

Control and Coordination

Stimuli- Change in the environment to which an organism responds

Response- Reaction of an organism to a stimulus

working together of various parts of body to respond to a stimuli is called coordination



COORDINATION IN ANIMALS

NERVOUS SYSTEM

ENDOCRINE SYSTEM

CENTRAL NERVOUS SYSTEM

PERIPHERAL NERVOUS SYSTEM

BRAIN

SPINAL CORD

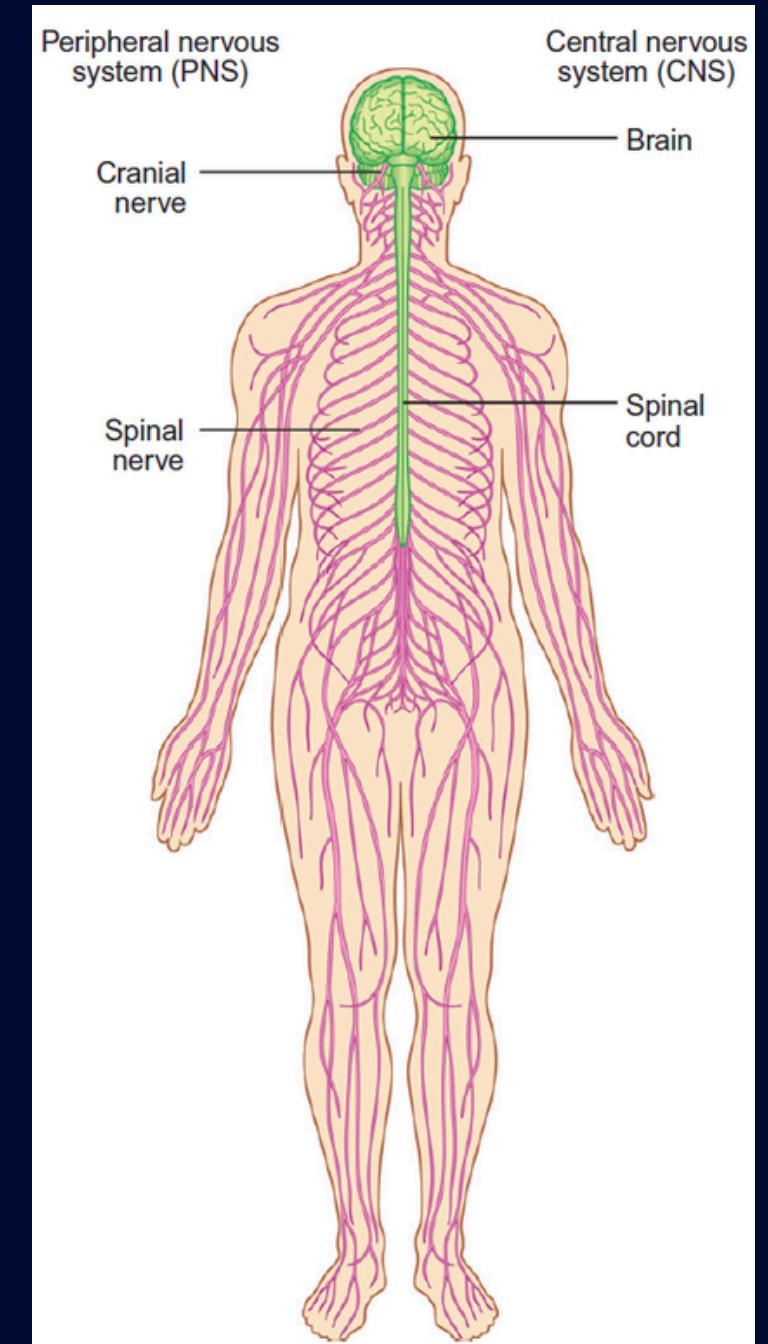
CRANIAL NERVES
Arise from brain

SPINAL NERVES
Arise from Spinal Cord

CNS



PNS



Nervous Tissues

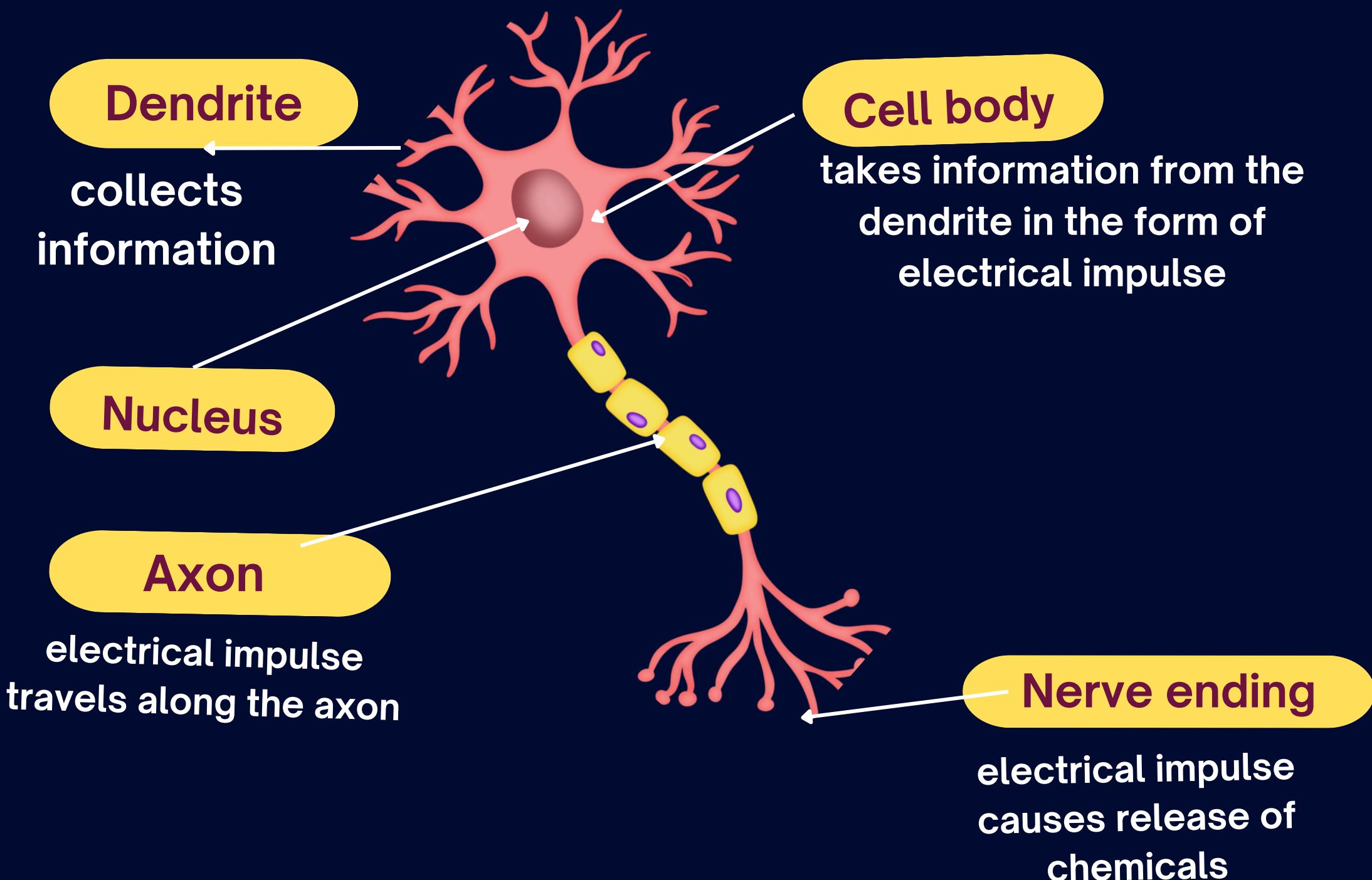
- made up of an organized network of nerve cells
- bundle of neurons

