CHAPTER - 7

CONTROL AND COORDINATION

CLASS X BIOLOGY

RAJNI A

1a) 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.

b) Coordination :-

For a proper response to a stimulus many organs in the body should work together. 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.

2) Coordination in animals :-

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

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

a) **Receptors :-** are the sense organs which receive the stimuli and pass the message to the brain or spinal cord through the sensory nerves.

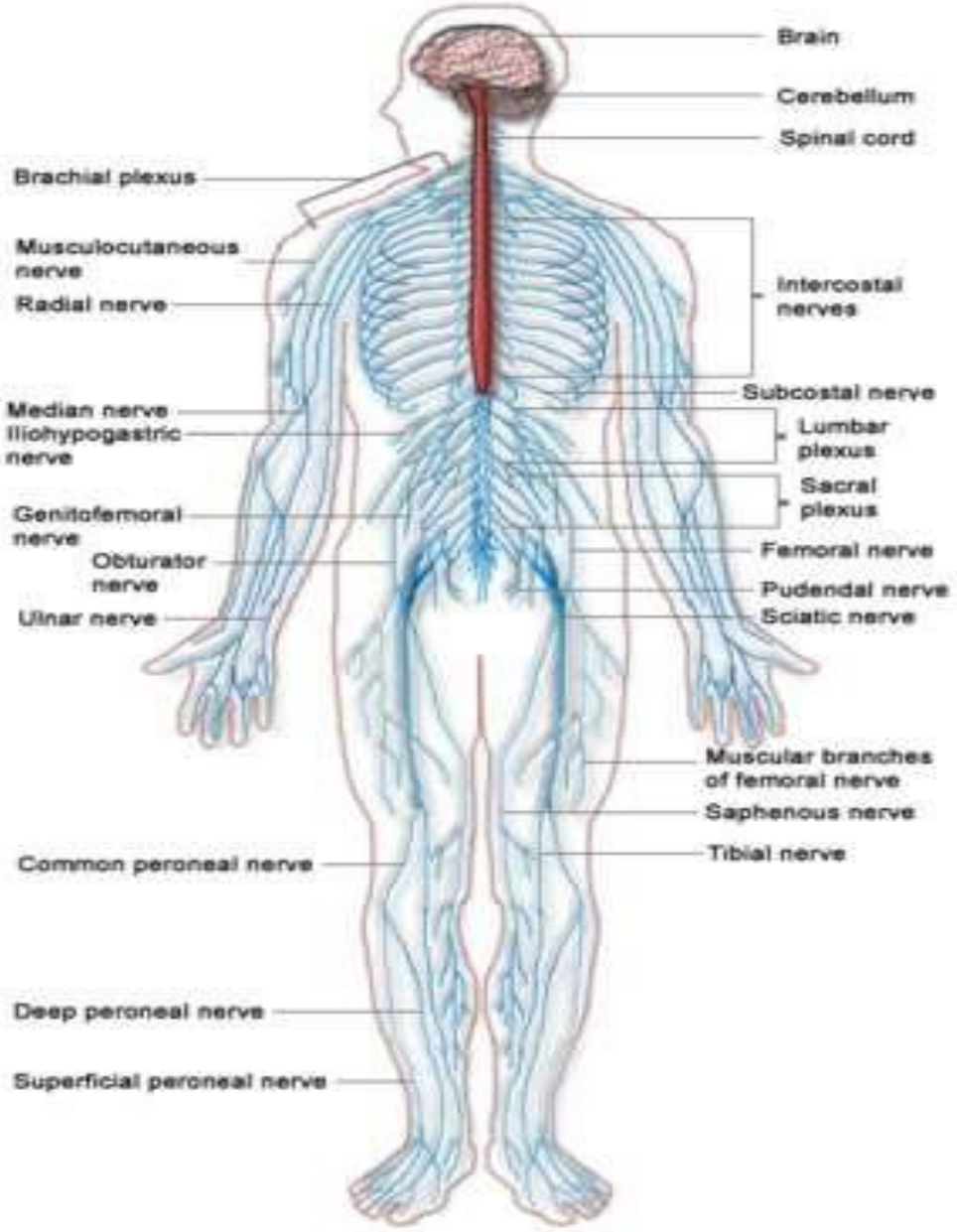
Eg :- Photoreceptors in the eyes to detect light.
Phonoreceptors in the ears to detect sound.
Olfactory receptors in the nose to detect smell.
Gustatory receptors in the tongue to detect taste.
Tangoreceptors in the skin to detect touch.

b) **Effectors :-** are the muscles and glands which respond to the information from the brain and spinal cord through the motor nerves.

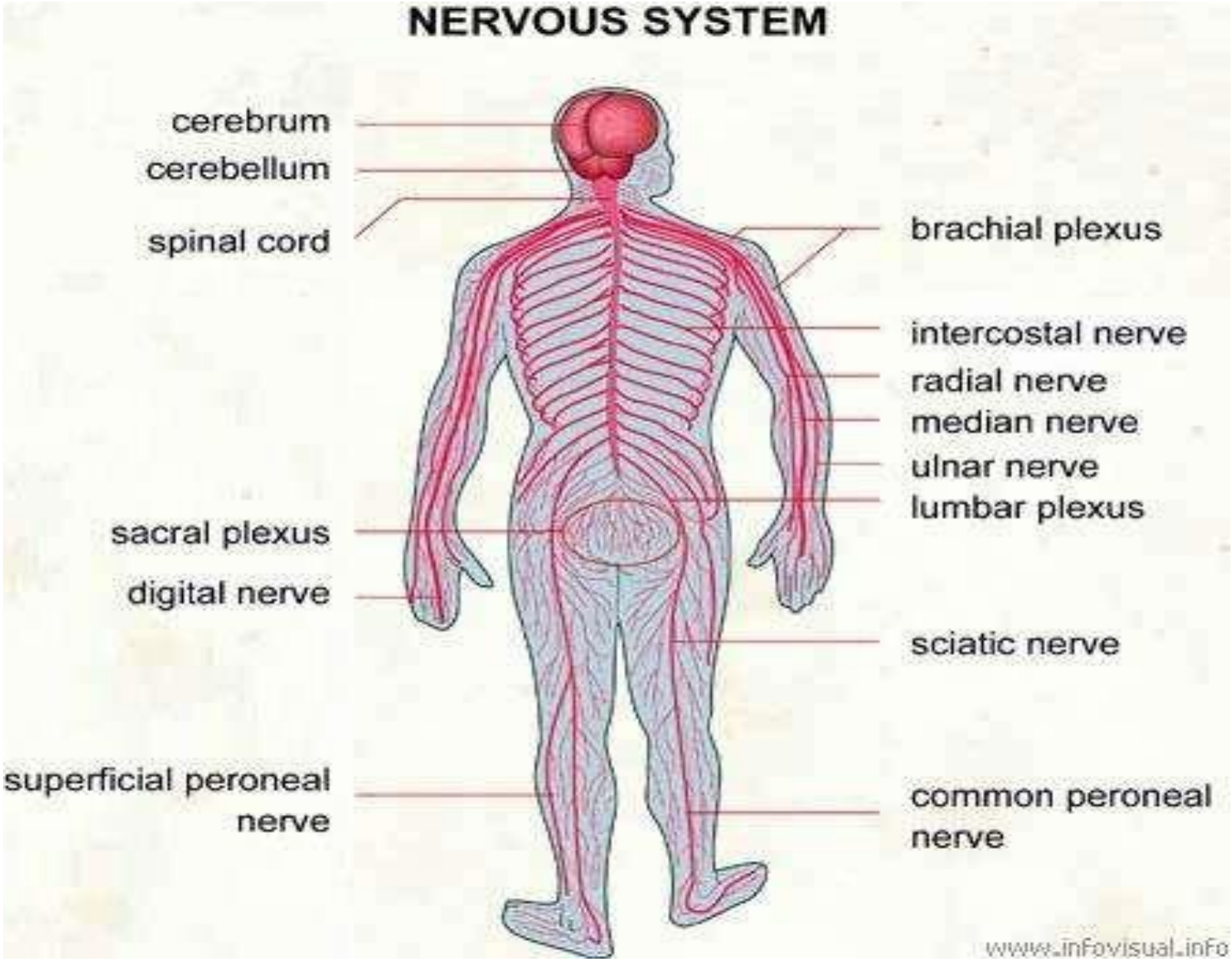
c) **Sensory nerves :-** are nerves which carry information from the receptors (sense organs) to the brain and spinal cord.

