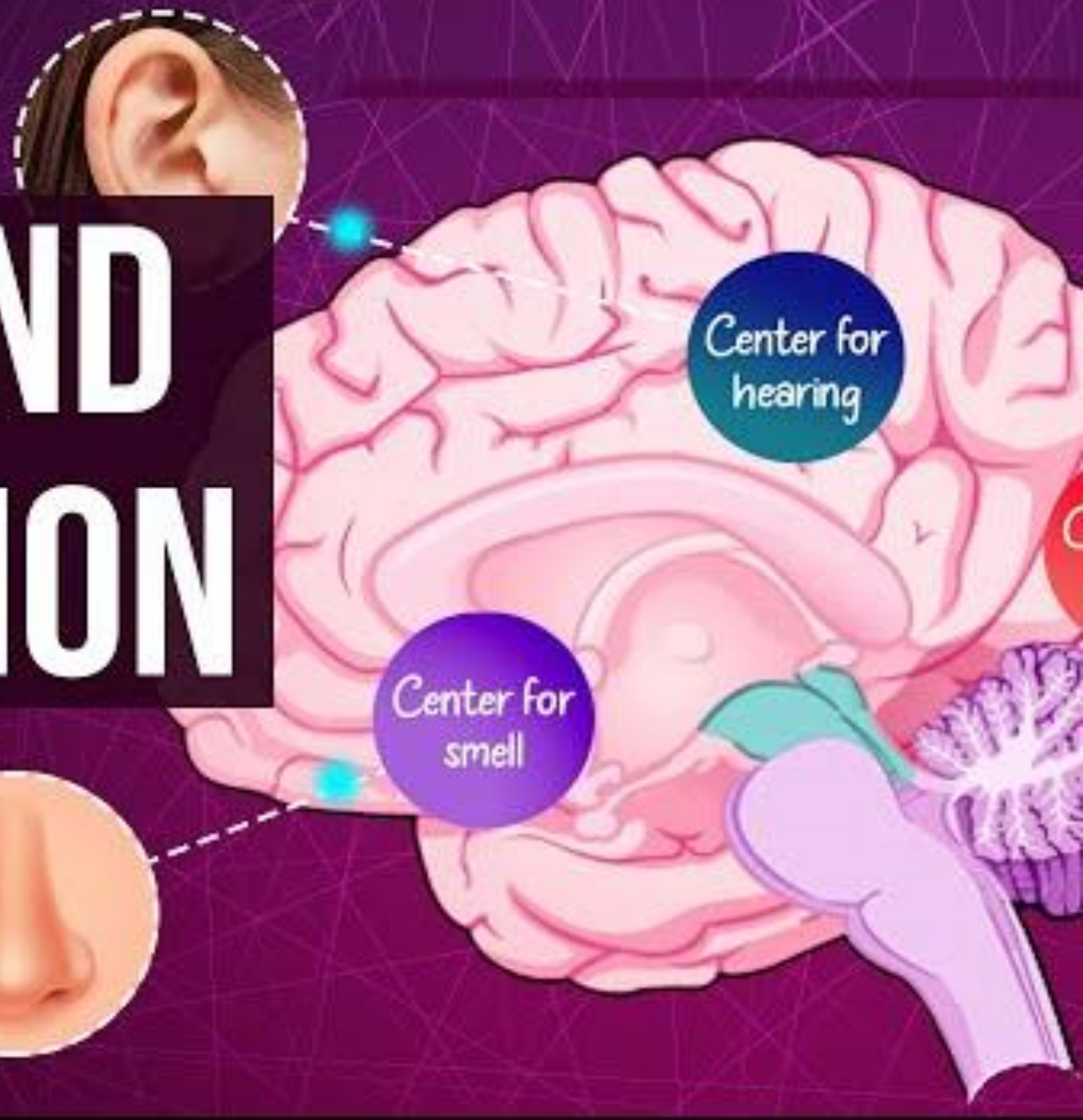
CLASS 10 BIOLOGY

CONTROL AND COORDINATION

Full chapter in Animation

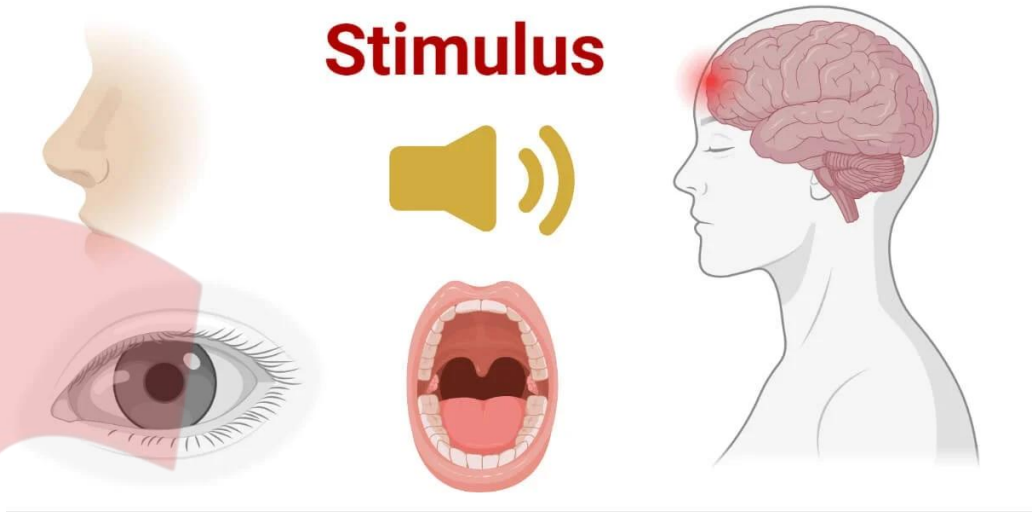


Control And Coordination

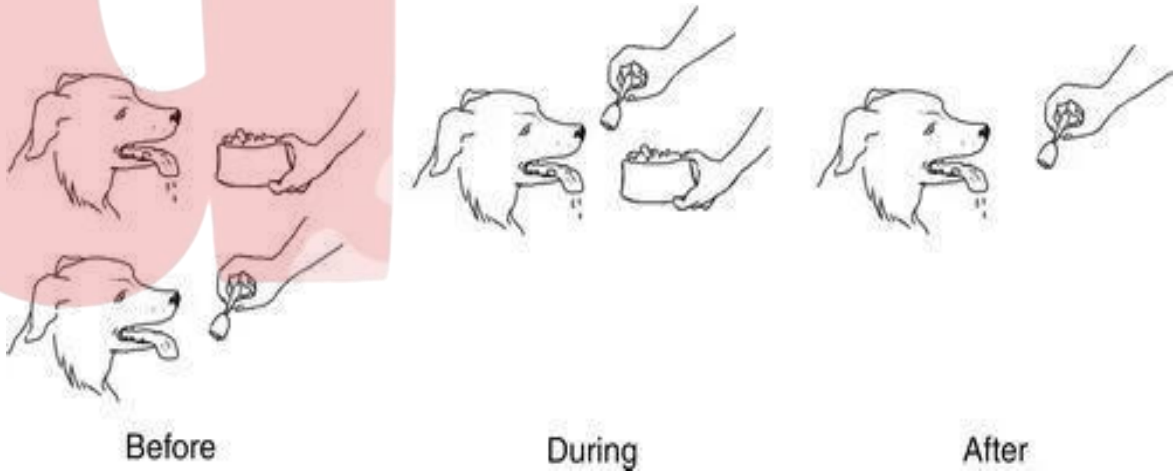
Control And Coordination

- All the living organisms respond and react to changes in the environment around them.

- The changes in the environment to which the organisms respond and react are called **stimuli** (singular of stimuli is stimulus) such as light, heat, cold, sound, smell, touch etc.
- Both plants and animals respond to stimuli but in a different manner.



Coordination :- The working together of the various organs of an organism in a systematic manner so as to produce a proper response to the stimulus is called coordination.



Control And Coordination in plants

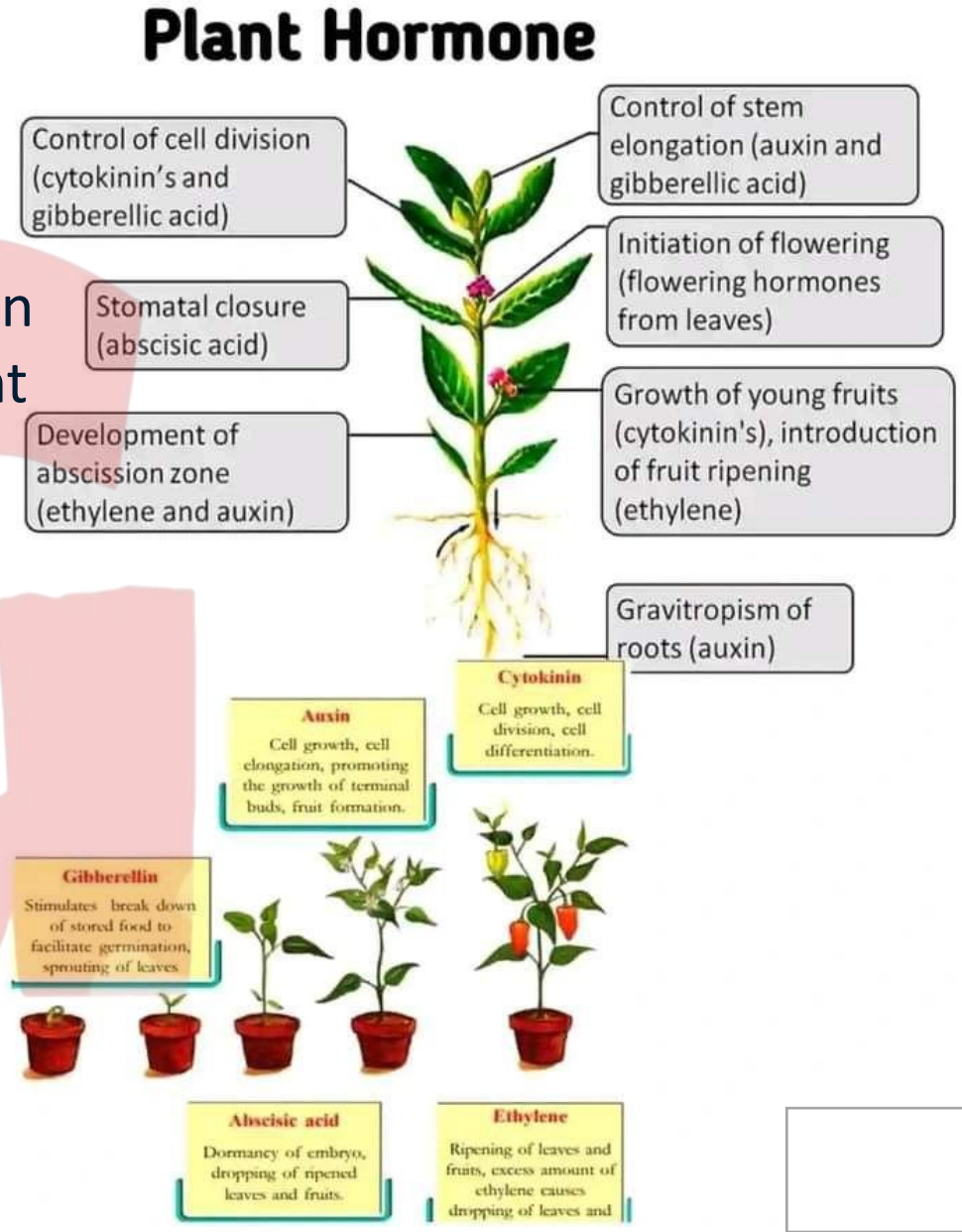
The function of control and coordination in plant is performed by chemical substance called plant hormones.

Plant hormones, or phytohormones, are naturally occurring chemical compounds produced by plants that, in extremely low concentrations, regulate all aspects of plant growth, development, and responses to environmental stimuli, acting as signal molecules.

There are four major plants hormones :-

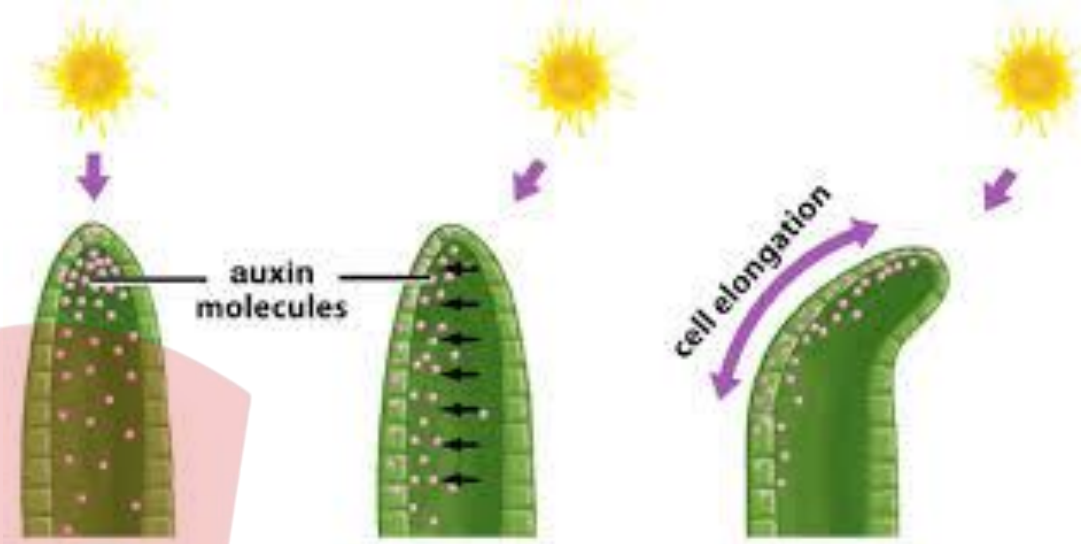
1. Auxin
2. Gibberellins
3. Cytokinin
4. Abscisic acid