Receptors- Cells, tissues or organs that receive the stimulus

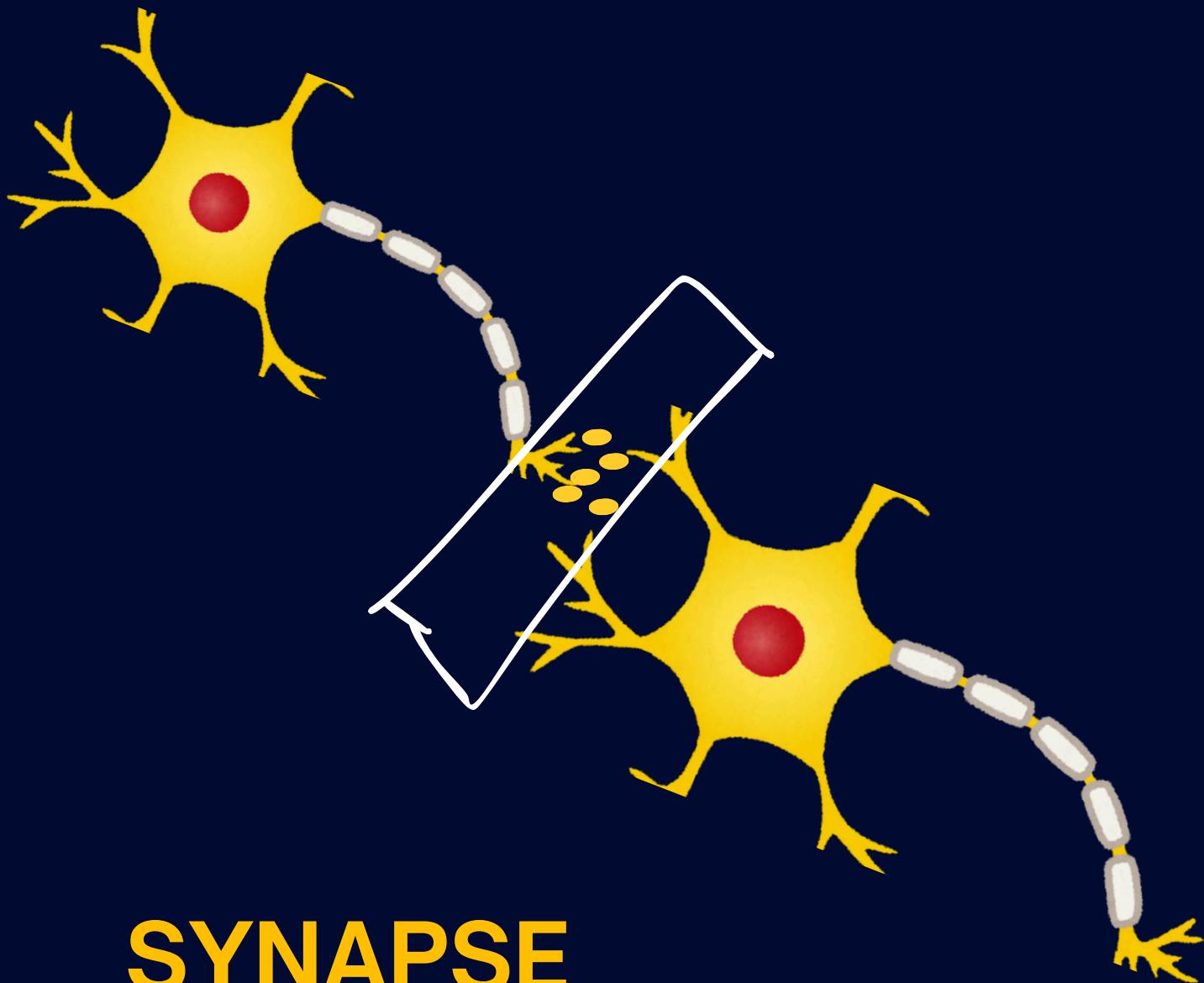
Receptor	Sense Organ	Stimuli
Photo receptors	Eyes	Light
Olfactory receptors	Nose	Smell
Gustatory receptors	Tongue	Taste
Phono receptors	Ear	Sound
Thermoreceptors	Skin	Heat/Cold
Nociceptors	Skin	Pain