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

HUMAN NERVOUS SYSTEM



HUMAN NERVOUS SYSTEM



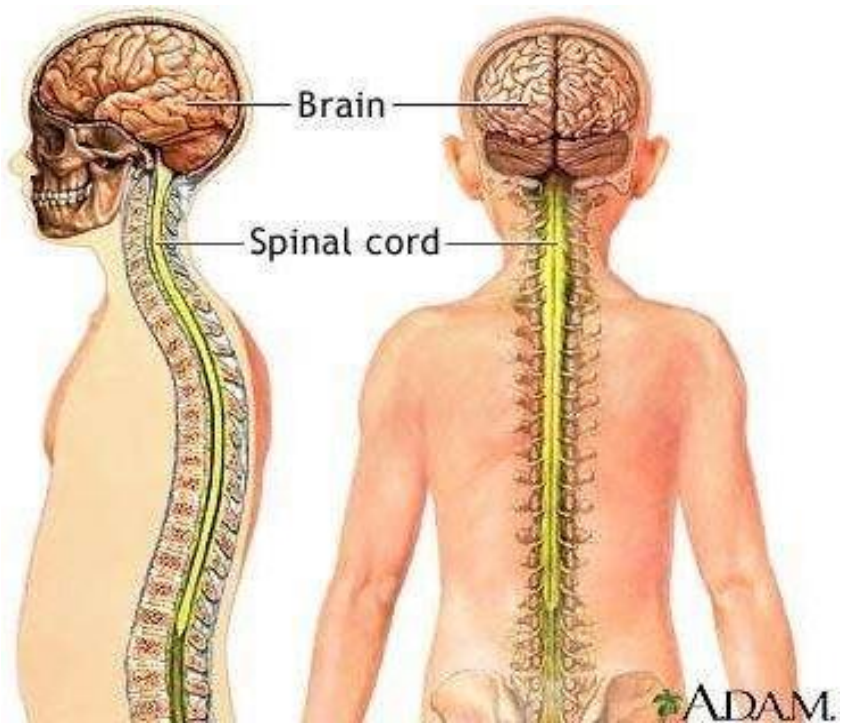
3) Human nervous system :-

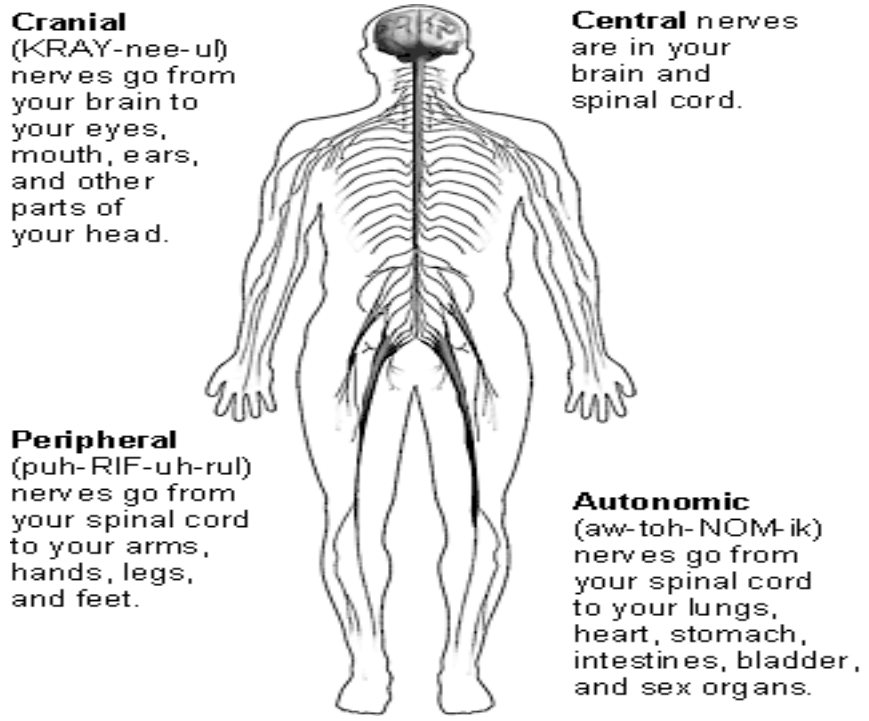
a) Parts of the nervous system :-

The human nervous system consists of the Central Nervous System and Peripheral Nervous System.

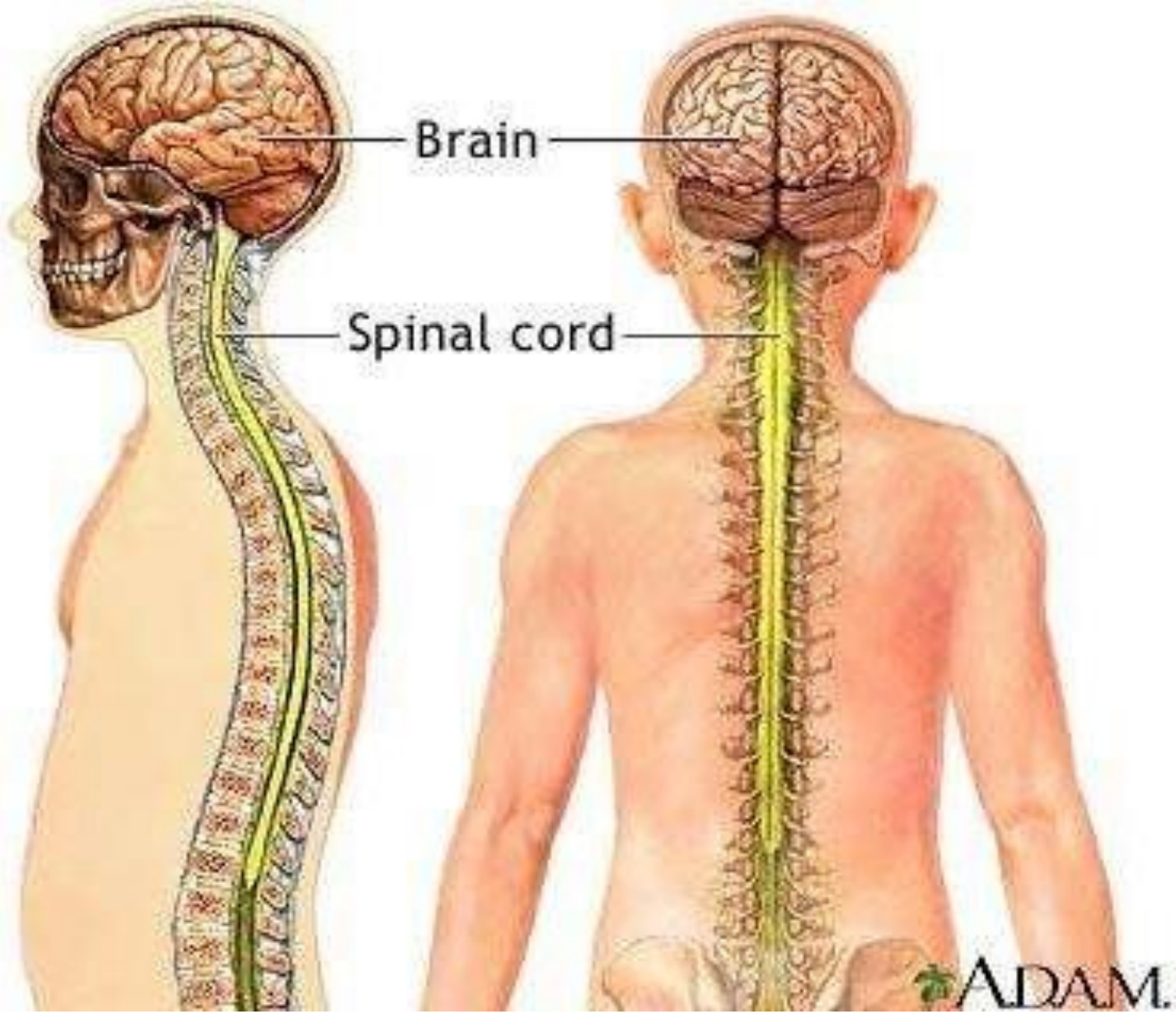
i) The central nervous system :- consists of the brain, and spinal cord.

ii) The peripheral nervous system:- consists of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.





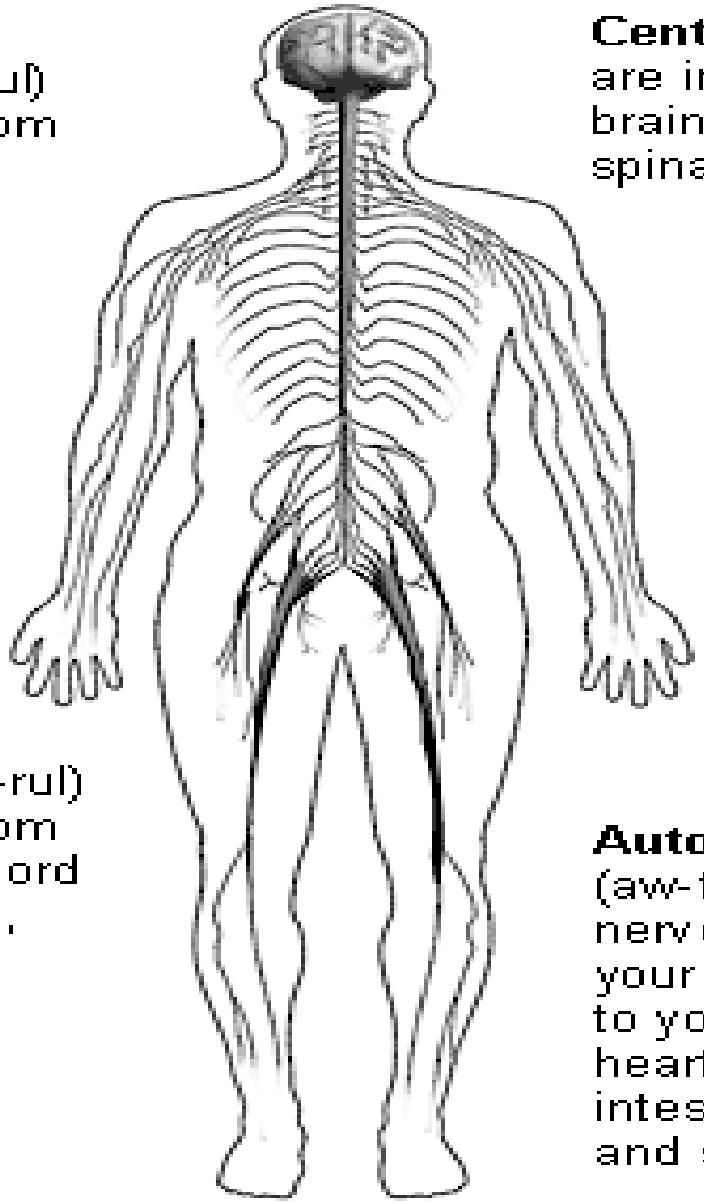
CENTRAL NERVOUS SYSTEM



PERIPHERAL NERVOUS SYSTEM

Cranial (KRAY-nee-ul) nerves go from your brain to your eyes, mouth, ears, and other parts of your head.

Central nerves are in your brain and spinal cord.



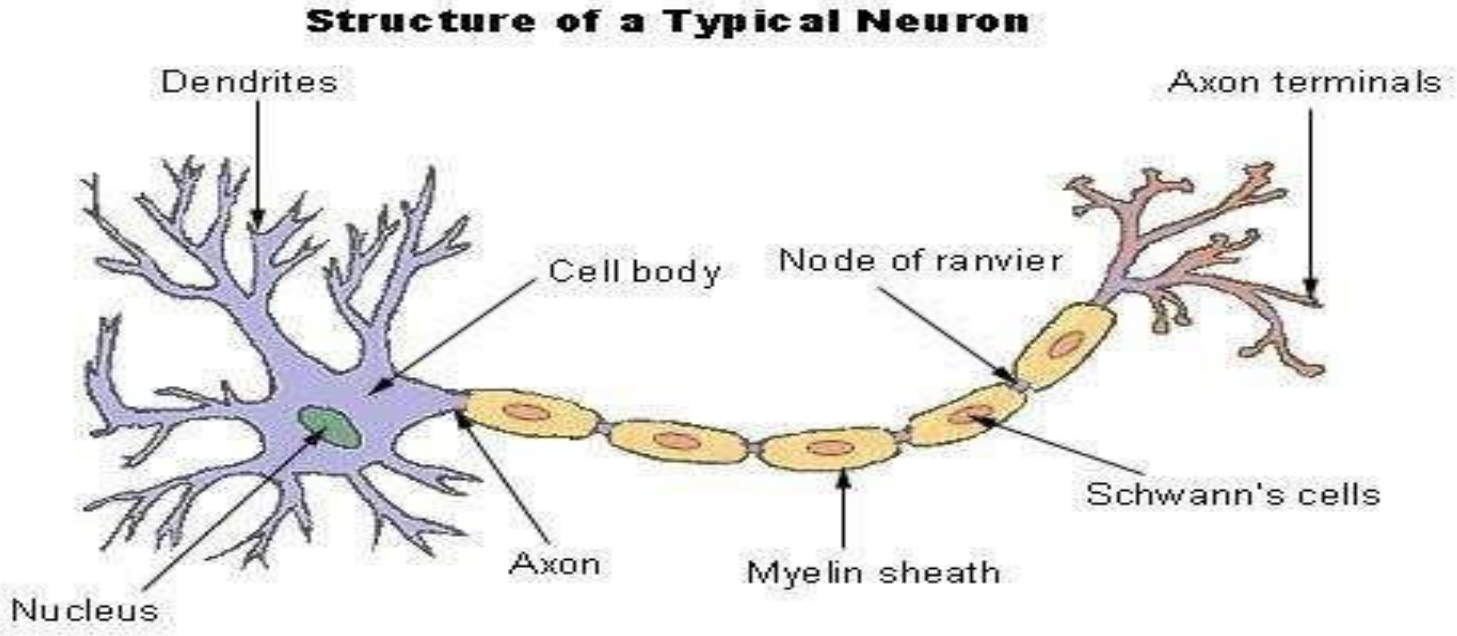
Peripheral (puh-RIF-uh-rul) nerves go from your spinal cord to your arms, hands, legs, and feet.

