E-CONTENT PREPARATION FOR CLASS X SCIENCE

CHAPTER 7

CONTROL AND COORDINATION

CONTROL AND COORDINATION

Learning Outcomes

Students will be able to:

i. Define reflex action, Tropic and Nastic movements.

ii. Identify the different parts of the brain.

iii. Differentiate the different types of nerves based on structure and function.

iv. Understand the communication between CNS and parts of the body and the mechanism of reflex action.

Vi. Acquire knowledge about the structure and function of nervous system in animals and coordination in plants.

Vii .Appreciate the role of feedback mechanism of endocrine system in our life.

Stimuli

The changes in the environment to which living organisms respond are called stimuli.

Eg :- heat, cold, sound, smell, taste, touch, pressure, gravity, water etc.

Living organisms respond to stimuli in the form of body movements.

Coordination :-

. The working together of various organs in an organism to produce a proper response to a stimulus is called coordination.

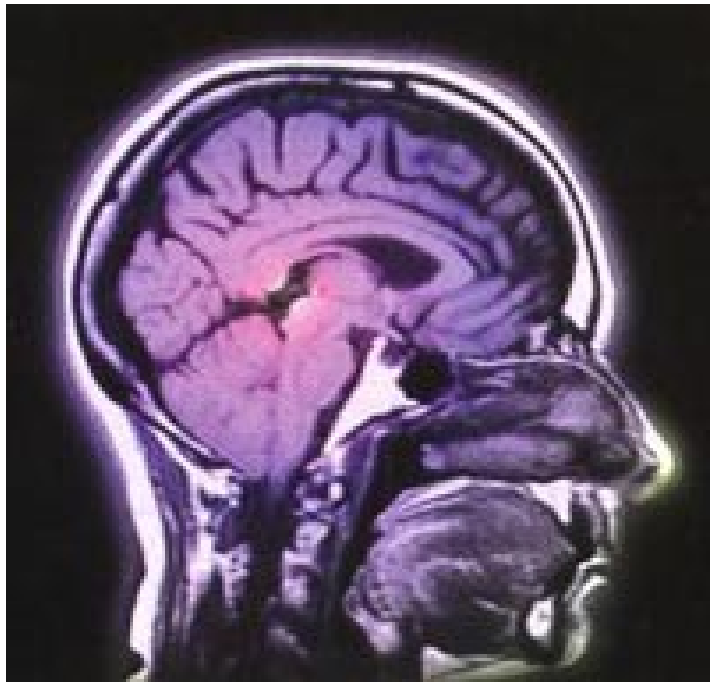
i) In animals control and co ordination is done by the nervous system and endocrine system.

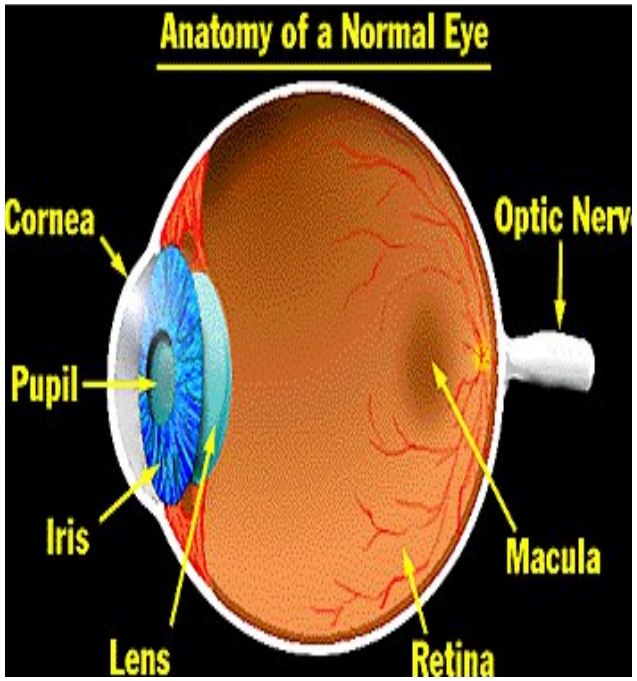
ii) In plants control and co ordination is done by chemical substances called plant hormones or phytohormones

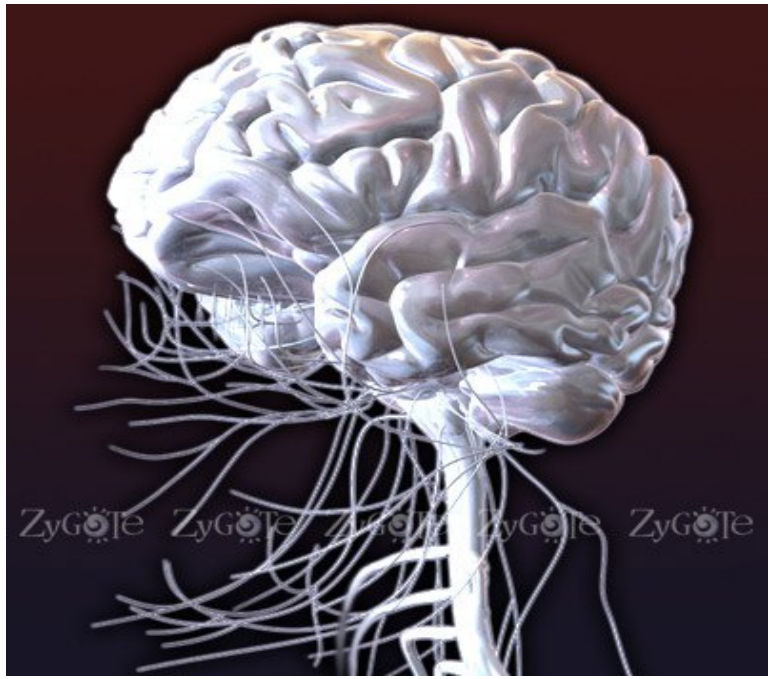
ANIMAL NERVOUS SYSTEM AND COORDINATION

In animals control and co ordination is done by the nervous system and endocrine system.

The nervous system consists of the brain, spinal cord , nerves and sense organs.







Sense Organs: Eyes, Skin, Ears, Nose & Tongue

Coordination by Brain

Stimulus

Sound, sight, smell, taste, pain or touch

Receptor

Sense organs like, ears, nose, eyes etc

Coordinator

Brain

Effector

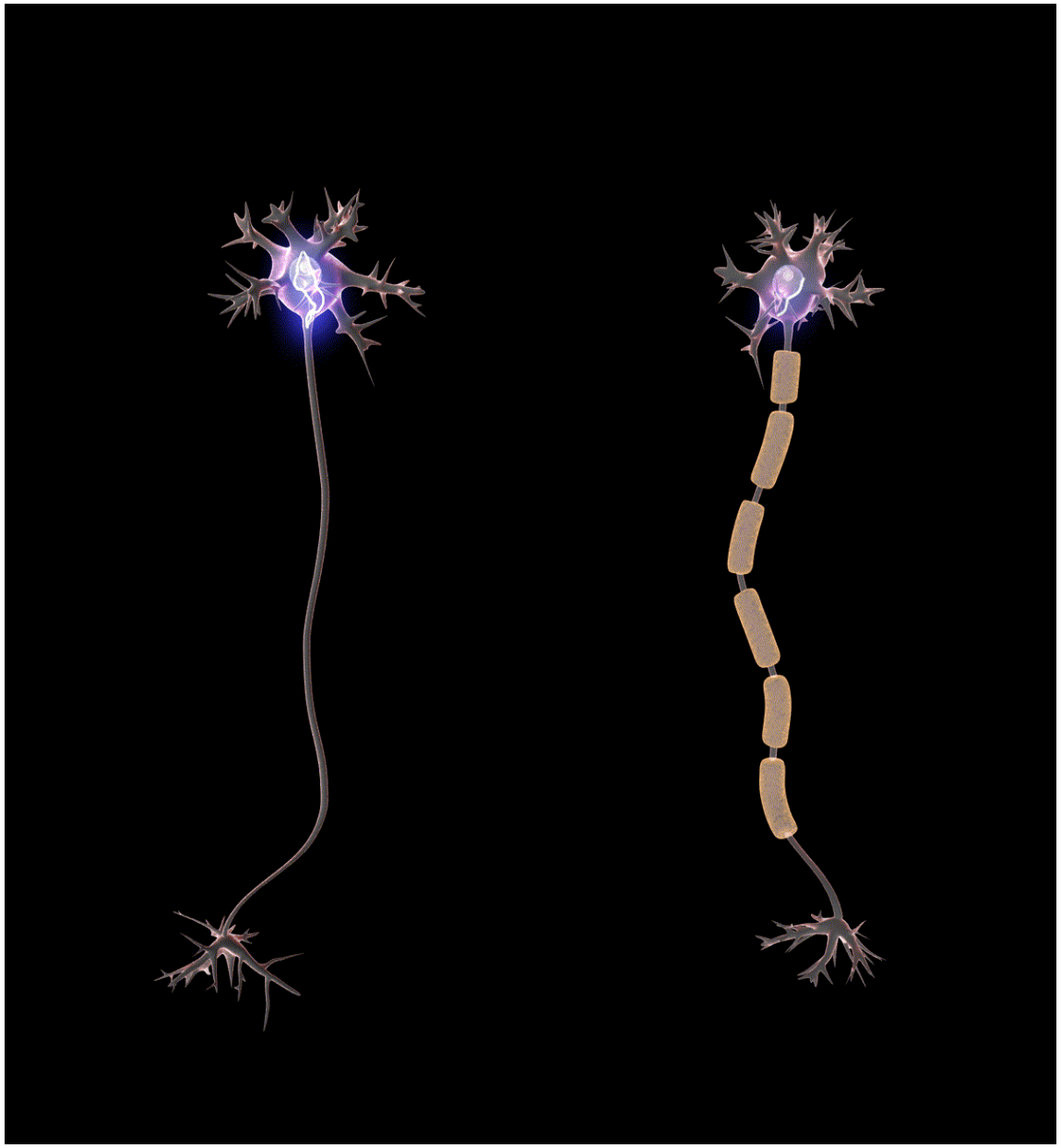
Muscles

Response

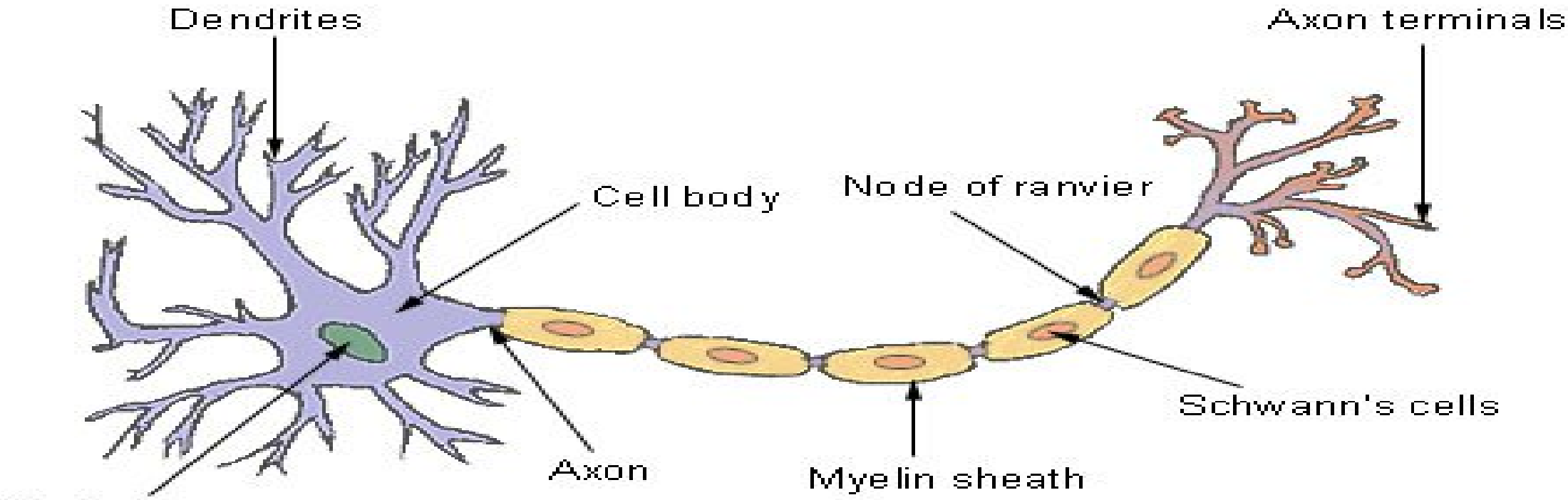
Movement on the basis of type of stimuli

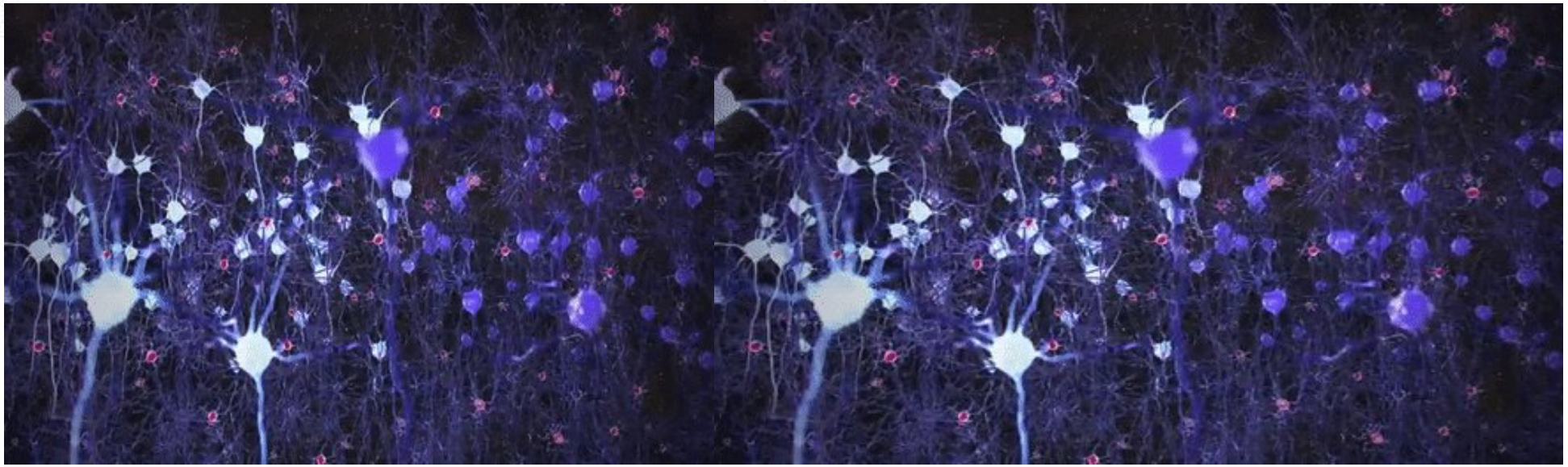
THE NEURON

- Nervous system is made of millions of neurons
- A nerve is an organ containing a bundle of nerve cells called neurons.
- Neurons carry electrical messages called impulses throughout the body.
- Impulse travels from dendrite to cell body, then along axon to axon terminal



Structure of a Typical Neuron





SYNAPSE

Because neurons never touch, chemical signallers called neurotransmitters must travel through the space called synapse between two neurons.