NEURON

- Structural and functional unit of nervous system
- Longest cell in body
- Carry messages in the form of electrical impulses



effectors - muscles/tissues/glands which act in response to a stimuli



SYNAPSE

Microscopic gap between two neurons

There is a release of chemical substances at the synapse between two neurons which help in the transmission of electrical impulse

Neurotransmitters- Chemical substances that help in the transmission of nerve impulse

TRANSMISSION OF IMPULSE BETWEEN 2 NEURONS

- Receptors receive the stimulus
- Information is collected at the end of dendritic tip
- Chemical reaction creates an electrical impulse
- Impulse travel from dendrite to cell body
- Impulse travels through the axon
- Reaches nerve endings
- Release of chemicals at the synapse

NEUROMUSCULAR JUNCTION

Junction between nerve ending of a motor neuron and a muscle



TYPES OF NEURONS

Sensory Neurons

Transmit impulse from Receptor to CNS

Motor Neurons

Transmit impulse from CNS to Effectors (muscle or gland)

Relay Neurons/ Interneurons

Connects Sensory and Motor neurons

Presence of stimulus



Receptors receive the stimulus



Impulse taken by sensory neurons



Conduction of impulse through the neurons



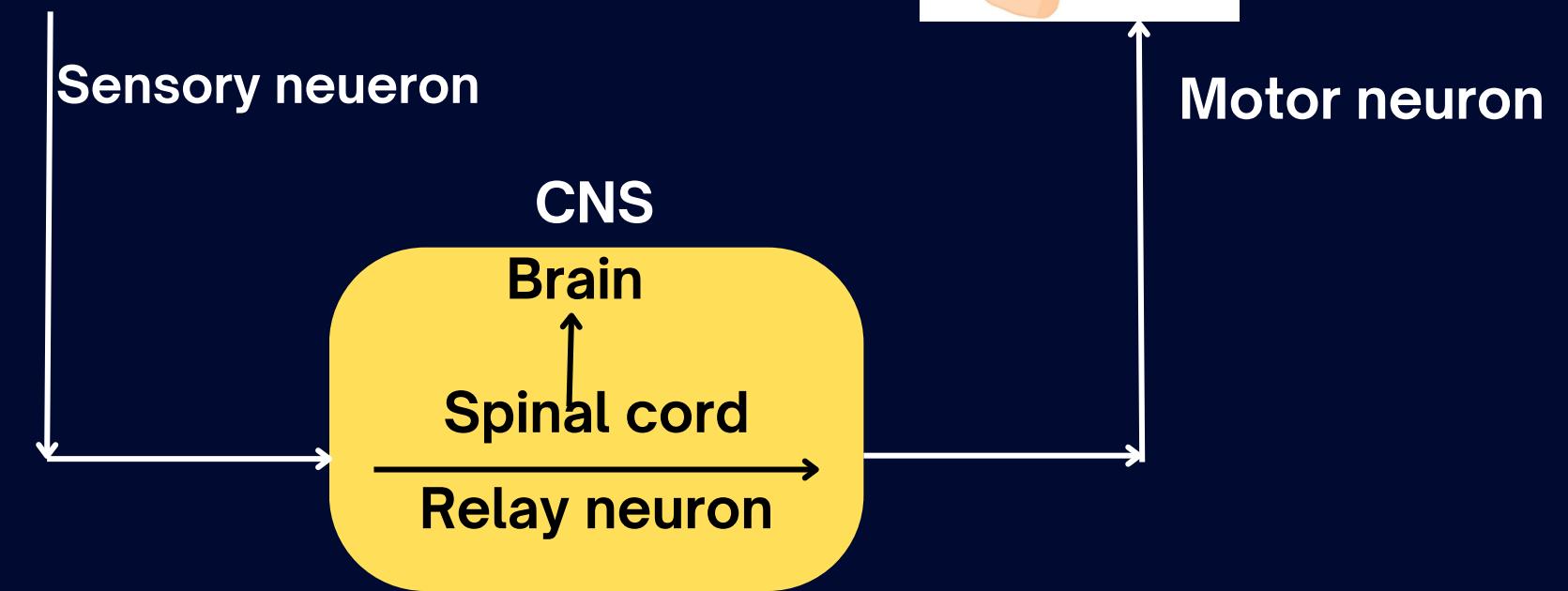
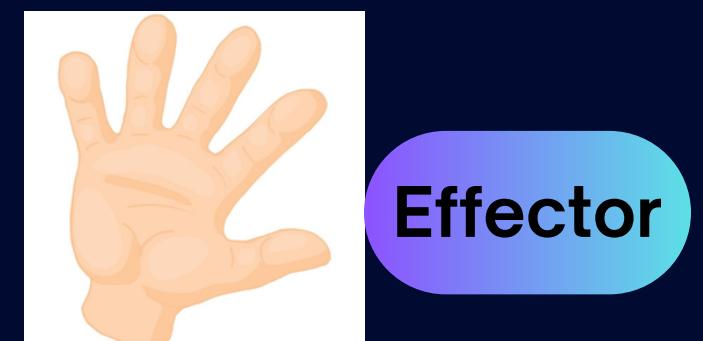
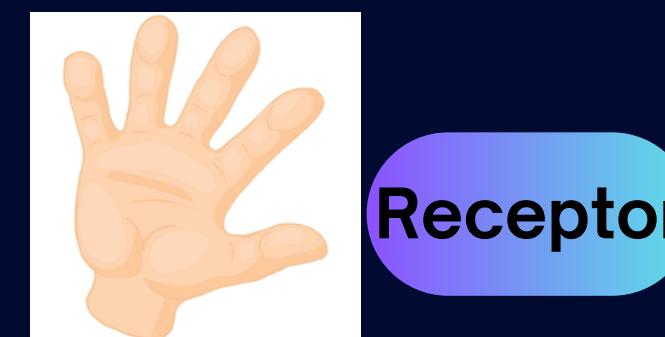
Information reaches to CNS

Relay neurons present in CNS transfers impulse from sensory to motor neurons



Motor neurons carry information from CNS to effectors

Effectors (muscles/glands) respond to stimuli



How do muscles move?

