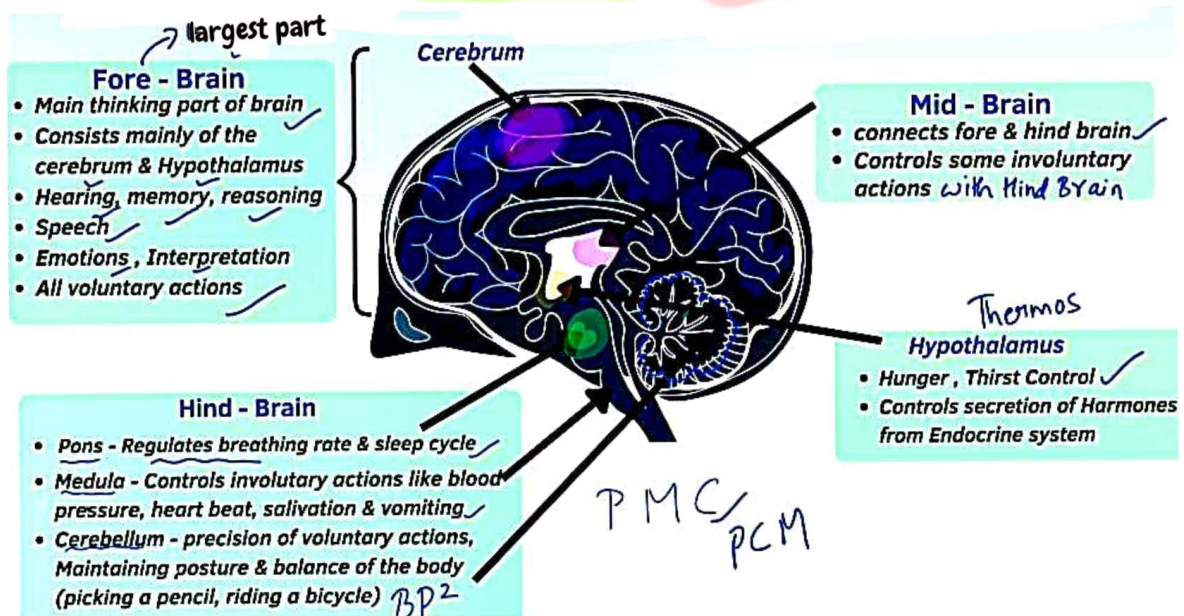


Reflex arcs are formed mainly in the spinal cord.

Reflex arcs are considered more efficient for quick responses because -

- (1) They skip the brain's complex processing.
- (2) Allows an instant reaction through the spinal cord.
- (3) Reduces response times significantly.

BRAIN -> control Centre (PM)

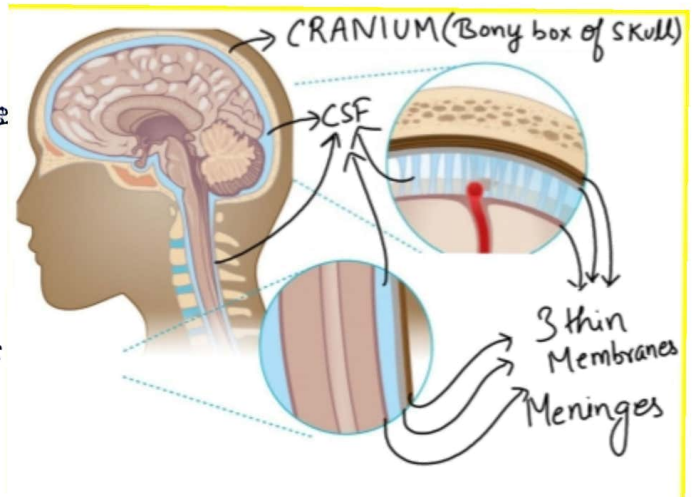


Protection of Brain

- (1) Cranium — part of skull
- (2) 3 thin membranes — Meninges
- (3) CSF — to absorb any shock
Cerebro spinal fluid.