Autonomic (aw-toh-NOM-ik) nerves go from your spinal cord to your lungs, heart, stomach, intestines, bladder, and sex organs.

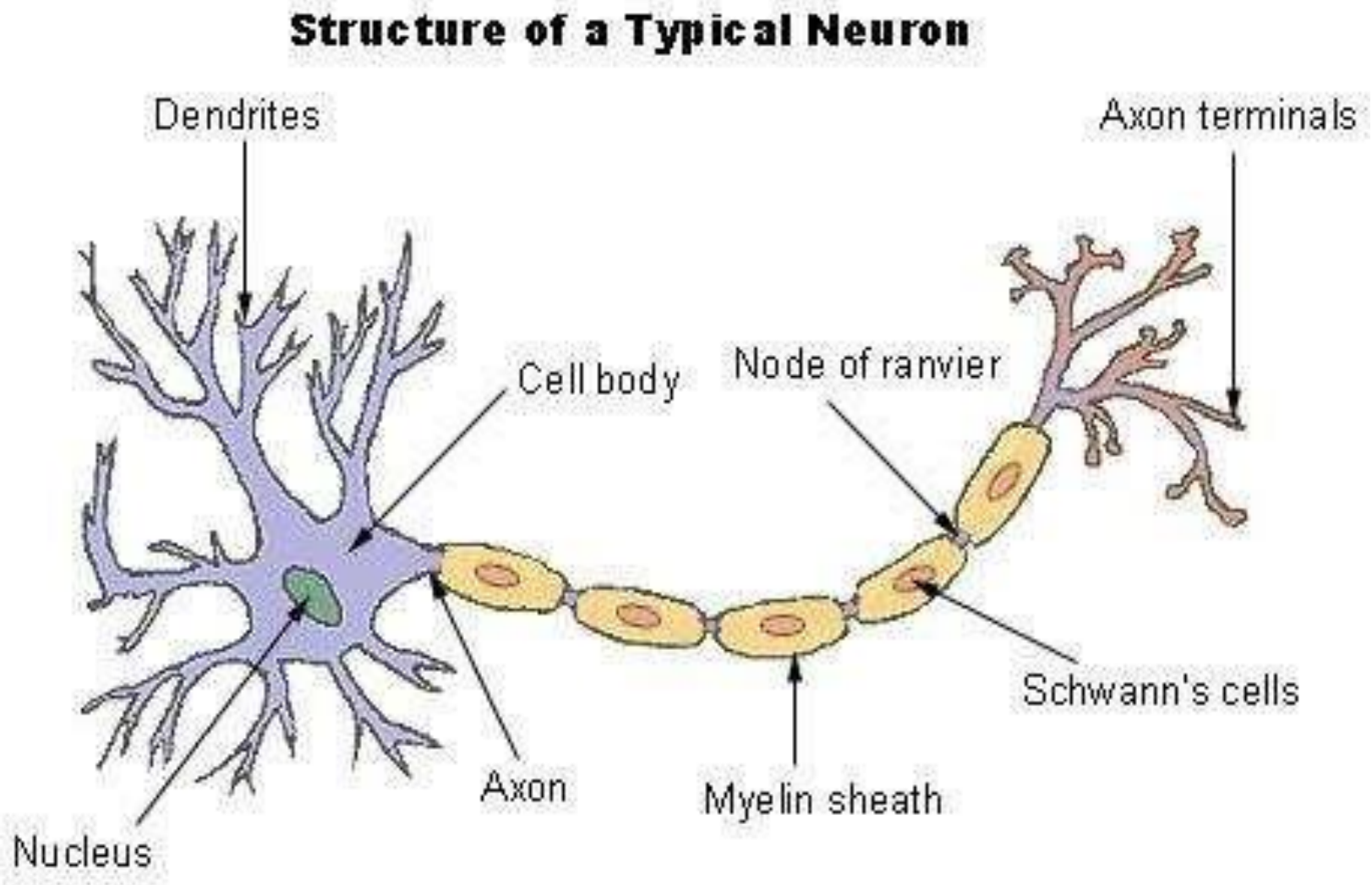
b) Nerve cell (Neuron) :-

Neuron is the structural and functional unit of the nervous system. It has a cell body called cyton containing a nucleus and cytoplasm. It has several branched structures called dendrites. It has a long nerve fibre called axon which is covered by a protective covering called Myelin sheath. The junction between two neurons is called synapse.

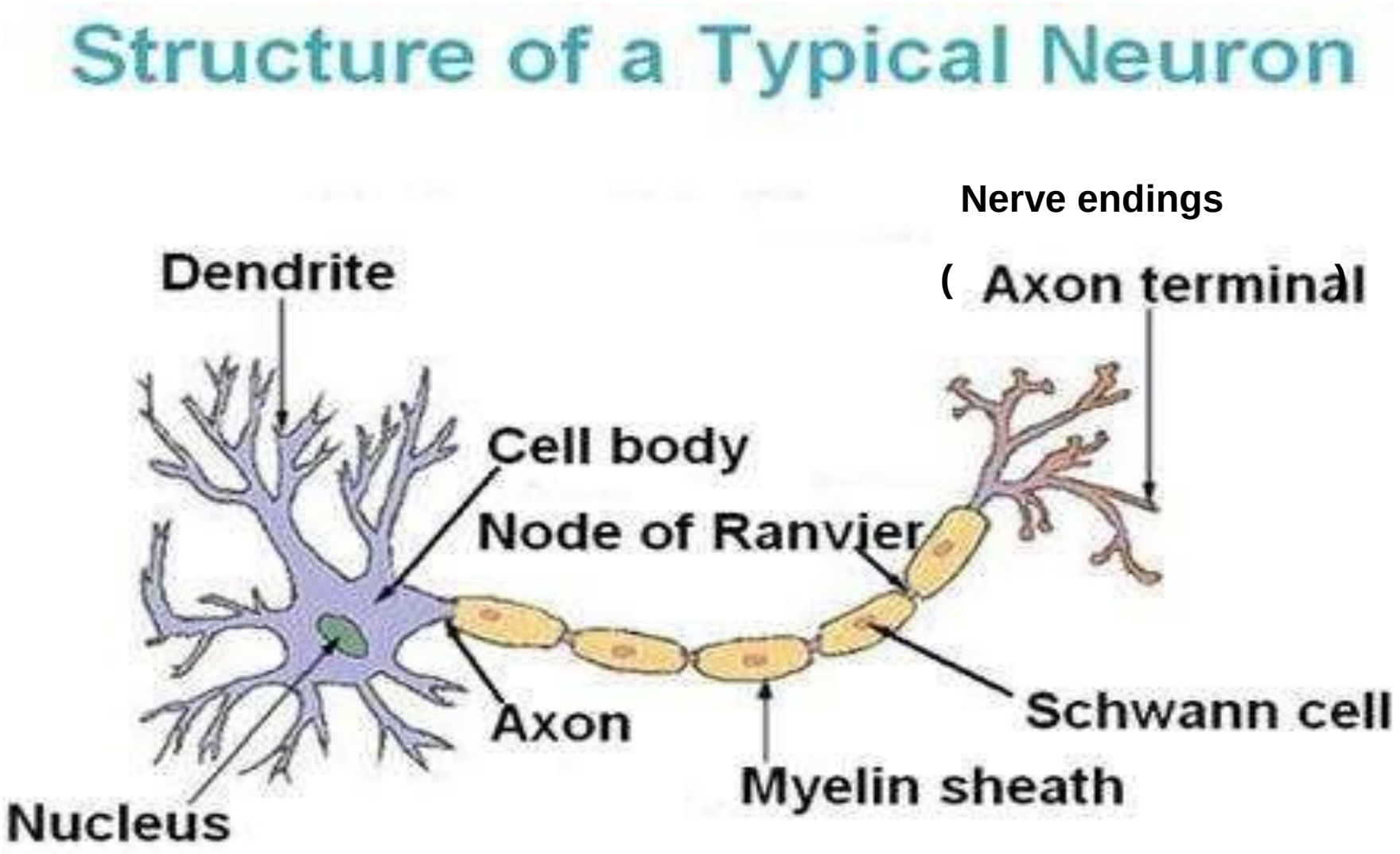
Messages pass through the nerve cell in the form of chemical and electrical signals called nerve impulse. The dendrites receive the information and starts a chemical reaction which produce electrical impulse which passes through the axon.