5. Ethylene (not in syllabus)



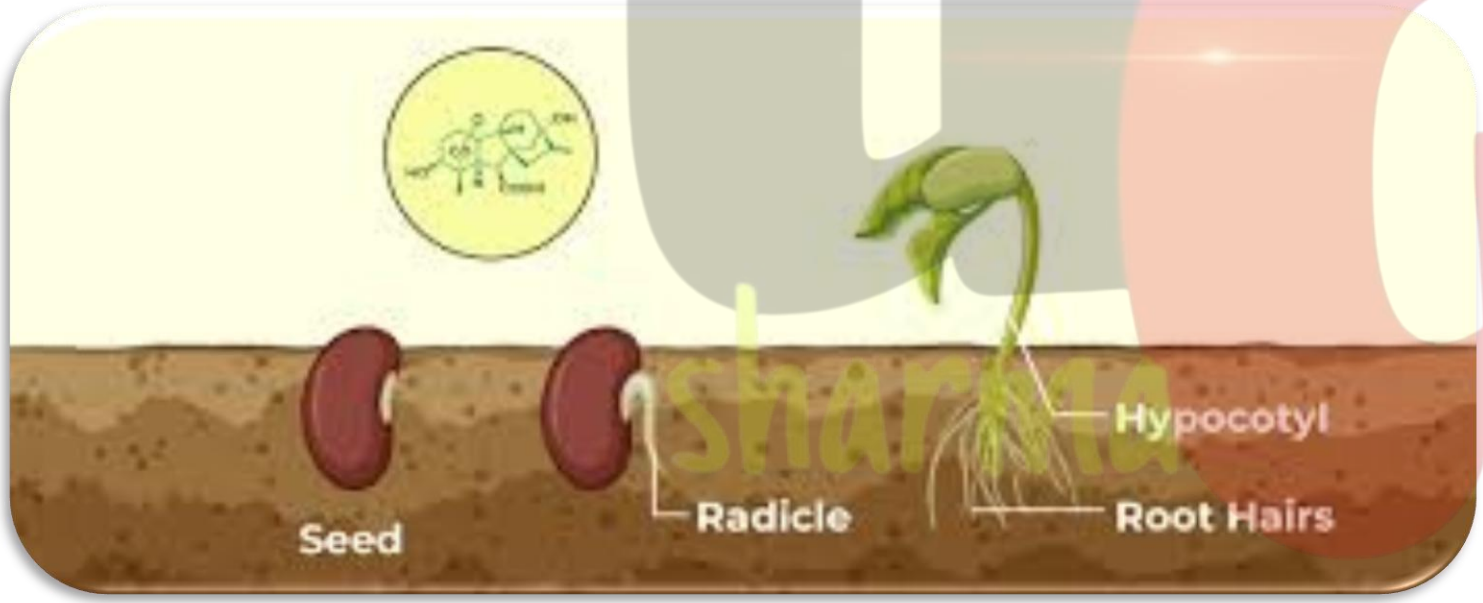
01. Auxins

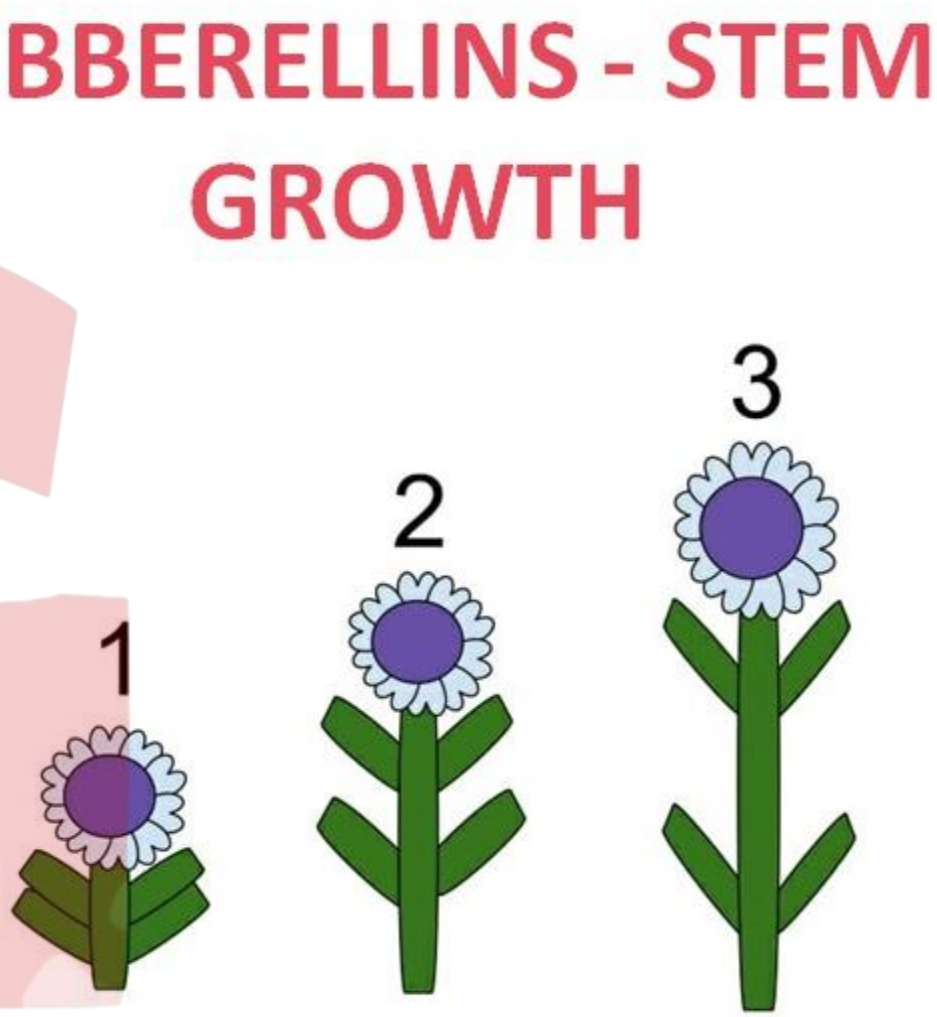
- Promote cell enlargement & cell differentiation.
- Promote fruit growth.
- Form in tip of stems and roots
- Opposite effect in growth of stems & roots.



02. Gibberellins

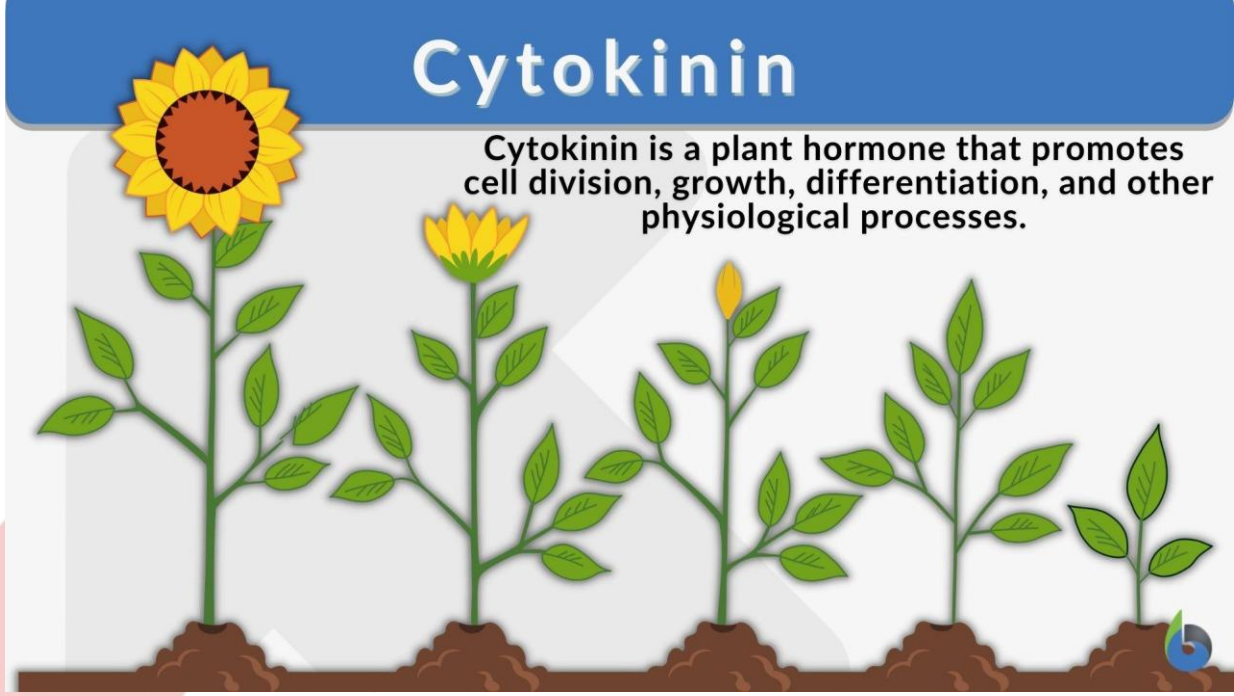
- Promote cell enlargement & cell differentiation in presence of auxin.
- Promote fruits growth.
- Breaking the dormancy in seeds & buds.

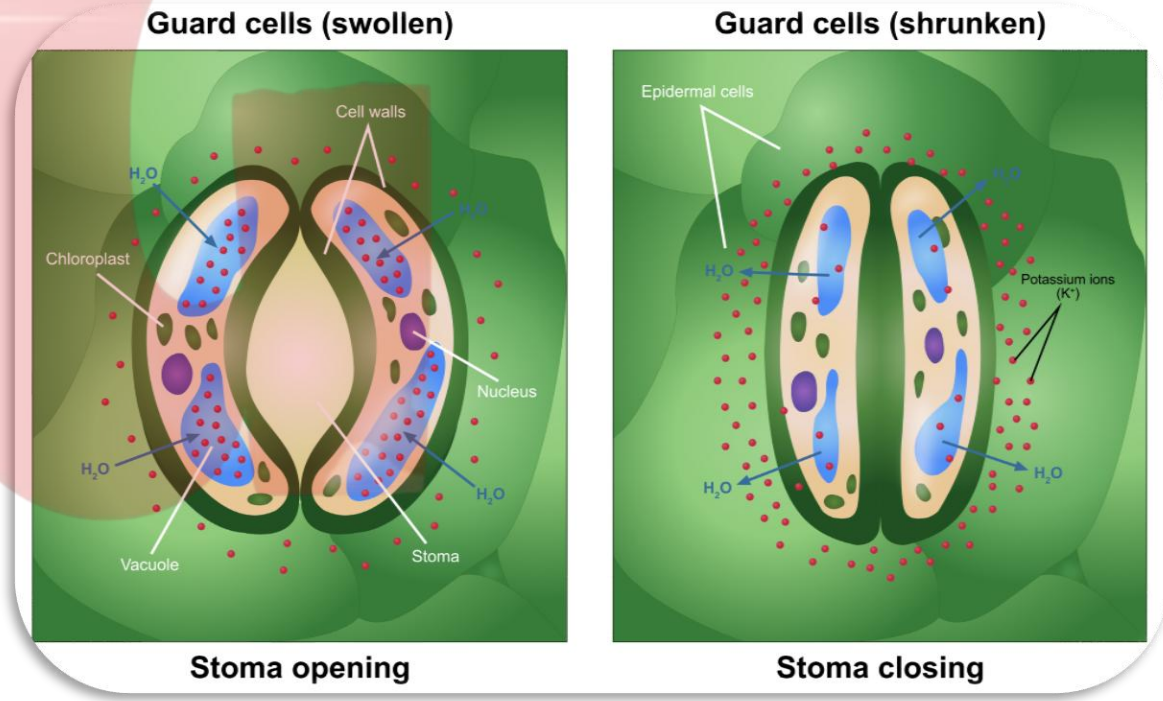




03. Cytokinin

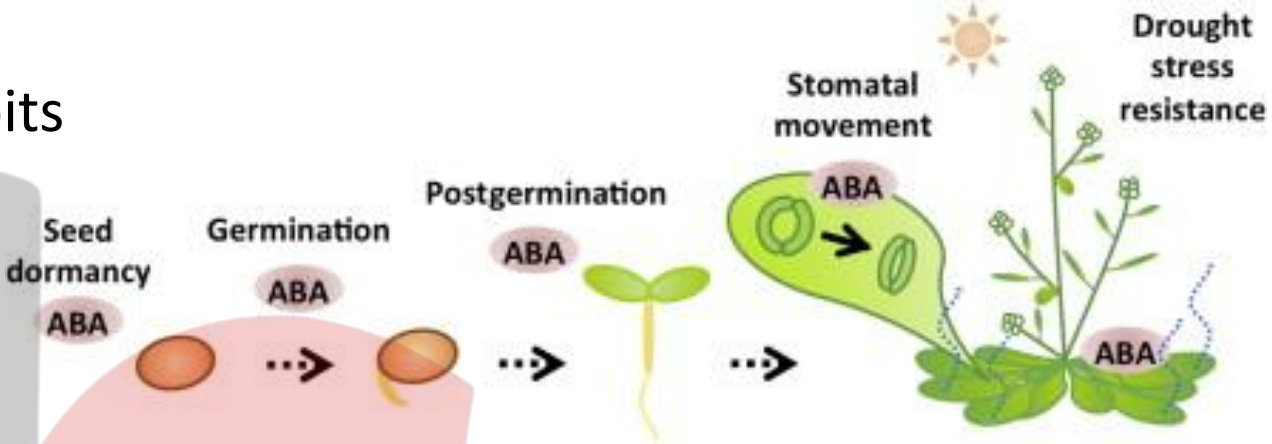
- Promote cell division.
- Promote fruits growth.
- Breaking the dormancy in seeds & buds.
- Promote opening of stomata.





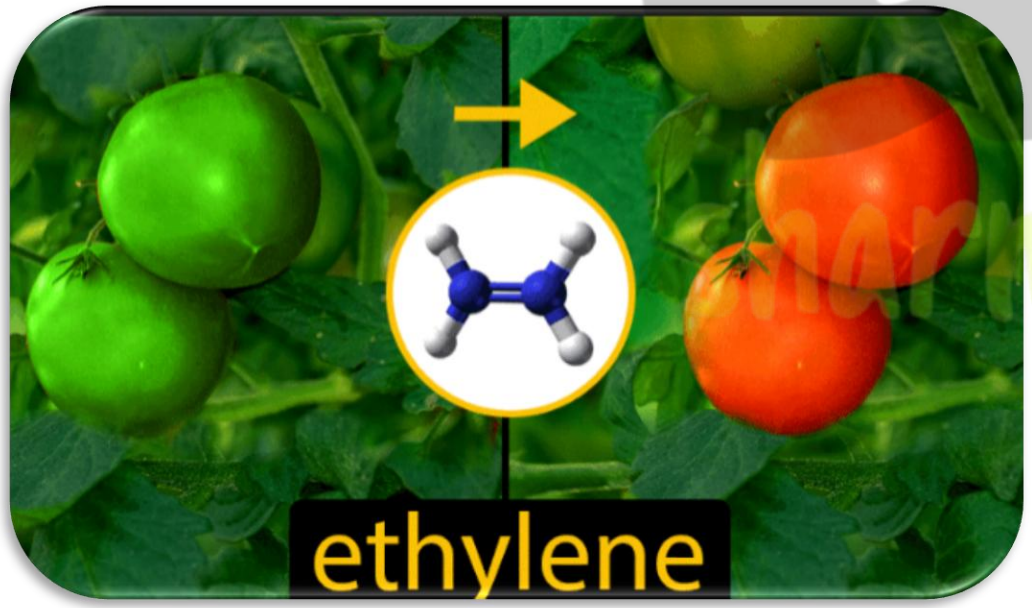
04. Abscisic acid

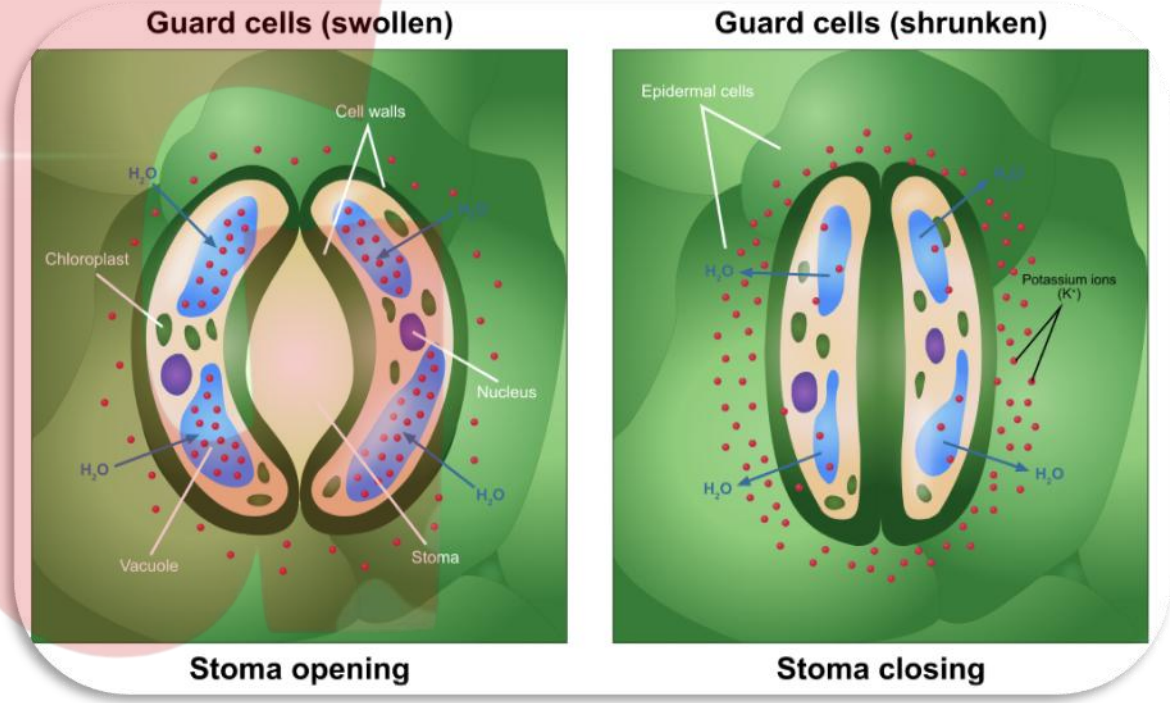
- Oppose the dormancy in seeds (i.e Inhibits germination).
- Promotes the falling of leaves & fruits.
- Promote closing of stomata.