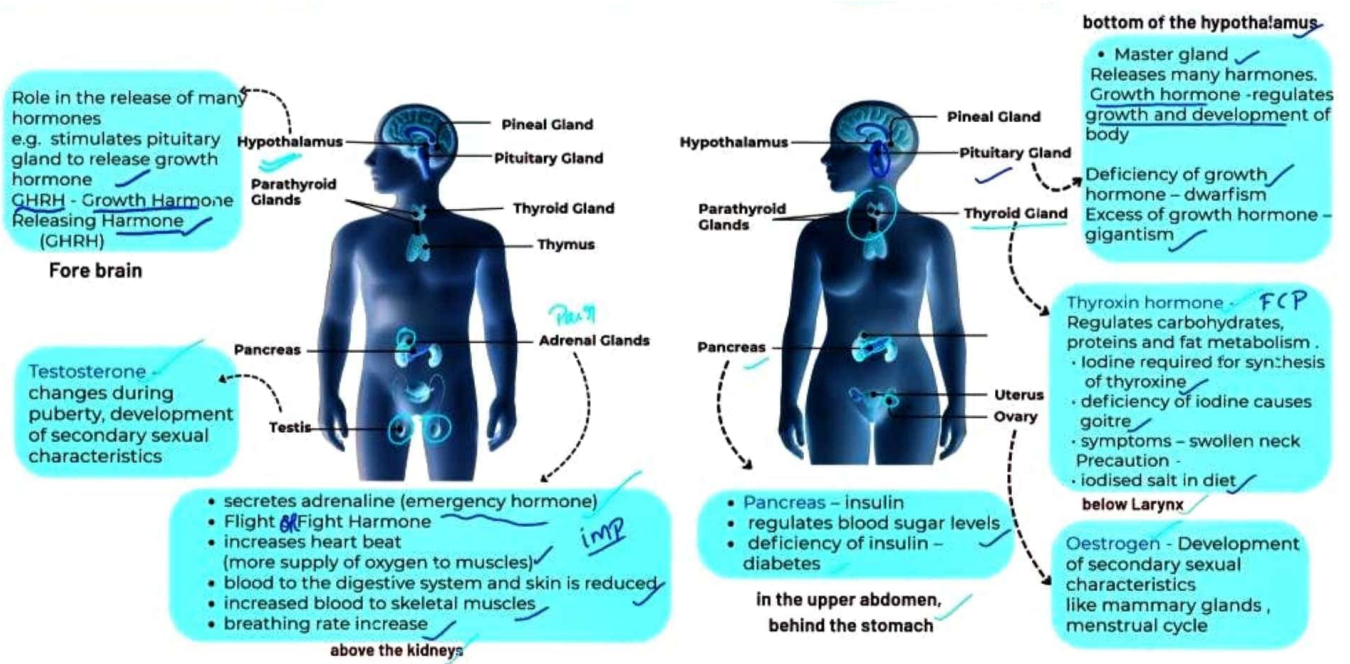
Protection of Spinal Cord

- (1) Vertebral Column
- (2) 3 thin membranes — Meninges
- (3) CSF - to absorb any shock
cerebro spinal fluid



Endocrine System

- ✓ Network of endocrine glands that produces and release hormones.
- ✓ Hormones - chemical substances that act like messenger molecules in the body.



Feed back mechanism - the timing and amount of hormones released are regulated by feedback.

- e.g. Blood sugar levels increase $\rightarrow$ pancreas produces more insulin.
• Blood sugar levels decrease $\rightarrow$ insulin secretion is reduced.

Gland	Hormone	Function	Related Disease
Hypothalamus ✓	GHRH ✓	Stimulates pituitary gland to release hormones ✓	
Pituitary gland	Growth hormone	Body growth, development of bones & muscles	Excess - Gigantism Deficiency - Dwarfism
Thyroid gland	Thyroxine	Regulates carbohydrate, protein, fat metabolism ✓ ✓ ✓	Deficiency of iodine - Goitre (hypothyroidism)
Pancreas ✓	Insulin	Control blood sugar levels ✓	Diabetes ✓
Adrenal gland ✓	Adrenaline ✓	Prepare body to cope with emergency situations ✓	✗
Testes in males ✓	Testosterone ✓	Development of secondary male characters: deep voice, beard, and sex organs ✓	
Ovaries in females ✓	Oestrogen ✓	Development of secondary female characters like mammary glands, menstrual cycle and sex organs ✓	

Coordination in Plants :-

The stimulus is not transmitted through a nervous system like in animals. Instead, it's communicated through a combination of electrical and chemical signals.

These signals travel from cell to cell.