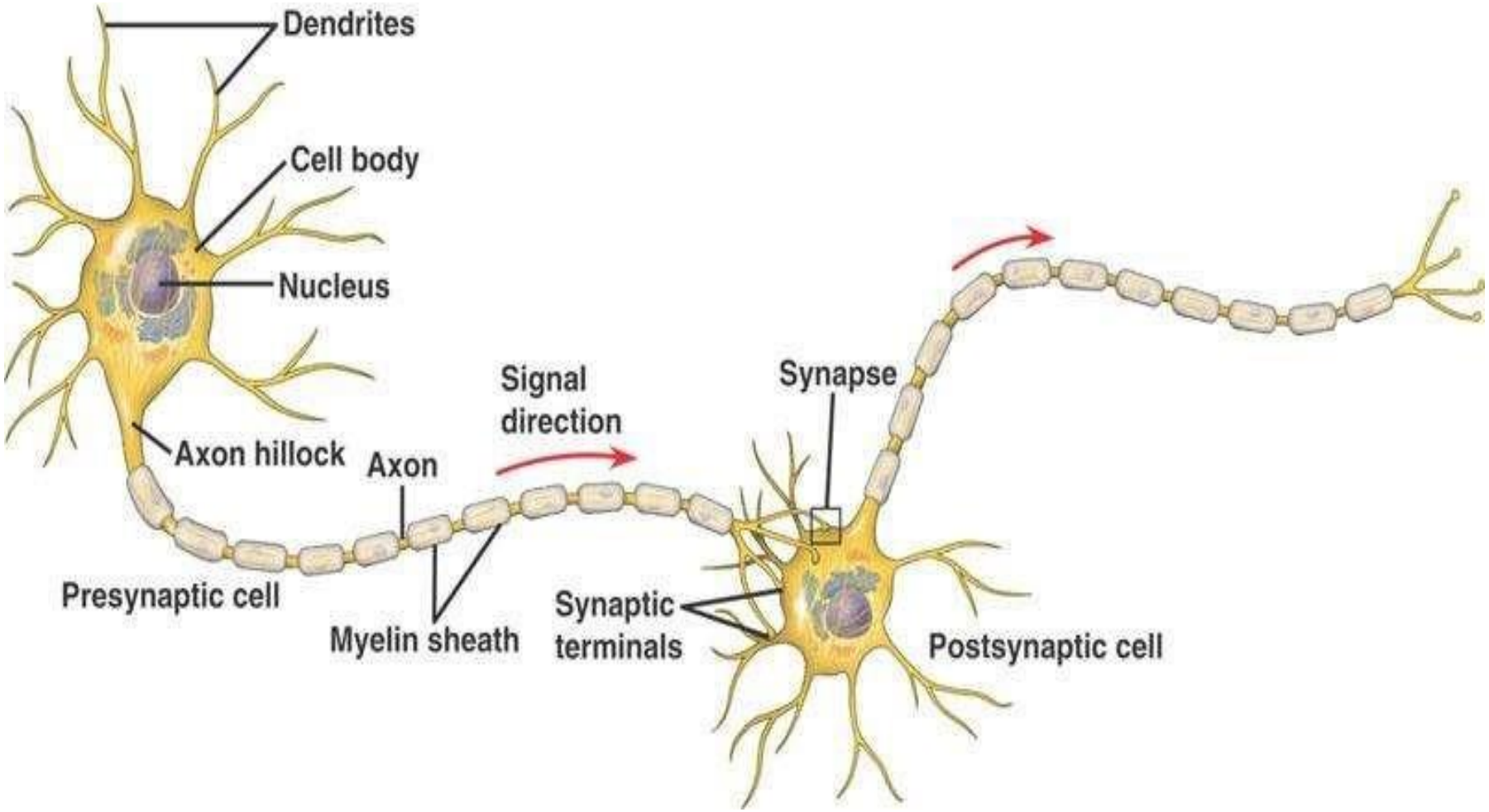
Structure of neuron (Nerve cell)



Structure of neuron (Nerve cell)



Transmission of messages through neurons



c) 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.

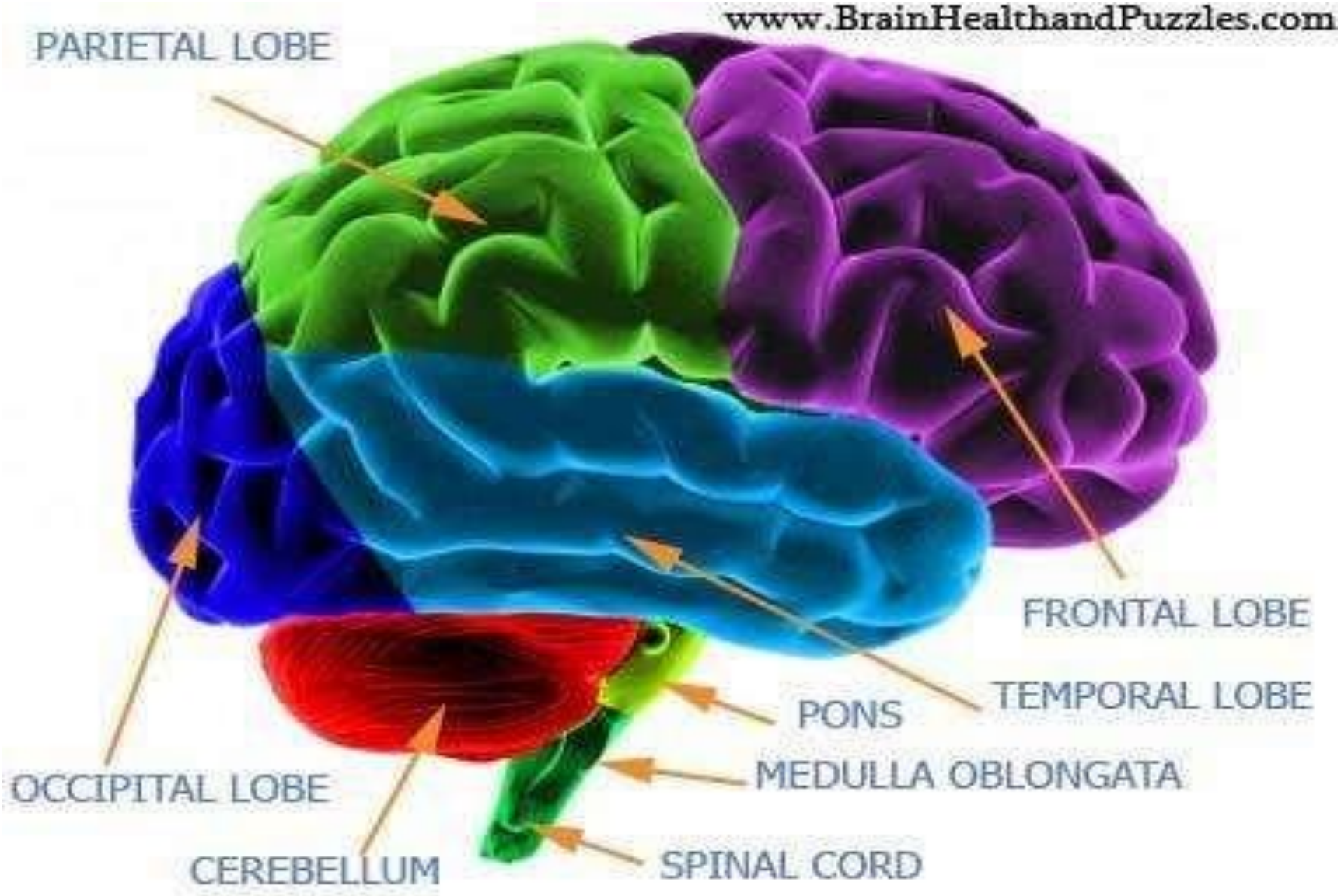
The brain has three main parts. They are fore brain, mid brain and hind brain.

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.

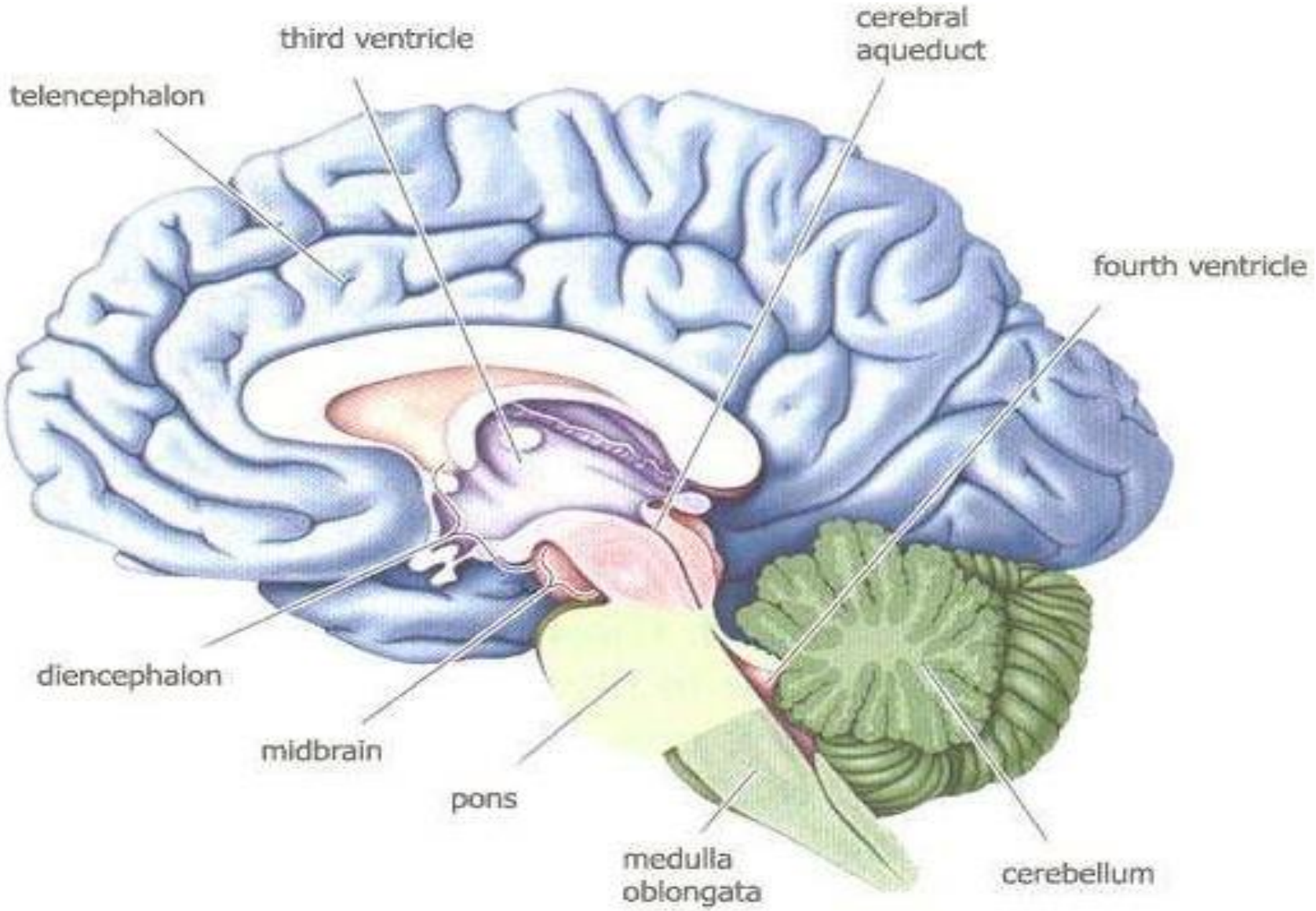
ii) **Mid brain :-** controls involuntary actions and reflex movements of head, neck, eyes etc.