- Muscle cells move by changing their shape so that they shorten
- Muscle cells have special proteins that change their shape and arrangement in the cell in response to nervous electrical impulses

- (i) What is meant by receptors in the human body?
- (ii) Name any four types of receptors with their locations.

(CBSE 2018,2020, 2023,2024)

Draw a diagram of neuron and label its parts:

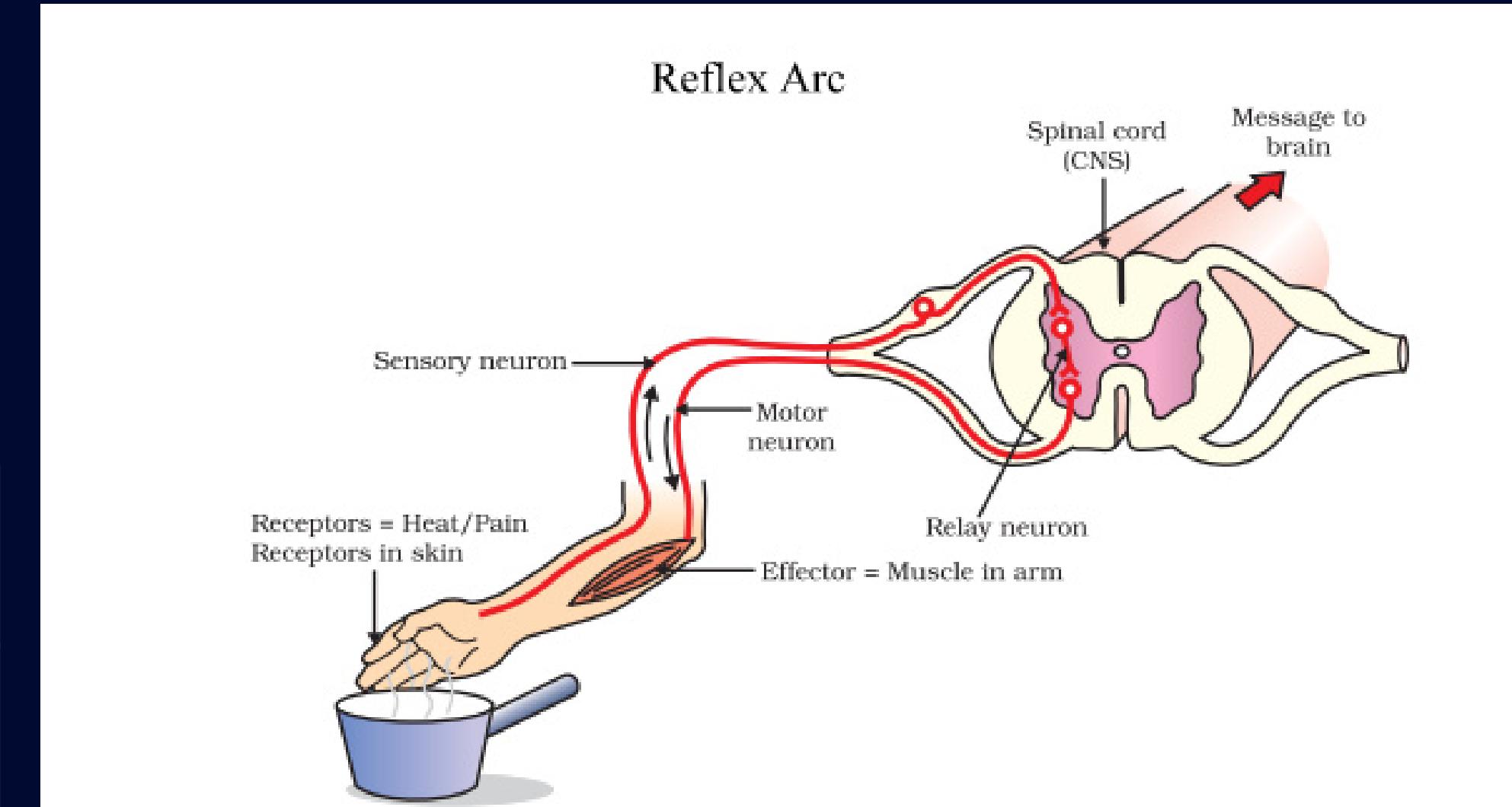
- (i) where information is acquired,**
- (ii) through which information travels as an electric impulse, and**
- (iii) where the electric impulse must be converted into a chemical signal for onward transmission.**

(CBSE 2018,2019)

REFLEX ACTIONS (Reflex Movement)