Movement in Plants

Nastic Movement

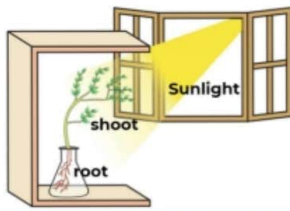
Tropic Movement

Tropic Movement

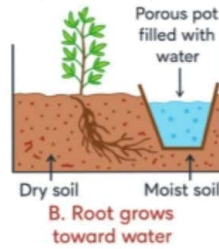
- Growth movement of a plant part in response to external stimuli is called tropism.
- Tropic Movement - growth dependent.
- Direction of stimulus determines the direction of response.
- Growth of plants towards stimulus → positive tropism.
- Growth of plants away from stimulus → negative tropism.

Phototropism Light	Growth of plant part towards or away from Light	• Positive Phototropism ✓ • e.g. stem of a growing plant bends towards light ✓ shoot	• Negative Phototropism - • e.g. roots of a plant moves away from light ✓
Geotropism gravity	Growth of plant part towards or away from gravity	• Positive Geotropism - • e.g. roots of a plant moves downward towards gravity ✓	• Negative Geotropism - • e.g. stem of a plant moves upward against gravity ✓
Hydrotropism water ✓	Growth of plant part towards or away from water	• Positive Hydrotropism - • e.g. roots of a plant grow towards water ✓ diagram	• Negative Hydrotropism - movement away from water
Chemotropism ✓	Growth of plant part towards or away from chemicals	• Positive Chemotropism ✓ • e.g. growth of pollen tube towards ovule during fertilisation ✓ R.P.	• Negative Chemotropism - movement away from chemical ✓
Thigmotropism Touch ✓	Growth of plant part towards or away from touch	• e.g. climbing parts of a plant such as tendrils grow towards support and wind around them ✓	

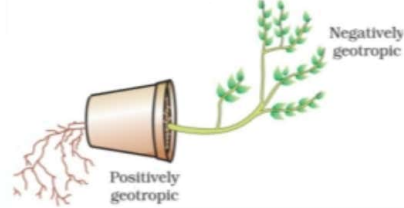
Phototropism



Hydrotropism



Geotropism



Nastic Movement:-

Amount of water change.

- Growth independent movement.
- e.g. when we touch the leaves of a sensitive plant like Mimosa pudica (chhuimui), they fold.



Characteristic	Tropic Movements	Nastic Movements
Response to Stimulus	Unidirectional Response to Stimulus	Non-directional Response to Stimulus
Dependency on Growth	Growth-dependent movements	Growth-independent movements
Nature of Movement	Permanent and irreversible ✓	Temporary and reversible ✓
Occurrence in Plants	Found in all plants ✓	Found only in a few specialized plants ✓
Speed of Movement	Slow action ✓	Immediate action ✓

ANIMALS	PLANTS
Specialised tissues for conduction of information ✓	No specialised tissues for conduction of information
The movement happens due to because of specialised proteins in muscles ✓	The movement happens due to <u>because of</u> change in amount of water in cells (resulting in swelling/shrinking) ✓

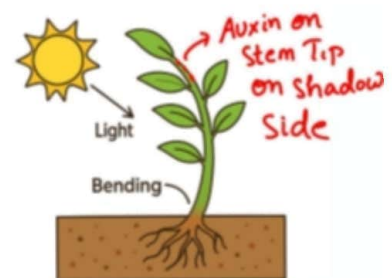
Hormones in Plant

Plant Hormone	Function
Auxin (GP)	• Promotes cell elongation in shoots • Controls phototropism
Gibberellins (GP)	• Stimulates stem elongation • present in greater concentration in areas such as fruits and seeds
Cytokinin (GP)	• Promote cell division • Delays ageing of leaves, flower
Stress Hormone Abscissic Acid (GI)	• Causes stomata to close • Maintains dormancy in seeds • Wilting of leaves

Growth Promoter GP, Growth inhibitor GI

Bending of plant

When light falls on a plant from one side, Auxin moves and accumulate on the shaded side. Auxin stimulates cell growth, so cells on shadow side elongates and stem bends towards light.



(CBSE 2025, 2022, 2019)

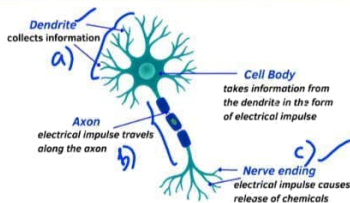
- Q1. What is meant by receptors in the human body?
Q2. Name any four types of receptors with their locations.

