Neural Control and Coordination

Prepared by Mr. John Ebenezer

MULTIPLE CHOICE QUESTIONS

1. Chemicals which are released at the synaptic junction are called

a. Hormones

b. Neurotransmitters

c. Cerebrospinal fluid

d. Lymph

Ans: b. Neurotransmitters

2. The potential difference across the resting membrane is negative. This is due to the differential distribution of the following ions

a. Na^+ and K^+

b. CO_3^{++} and CI

c. Ca^{++} and Mg^{++}

d. Ca^{++} and CI

Ans: a. Na^+ and K^+

3. Resting membrane potential is maintained by

a. Hormones

b. Neurotransmitters

c. Ion pump

d. None of the above

Ans: c. Ion pump

4. The function of our visceral organs is controlled by

a. Sympathetic and somatic neural system

b. Sympathetic and parasympathetic neural system

c. Central and somatic nervous system

d. None of the above

Ans: b. Sympathetic and parasympathetic neural system

5. Which of the following is not involved in Knee-jerk reflex?

a. Muscle spindle

b. Motor neuron

c. Brain

d. Interneurons

Ans: c. Brain

6. An area in the brain which is associated with strong emotions is

a. Cerebral cortex

b. Cerebellum

c. Limbic system

d. Medulla

Ans: c. Limbic system

1. What are the two major parts of neural system?

The human neural system is divided into two parts:

(i) the central neural system (CNS)

(ii) the peripheral neural system (PNS)

2. Describe the peripheral nervous system.

The PNS comprises of all the nerves arise from brain and spinal cord.

The nerve fibres of the PNS are of two types:

(a) afferent fibres

(b) efferent fibres

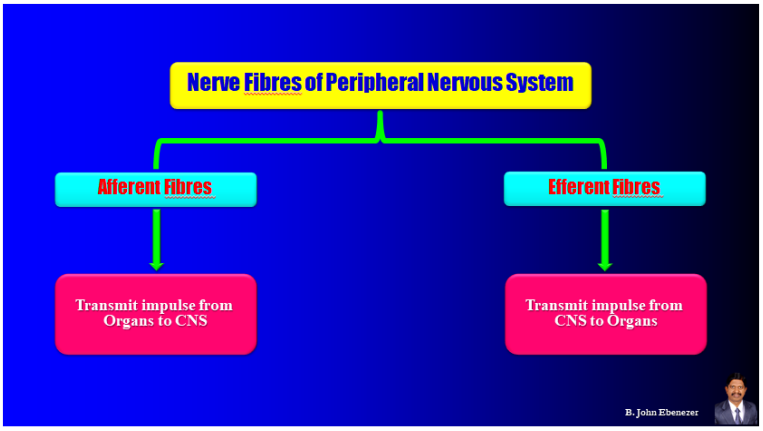
The afferent nerve fibres transmit impulses from tissues/organs to the CNS and the efferent fibres transmit regulatory impulses from the

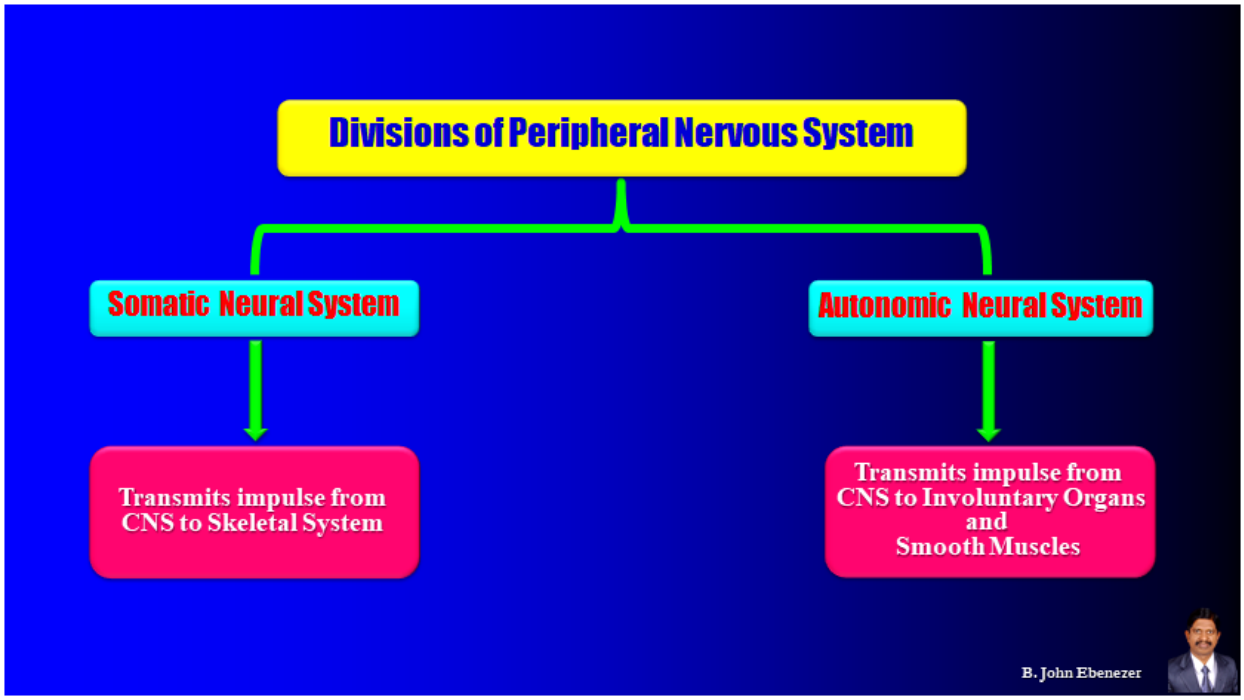
CNS to the concerned peripheral tissues/organs.