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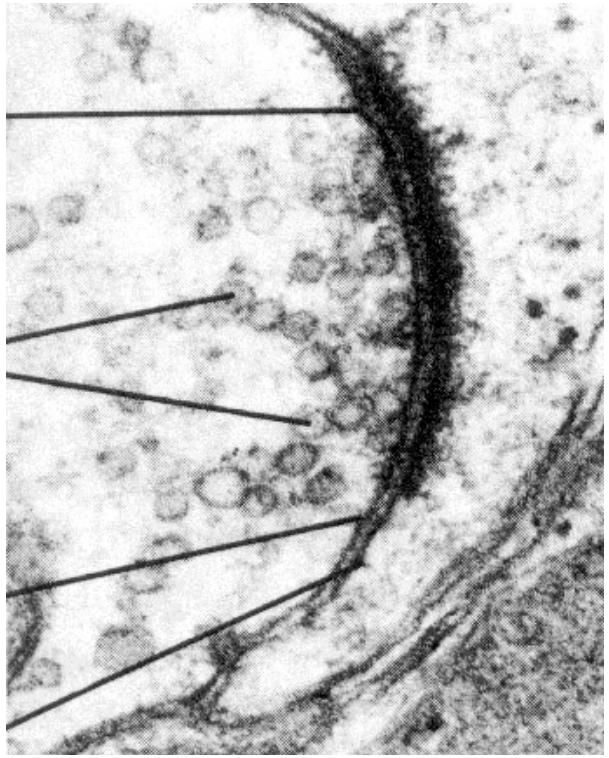
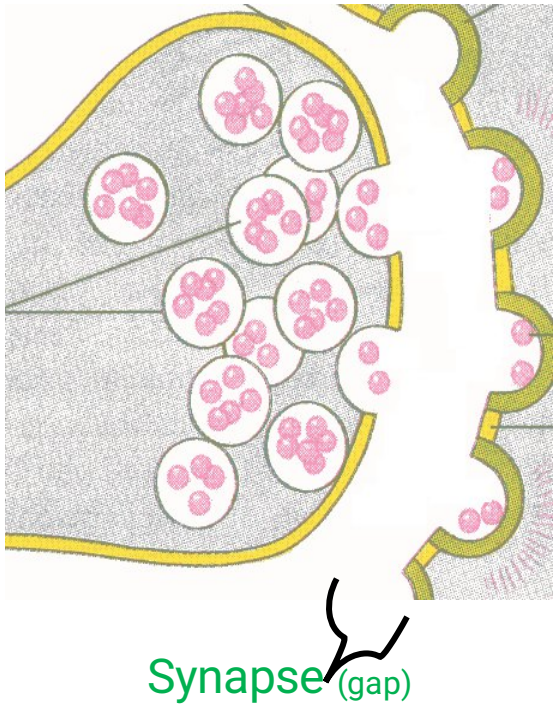
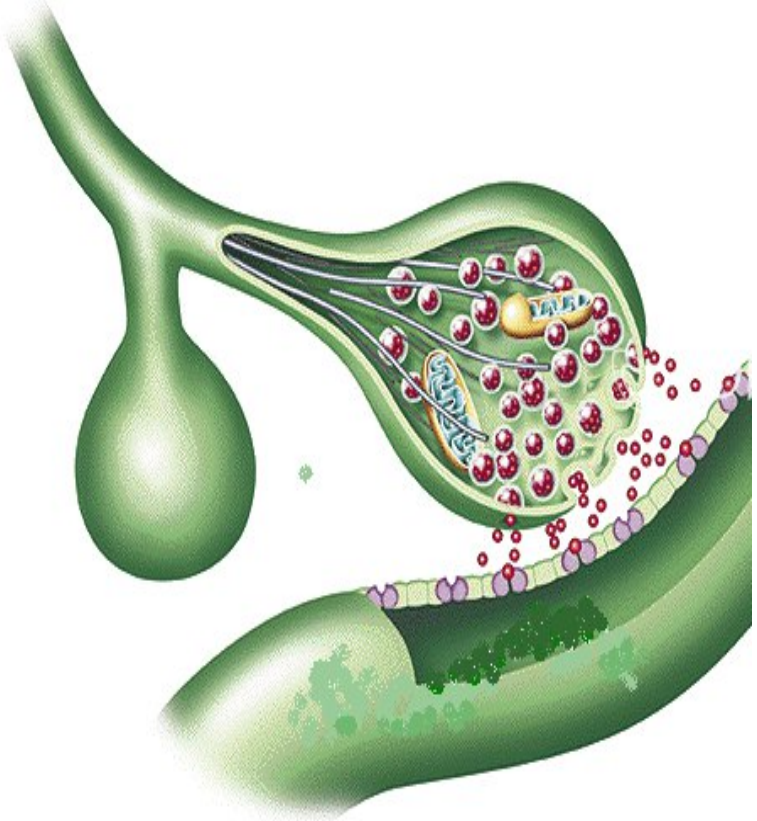




The message is transferred when RECEPTORS receive neurotransmitters (pink spheres)

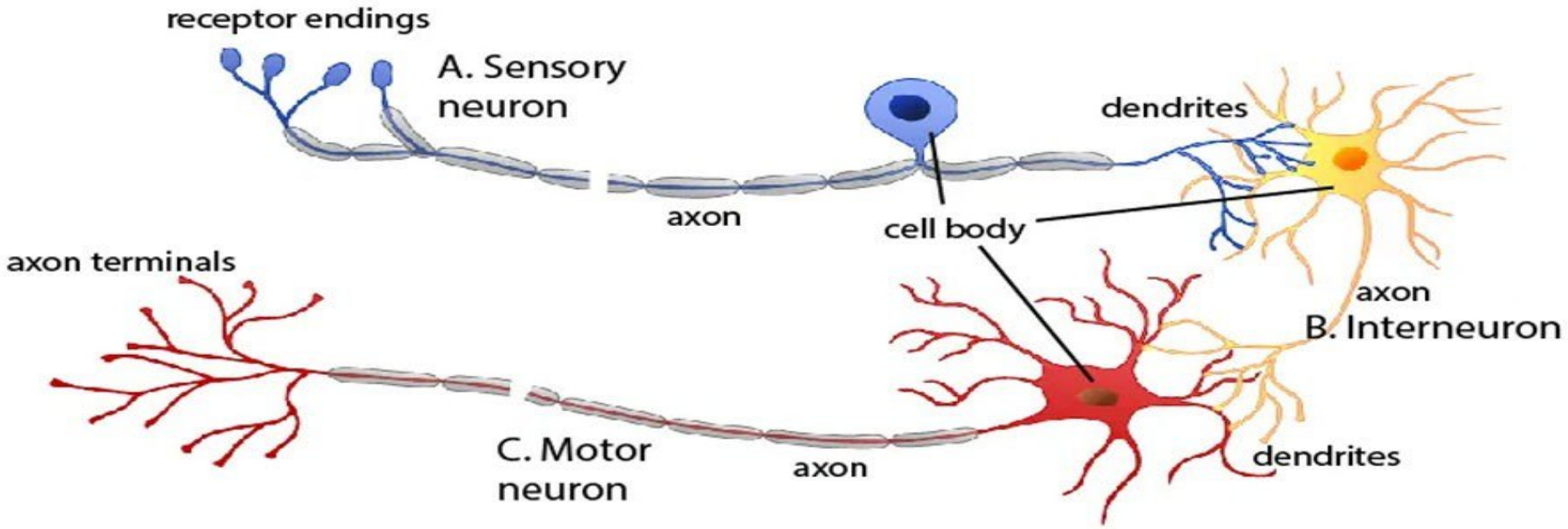


IMPORTANT TERMS

- a) Receptors :- are the specialized tips of nerve cells which receive the stimuli and pass the message to the brain or spinal cord through the sensory nerves.
- Eg :- Photoreceptors in the eyes to detect light.
- Phonoreceptors in the ears to detect sound.
- Olfactory receptors in the nose to detect smell.
- Gustatory receptors in the tongue to detect taste.
- Tangoreceptors in the skin to detect touch.
- b) Effectors :- are the muscles and glands which respond to the information from the brain and spinal cord through the motor nerves.
- c) Response - Any behavior of a living organism that results from an external or internal stimulus. (e.g. pulling hand away from a hot plate is a response)

. d) Sensory nerves :- are nerves which carry information from the receptors (sense organs) to the brain and spinal cord.

- e) Motor nerves :- are nerves which carry information from the brain and spinal cord to the effectors (muscles and glands)