CBSE 2025, 2024, 2023, 2020, 2018

Q.3 Draw a diagram of neuron and label its parts:

- 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.

CBSE 2019, 2018



Q.4 Electrical impulse travels in a neuron from

(CBSE 2025, 2019, 2018)

- A Nerve ending → Axon → Cell body → Dendrite
B Dendrite → Cell body → Axon → Nerve ending
C Cell body → Dendrite → Axon → Nerve ending
D Dendrite → Axon → Nerve ending → Cell body



Q. 5 What is a synapse? How is an electrical impulse created in a nerve cell and what is the role of synapse in this context?

(CBSE 2025, 2019, 2015)

Synapse is a microscopic gap between the nerve ending of one neuron and dendritic tip of other neuron.

In a neuron, an electrical impulse is created by the difference in potential created by movement of ions across the neuron's membrane.

The role of the synapse is to transmit the electrical impulse from one neuron to another. At a synapse, the electrical impulse causes the release of Chemicals (neurotransmitters) from the Nerve ending of one neuron. These chemicals cross the synaptic gap and reach dendritic tip of next neuron, generating a new electrical impulse in that neuron.

Q.6 Ravi accidentally touches a hot pan while cooking and immediately pulls his hand away. This rapid response saves him from a severe burn.

- What is the correct sequence of events when Ravi's hand touches the hot pan unconsciously?
- Define a reflex action. Using a flowchart, illustrate the path of the reflex action Ravi experienced when he touched the hot pan.
- Explain why reflex arcs are considered more efficient for quick responses in such situations.

CBSE 2024

Stimulus (Heat) → Thermo Receptor → Sensory Neuron → Spinal Cord (Interneuron) → Motor Neuron → Effector (Muscles) → Response (Hand moves away)

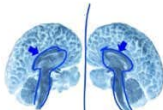
- A Reflex action is a Sudden, quick and Involuntary movement in which thinking is Not Involved. Reflex actions are controlled by spinal cord. It helps protect the body by producing a quick reaction.
- Reflex arcs are considered more efficient for quick responses because-
1) They skip the brain's complex processing 2) Allows an instant reaction through the spinal cord. 3) reduces response times significantly

Q.7 Explain how the brain and spinal cord are protected from shocks and injuries.

(CBSE 2023, 2020)

Corpus Callosum

The Right Hemisphere & Left Hemisphere of brain are connected by bundle of nerve fibres called Corpus Callosum



Q.8 Which among the following is not a neural action controlled by the part of human brain labelled 'X' in the figure above?

(CBSE 2025)

- A Salivation
B Hunger
C Vomiting
D Blood Pressure



Q.9 Which part of the human brain is responsible for the following functions?

- (a) Thinking → Cerebrum (F-B)
(b) Picking up a pencil → Cerebellum BP²
(c) Controlling blood pressure → Medulla
(d) Controlling hunger → Hypo

(CBSE 2025, 2024, 2023, 2020)

- A (a) Cerebrum, (b) Cerebellum, (c) Medulla oblongata, (d) Hypothalamus
B (a) Cerebellum, (b) Cerebrum, (c) Hypothalamus, (d) Medulla oblongata
C (a) Medulla oblongata, (b) Hypothalamus, (c) Cerebrum, (d) Cerebellum
D (a) Hypothalamus, (b) Cerebrum, (c) Cerebellum, (d) Medulla oblongata

Q.10 (i) Identify which parts of the brain are responsible for

- (a) maintaining posture and balance. → BP² → Cerebellum
(b) controlling heartbeat.
(c) enabling thinking.
(d) regulating blood pressure.

(CBSE 2023, 2020)

- (a) maintaining posture and balance. - Cerebellum
(b) controlling heartbeat. - Medulla
(c) enabling thinking. - Cerebrum (Fore brain)
(d) regulating blood pressure. - Medulla

Q.11 Which gland secretes thyroxine and what is its main function?

(CBSE 2025, 2024, 2023, 2020)

- A Pancreas - Controls blood sugar
B Thyroid gland - Regulates metabolism of carbohydrates, proteins and fats
C Pituitary gland - Controls growth of the body
D Adrenal gland - Increases heartbeat and blood pressure

Q.12 (A) Write the role of insulin in regulating blood sugar levels in the human body. Mention the disease caused due to it.

(B) How is the timing and the amount of release of insulin in the blood regulated?