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


www.BrainHealthandPuzzles.com
PARIETAL LOBE
FRONTAL LOBE
TEMPORAL LOBE
PONS
MEDULLA OBLONGATA
OCCIPITAL LOBE
CEREBELLUM
SPINAL CORD

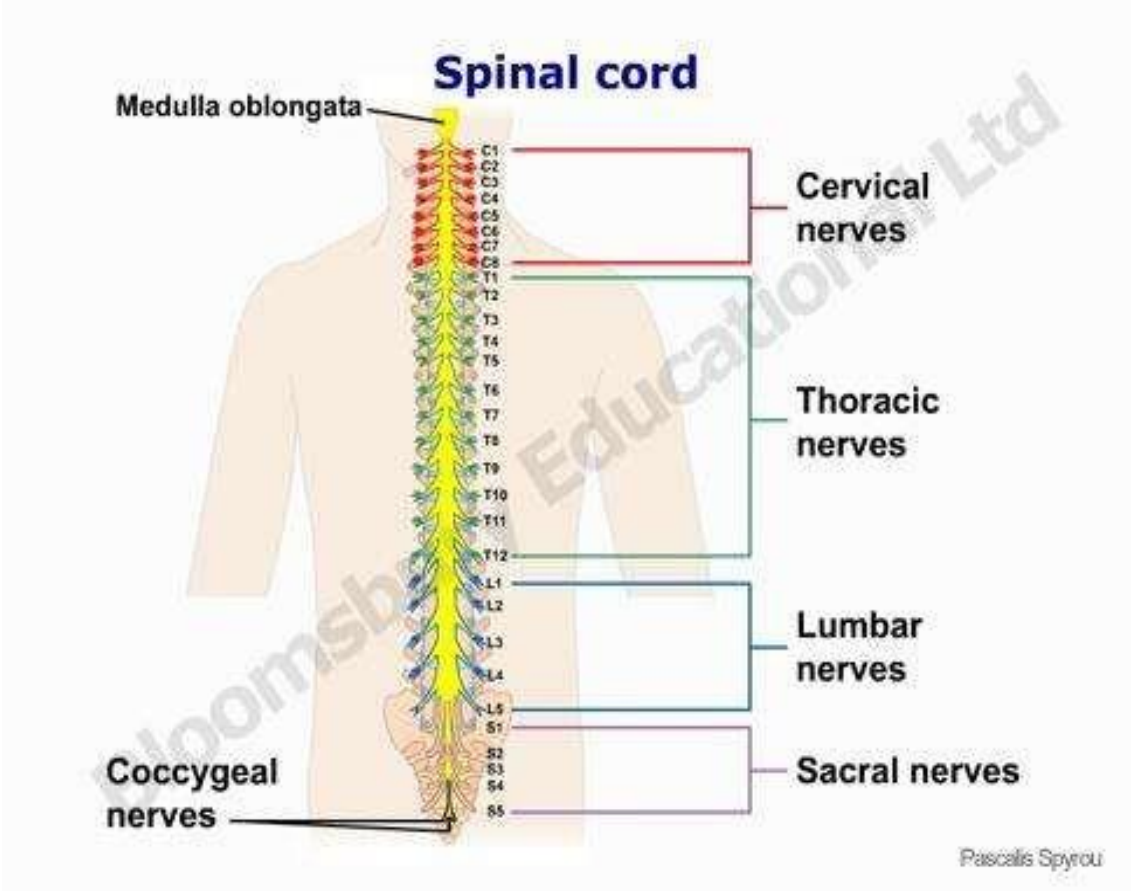
HUMAN BRAIN


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

d) Spinal cord :-

The spinal cord starts from the brain and extends through the vertebral column. It has 31 pairs of spinal nerves.

It carries messages to and from the brain. It also controls reflex actions.

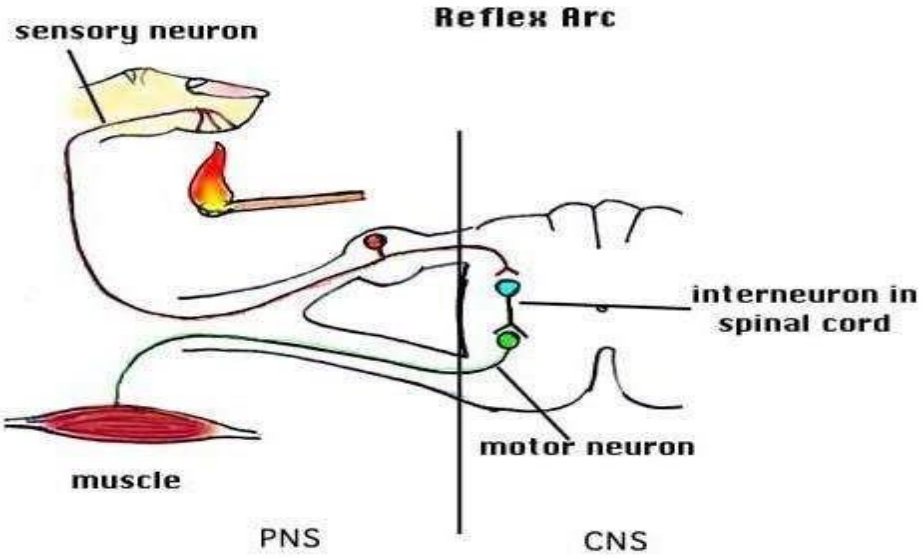


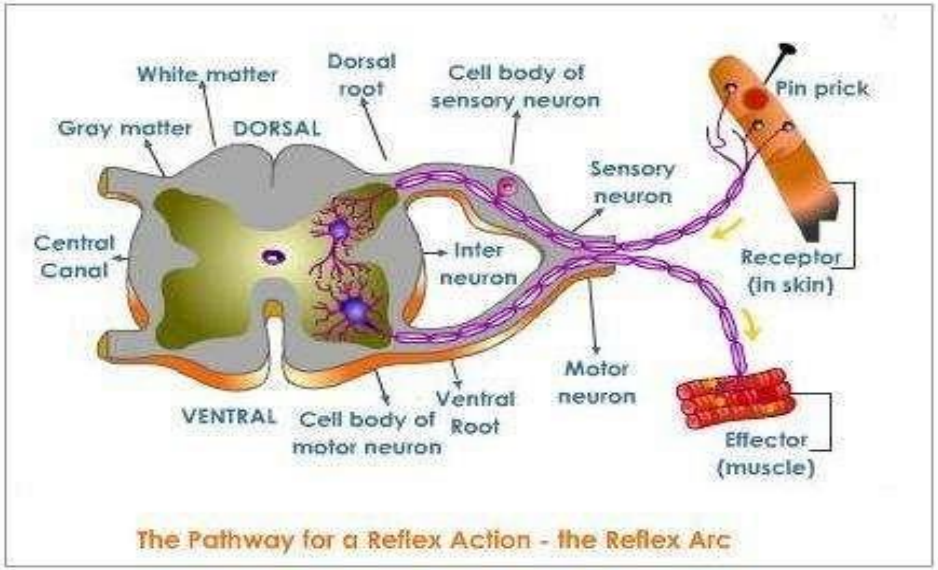
4a) Reflex action :-

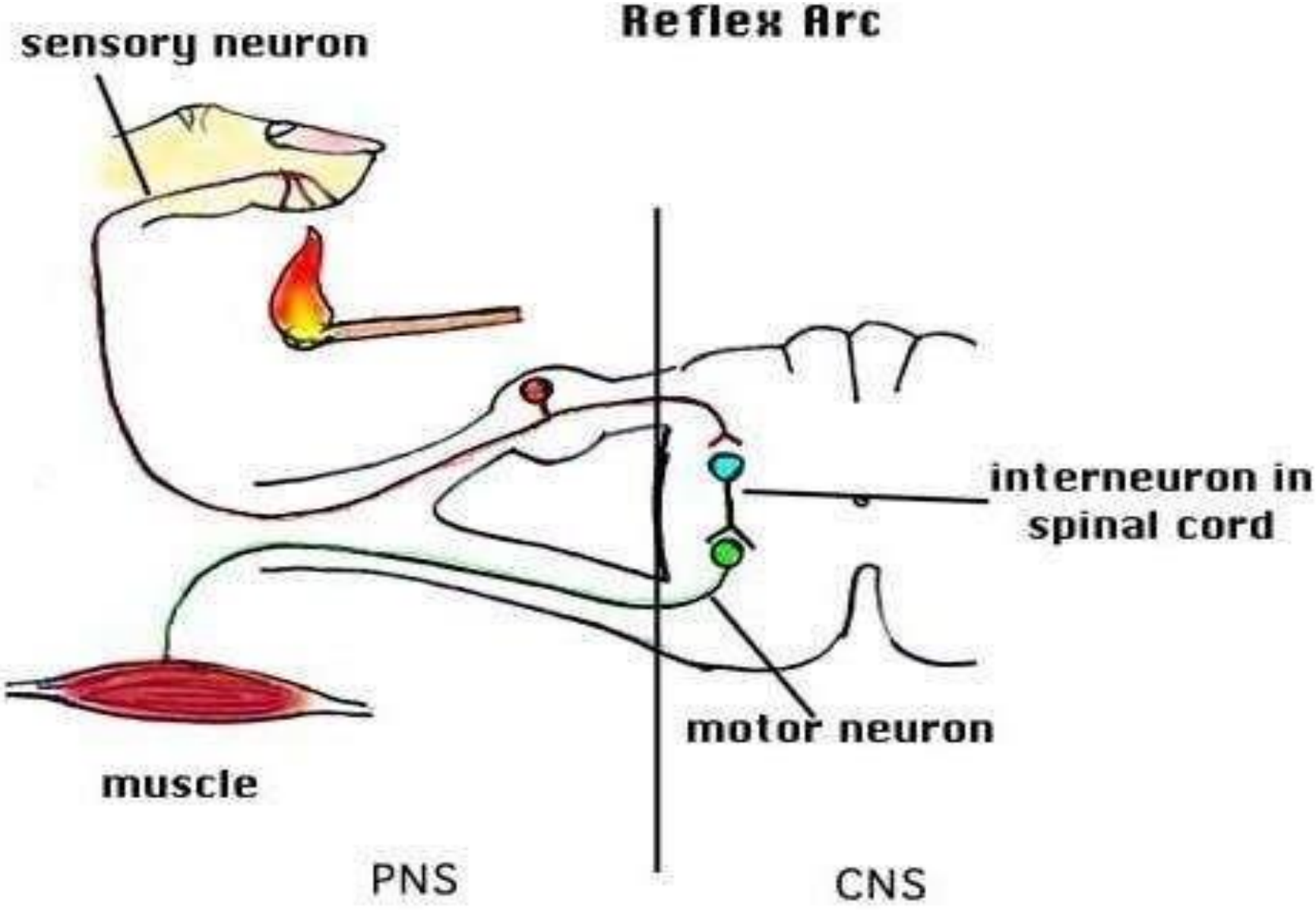
Reflex action is a sudden, unconcious and involuntary response of the effectors to a stimulus.