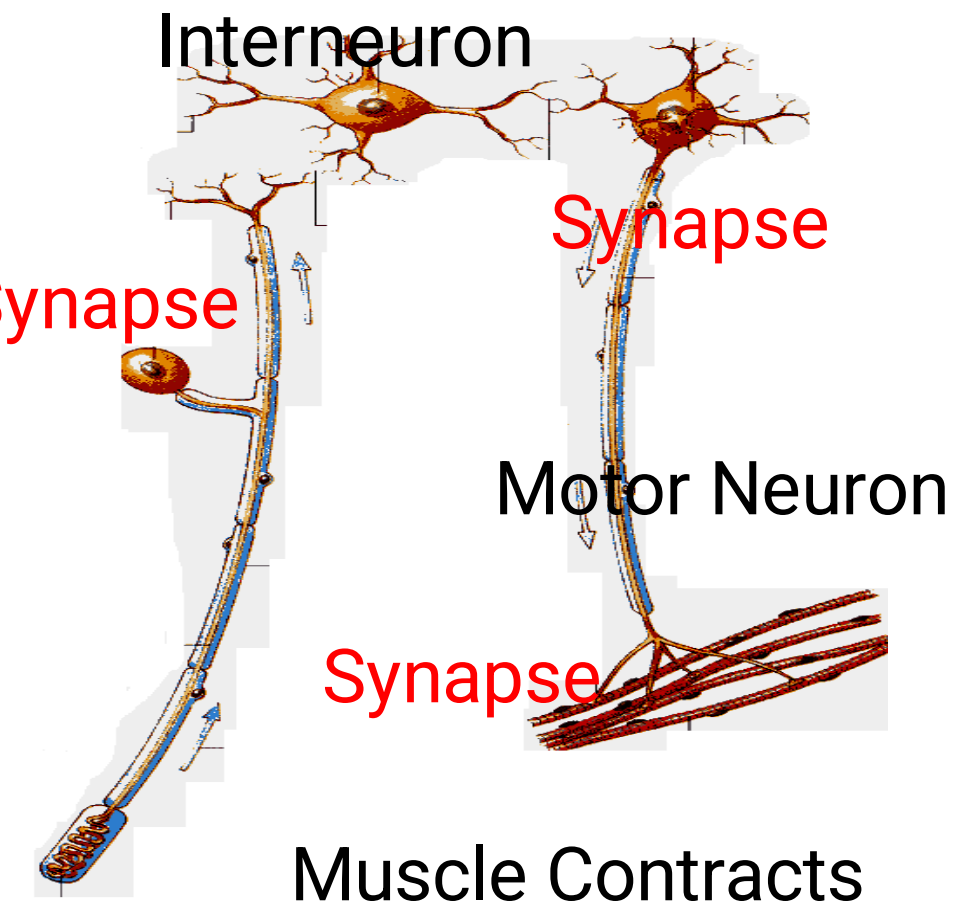


TYPES OF NEURONS

Sensory Neuron

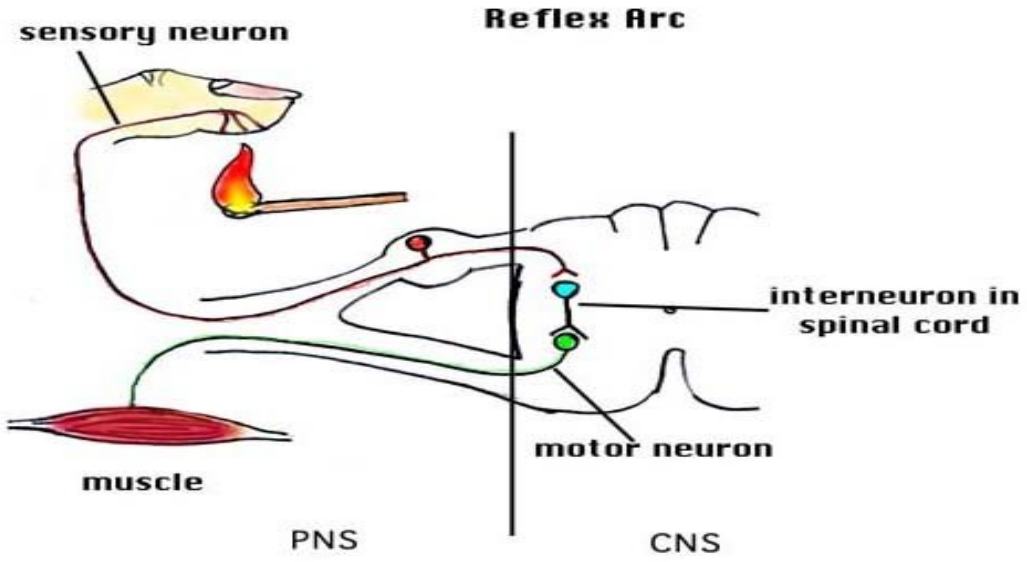
Interneuron

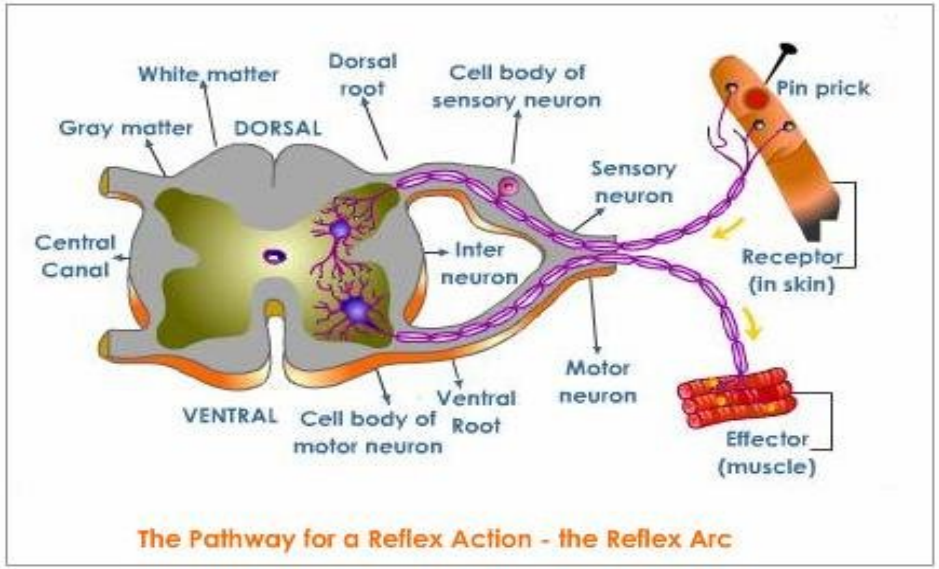
Motor Neuron



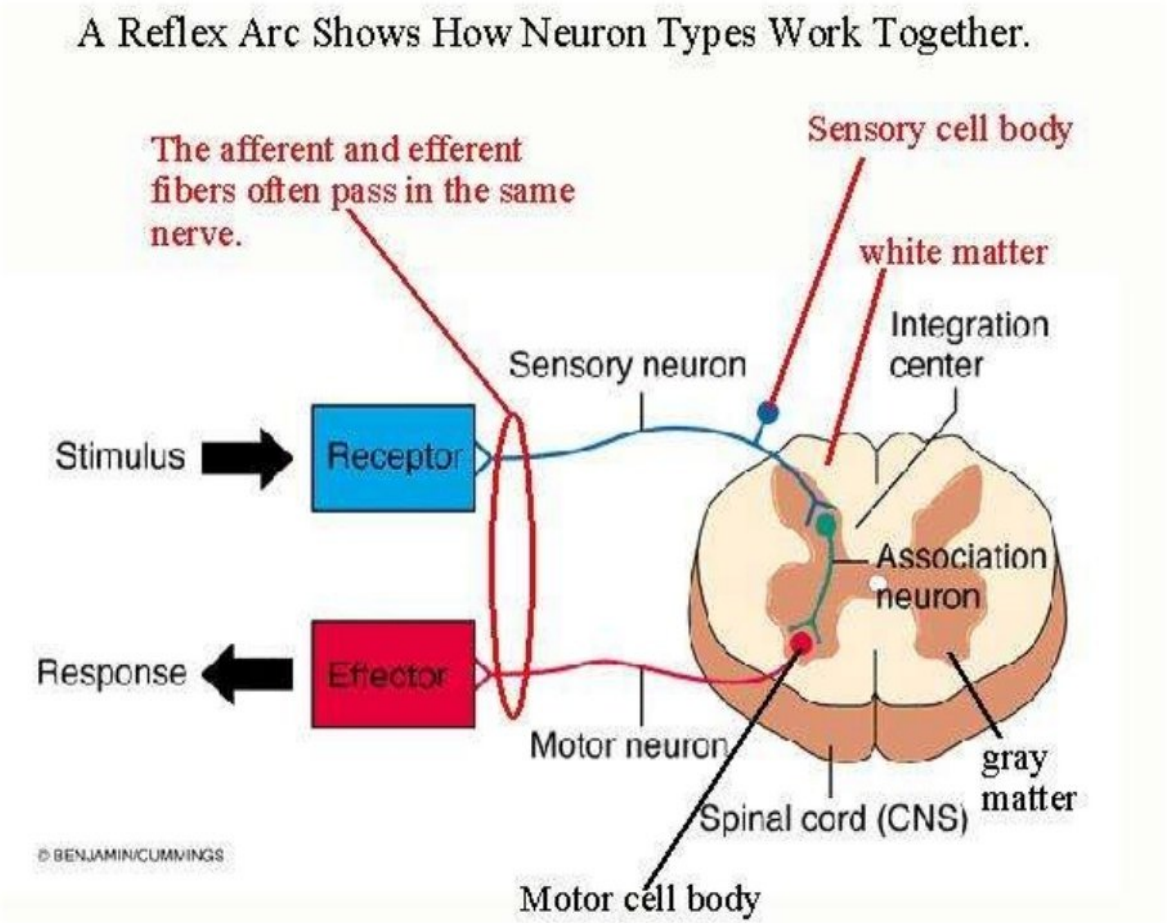
REFLEX ACTION

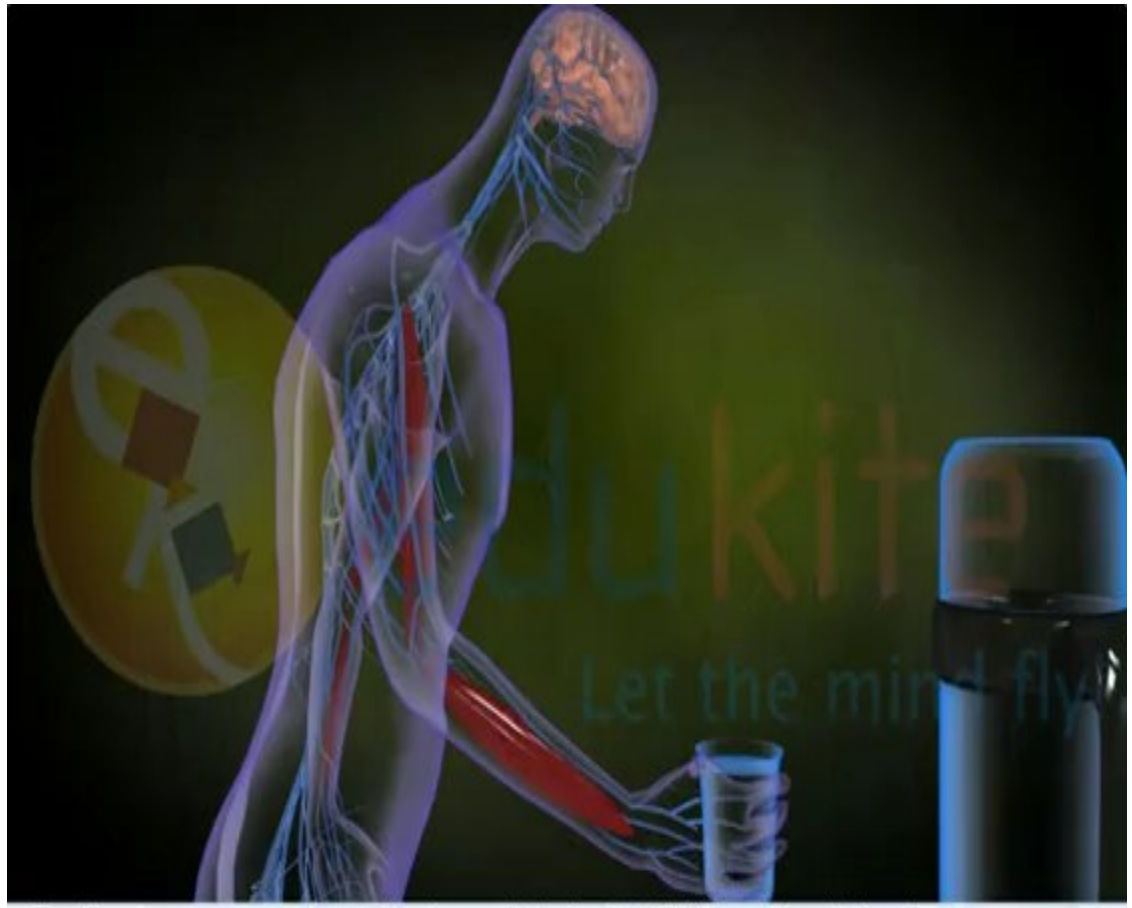
- Reflex action is a sudden, unconcious and involuntary response of the effectors to a stimulus.
- Eg :- We suddenly withdraw our hand if we suddenly touch a hot object.
- In this reflex action, the nerves in the skin (receptor) detects the heat and passes the message through the sensory nerves to the spinal cord. Then the information passes through the motor nerves to the muscles (effector) of the hand and we withdraw our hand.





REFLEX ARC



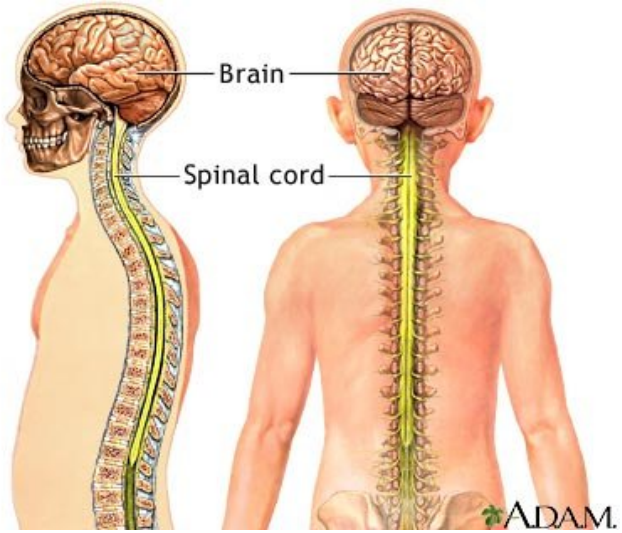


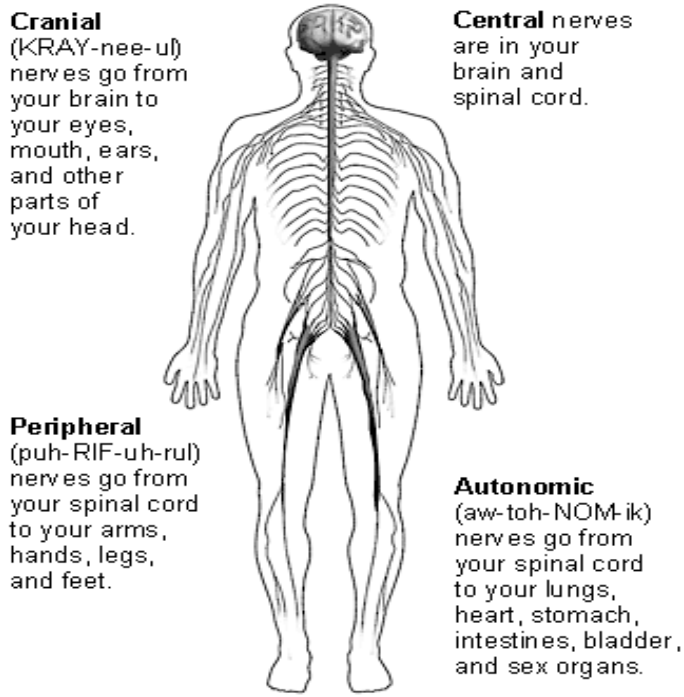
The afferent neurons (or receptors), taking the causal stimulus to the CNS (the spinal cord), the efferent neurons or effecters, the exciter neurons and the action performed in response to the stimulus together form the Reflex Arc.