05. Ethylene

- Fruits ripening.
- Helps in determining the sex of flower.

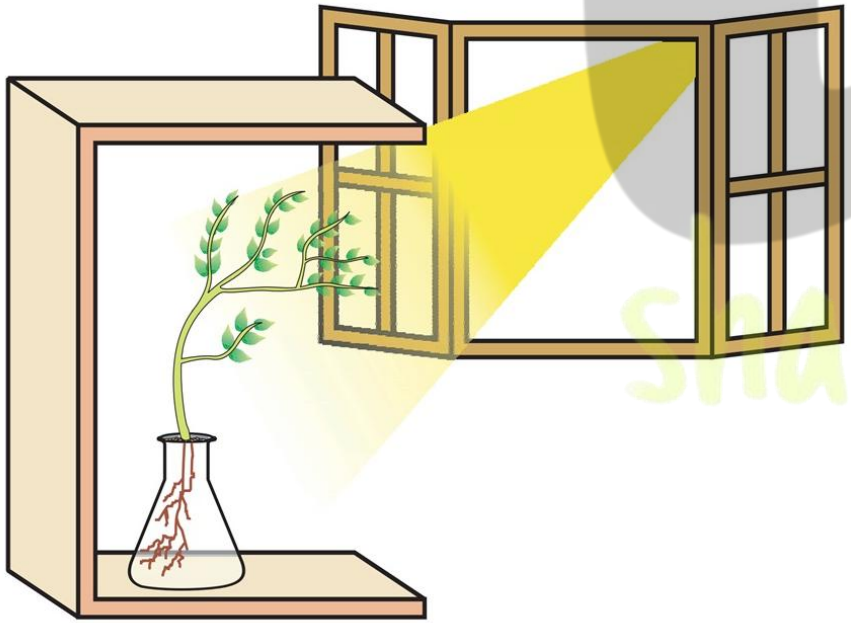


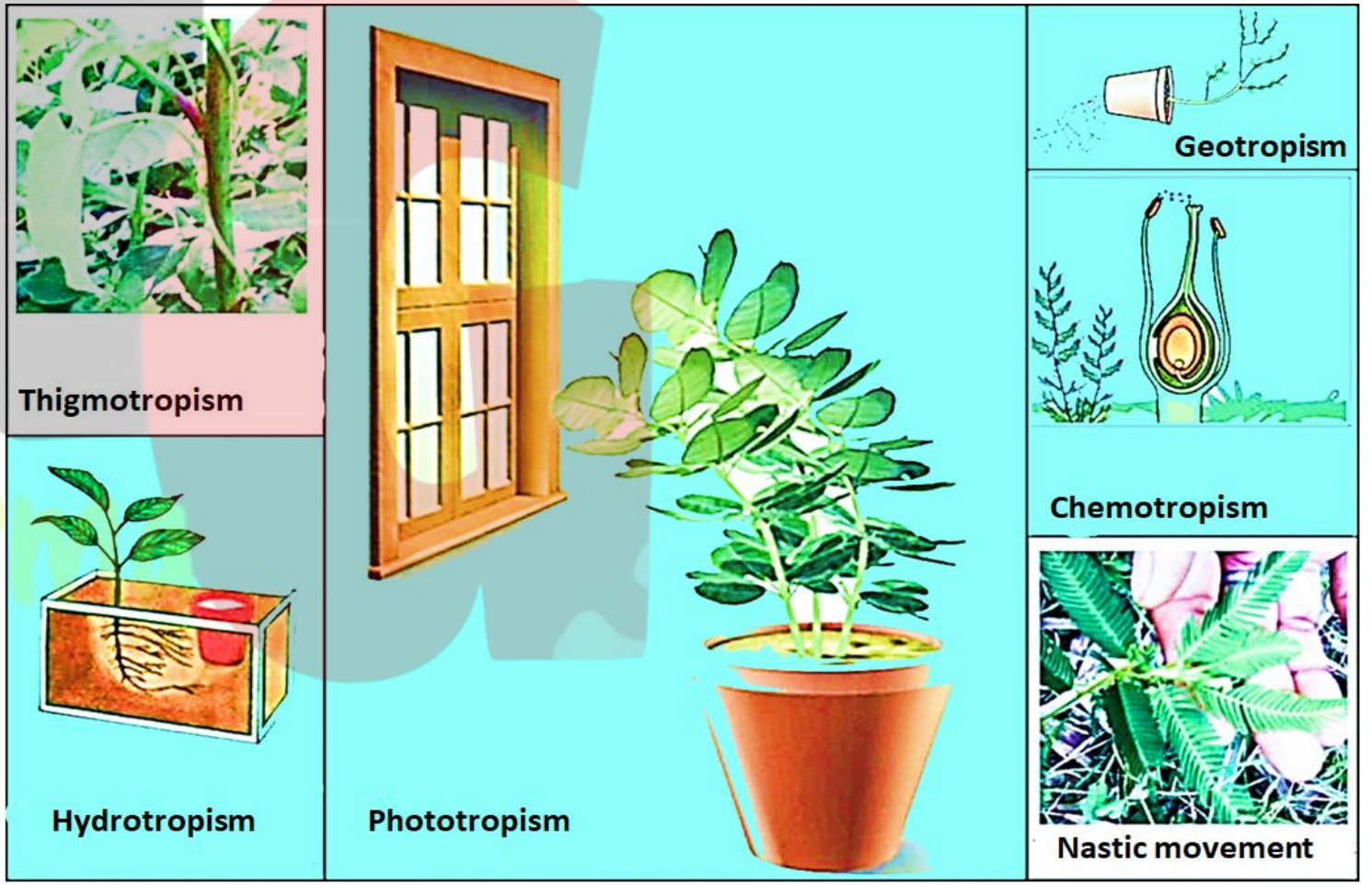


Tropic movement

Tropisms :- A growth movement of plants in response to an external stimulus in response to an external stimulus in which the direction of stimulus determines the direction of response is called tropism.

Phototropism



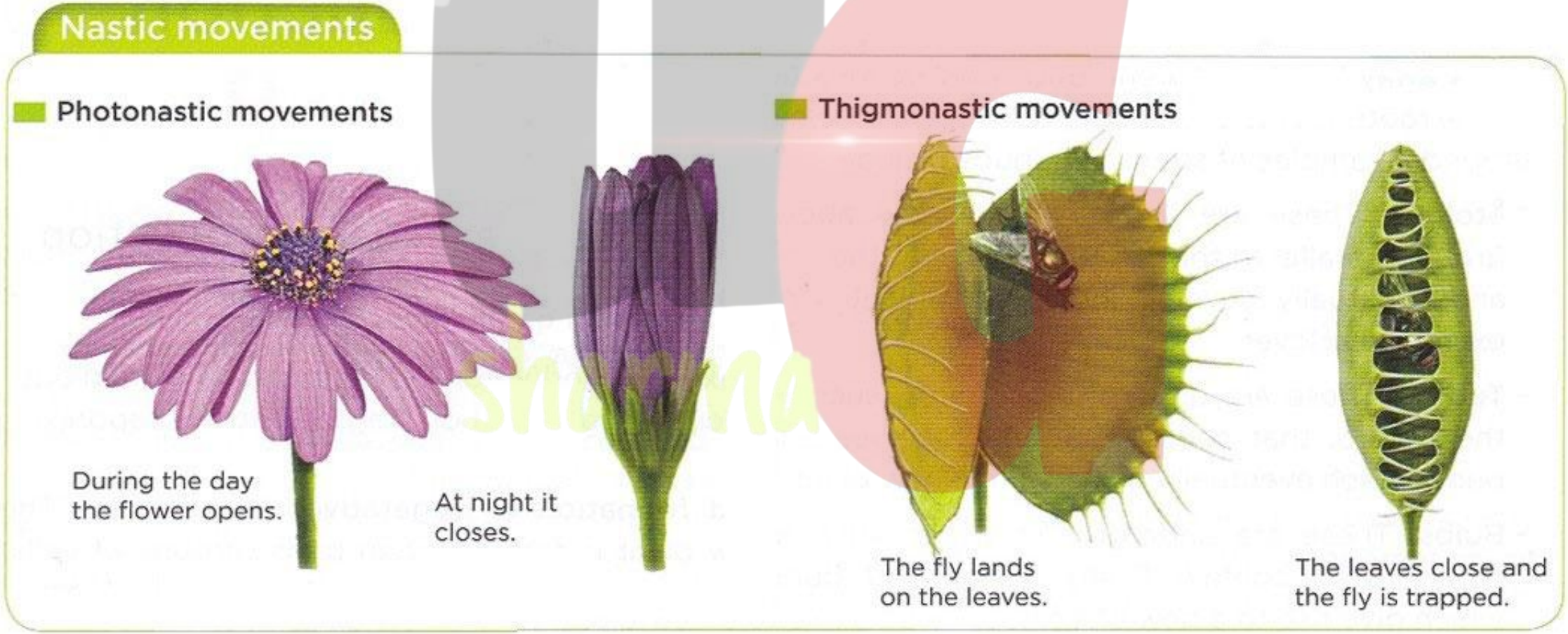


Movement	Stimulus	Example
Phototropism	Light	Bending or shooting towards light.
Geotropism	Earth's gravity	Bending of roots towards ground.
Chemotropism	Chemicals	Growth of pollen tube towards ovule.
Hydrotropism	Water	Movement of roots towards ground water.
Thigmotropism	Contact	Movement of tendril towards support.

Nastic movement

Nasties :- The movement of plants part in response to an external stimulus in which the direction of response is not determined by the direction of stimulus is called nastic movement.

- It is not growth movement.

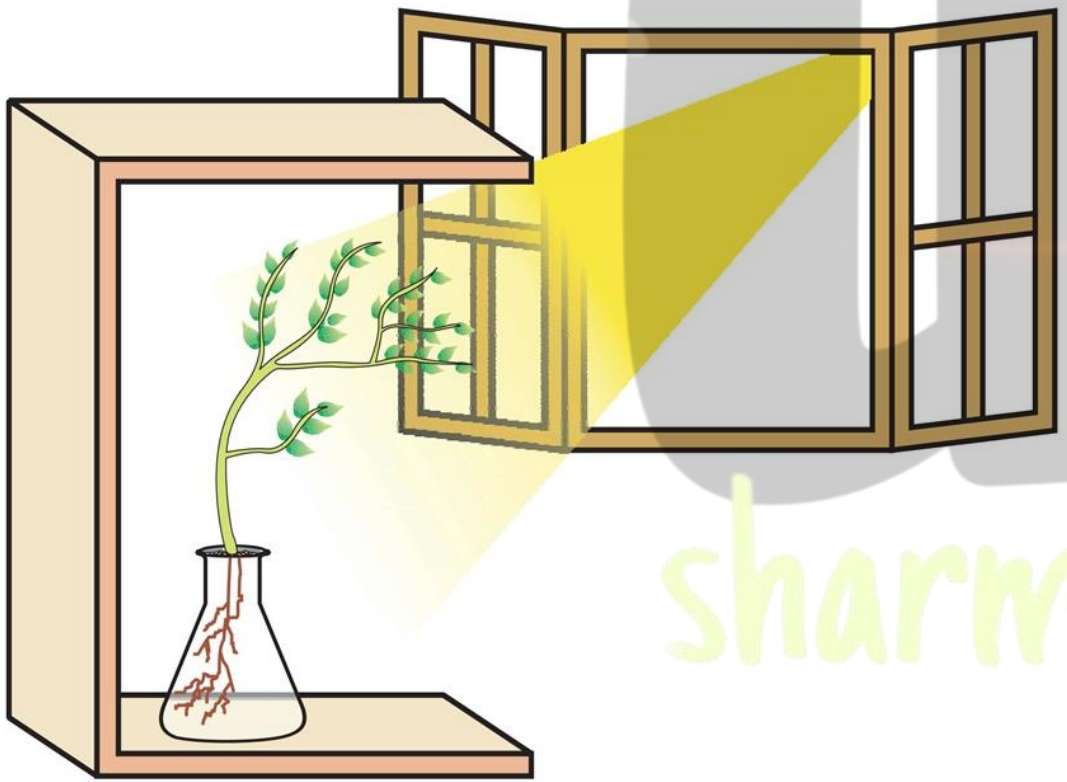


Stimulus	Types of nasty	Example
O1. Touch	Thigmonasty	• Movement of plant mimosa pudica (chhui-mui) in response to touch
02. Light	Photonasty	• Movement of petal of flowers in response of light.

Note :- The opening and closing of flowers in response to light or photonasty are growth movement.

TROPIC MOVEMENTS Vs NASTIC MOVEMENTS

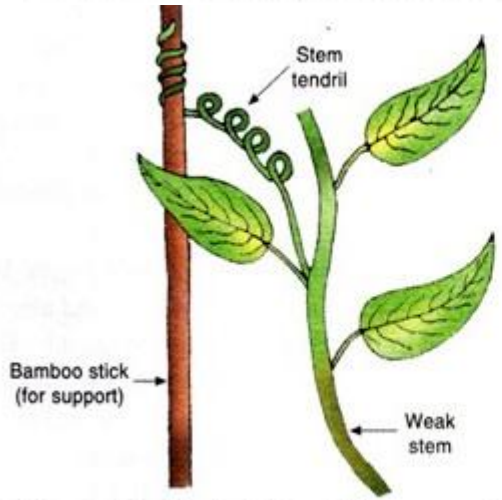
Phototropism



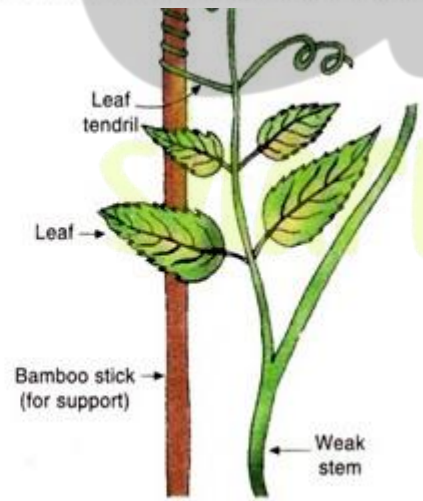
Touch me not response to stimuli

Table 1 Differences between tropic and nastic movements

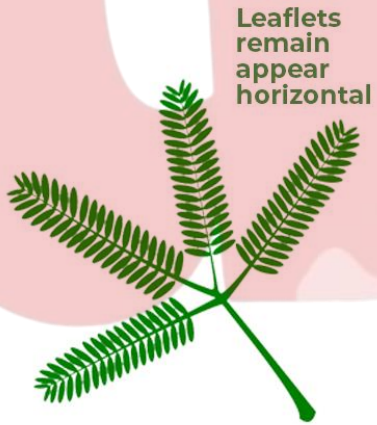
Tropic movements	Nastic movements
Unidirectional response to the stimulus	Non-directional response to the stimulus
Growth dependent movements	Growth independent movements
More or less permanent and irreversible	Temporary and reversible
Found in all plants	Found only in a few specialized plants
Slow action	Immediate action