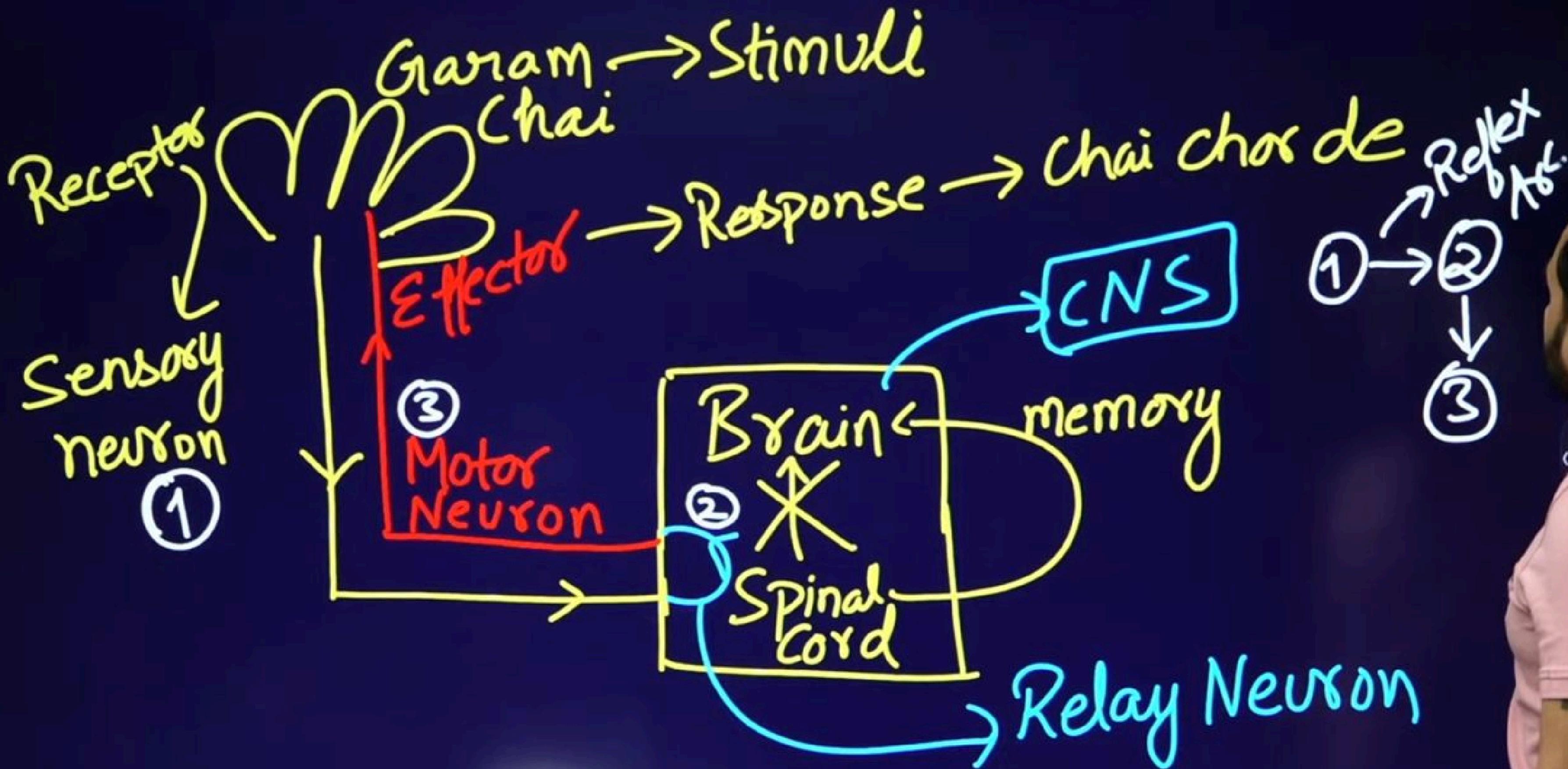
- Sudden and quick movement
- Involuntary movement
- Brain not involved (directly not involved)
- Reflex actions are controlled by spinal cord

Type of Action	Description	Examples
Voluntary Actions	- Controlled by will- Thinking and brain involved	Walking, Writing, Dancing
Involuntary Actions	- Uncontrolled- No thinking- Brain involved	Blood pumping, Peristalsis
Reflex Actions	- Uncontrolled- No thinking- No brain involved	Hand withdrawal, Sneezing