HUMAN NERVOUS SYSTEM

- a) Parts of the nervous system :-
- The human nervous system consists of the Central Nervous System and Peripheral Nervous System.
- i) The central nervous system :- consists of the brain, and spinal cord.
- ii) The peripheral nervous system:- consists

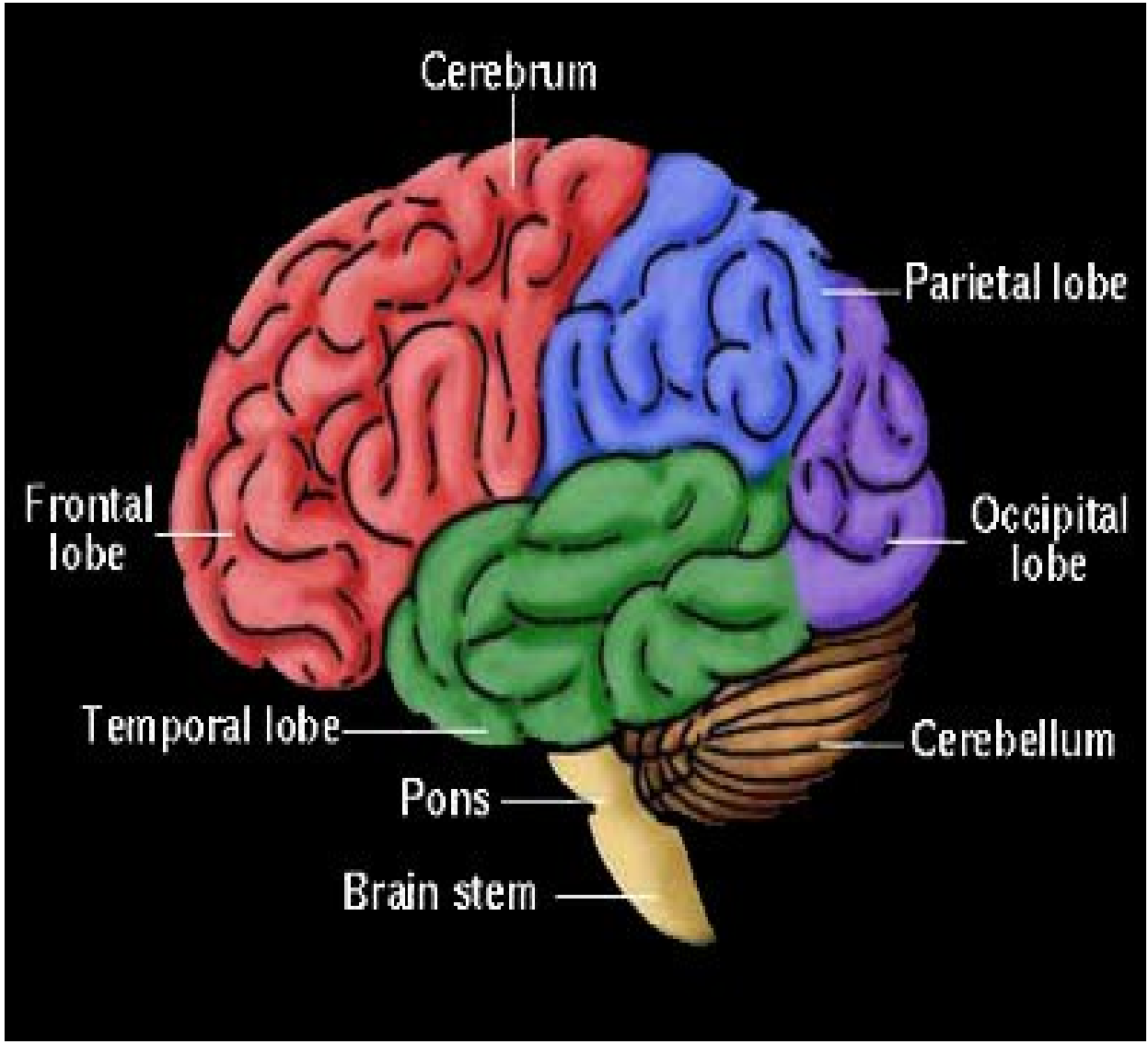
of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.





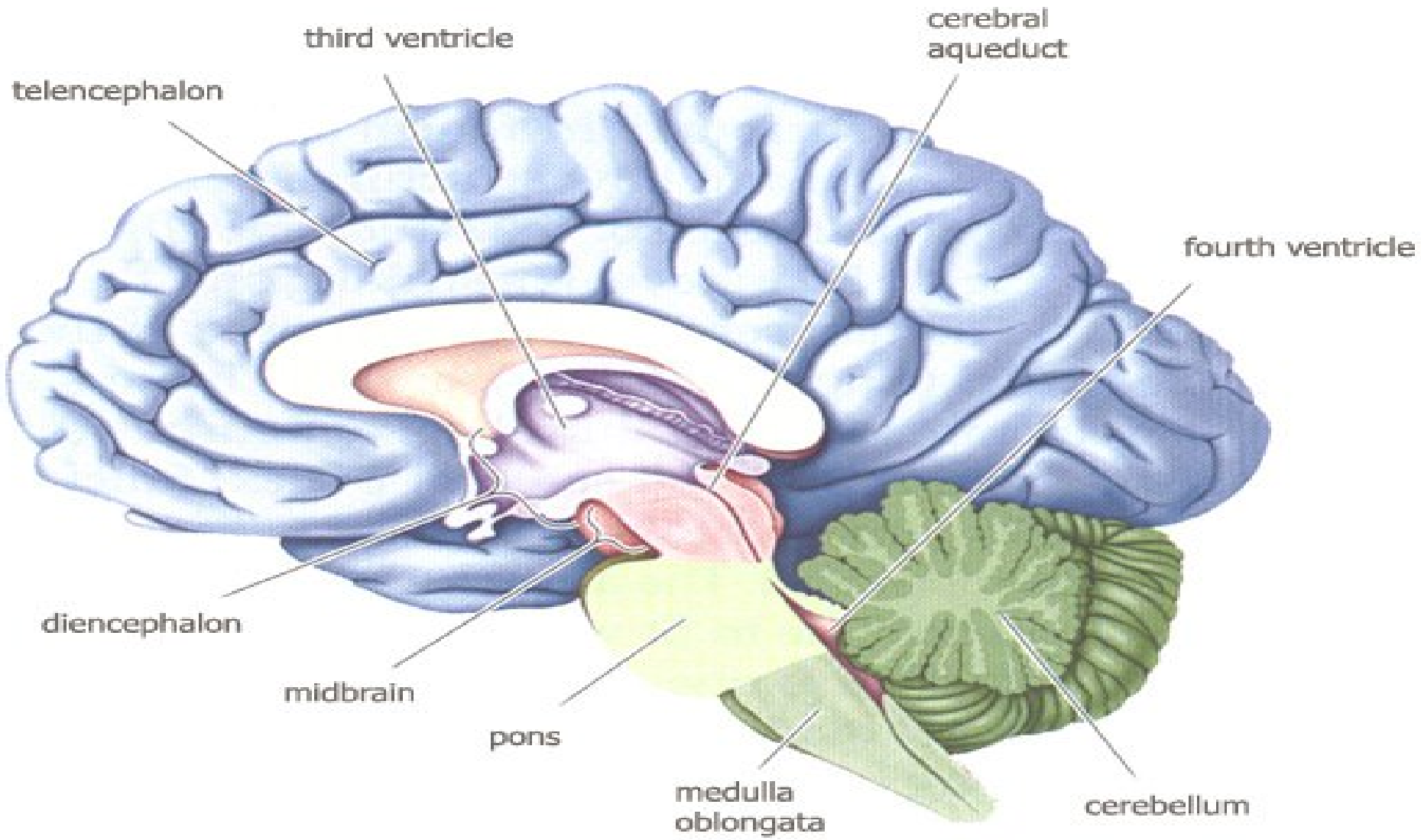
HUMAN BRAIN

- The brain is the main coordinating centre in the human body.
- It is protected by the cranium.
- It is covered by three membranes called meninges filled with a fluid called cerebrospinal fluid which protects the brain from shocks
- The brain has three main parts. They are fore brain, mid brain and hind brain



- i) Fore brain :- consists of the cerebrum and olfactory lobes. It is the thinking part of the brain and controls voluntary actions. It controls touch, smell, hearing, taste, sight, mental activities like thinking, learning, memory, emotions etc.
- ii) Mid brain :- controls involuntary actions and reflex movements of head, neck, eyes etc.
- iii) Hind brain :- consists of cerebellum, pons and medulla.
- Cerebellum :- controls body movements, balance and posture.
- Pons :- controls respiration.
- Medulla :- controls heart beat, blood pressure, swallowing, coughing, sneezing, vomitting etc.

HUMAN BRAIN

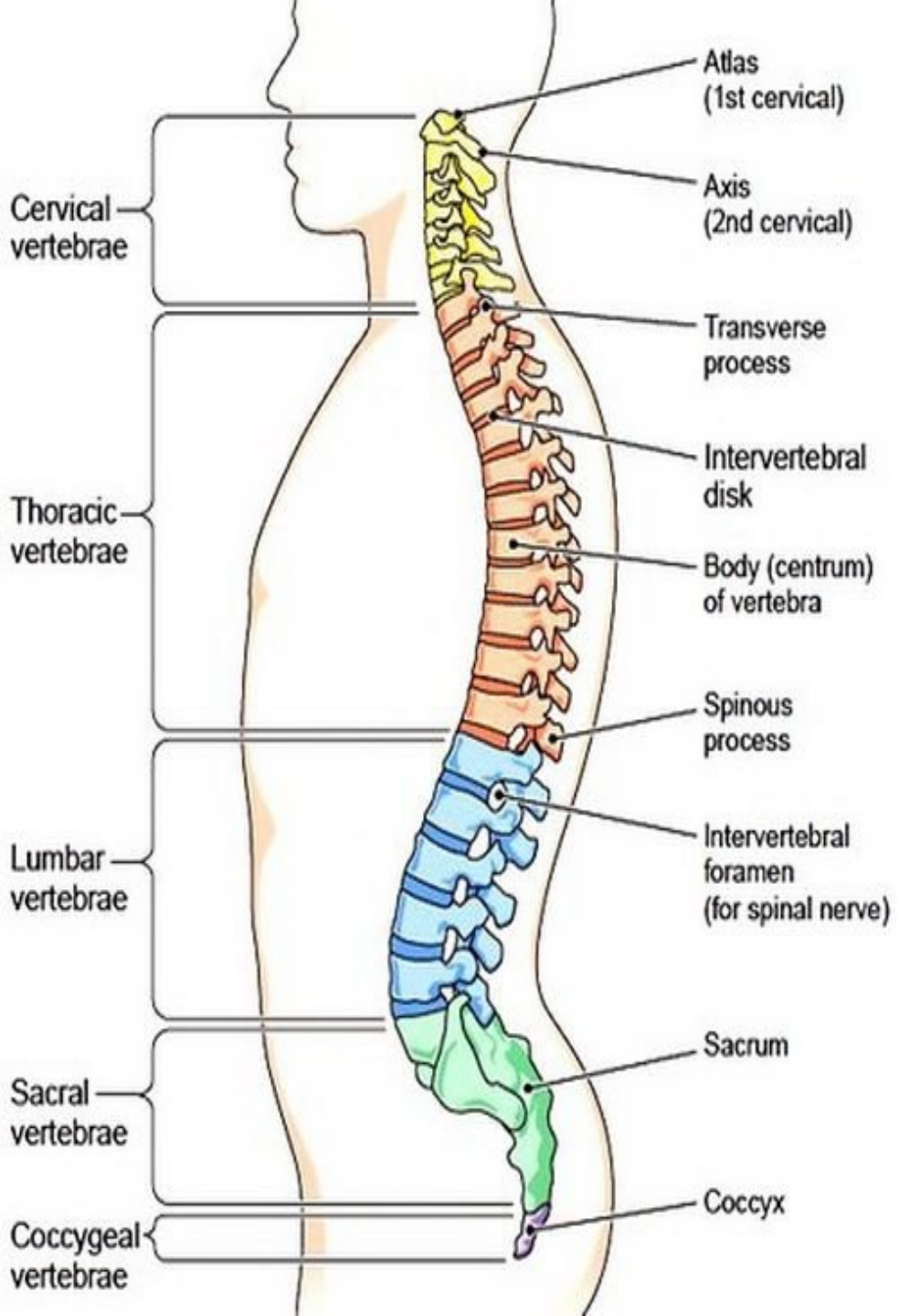

third ventricle
cerebral aqueduct
telencephalon
fourth ventricle
diencephalon
midbrain
pons
medulla oblongata
cerebellum

SPINAL CORD

- The spinal cord starts from the brain and extends through the vertebral column.
- It carries messages to and from the brain. It also controls reflex actions.