(*a*) Stem tendrils help the plant to climb up a support



(*b*) Leaf tendrils also help the plant to climb up a support



Before touch

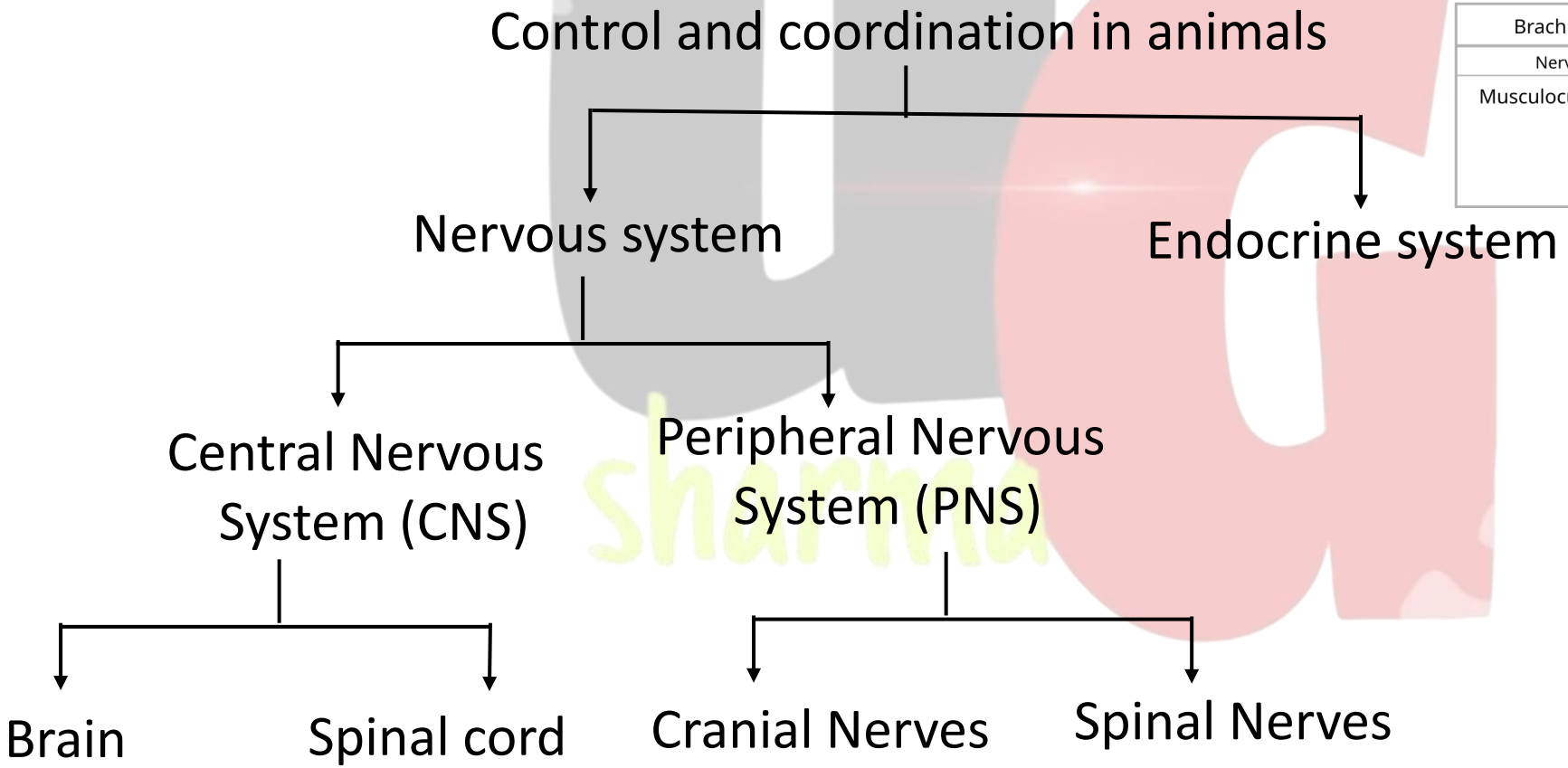
After touch

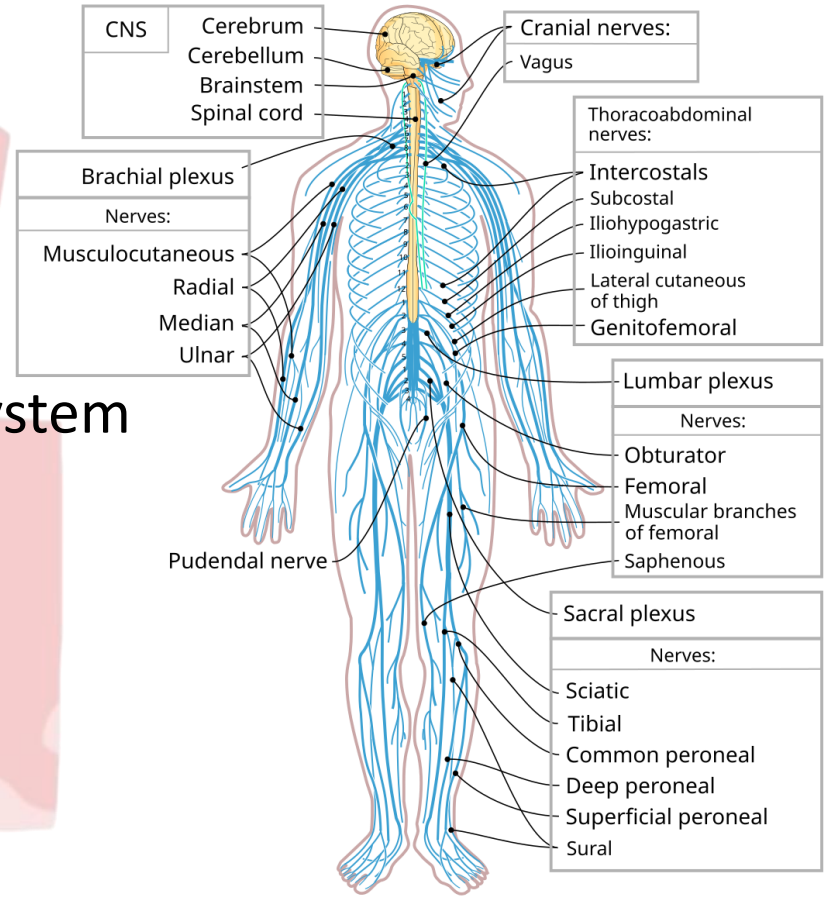
QUESTIONS

1. What are plant hormones?
2. How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light?
3. Give an example of a plant hormone that promotes growth.
4. How do auxins promote the growth of a tendril around a support?
5. Design an experiment to demonstrate hydrotropism.

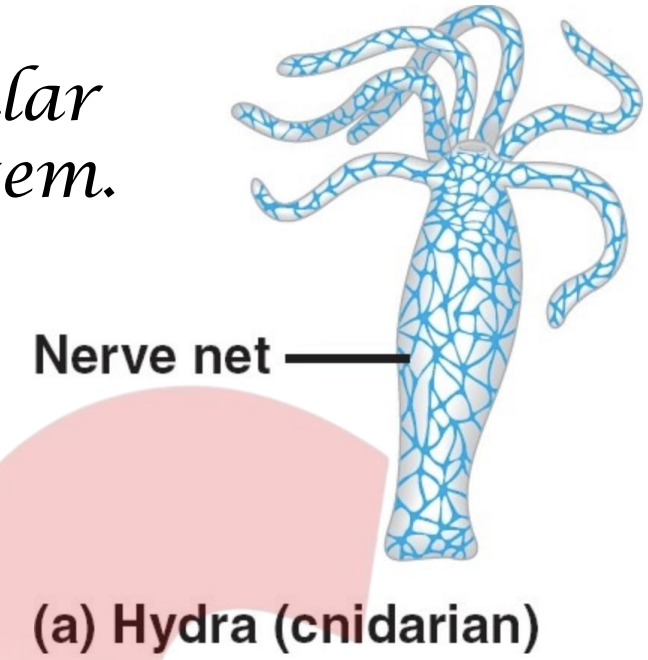
Control And Coordination in Animals

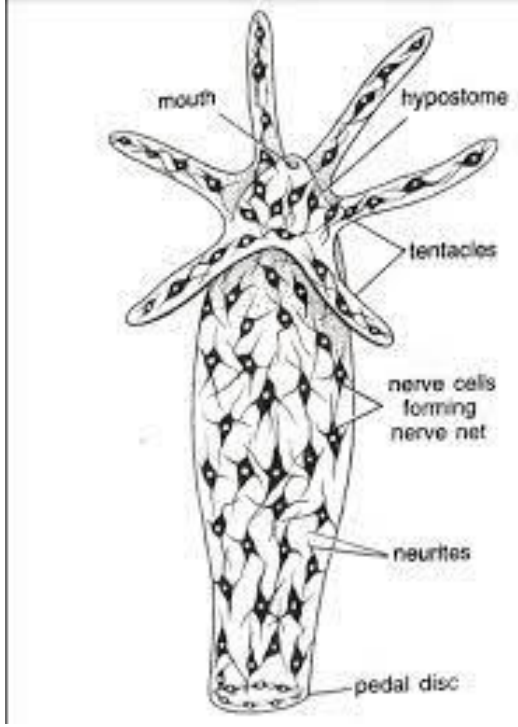
The control & coordination in higher animals c/d vertebrates (including human being) takes place through nervous system as well as hormonal system c/d endocrine system.



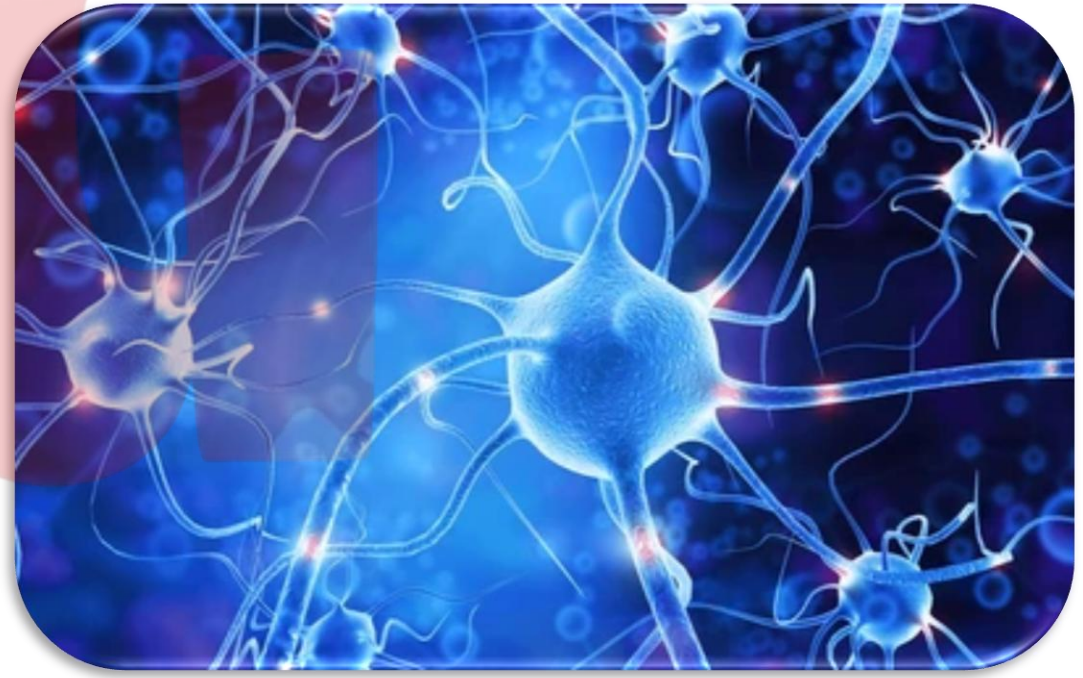


Note *:- Hydra is a simple multicellular animal and it has nervous system.*

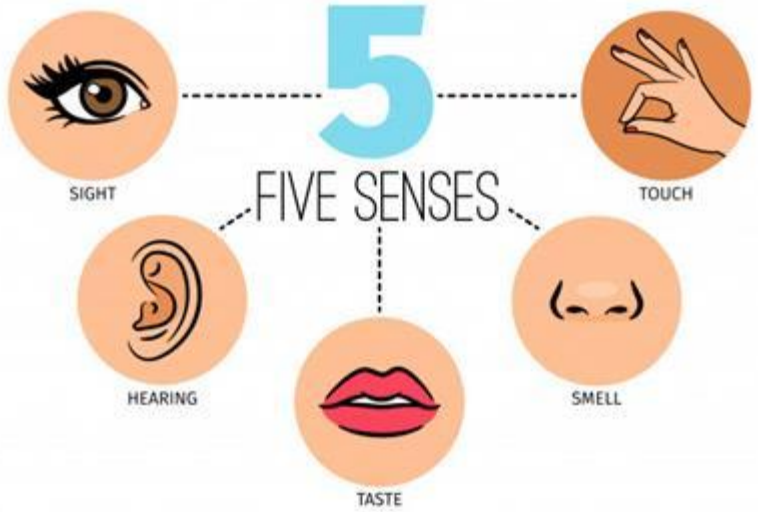




- Control and coordination are provided by nervous and muscular tissues.
- Nervous tissue is made up of an organized network of nerve cells or neurons which is specialized for conducting information via electrical impulses from one part of the body to another



Receptor :-

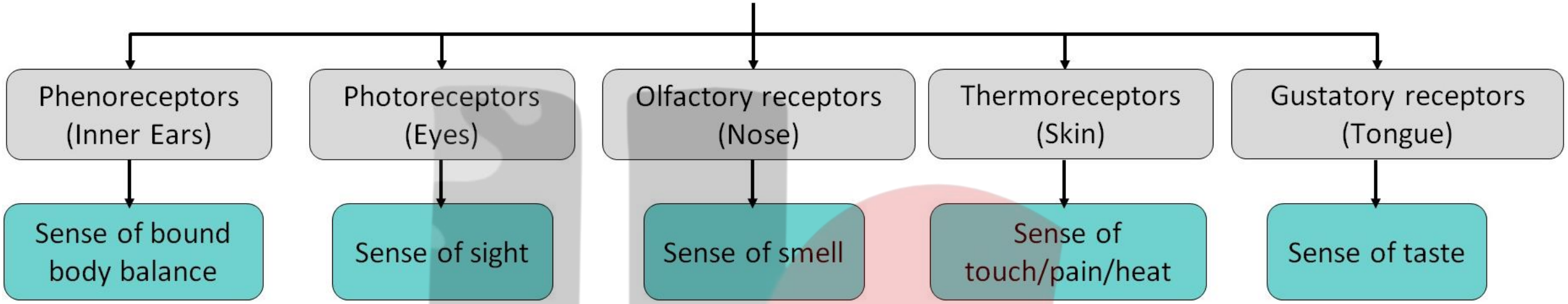


A receptor is a cell or a group of cells in a sense organ, which is sensitive to particular types of stimulus.

There are five receptors (sense organ). These are:-

Receptor	Location	Functions
01. Photoreceptors	In the eyes	to detect light (vision)
02. Phonoreceptors	In the internal ears	to detect sound
03. Gustatory receptors	On the surface of tongue	to detect taste
04. Olfactory receptors	In the nasal epithelium	to detect smell
05. Thigmoreceptors	In the skin	to detect touch

5 BASIC SENSORY RECEPTORS IN HUMAN



Effector :-

An effector is a muscle or gland that responds to instructions from the nervous system to produce an action.

Effectors are primarily classified as either muscles or glands.

(i). Muscles: They respond by contracting, which results in movement.

(ii). Glands: They respond by secreting substances like hormones or saliva.

Example :- When you eat, your salivary glands secrete saliva to aid digestion; they are acting as effectors.