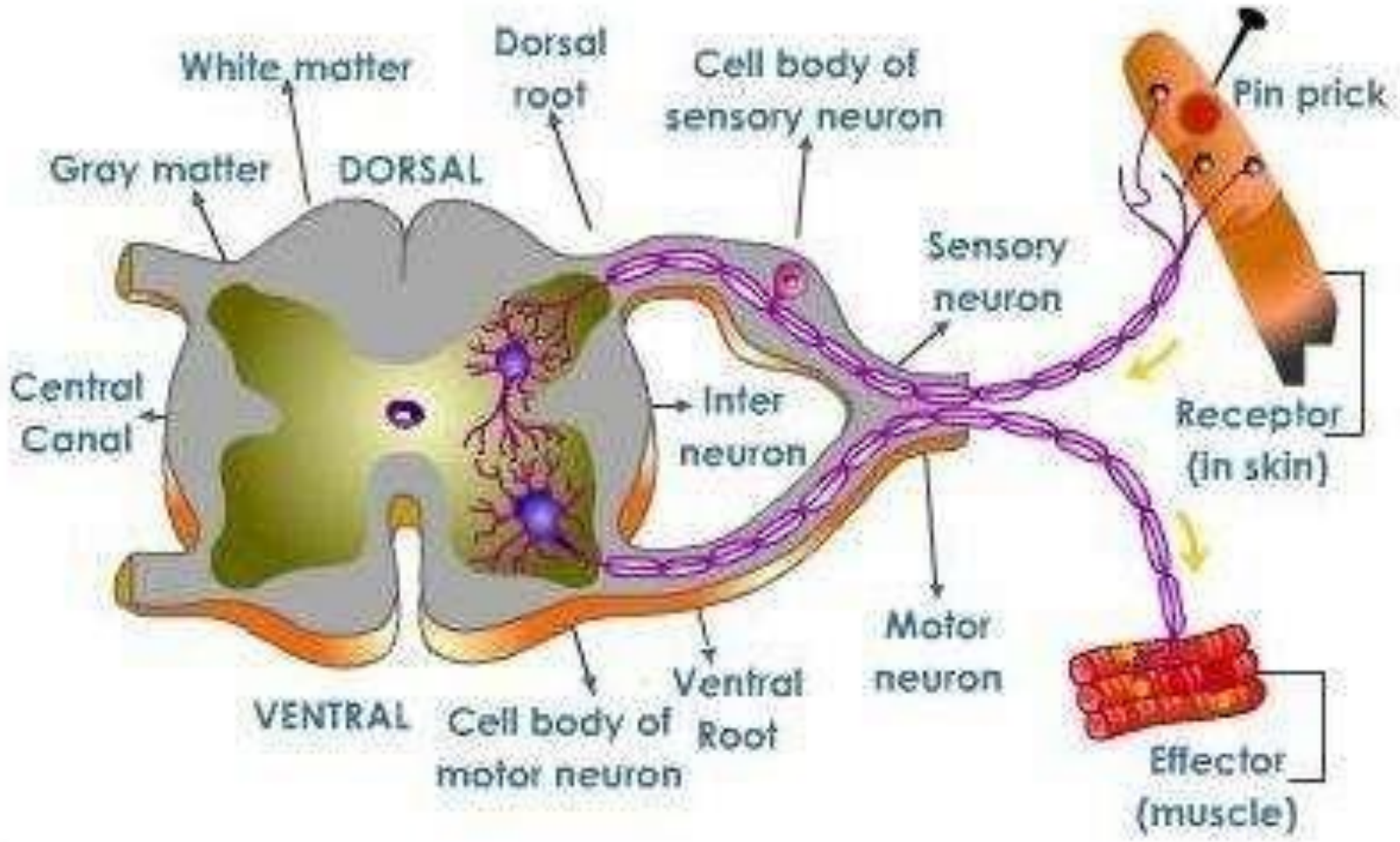
Eg :- We suddenly withdraw our hand if we suddenly touch a hot object.

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.



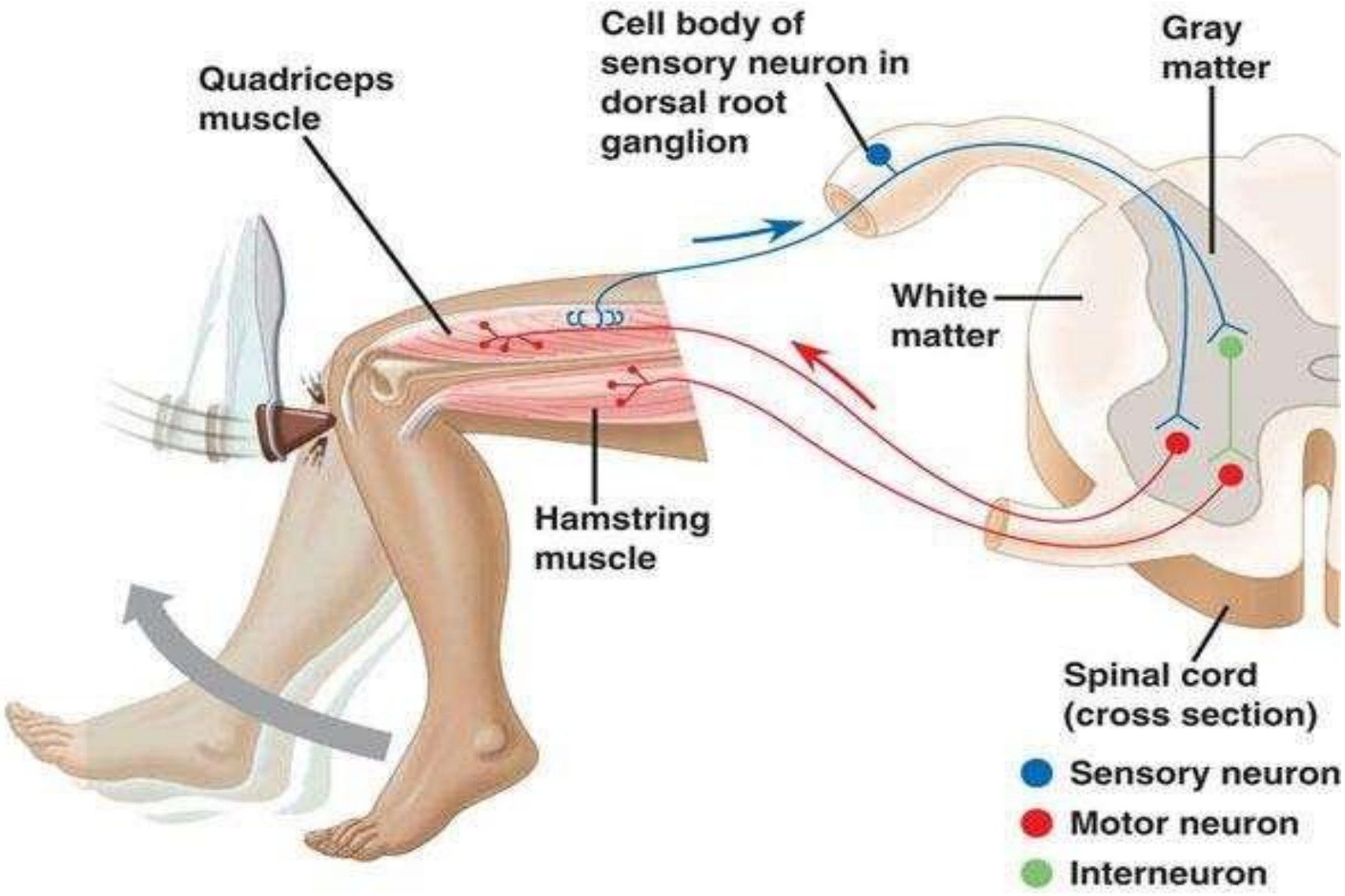



Reflex Arc
sensory neuron
interneuron in spinal cord
motor neuron
muscle
PNS
CNS



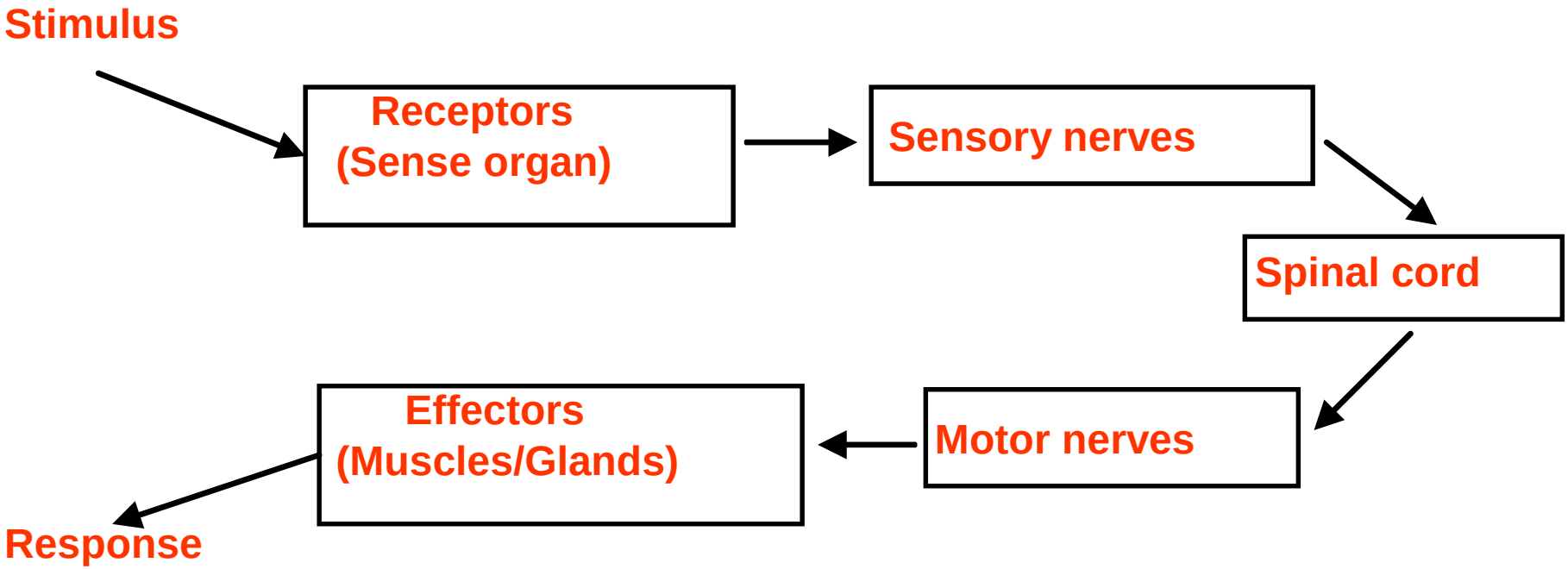
The Pathway for a Reflex Action - the Reflex Arc