CRANIUM AND VERTEBRAL COLUMN

- Brain which is a delicate organ is protected inside a bony box.
- Inside the box brain is contained in a fluid filled balloon which provides shock absorption
- Vertebral column protects the spinal cord

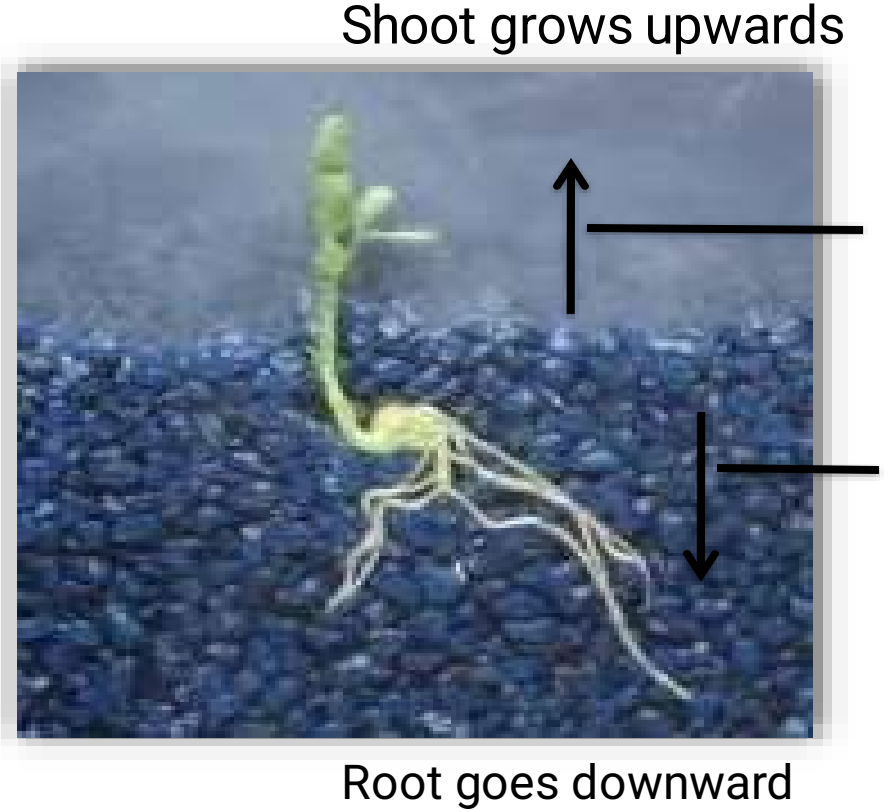


CO ORDINATION IN PLANTS

- In animals, control and coordination in governed by the nervous system. However, plants do not have a nervous system.
- how do plants respond to stimuli
  - Plants respond to stimuli by showing movement.

SEEDLING GROWTH

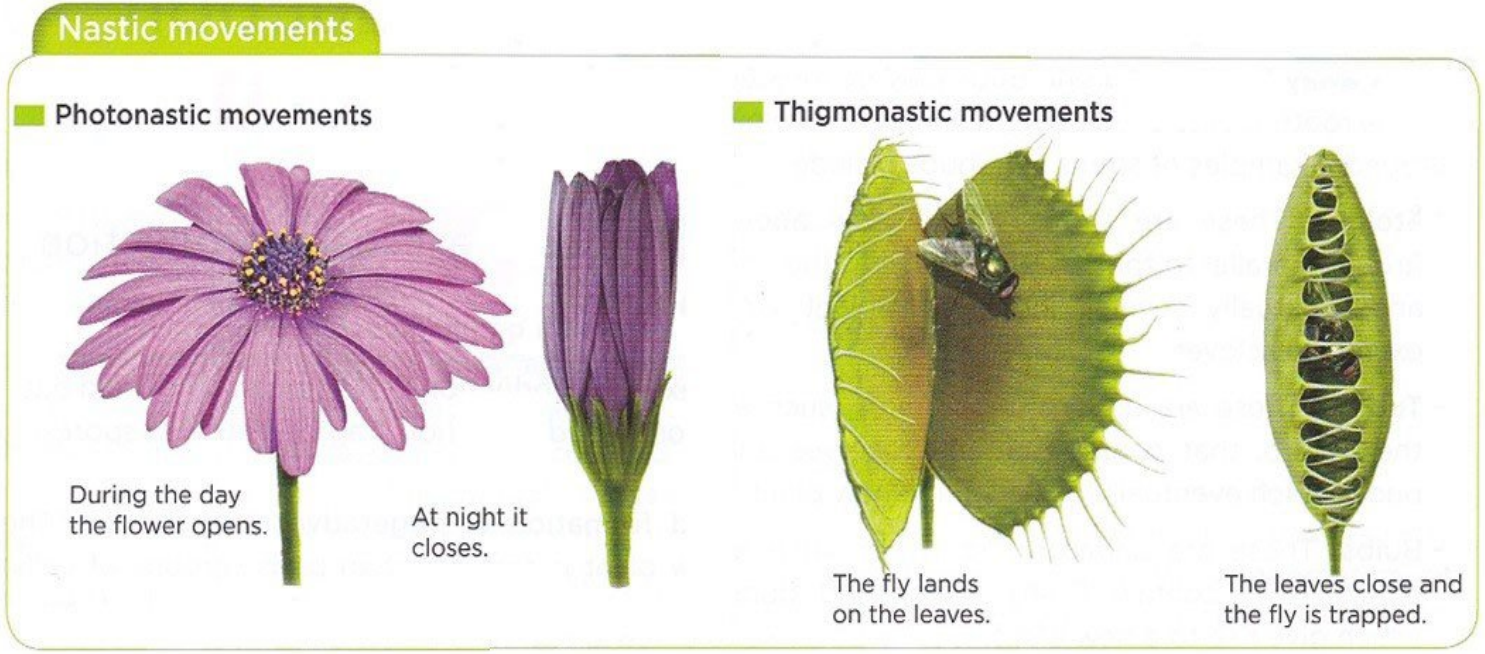
- when you touch a sensitive plant such a touch-me-not(Mimosa pudica), the plant folds its leafs.
- When a seed germinates, the root grows down in the soil and stem grows up .
- In the first example, by responding to the stimuli (touch) shows movement by folding leafs.
  - In second example, the seed germinates and shows directional movement.
  - In first example, movement is independent of growth. However, in the second example, growth is dependent of growth.
  - Thus,plants exhibit both growth-dependent and growth independent movements.

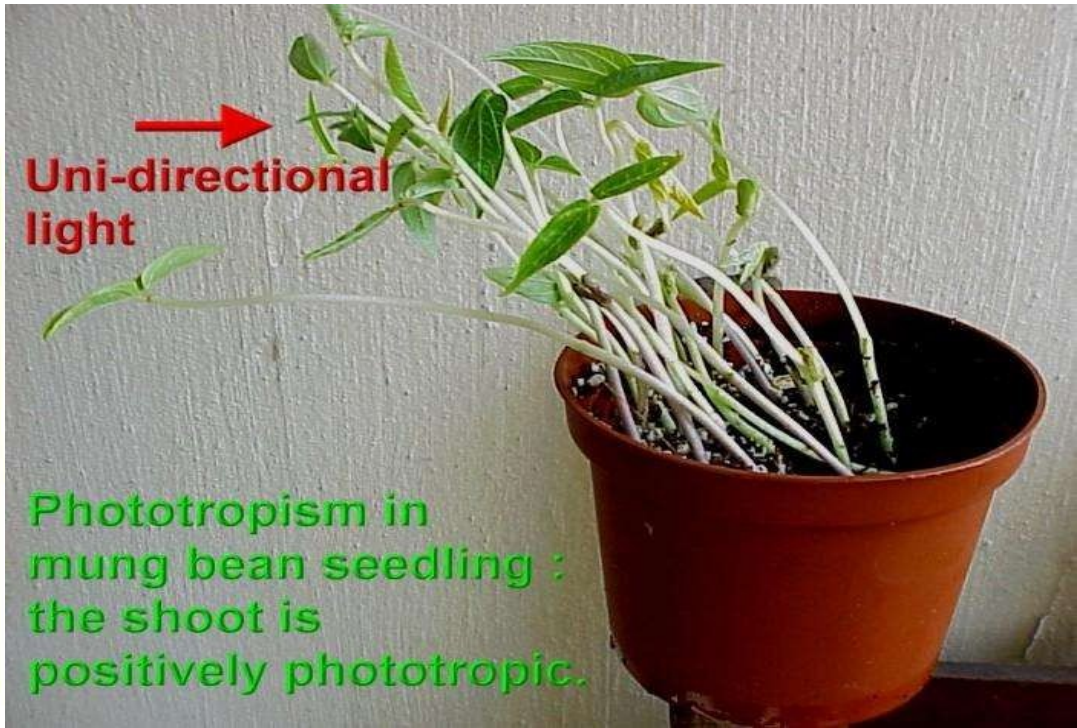


6) Movements in plants :-

Movements in plants are of two main types. They are :-Tropic movements and Nastic movements.

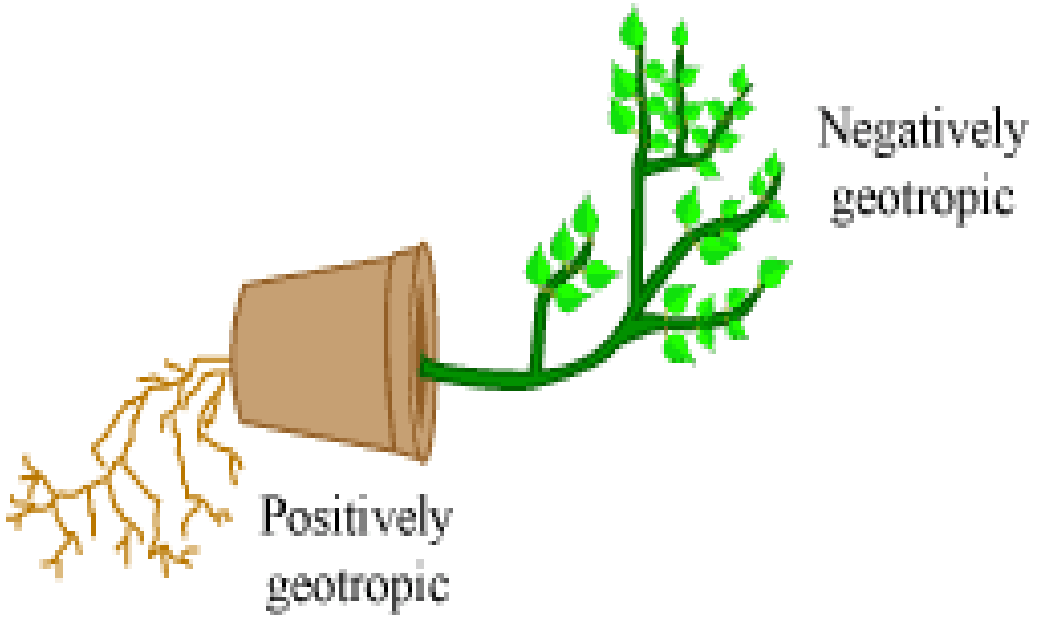
a) Tropic movements :- are directional movements towards or away from the stimulus and it depends on growth. They are of different types like phototropism, Geotropism, chemotropism, Hydrotropism etc.





- i) Phototropism :-

- Movement of plants in response to light. If it is towards light, it is called positive phototropism.
- Eg:- Bending of shoot towards light.
- If it is away from light, it is called negative phototropism.
- Eg:- Bending of root away from light.

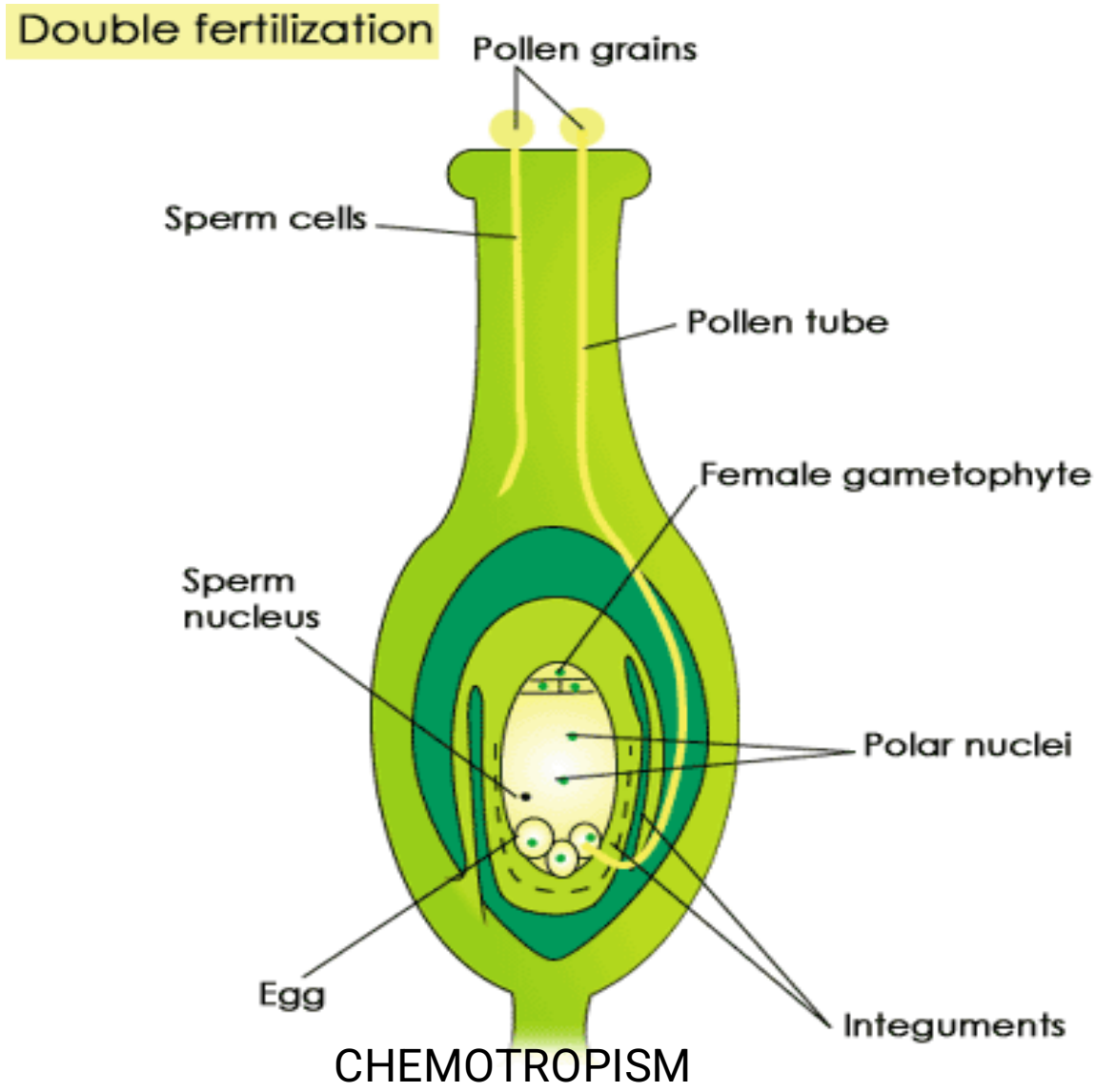


iii) Chemotropism :- is movement of plant in response to chemical stimuli.