Human Nervous System

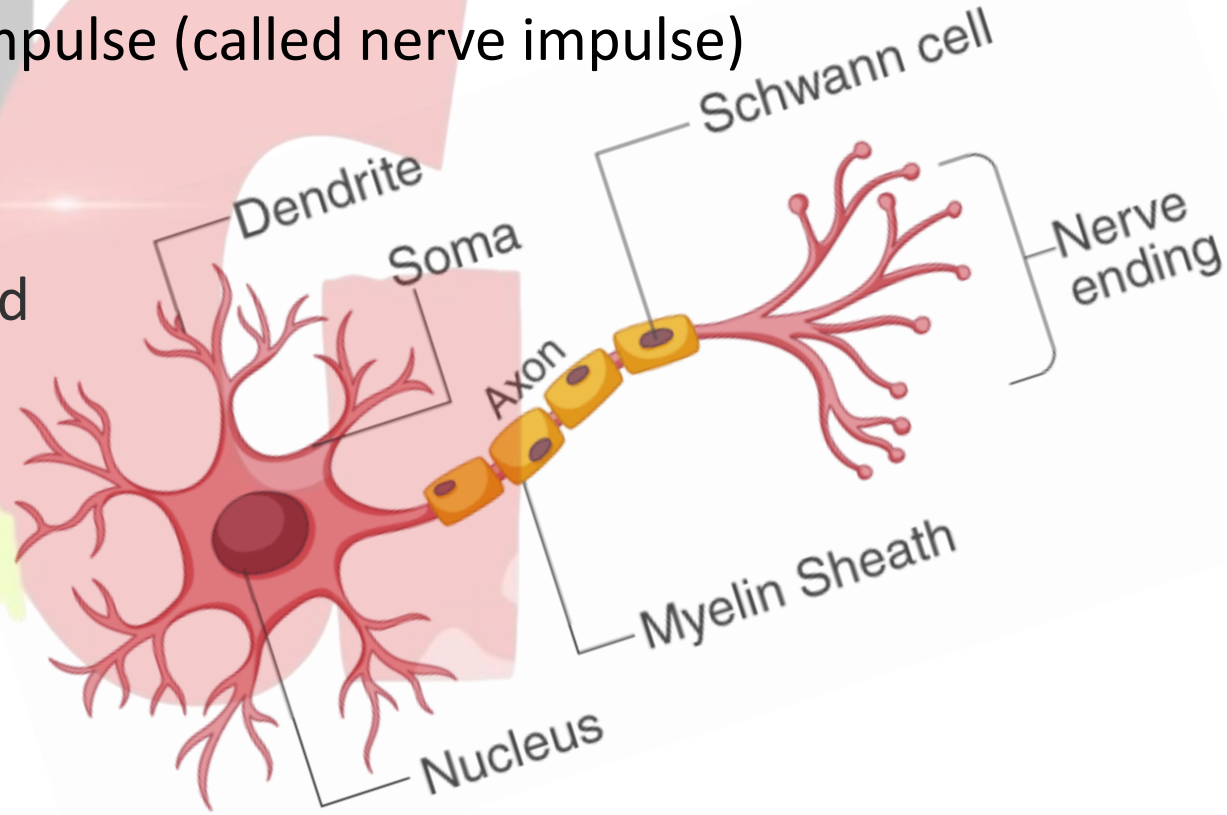
- Nervous system is made up of special cell called **neurons** (or unit of nervous system).
- Largest cell of the body.
- Carry messages in form of electrical impulse (called nerve impulse)

Parts of Neuron

(i). Dendrite: It acquires information.

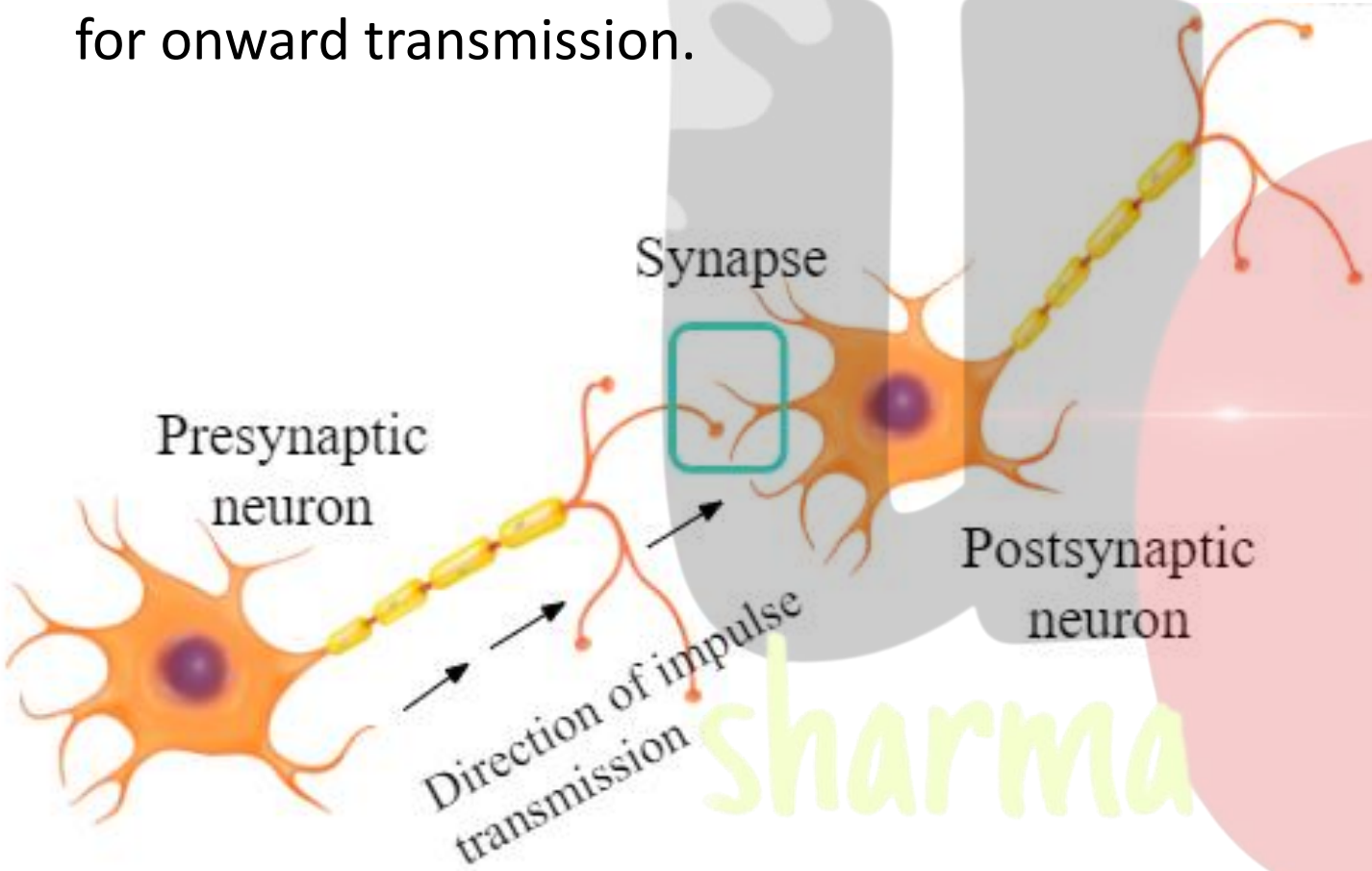
(ii). Cell body: The information acquired by it travels as an electrical impulse.

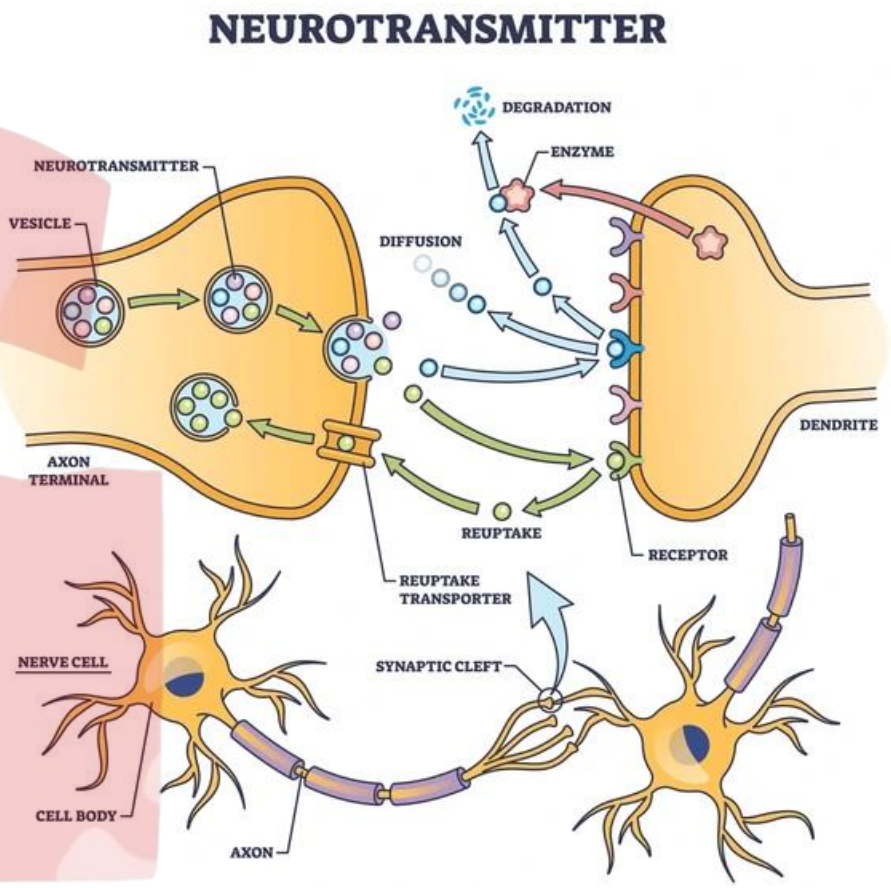
(iii). Axon: It is the longest fibre on the cell body is called axon. It transmits electrical impulse from cell body to dendrite of next neuron.



Synapse: It is the microscopic gap between the nerve ending of one neuron and dendrite of the other neuron.

Here, electrical signal is converted into chemical signal (called neurotransmitter chemical) for onward transmission.





Note :- The axon has an insulating and protective sheath (or cover) of myelin around it.

- Myelin is made up of fat & protein.

SIGNALS PASS THROUGH AND BETWEEN NEURONS

Information is collected by the dendritic tips

↓

The chemical reaction sets of electric impulse

↓

Electric impulses pass from dendrite to cell body

↓

Then passes from cell body to through the axon

↓

Reaches nerve endings at the end of axon

↓

Electric impulse sets off signals called neurotramitted across the synapse

↓

This again passes as electric signals in the next dendrite and so on

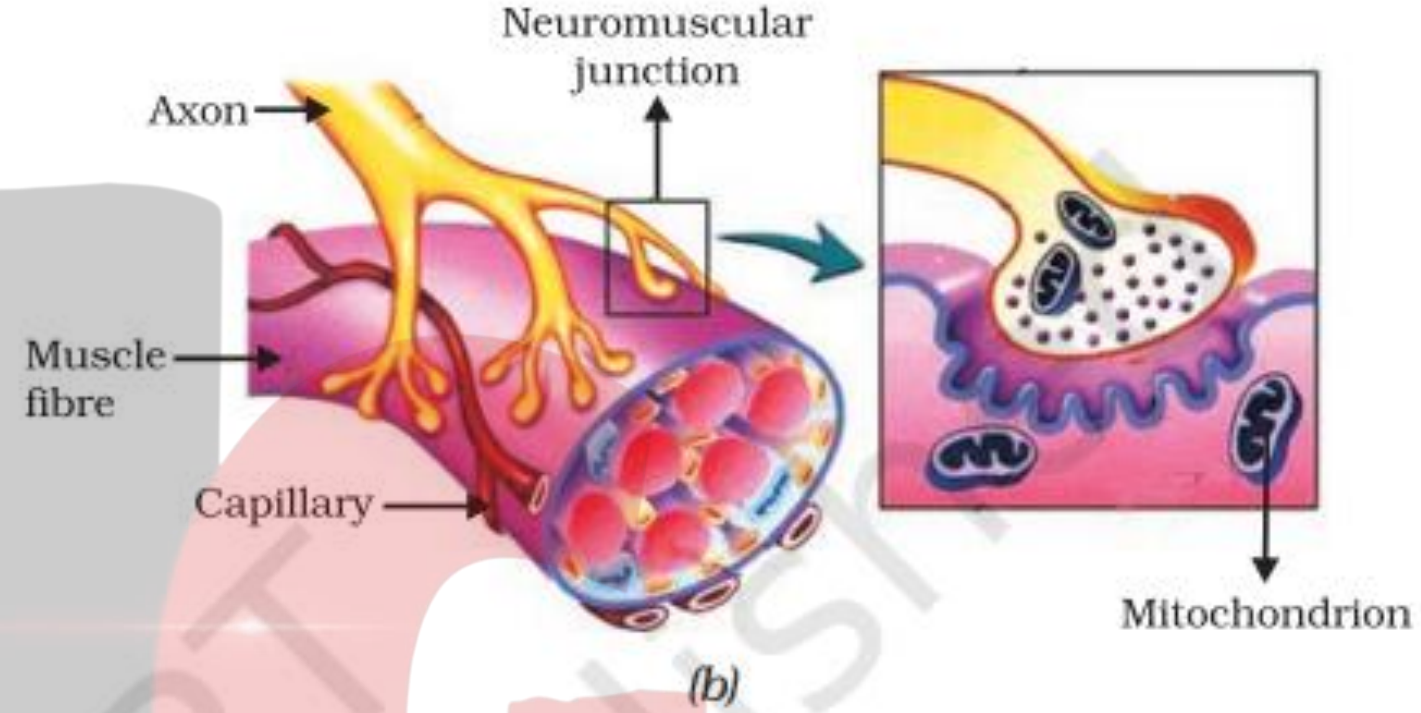
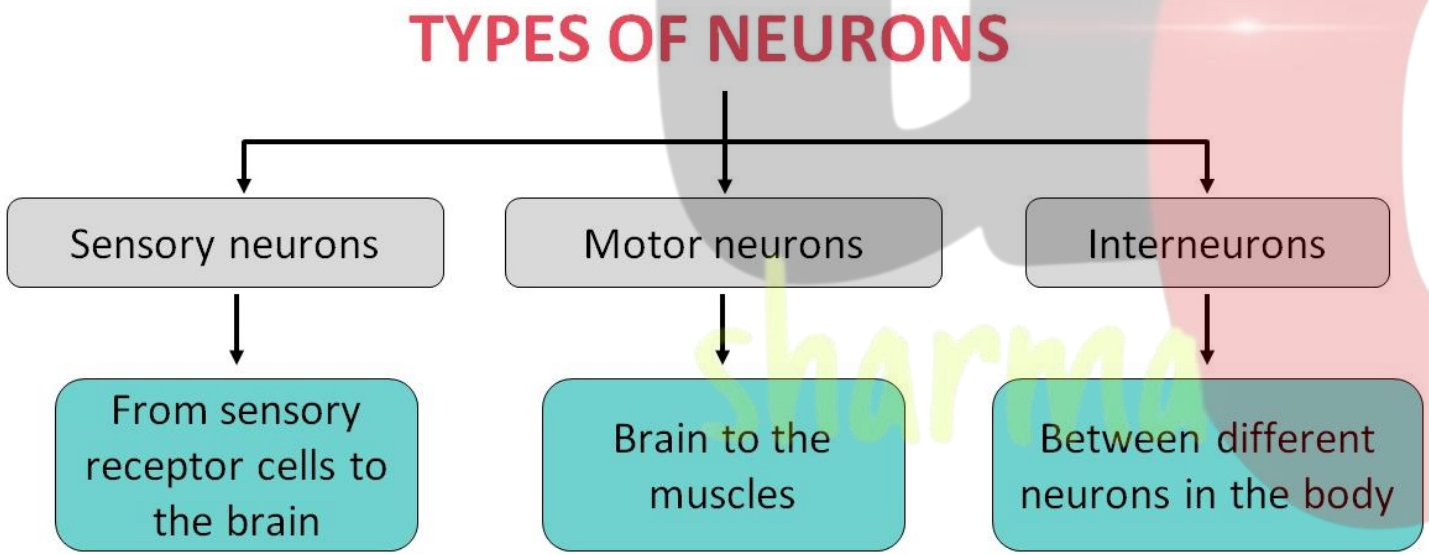