REFLEX ACTION

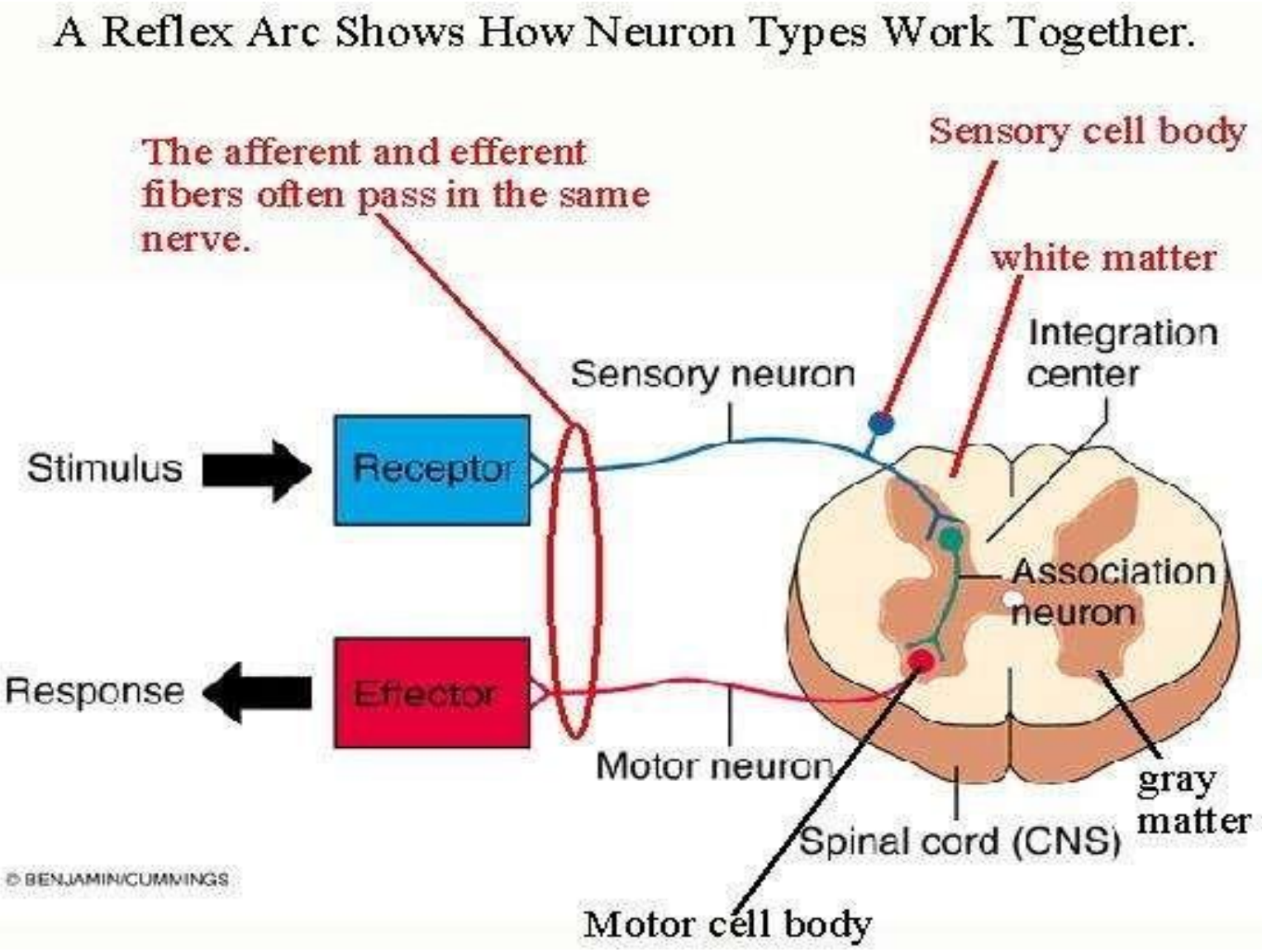


b) Reflex arc :-

The pathway of a reflex action is called reflex arc. In a reflex arc the stimulus is received by the receptors (sense organs) and it passes through the sensory nerves to the spinal cord. From the spinal cord the information passes through the motor nerves to the effectors (muscles/glands) for the response.



REFLEX ARC


A Reflex Arc Shows How Neuron Types Work Together.
The afferent and efferent fibers often pass in the same nerve.
Sensory cell body
white matter
Integration center
Sensory neuron
Stimulus
Receptor
Association neuron
Response
Effector
Motor neuron
gray matter
Spinal cord (CNS)
Motor cell body
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5) Coordination in plants :-

In plants control and coordination is done by chemical substances called plant hormones or phytohormones.

There are five main types of plant hormones. They are :- Auxins, Gibberillins, Cytokinins, Abscisic acid and Ethylene.

i) Auxins :- help in cell division, cell elongation and growth.

ii) Gibberillins :- help in growth of stem and branches.

iii) Cytokinins:- help in cell division, formation of fruits and seeds.

iv) Abscisic acid :- inhibits growth and affects wilting of leaves.

vi) Ethylene :- helps in flowering and ripening of fruits.

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.

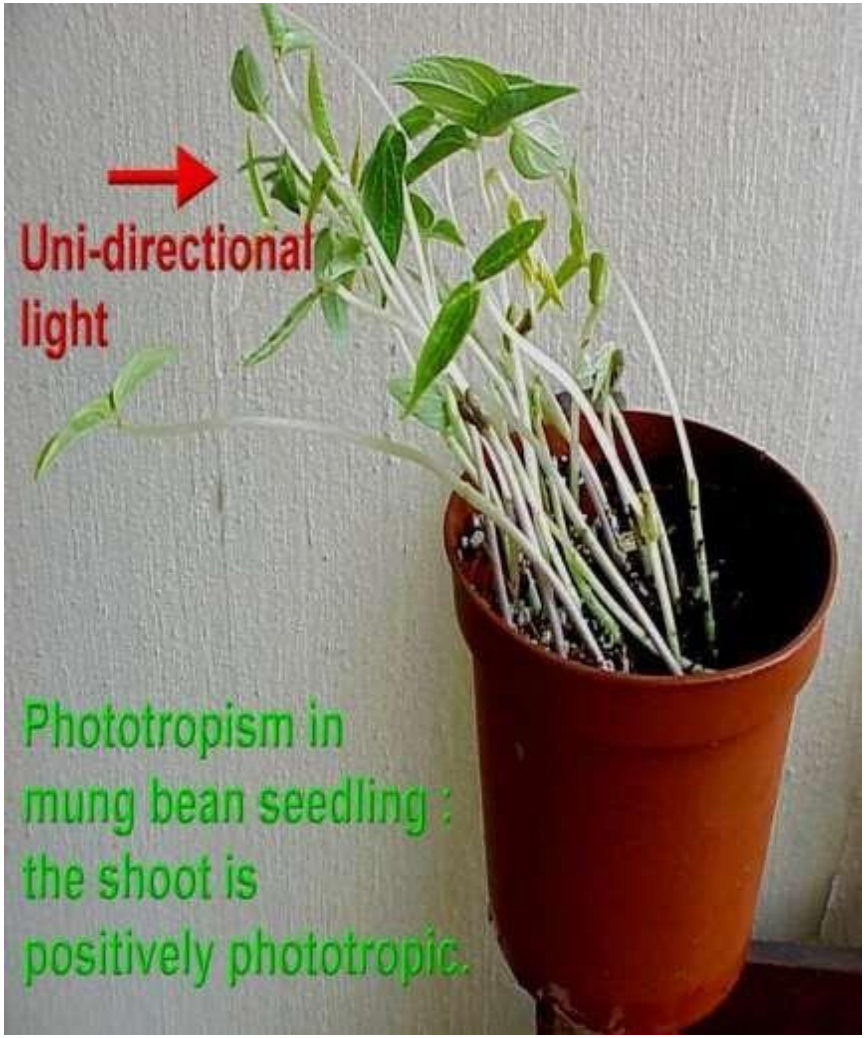
i) **Phototropism :-** is movement of plants in response to light. If it is towards light, it is called positive phototropism. Eg:- Bending of shoot towards light. If it is away from light, it is called negative phototropism. Eg:- Bending of root away from light.

ii) **Geotropism :-** is the movement of plants in response to gravity. If it is towards gravity it is called positive geotropism. Eg:- Downward growth of roots. If it is away from gravity it is called negative geotropism. Eg:- Upward growth of shoot.

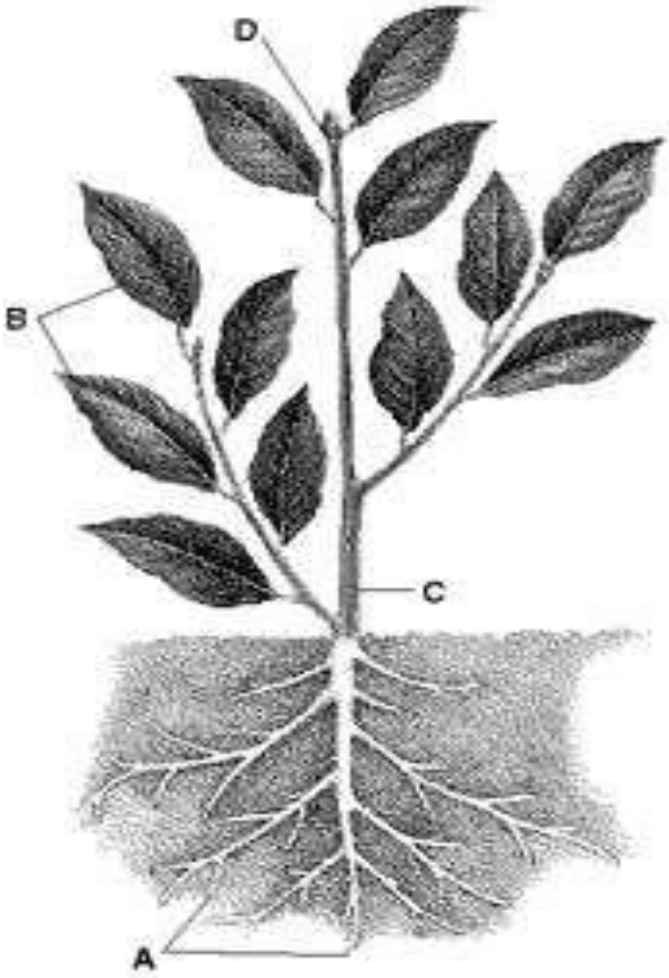
iii) **Chemotropism :-** is movement of plant in response to chemical stimuli. Eg:- Growth of pollen tube towards the ovule.