Eg:- Growth of pollen tube towards the ovule.

iv) Hydrotropism :- is the movement of plants in response to water.

Eg :- Growth of roots towards water.



CHEMOTROPISM

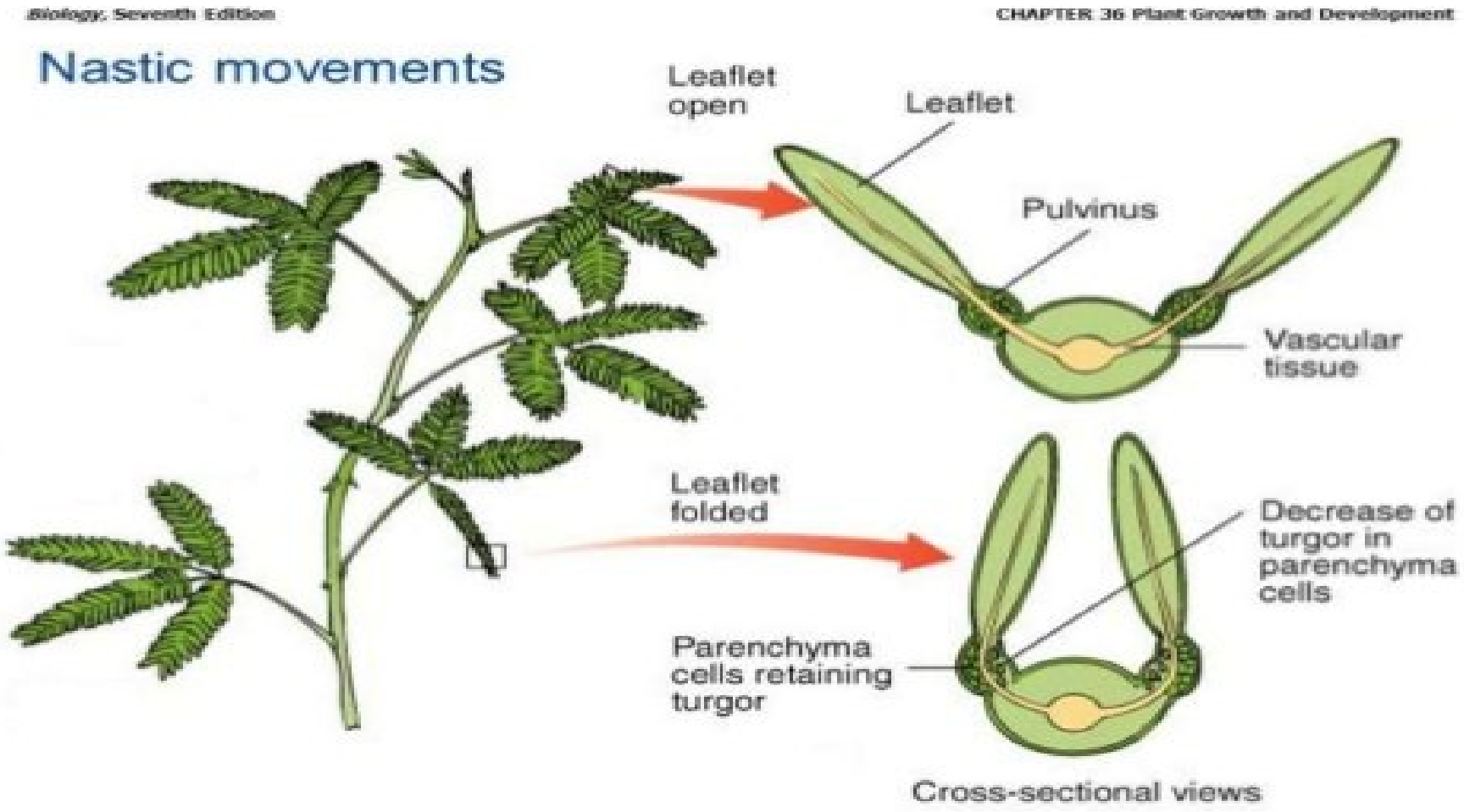
b) Nastic movements :-

Non directional movements which are neither towards or away from the stimulus and it does not depend on growth.

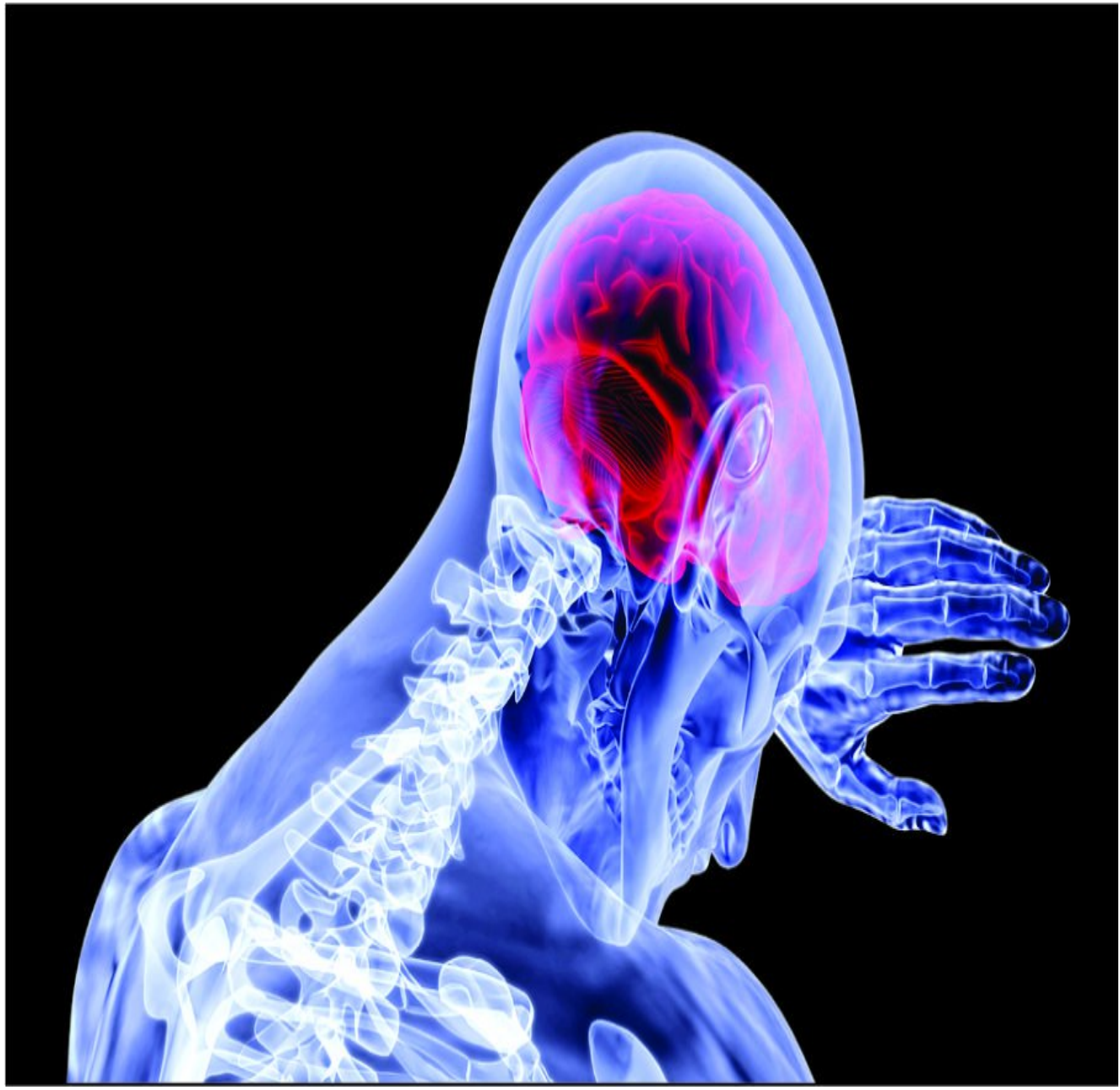
Eg :- If we touch the leaves of touch me not plant, its leaves fold up and droops down immediately due to the change in the amount of water in the leaves. Depending upon the amount of water in the leaves, it swells or shrinks

- Plants respond to stimulus by some chemical changes as in case of Mimosa pudica. It is very quick movements.
- Immediate response such as in Mimosa the information is transferred by electrochemical changes from cell to cell and the movement occurs by change in cell size by osmosis.

- In normal condition the cell remains turgid and maintains normal posture but as a stimulus received the cells stars exosmosis as a result water comes out of the cells and shrinks in size.



- Chemical Coordination
- The electrical impulses of nervous system have limitations as it does not associate with each and every cell and it require a resting period before setting a new impulse.
- So there is a need of having a system in which cell secretes some chemicals which can diffuse all around it and be detected by other cell's receptors and even transmitted by them also.