(CBSE 2025, 2023, 2020, 2017, 2016, 2015)

Insulin helps in lowering the blood glucose (sugar) level. After a meal, glucose levels in the blood rise. Insulin enables body cells to absorb glucose from the blood and use it for energy or store it as glycogen. If the body does not produce enough insulin, it leads to a condition known as Diabetes Mellitus.

The amount and timing of insulin released is regulated through feedback mechanism

- Higher glucose level in blood = More insulin secretion
- Lower glucose level in blood = Less insulin secretion

Q.13 What hormone is secreted by the adrenal gland during stressful situations, and what are three responses the body exhibits when this hormone is released into the blood?

(CBSE 2024, 2023, 2020)

The adrenal glands are located on top of each kidney. It secretes adrenaline hormone (emergency hormone) (Flight & Fight Hormone). Three responses -
increases heart rate (more supply of oxygen to muscles)
blood to the digestive system and skin is reduced
increased blood to skeletal muscles

Q.14 A hormone 'X' is secreted in blood when a person is under scary situation.

- (a) Identify the hormone 'X' and the gland that secretes it.
(b) Explain its role in dealing with scary or emergency situations.

(CBSE 2025)

Q.15 (i) Where is the thyroid gland located in the human body? Name the hormone secreted by the thyroid gland and explain its function.
(ii) What is hypothyroidism? How can it be managed? What dietary changes can help regulate TSH levels?

(CBSE 2024, 2023, 2020)

The thyroid gland is located in the front of the neck, just below the larynx. The thyroid gland secretes the hormone thyroxine. Function - Regulates carbohydrate, protein and fat metabolism.

Hypothyroidism is a medical condition in which the thyroid gland does not produce enough thyroid hormones due to deficiency of iodine. This leads to condition called Goitre in which swelling on neck.

Dietary change - taking Iodized salt.

Q.16 State two limitations of electrical impulses in multicellular organisms. Why is chemical communication better than electrical impulses as a means of communication between cells in multicellular organisms? (CBSE 2025)

IMPORTANT

Two limitations of electrical impulses are-

- Limited Range** *Fast*
Electrical signals can only reach to cells connected to the nervous system. They cannot reach every cell in the body.
- Reset Time**: After a neuron transmits an electrical impulse, it needs a period to reset its mechanisms before it can transmit another signal. This delay limits the frequency and rate of signaling.

Why Chemical Communication is Better:

- Wider Range**
Chemical signals, like hormones, can diffuse through the bloodstream and reach all cells of the body.
- Slow but Long Lasting Effects**
Chemical signals can have longer-lasting effects compared to the short-lived nature of electrical impulses, which is essential for regulating growth, metabolism, etc.
- Targeted Specificity**
Chemical signals are highly specific and can act on particular receptors on target cells.

Q.17 (I) Name the movement which causes 'X' and 'Y' to grow downwards and upwards respectively.



Geotropic Movement - Stimuli is gravity.

(CBSE 2025, 2022, 2020, 2019)

Q.18 Observe the given figures A and B. When chhui-mui (sensitive) plant is touched, its leaves fold. This is due to:

- Hormonal effect *x*
- Thermal effect *x*
- Change in amount of water in cells *✓*
- Electromagnetic effect

Nastic

(CBSE 2025, 2024, 2016)



Q.19 Leaves of the sensitive plant move very quickly in response to 'touch'. How is this stimulus of touch communicated and explain how the movement takes place. (CBSE 2025, 2022, 2020, 2019)

The stimulus is not transmitted through a nervous system like in animals. Instead, it's communicated through a combination of electrical and chemical signals. These signals travel from cell to cell.

This movement is called Nastic Movement and happens immediately. The movement happens due to change in amount of water in cells (resulting in swelling/shrinking).

imp

Q.20 The plant hormones promoting rapid cell division in seeds and wilting of leaves respectively are (CBSE 2025, 2024)

- | | |
|------------------------------------|--|
| A Auxins and Absciscic acid | B Cytokinins and Absciscic acid |
| C Gibberellins and Auxins | D Absciscic acid and Gibberellins |

Q.21 The plant hormone whose concentration stimulates the cells to grow longer on the side of the shoot which is away from light is: (CBSE 2025)

- | | |
|---------------------|-----------------------|
| A Cytokinins | B Gibberellins |
| C Adrenaline | D Auxins |