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

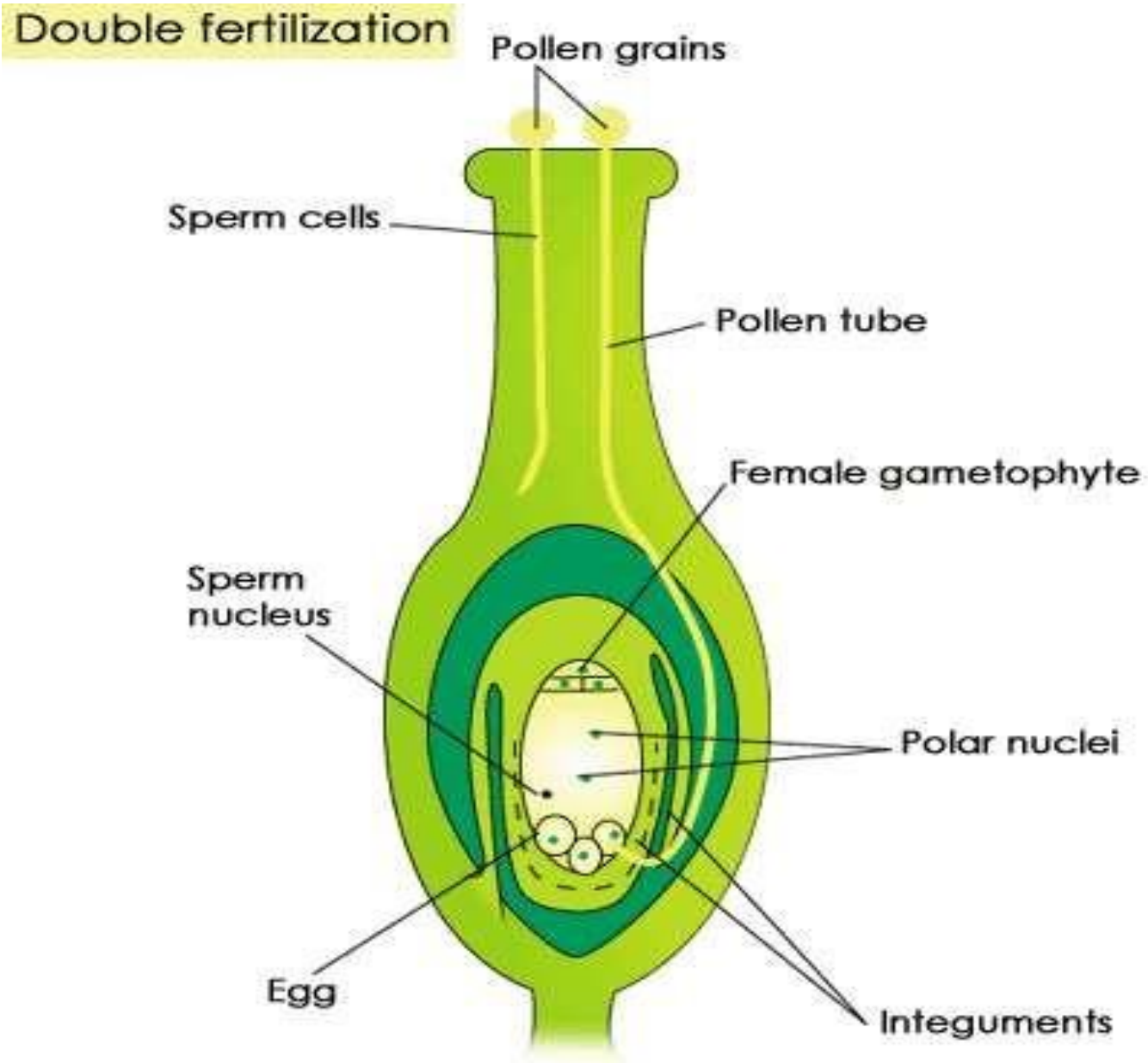
PHOTOTROPISM



GEOTROPISM



CHEMOTROPISM



b) Nastic movements :- are 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.

7) Endocrine glands in human beings :-

The endocrine glands also help in control and coordination. The endocrine glands produce chemical substances which help to control and coordinate various activities in the body.

The endocrine glands in our body are :- pineal, hypothalamus, pituitary, thyroid, parathyroid, thymus, adrenal, pancreas, testes and ovary.

Examples of coordination by endocrine glands :-

i) When we are frightened or angry, the adrenal glands produce more adrenalin hormone which is sent through the blood to the heart, rib muscles and diaphragm. This increases breathing rate to supply more oxygen to the muscles to prepare the body to either run away or fight with the enemy.

ii) Iodine is needed by the thyroid gland to produce the hormone thyroxin. Thyroxin controls the metabolism of carbohydrates, fats and proteins and helps in proper growth. If the diet is deficient in iodine it causes goitre.

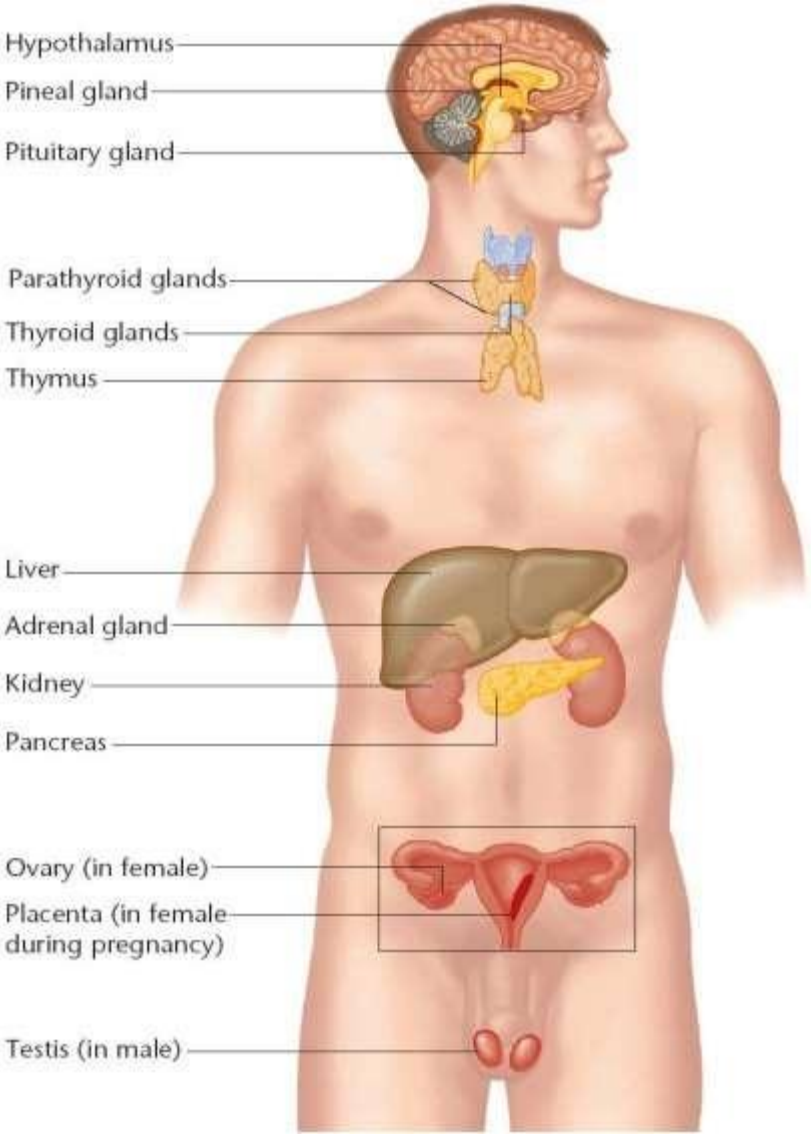
iii) The pituitary gland produce growth hormones. Deficiency of this hormone in childhood causes dwarfism. Excess of this hormone causes tall growth.

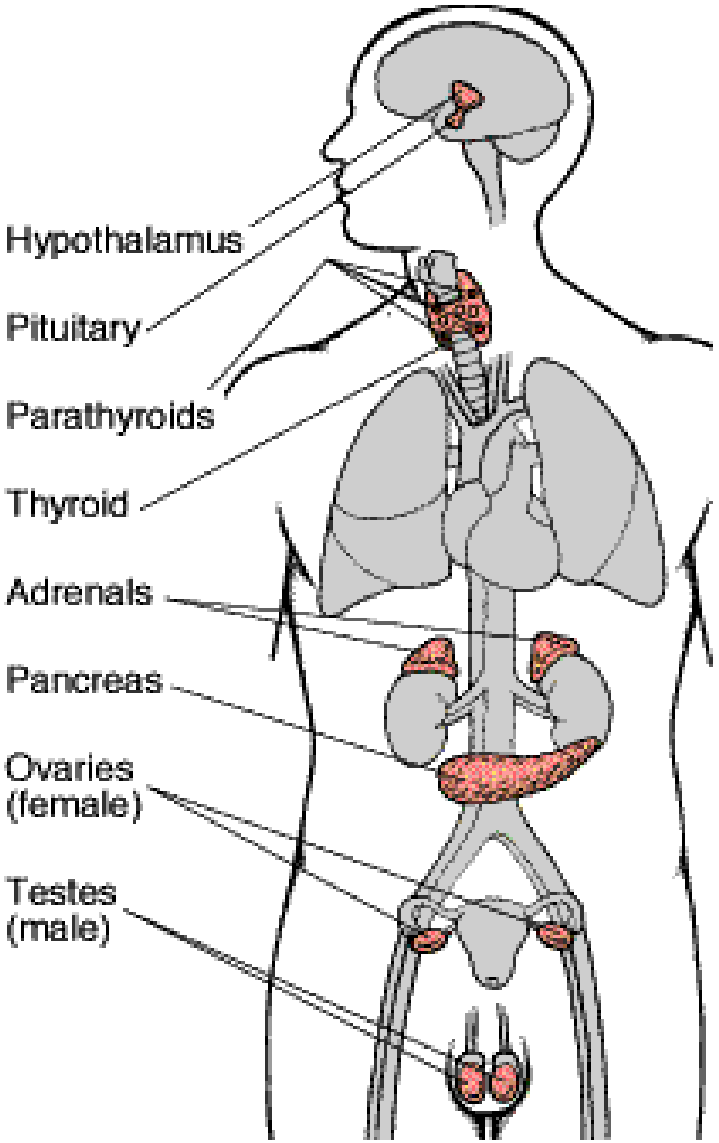
iv) The pancreas produces the hormone insulin which controls the blood sugar level. Increase in blood sugar level causes diabetes. A diabetic patient has to take insulin injections to control his blood sugar level.

v) The testes in males produces the hormone testosterone which controls the production of sperms and changes during puberty.

The ovary in females produces the hormone oestrogen which controls the

ENDOCRINE GLANDS IN HUMAN BEINGS





ENDOCRINE GLANDS IN HUMAN BEINGS