Reflex Arc - Path followed by nerve impulse during reflex action

Evolution of reflex arc in animals

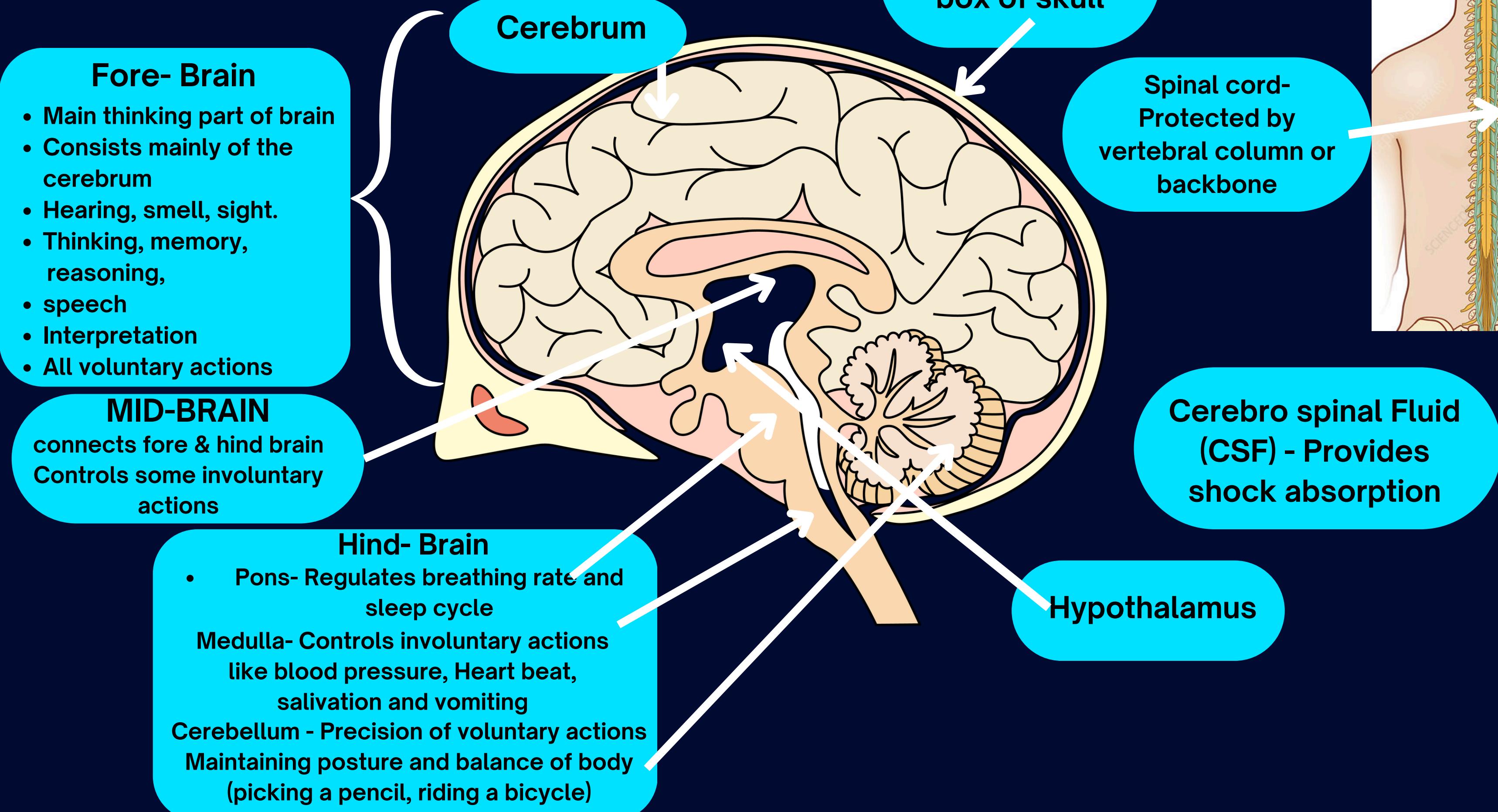


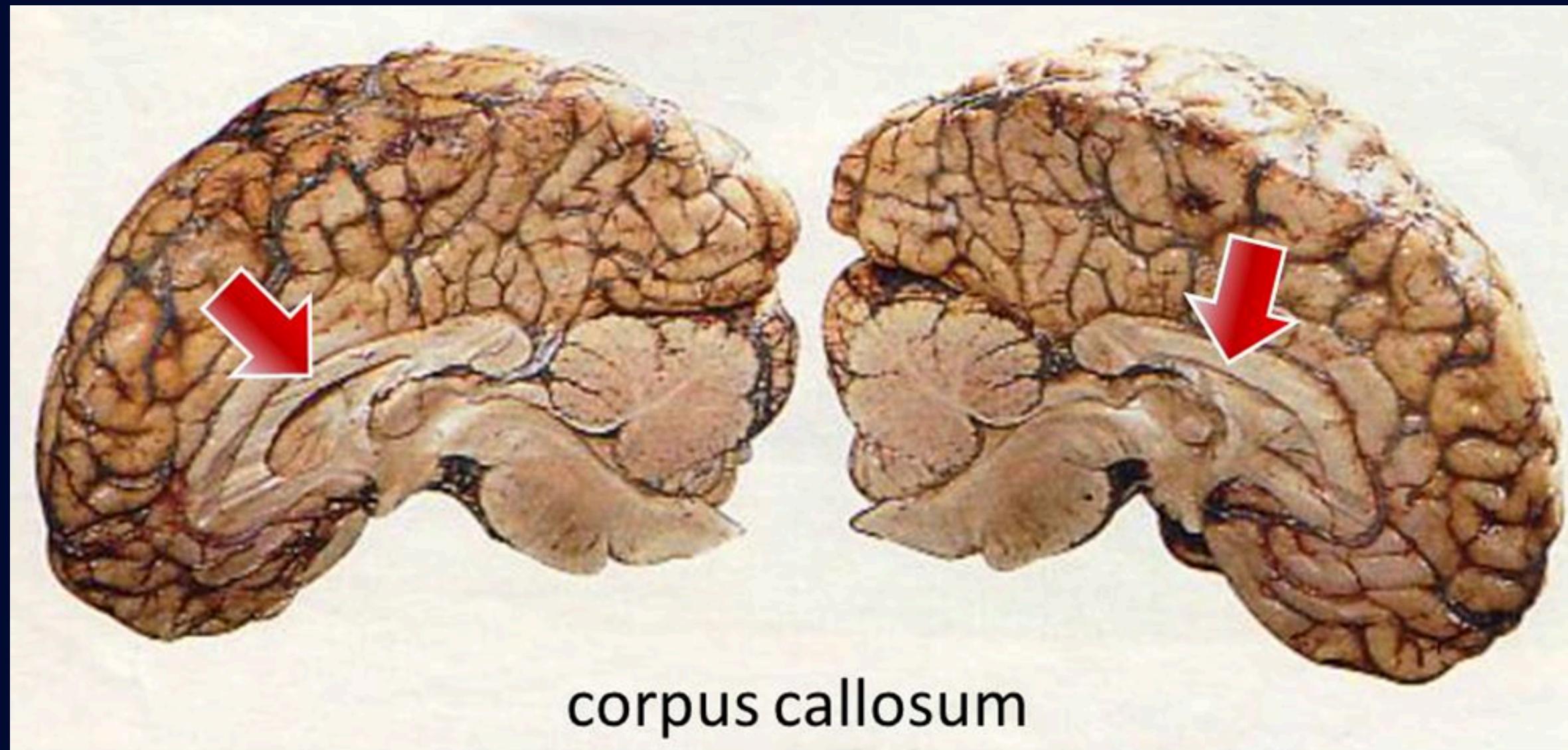
Ravi accidentally touches a hot pan while cooking and immediately pulls his hand away. This rapid response saves him from a severe burn.

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

BRAIN

- CNS --> Brain + Spinal Cord
- Main coordinating center of the body





corpus callosum

Which part of the brain is involved in activities like

- (i) picking a pencil with precision**
- (ii) vomiting?**

State whether these actions are voluntary or involuntary.

(CBSE 2024)

(i) Identify which parts of the brain are responsible for:

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

(ii) Explain how the brain and spinal cord are protected from shocks and injuries.

(iii) What constitutes the central and peripheral nervous systems?