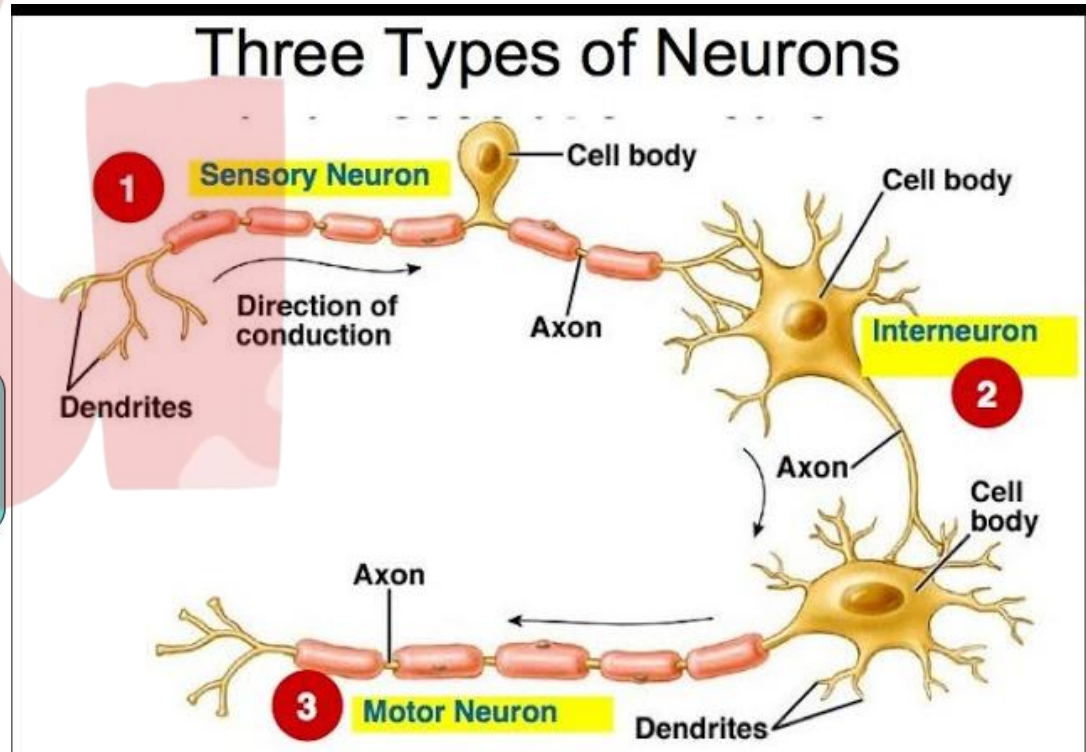
Figure 6.1 *(a) Structure of neuron, (b) Neuromuscular junction*

Note :- The neuromuscular junction is the point where a motor neuron communicates with a muscle fiber to initiate movement

Neurons are of three types :-

1. **Sensory Neurons:-** which transmit signals from sensory organs (or receptors) to the central nervous system (CNS).
2. **Motor Neurons:-** which carry signals from the CNS to muscles and glands (or effectors) to produce a response.
3. **Relay neurons (Interneurons):-** It occurs in CNS where they serve as a link b/w sensory and motor neuron.



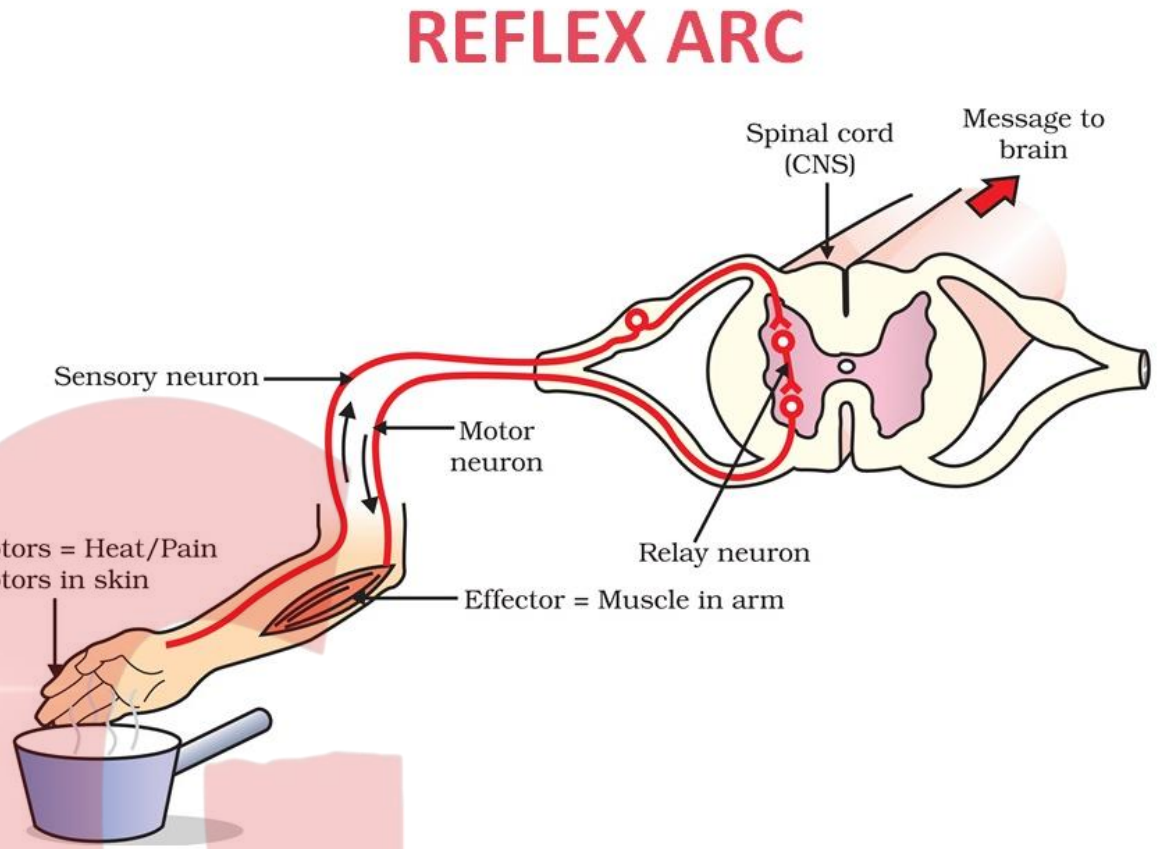


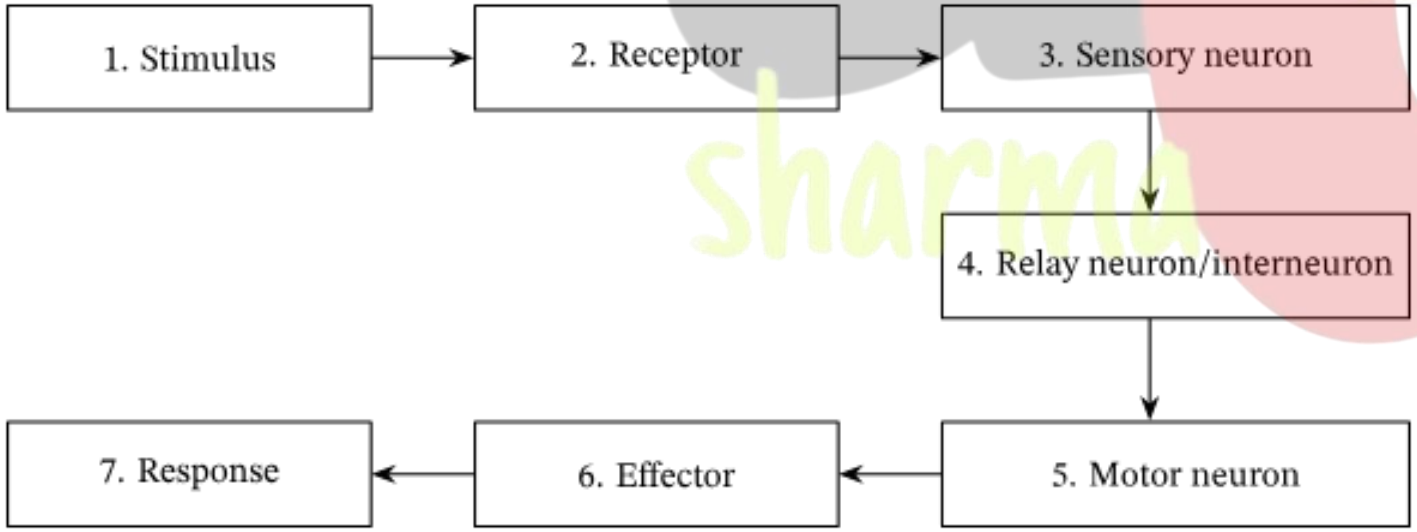
Reflex Action

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

Reflex Arcs

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





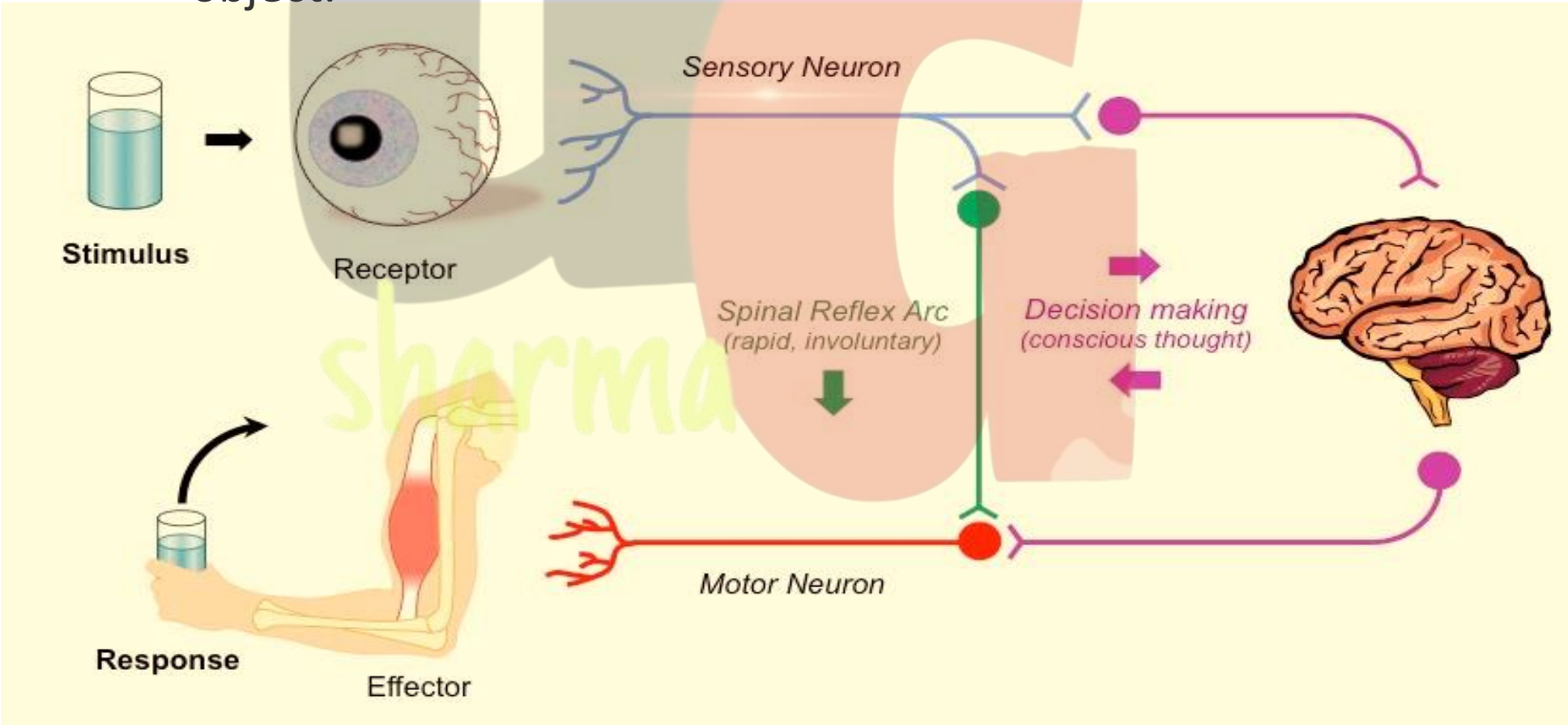
Response: It is the final reaction after the reflex action.

Three types of responses:

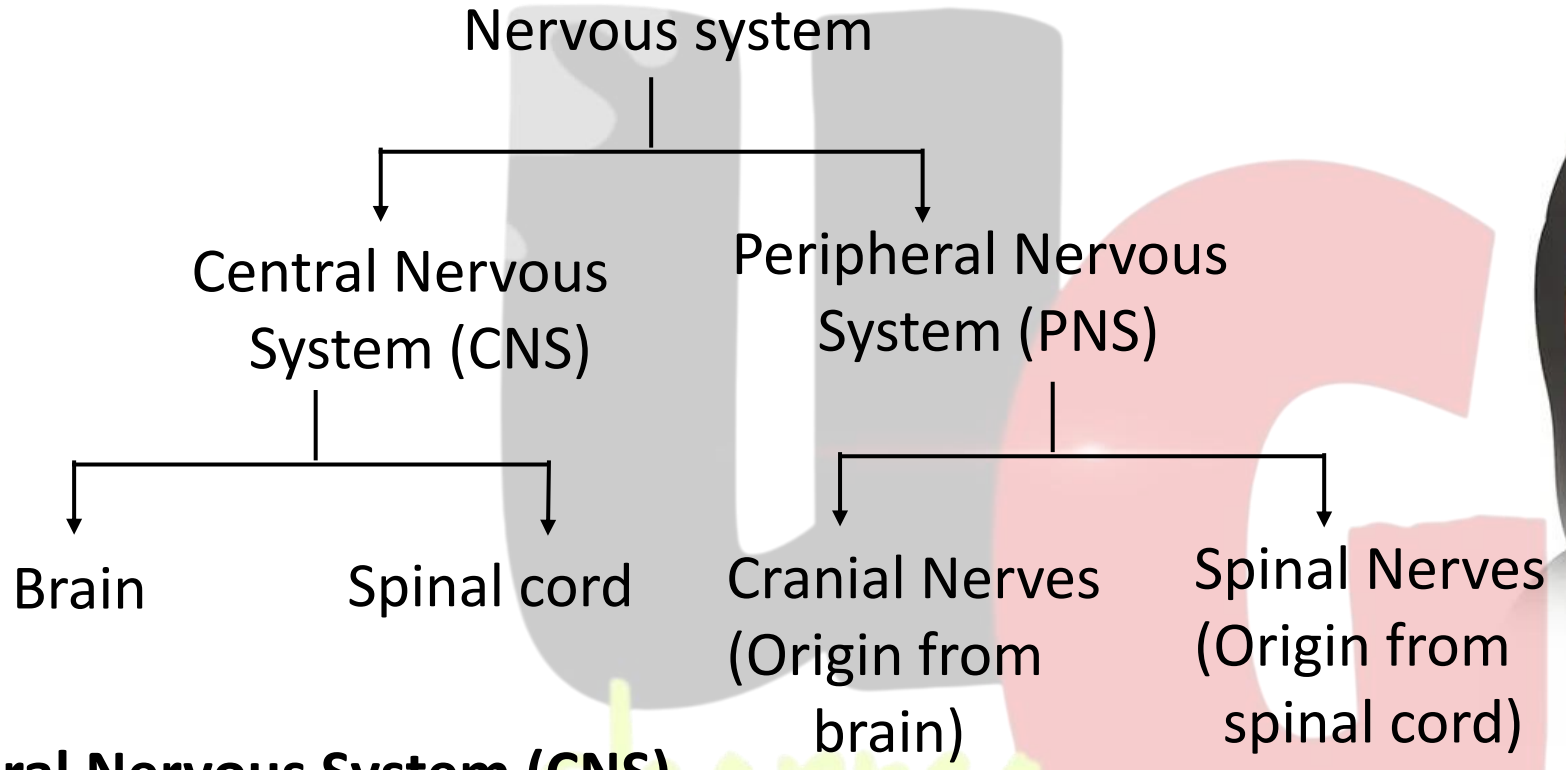
(i) Voluntary: Controlled by fore brain. Example: talking, writing.