- Hormones
- These are chemical messengers which are secreted by endocrine glands and released directly into the blood from where they can reach to the target organ and show their effect.
- They are secreted in very small quantity by glands and act u
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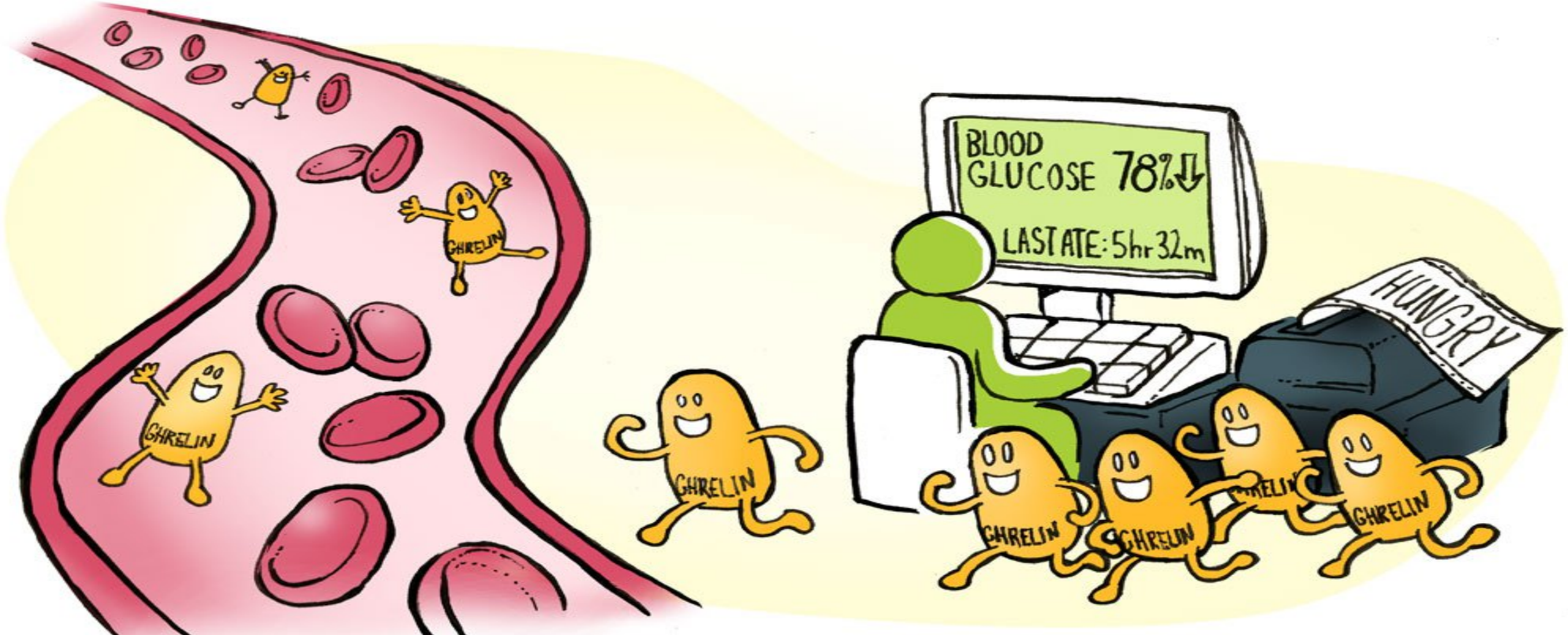
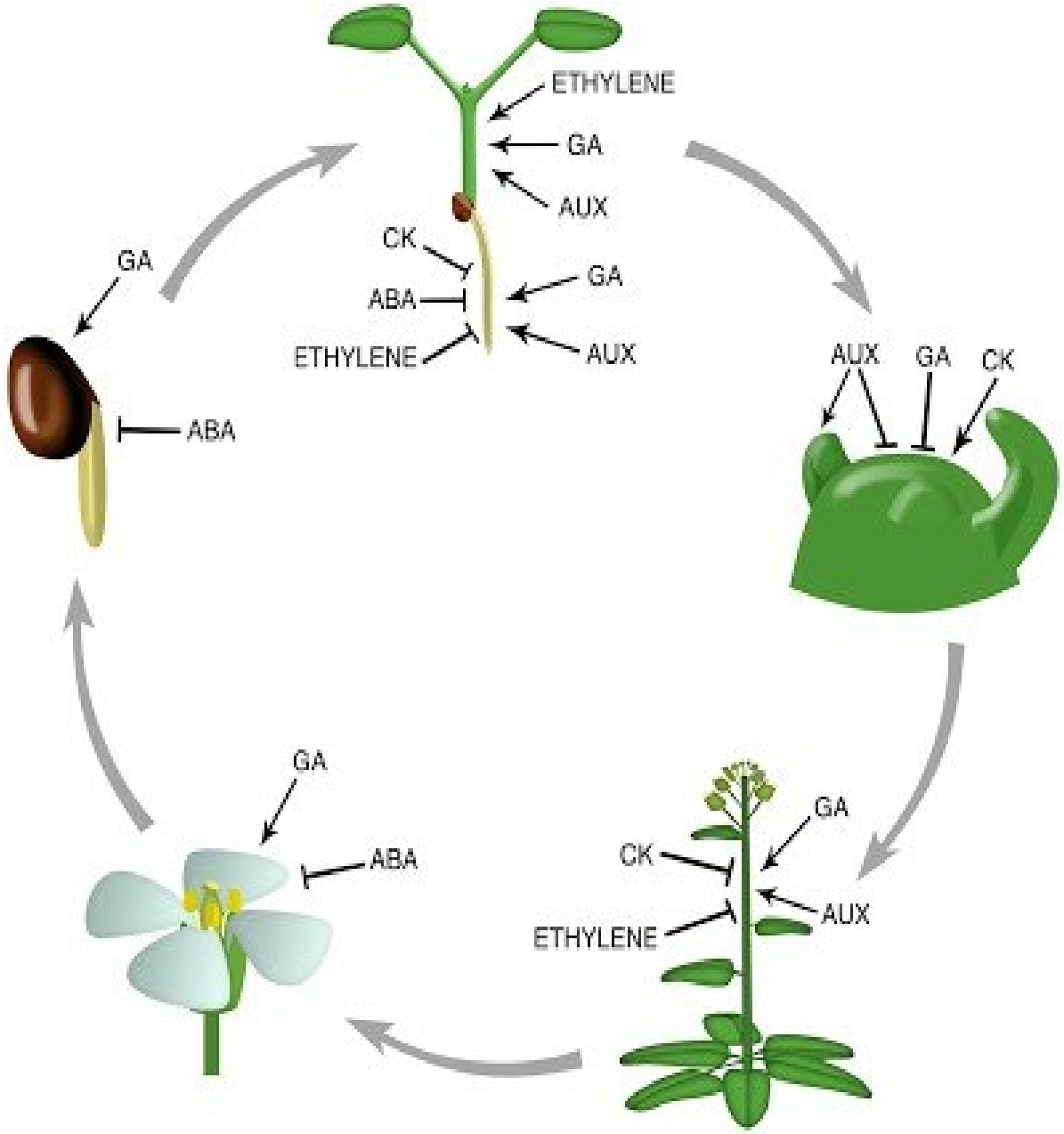
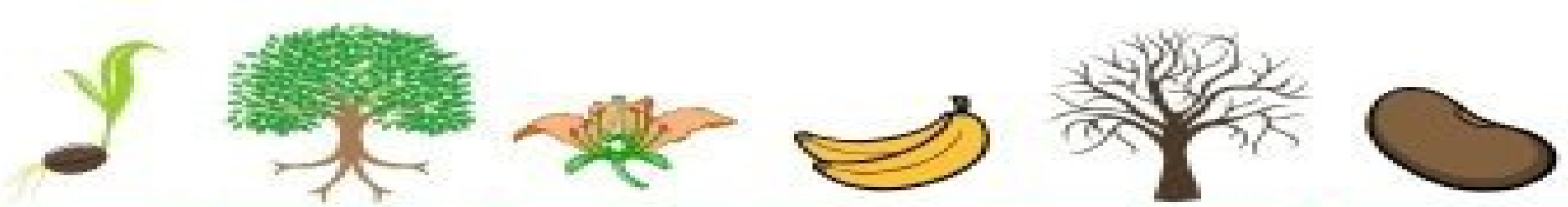


- Plant Hormones
- In plants, growth, development, and response to the environment is controlled and coordinated by naturally occurring organic chemical substances known as Phytohormones/plant hormones.
- These hormones are produced in one part of the plant body in minute quantities and and diffuse/ translocate to other parts as required.



Auxins:

- When the growing parts of a phototropic plants detect sunlight, auxins (synthesized at the shoot tips) help the cells grow longer. When light falls on one side of the plant, the auxins generally diffuse towards the shaded side of the shoot. This stimulates the cells in the shaded area to grow longer than the corresponding cells of the illuminated region. This results in the curvature of the plant stem tip towards light

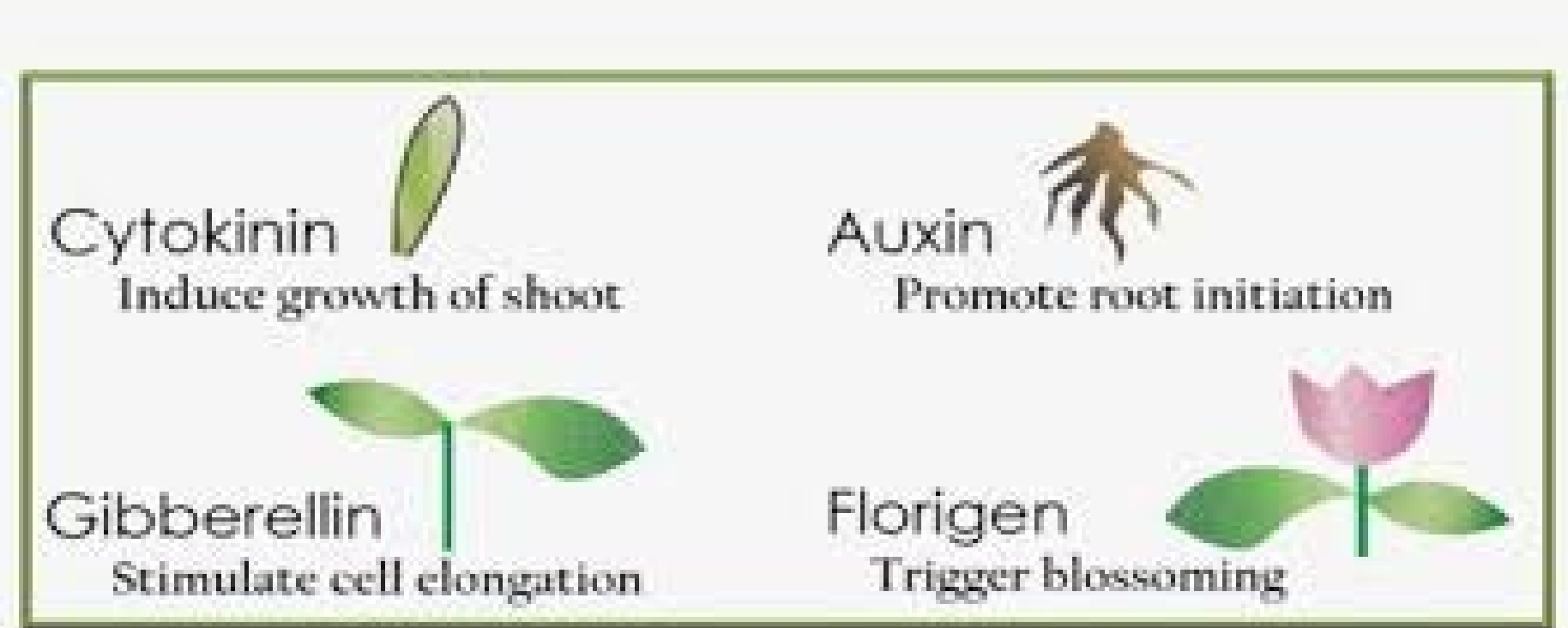


	Germination	Growth to Maturity	Flowering	Fruit Development	Abscission	Seed Dormancy
Gibberellin	✓	✓	✓	✓	✗	✗
Auxin	✗	✓	✓	✓	✗	✗
Cytokinins	✗	✓	✓	✓	✗	✗
Ethylene	✗	✗	✓	✓	✓	✗
Abscisic Acid	✗	✗	✗	✗	✓	✓

- Cytokinins:It promotes cell division and are present in greater concentration in those areas of the plants where rapid cell division occurs, such as in fruits and seeds

Gibberellins:It helps in growth of plant in length. They promote stem elongation by promoting cell division in the inter-nodal region.

- Abscisic Acid:It inhibits growth,causes wilting of leaves and also induces Dormancy (period in which no growth occurs during unfavorable conditions)



Animal Hormones

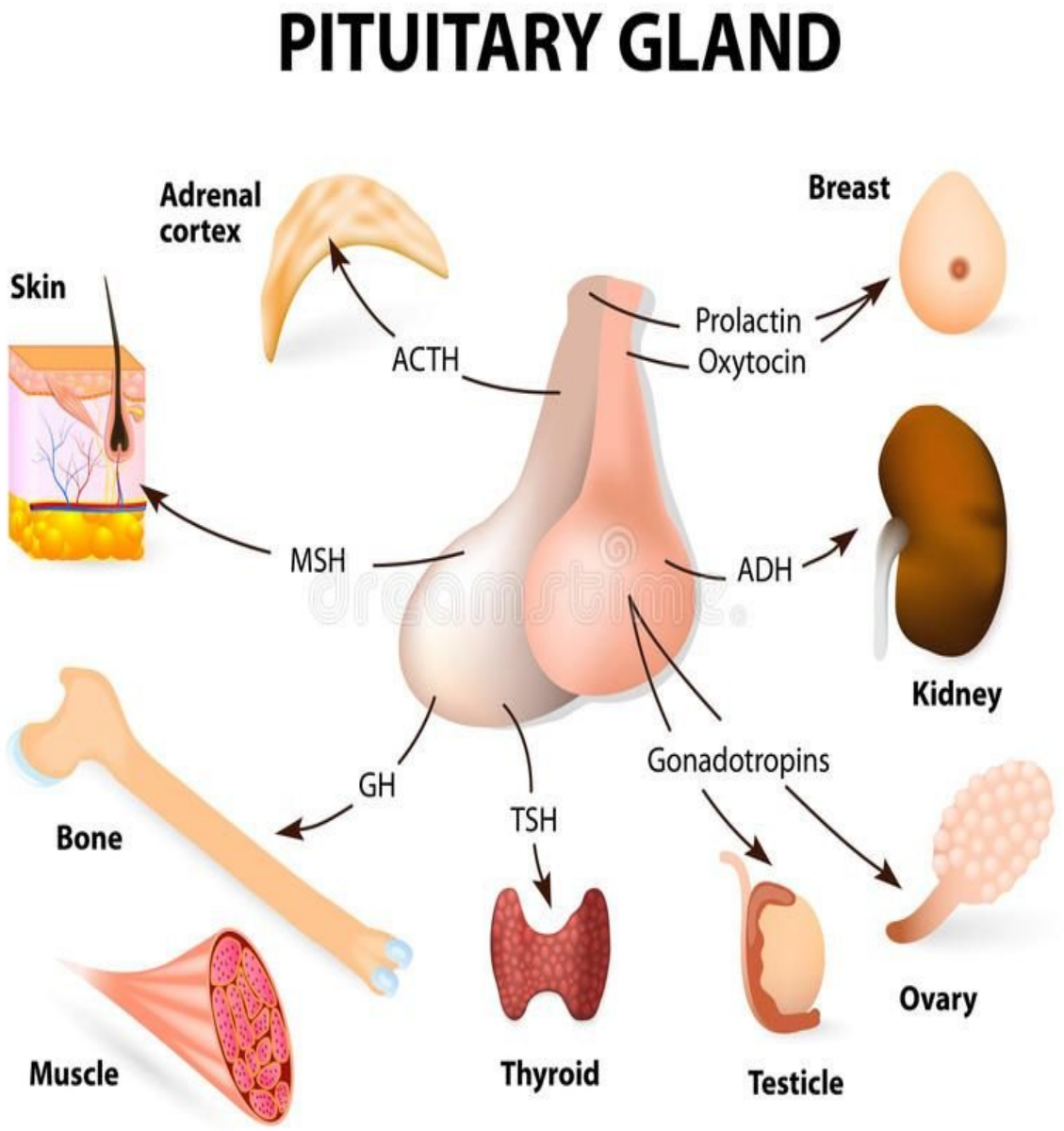
These are secreted by endocrine glands in animals. Some important glands are:

- Hypothalamus:

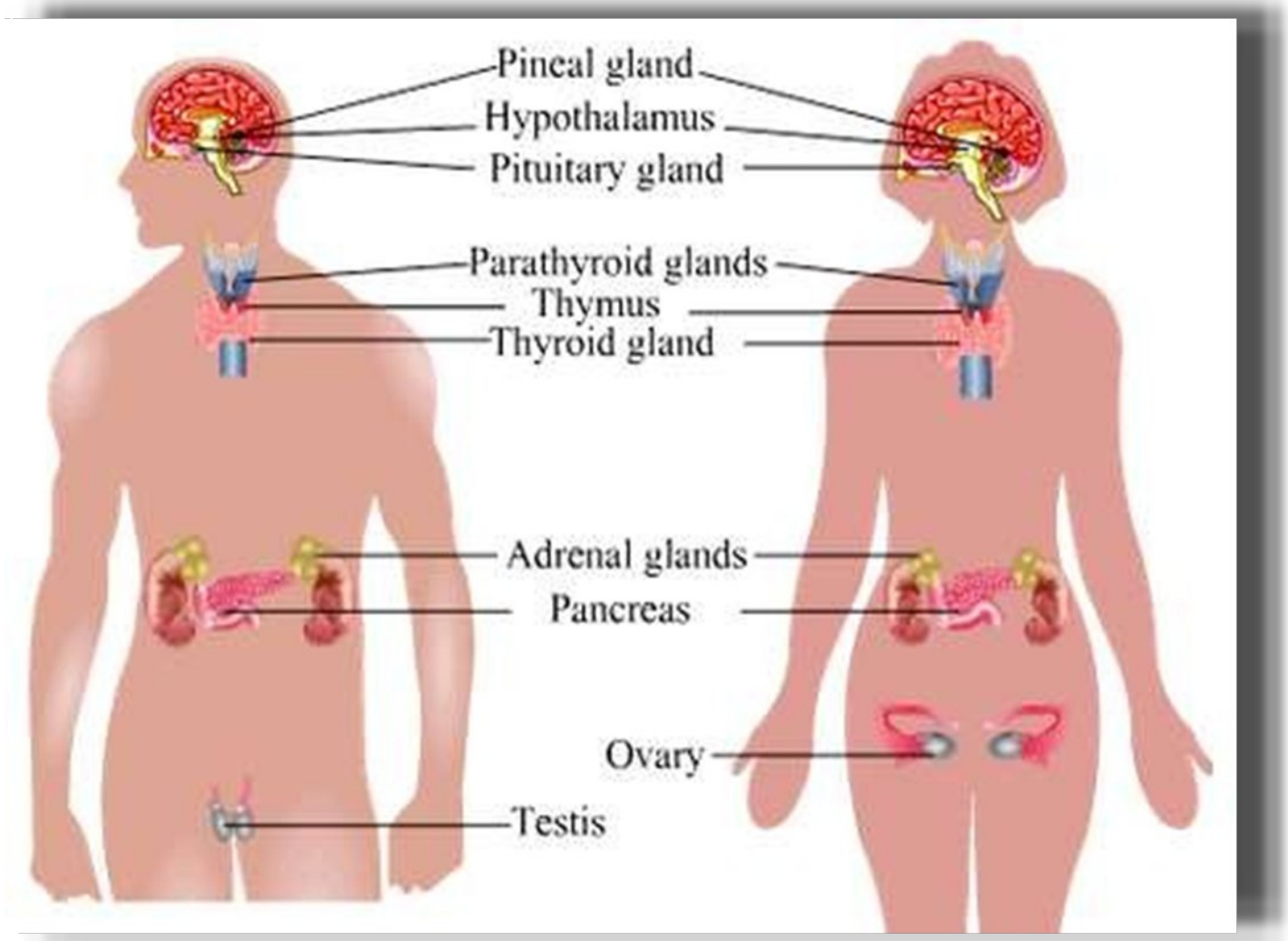
Situated in brain it releases some factors which control the secretions of pituitary gland.

- Pituitary Gland:

it is also situated in brain and is known as Master Gland of the Body. Its secretions control the other endocrine glands and regulate them. It also produces Growth hormone which regulates growth and development of the body. Deficiency of this can cause dwarfism



ENDOCRINE GLANDS IN HUMAN BEINGS

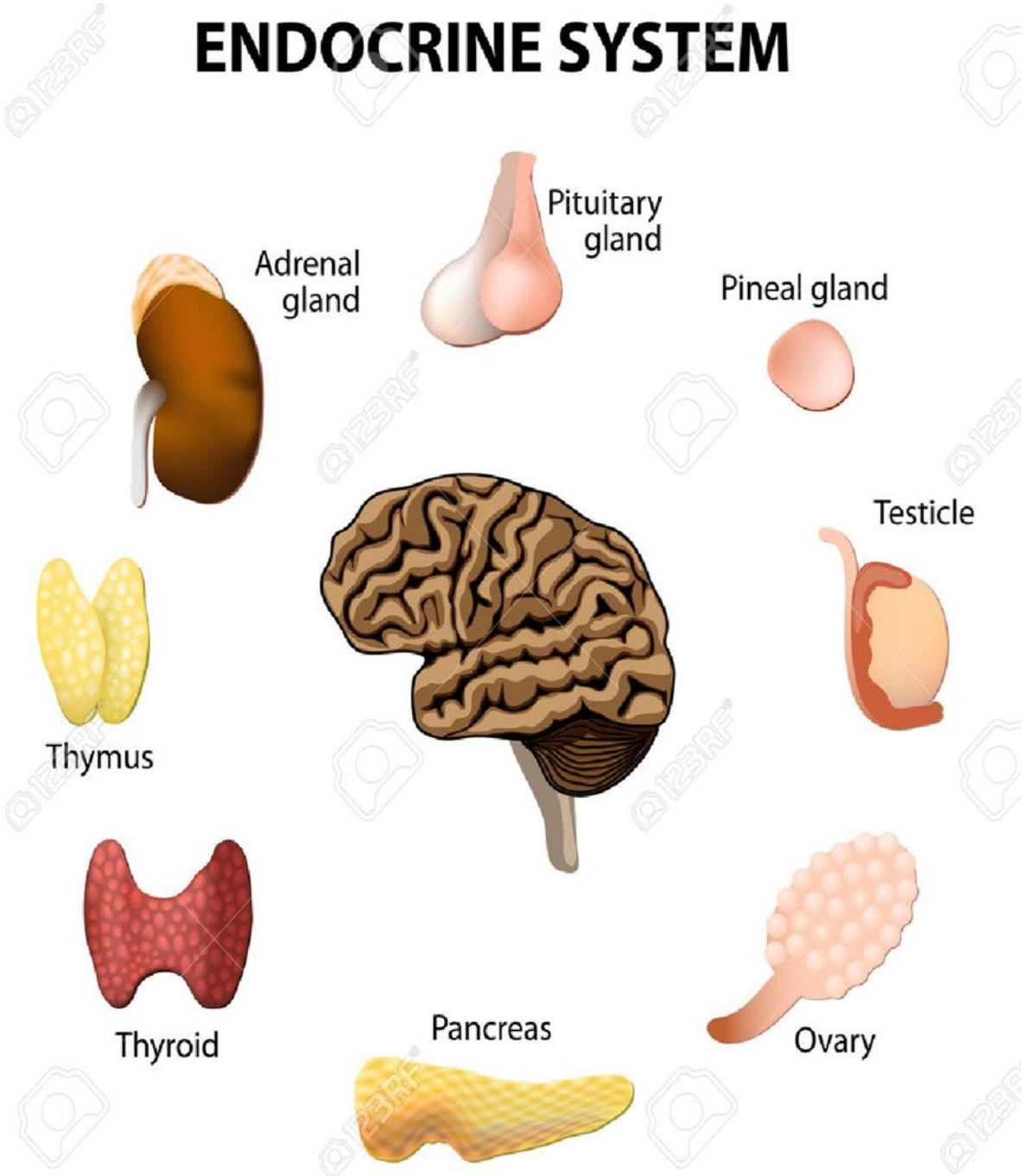


Thyroid:

It secretes Thyroxin which controls the metabolism of carbohydrates, fats and proteins. Iodine is essential for synthesis of thyroxin so deficiency of iodine in diet will cause goitre disease having symptom of swollen necks.

- Pancreas:

- It secrete Insulin hormone which control blood sugar level. If not secreted in enough quantities it will lead to Diabetes(rise of sugar level in blood).
  - Gonads(Sex organs):
- In males, Testes secrete Testosterone and in females ,Ovaries secrete Oestrogen and progesterone which control sex organs and sexual characteristics during puberty



- Adrenal:

- It secrete Adrenalin hormone which regulates heart beat to maintain proper oxygen supply in emergency condition .The muscles around small arteries to digestive system and skin contract and blood flow increases to skeletal muscles. Thebreathing rate also increases enabling body to deal with emergencies

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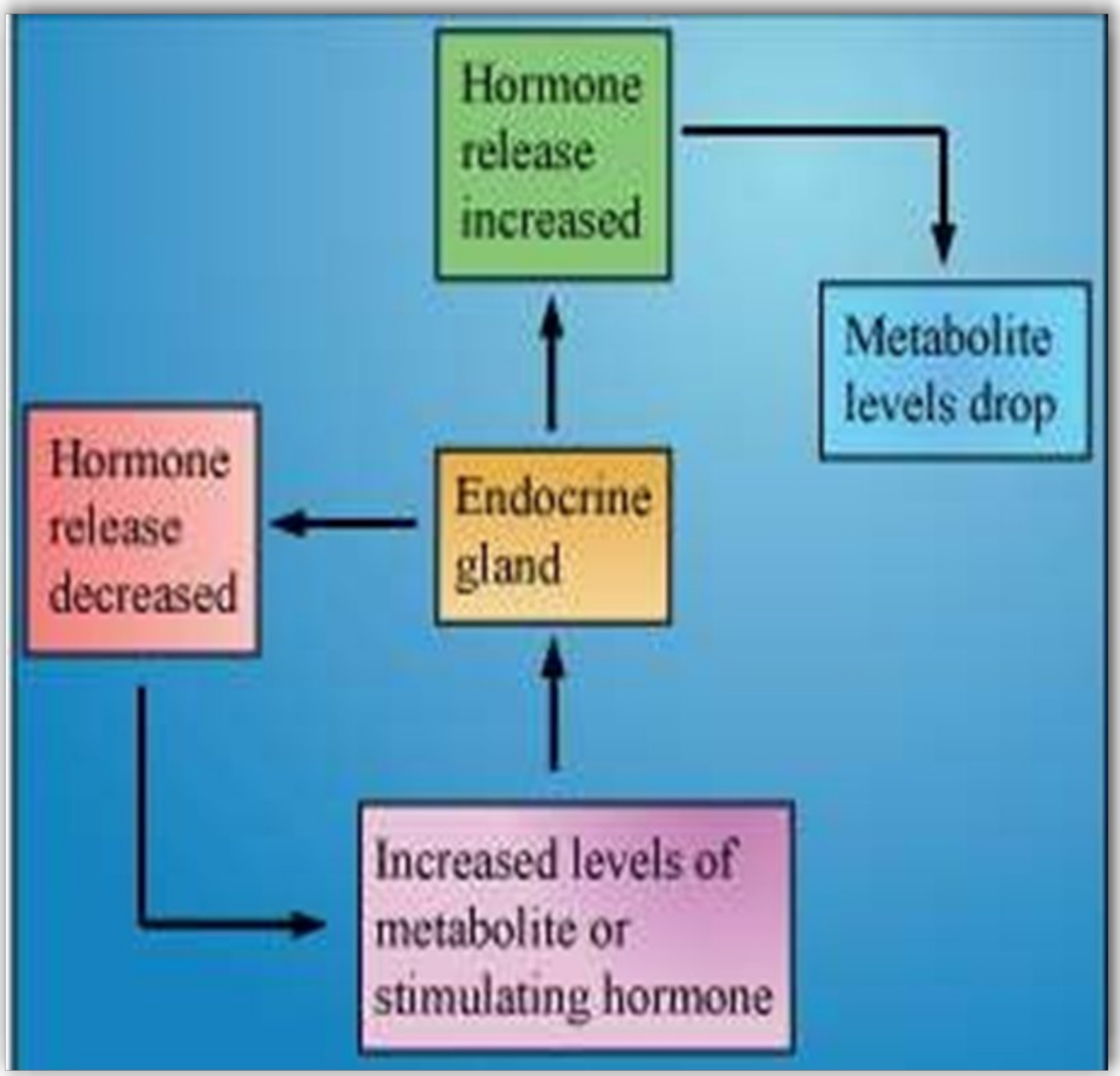
Feedback mechanism regulates the action of hormones



IMPORTANT E-LINKS FOR RESOURCE MATERIAL

- https://www.learncbse.in/control-coordination-chapter-wise-important-questions-class-10-science
- https://www.jagranjosh.com/articles/control-and-coordinationimportant-questions-preparation-tips-1372336848-1
- https://www.khanacademy.org/science/in-in-class-10-biology
- https://play.google.com/store/apps/details?id=in.gov.epathshala&hl=en_IN
- https://mycbseguide.com/blog/ncert-solutions-for-class-10-science-control-and-coordination-part-1/
- https://www.youtube.com/watch?v=HZh0A-lWSmY
- https://www.youtube.com/watch?v=OvVl8rOEncE&t=127s
- https://www.youtube.com/watch?v=8Ji3g4yp4VE

THE END

THANK YOU