(CBSE 2020, 2023)

HORMONES IN ANIMALS

Hormones - chemical substances that act like messenger molecules in the body

Gland - a structure that secretes a specific substance

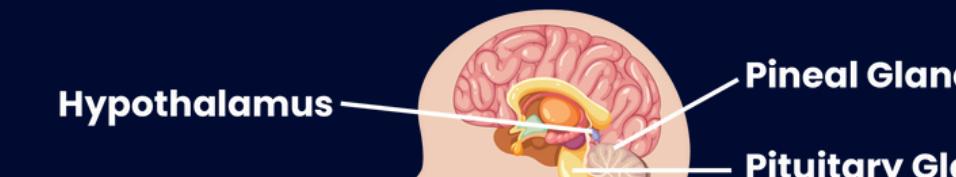
role in the release of many hormones e.g. releases growth hormone releasing hormone - stimulates pituitary gland to release growth hormone

(GHRH)



Testosterone- changes during puberty, development of secondary sexual characteristics

- secretes adrenaline (emergency hormone)
- increases heart rate (more supply of oxygen to muscles)
- blood to the digestive system and skin is reduced
- increased blood to skeletal muscles
- breathing rate increase



master gland releases many hormones growth hormone - regulates growth and development of body deficiency of growth hormone - dwarfism hypersecretion of growth hormone - gigantism

- thyroxin hormone regulates carbohydrates, proteins and fat metabolism in body
- Iodine required for synthesis of thyroxine
- deficiency of iodine causes goitre
- symptoms - swollen neck iodised salt in diet

Pancreas - insulin regulates blood sugar levels deficiency of insulin - diabetes

Oestrogen Development of secondary sexual characteristics

Gland	Hormone	Function	Related disease
Hypothalamus	Releasing hormones	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
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 like deep voice, beard, and sex organs	
Ovaries in females	Oestrogen	Development of secondary female characters like mammary glands, menstrual cycle and sex organs.	

- Feedback mechanism - the timing and amount of hormone released are regulated by feedback mechanism
- e.g. blood sugar levels increase - pancreas produces more insulin
blood sugar levels decrease - insulin secretion is reduced

Question - Rahul, a 14-year-old boy, has been experiencing abnormal growth patterns. His parents are concerned as he is much shorter than his peers. The doctor conducts a series of tests and finds that he has a deficiency of a particular hormone responsible for growth regulation. Meanwhile, his grandfather has been advised to reduce sugar intake due to high blood glucose levels.

- (i) What disease is Rahul's grandfather likely experiencing? Identify the hormone and the gland responsible for the imbalance.**
- (ii) What hormone deficiency is Rahul likely facing, which gland secretes it, and how does it impact growth regulation?**
- (iii) How does the timing and amount of hormone release get regulated in the body? Explain with an example.**

(CBSE 2016, 2018, 2020)

One day, while walking through a jungle, Aman suddenly spots a tiger nearby. His heartbeat increases, his breathing rate becomes rapid, and he feels an adrenaline rush in his body. He immediately climbs a tree to save himself. This reaction helps him survive the dangerous situation.

Answer the following questions based on the given case:

- (a) Name the hormone secreted by the adrenal gland in such stressful situations.**
- (b) List three responses shown by the human body when this hormone is secreted into the blood.**

(CBSE 2020, 2023)

Question -

- (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 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 2020, 2023, 2024)