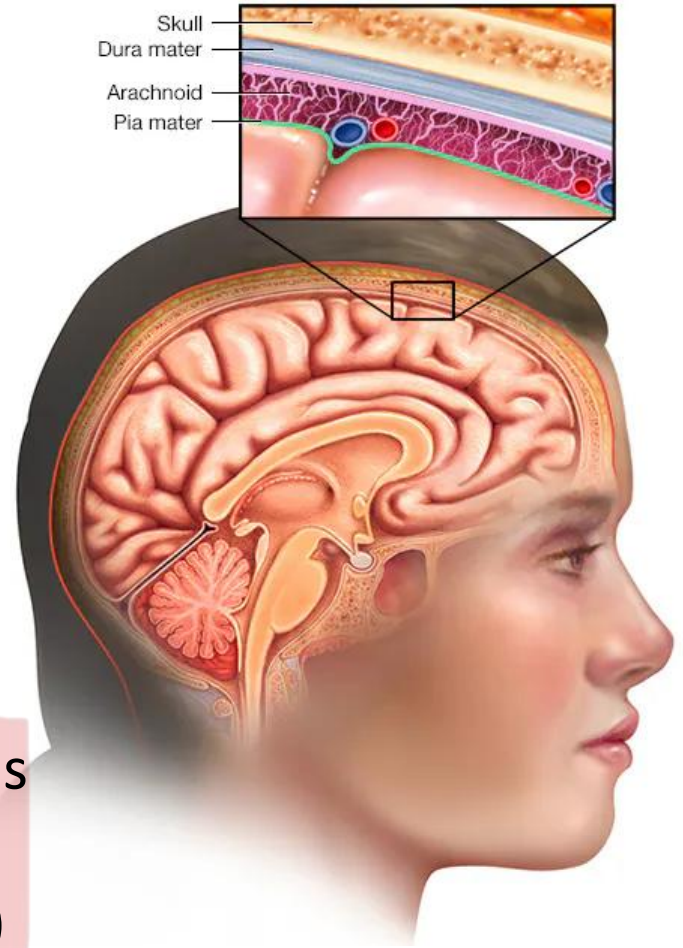
(ii) Involuntary: Controlled by mid and hind brain. Example: heart beat, vomiting, respiration.

(iii) Reflex action: Controlled by spinal cord. Example: withdrawal of hand on touching a hot object.



Human Nervous System





Central Nervous System (CNS)

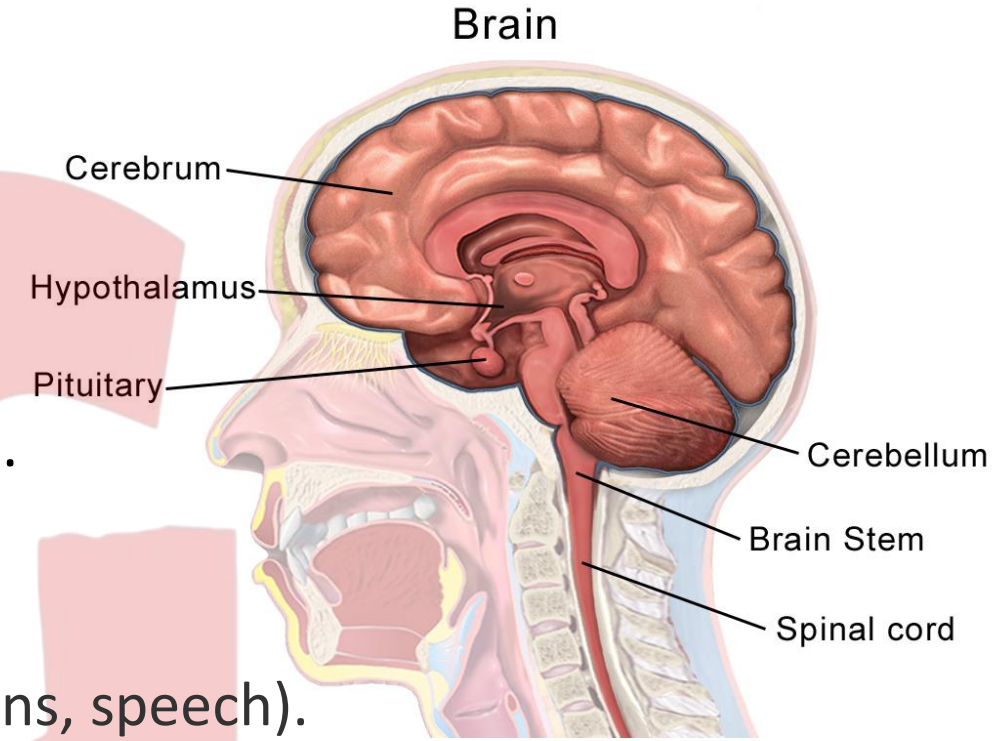
Brain

- Protected by a bony box in skull called ‘cranium’
- It is surrounded by three membranes c/d meninges, which help to protect it
- The space b/w the membranes (or meninges) is fill with a ‘cerebro spinal fluid’.

Human Brain

Brain is the main coordinating centre of the body. It has three major parts:

(i) Fore-brain
(ii) Mid-brain
(iii) Hind-brain



01. Forebrain

It is the most complex or specialised part of the brain.
It consists of cerebrum and hypothalamus.

Functions :

- Main thinking part of the brain (reasoning, emotions, speech).
- Control the voluntary actions.
- Store information (Memory).
- Receives sensory impulses from various parts of the body and integrate it.
- Centre associated with hunger(hypothalamus).

O2. Midbrain

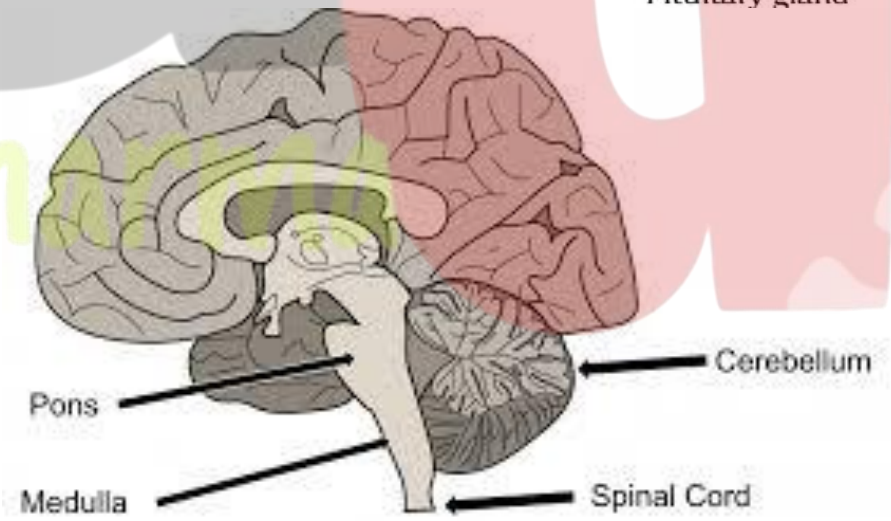
- Control reflex movements of head, neck & trunk in response to visual & auditory stimuli.
- Also control reflex movements (or involuntary movement) of the eye muscles, change in pupil size & shape of eye lens

O3. Hindbrain

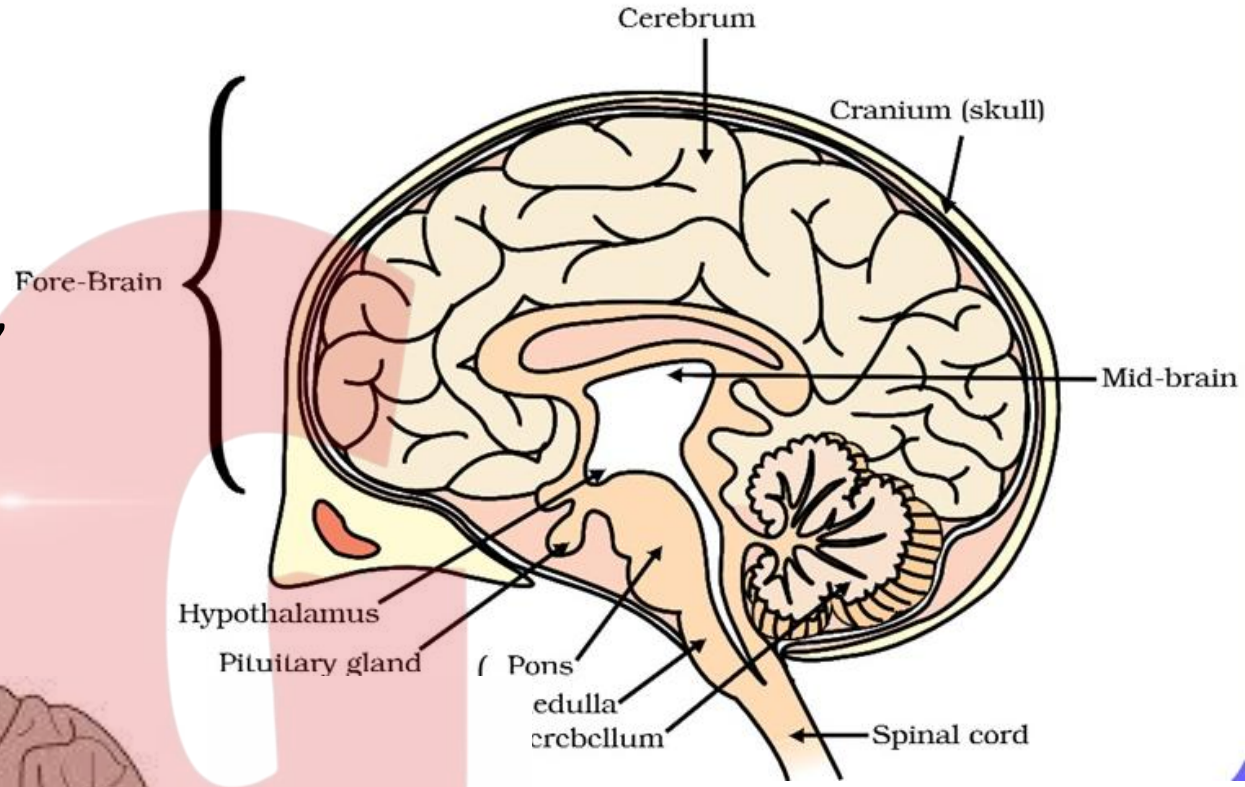
Consist of Pons, cerebellum and medulla

Pons :-

- Regulating respiration
- Involuntary actions



HUMAN BRAIN STRUCTURE



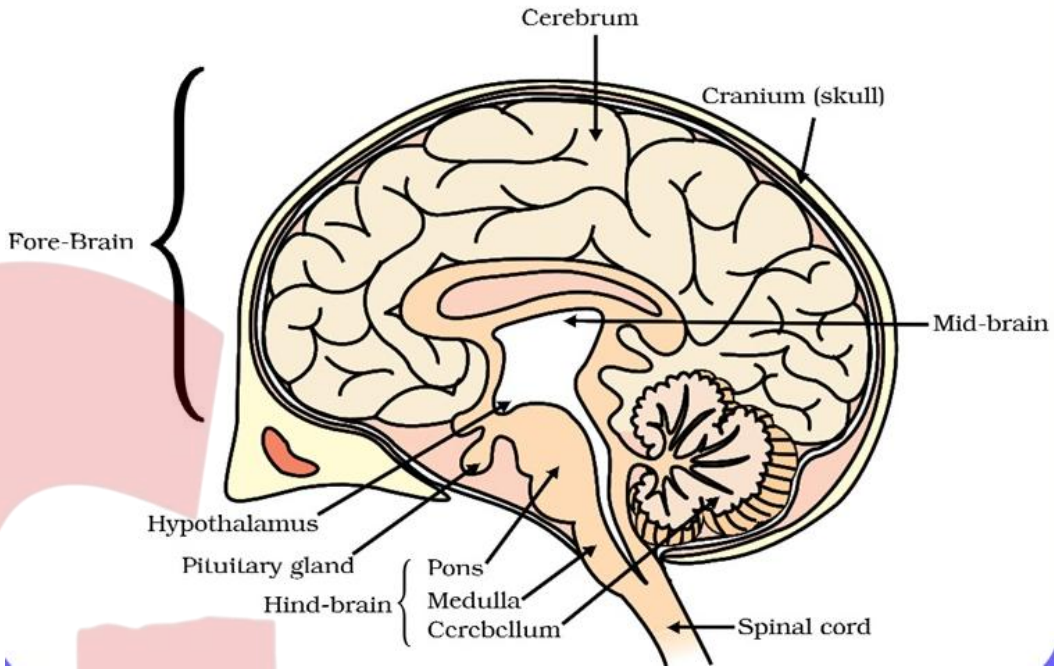
HUMAN BRAIN STRUCTURE

Cerebellum :-

- Help in maintain posture & balance of body.
- Coordinate smooth body movement as walking, dancing, writing , riding a bicycle, etc.

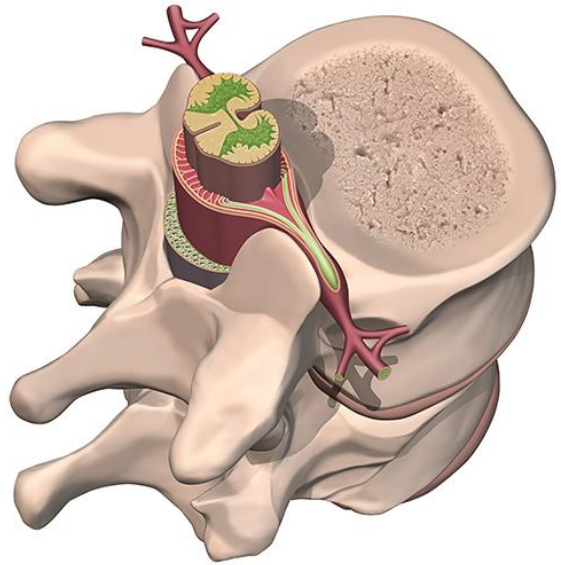
Medulla :-

- Controls involuntary actions. Example: blood pressure, heart beat, breathing, etc.
- Controlling centre for reflexes such as swallowing, coughing, sneezing, secretion of saliva & vomiting.



Spinal Cord

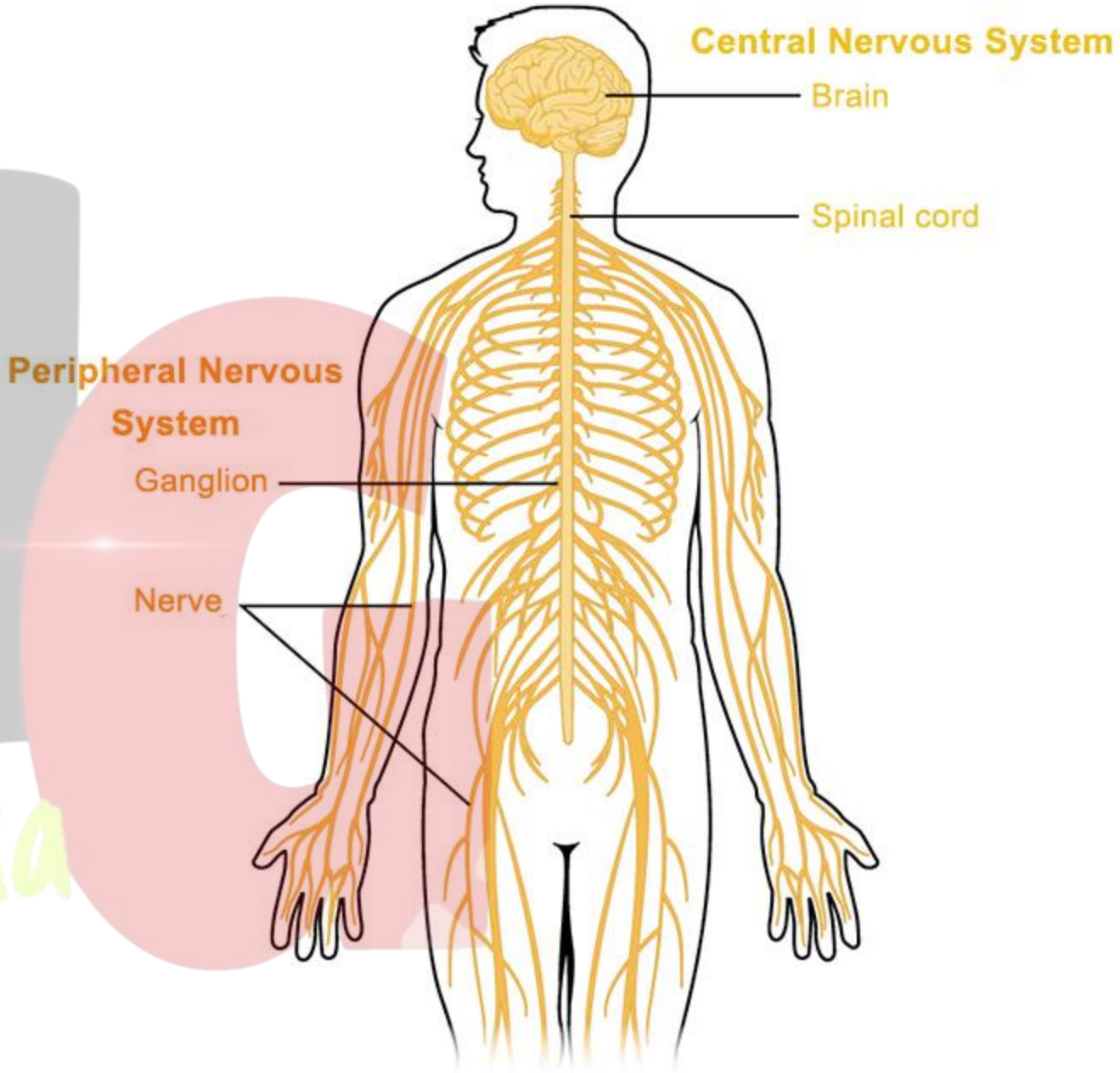
- Cylindrical structure, enclosed in a bony cage c/d vertebral column.
- Surrounded by membrane called meninges.
- Cerebrospinal fluid (CSF) to absorb any shock.
- As many as 31 pairs of nervous arises from spinal cord.



Peripheral Nervous System (CNS)

- Consist of the nerves that branch out from the brain and spinal cord.
- Communication network b/w the CNS & body parts
- It consist of

1. Spinal nervous (origin from spinal cord)
2. Cranial nervous (origin from brain)



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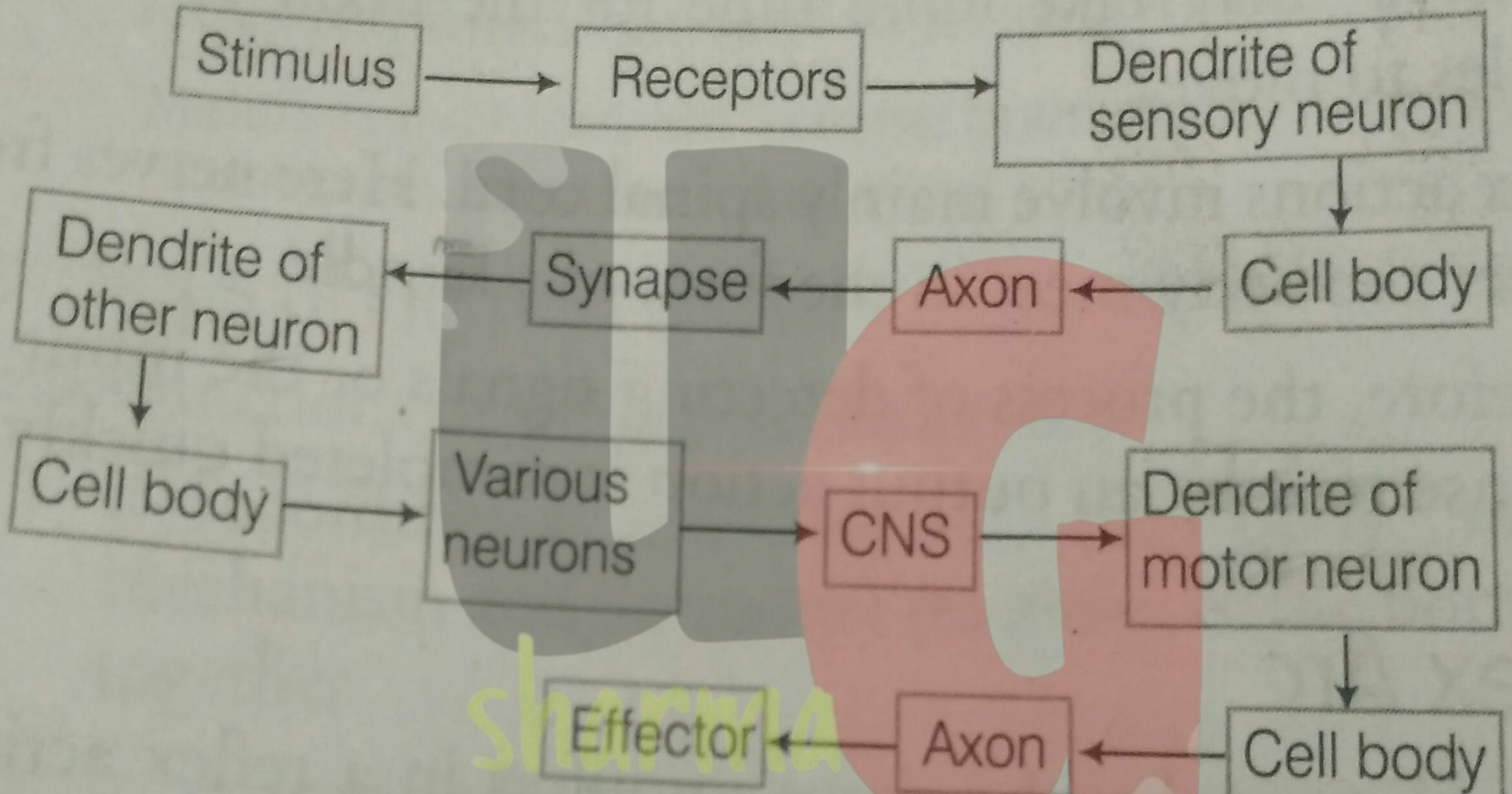


Nerve impulse pathway

QUESTIONS

1. What is the difference between a reflex action and walking?
2. What happens at the synapse between two neurons?
3. Which part of the brain maintains posture and equilibrium of the body?
4. How do we detect the smell of an *agarbatti* (incense stick)?
5. What is the role of the brain in reflex action?

Hormones in Animals

- Hormones are the chemical substances which coordinate the activities of living organisms and also their growth.
- Glands are responsible for secretion of hormones.

Glands

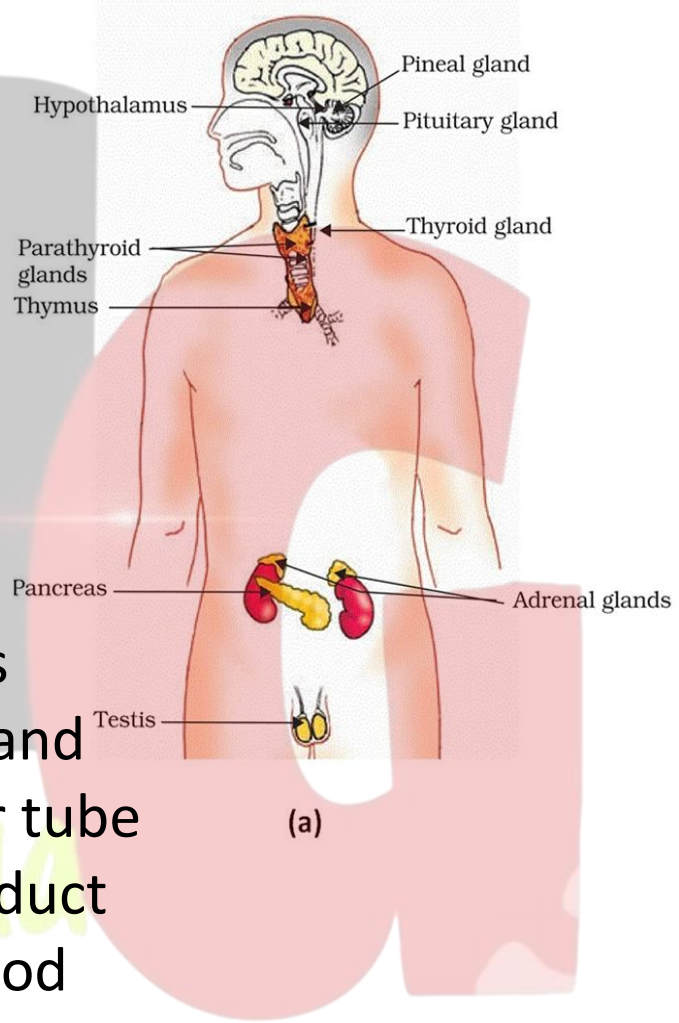
Exocrine glands
E.g :- Salivary gland

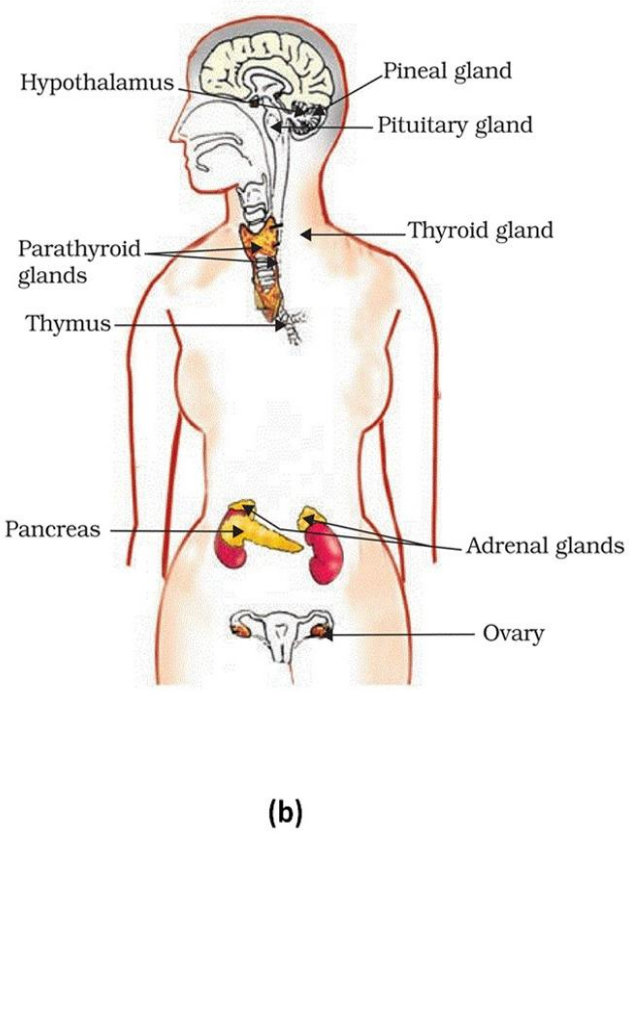
- Secretes its product into a duct or tube

Endocrine glands
E.g :- Pituitary gland

- Have no duct or tube
- Secretes its product directly into blood

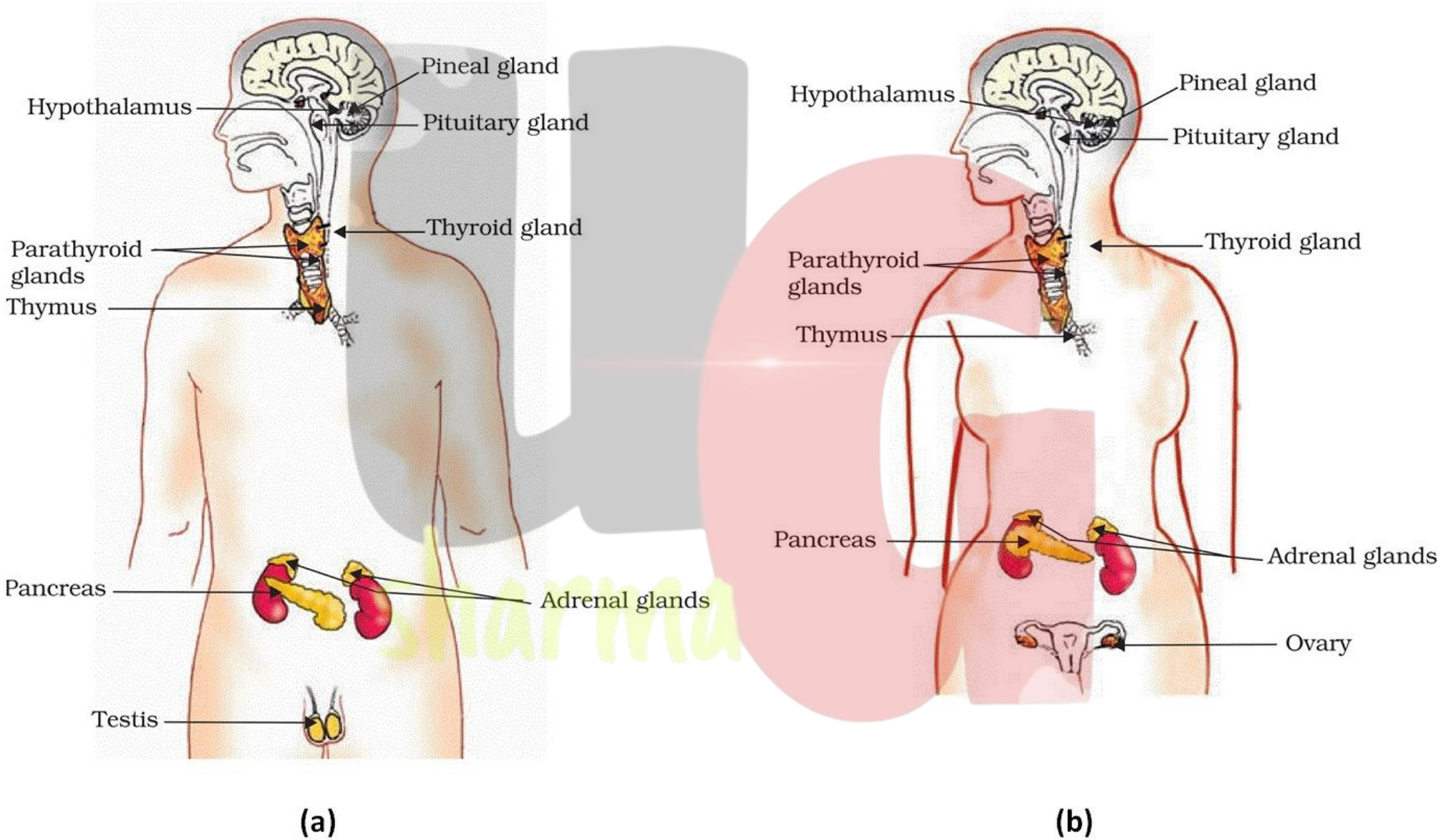
ENDOCRINE GLANDS IN HUMAN BEINGS (A) MALE, (B) FEMALE





Note :- Pancreas, testes & ovary are glands which have both exocrine and endocrine functions.

ENDOCRINE GLANDS IN HUMAN BEINGS (A) MALE, (B) FEMALE



QUESTIONS

1. How does chemical coordination take place in animals?
2. Why is the use of iodised salt advisable?
3. How does our body respond when adrenaline is secreted into the blood?
4. Why are some patients of diabetes treated by giving injections of insulin?

EXERCISES

1. Which of the following is a plant hormone?
   (a) Insulin
   (b) Thyroxin
   (c) Oestrogen
   (d) Cytokinin.
2. The gap between two neurons is called a
   (a) dendrite.
   (b) synapse.
   (c) axon.
   (d) impulse.
3. The brain is responsible for
   (a) thinking.
   (b) regulating the heart beat.
   (c) balancing the body.
   (d) all of the above.
4. What is the function of receptors in our body? Think of situations where receptors do not work properly. What problems are likely to arise?
5. Draw the structure of a neuron and explain its function.
6. How does phototropism occur in plants?
7. Which signals will get disrupted in case of a spinal cord injury?
8. How does chemical coordination occur in plants?
9. What is the need for a system of control and coordination in an organism?
10. How are involuntary actions and reflex actions different from each other?
11. Compare and contrast nervous and hormonal mechanisms for control and coordination in animals.
12. What is the difference between the manner in which movement takes place in a sensitive plant and the movement in our legs?

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