NASTIC MOVEMENT

TROPIC MOVEMENT

TROPIC MOVEMENT

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

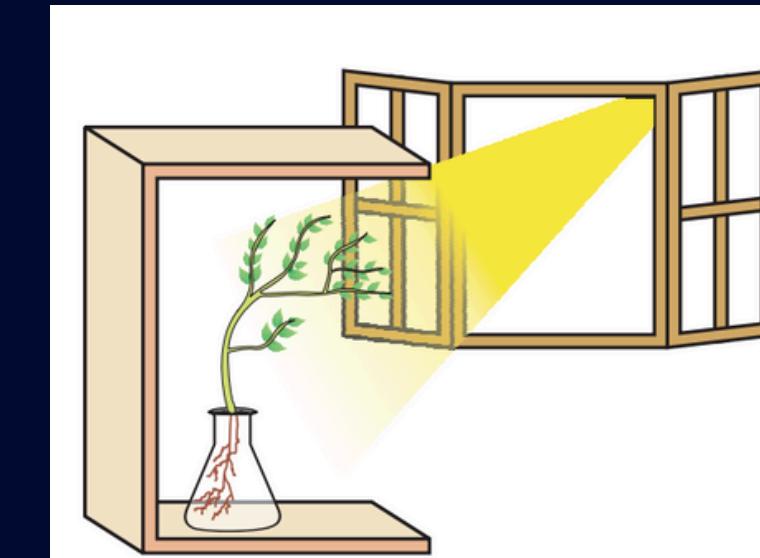


Figure 6.5
Response of the plant to the direction of light

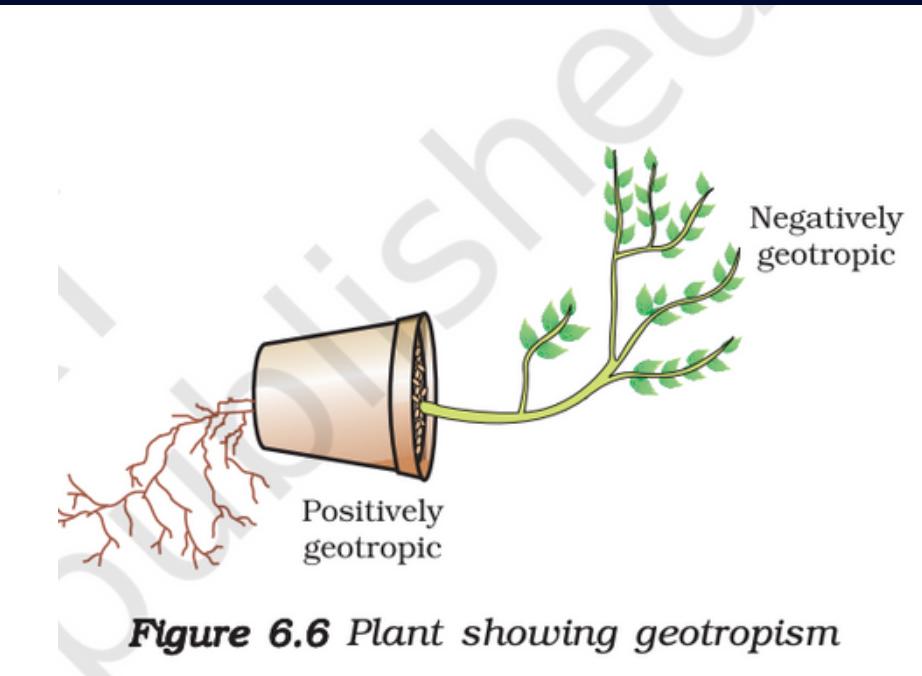


Figure 6.6 Plant showing geotropism

Phototropism	Growth of plant part towards or away from Light	<ul style="list-style-type: none"> • POSITIVE PHOTOTROPISM - movement towards light • eg. stem of a growing plant bends towards light 	<ul style="list-style-type: none"> • NEGATIVE PHOTOTROPISM - movement away from light • eg. roots of a plant moves away from light
Geotropism	Growth of plant part towards or away from Gravity	<ul style="list-style-type: none"> • POSITIVE GEOTROPISM - movement towards gravity • eg. roots of a plant moves downward towards gravity 	<ul style="list-style-type: none"> • NEGATIVE GEOTROPISM - movement against gravity • eg. stems of a plants moves upwards against gravity
Hydrotropism	Growth of plant part towards or away from water	<ul style="list-style-type: none"> • POSITIVE HYDROTROPISM - movement towards water • eg. roots of a plant grow towards water 	<ul style="list-style-type: none"> • NEGATIVE HYDROTROPISM - movement away from water
Chemotropism	Growth of plant part towards or away from chemicals	<ul style="list-style-type: none"> • POSITIVE CHEMOTROPISM - movement towards chemical • eg. growth of pollen tube towards ovule during fertilisation 	<ul style="list-style-type: none"> • NEGATIVE CHEMOTROPISM - movement away from chemical
Thigmotropism	Growth of plant part towards or away from touch	<p>the direction of growth movement of a plant part in response to the touch of an object</p> <p>e.g. climbing parts of a plant such as tendrils grow towards support and wind around them</p>	

NASTIC MOVEMENT

- Non-directional movement in plant in response to stimuli
- Growth independent movement
- e.g. - when we touch the leaves of a sensitive plant like *Mimosa pudica*, 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	ANIMALS	PLANTS
Occurrence in Plants	Found in all plants	Found only in a few specialized plants	Specialised tissues for conduction of information	No specialised tissues for conduction of information
Speed of Movement	Slow action	Immediate action	They change shape because of specialised proteins in muscles	They change shape because of change in amount of water in cells (resulting in swelling/shrinking)



Question -

- (i) The leaves of ‘chhui-mui’ plant begin to fold up and droop in response to a stimulus. Name the stimulus and write the cause for such a rapid movement. Is there any growth involved in the movement?
- (ii) State the types of movements seen in plants due to water and chemical stimulus and explain with the help of diagrams respectively.

(CBSE 2016, 2024)

Question - Define geotropism. Draw a well-labeled diagram of a plant showing geotropic movement of its parts. What is meant by positive and negative geotropism?

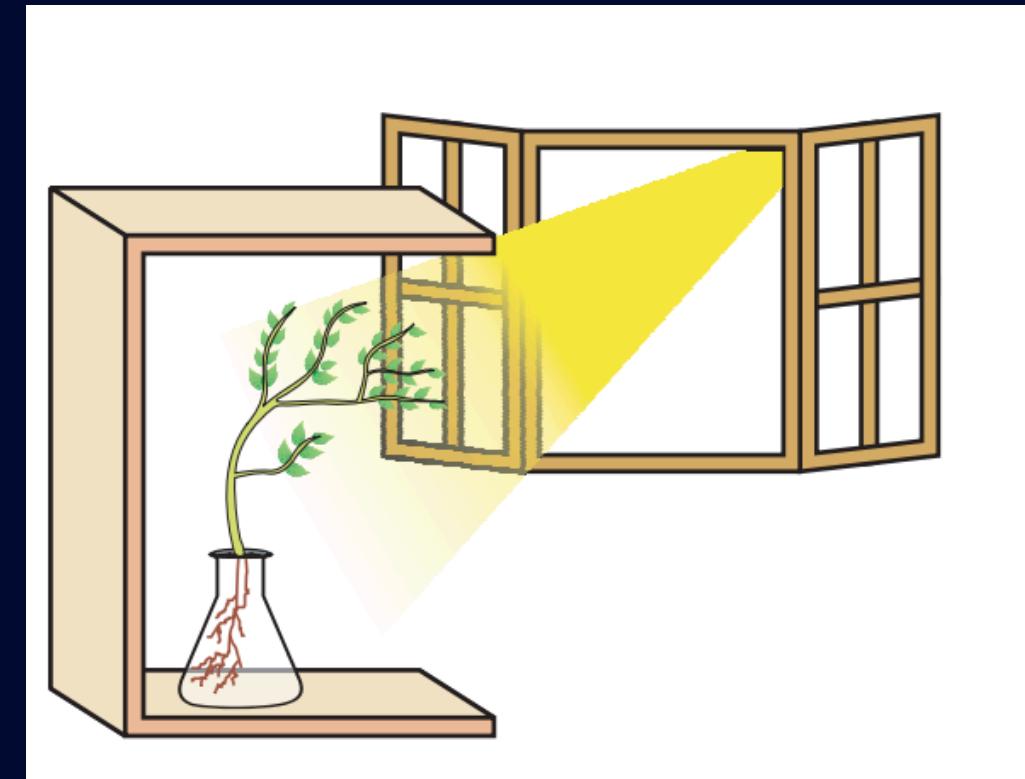
(CBSE 2019, 2020)

HORMONES IN PLANTS

AUXINS

- help cells to grow longer
- auxin is made by cells at the tip of stems

BENDING OF PLANT



- light comes on one side of plant
 - auxin diffuses toward shady side of shoot
 - cells grow longer on the side of shoot away from light
 - Thus plant appears to bend towards light

CYTOKININS

- promotes cell division
- present in greater concentration in areas of rapid cell division (such as fruits and seeds)

GIBBERELLINS

- help in growth of the stem

ABSCISIC ACID

- growth inhibitor
- Stress hormone
- wilting of leaves