The PNS is divided into two divisions called **somatic neural system** and **autonomic neural system**. The somatic neural system relays impulses from the CNS to skeletal muscles while

the autonomic neural system transmits impulses from the CNS to the involuntary organs and smooth muscles of the body.

The autonomic neural system is further classified into **sympathetic neural system** and **parasympathetic neural system**.





3. Describe the parts of a neuron and their functions.

A neuron is a microscopic structure composed of three major parts, namely, cell body, dendrites and axon.

The cell body contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

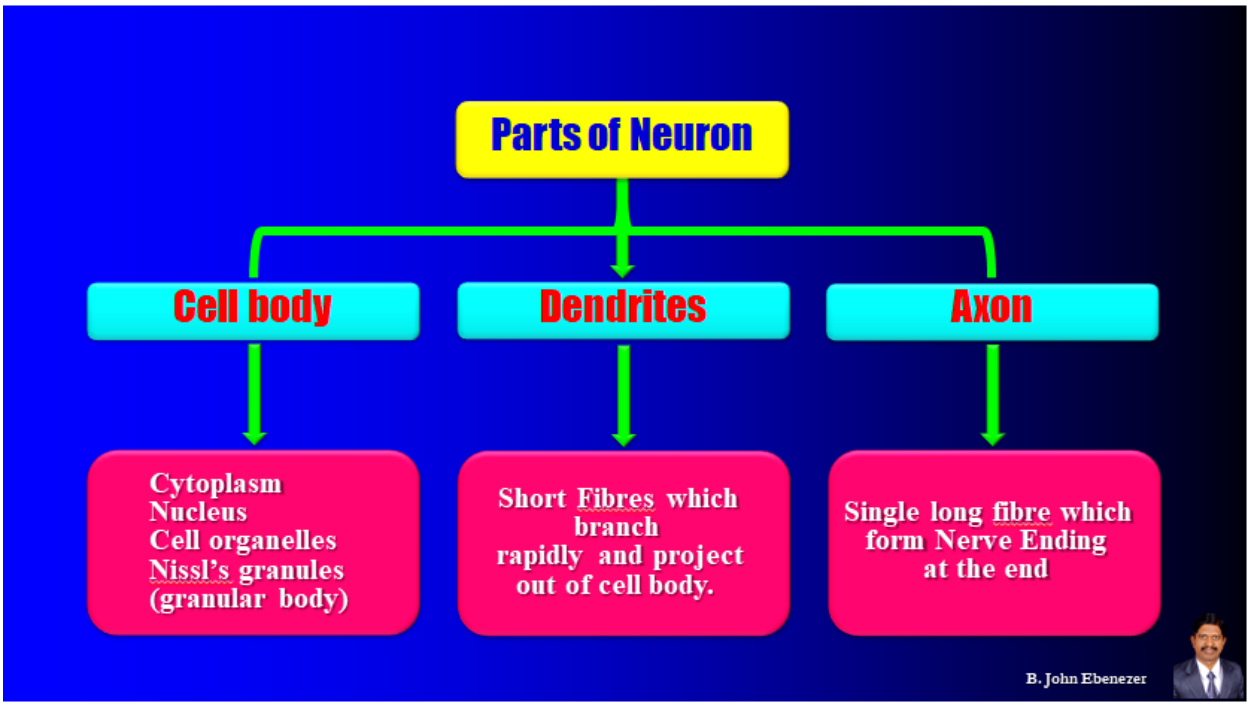
Short fibres which branch repeatedly and project out of the cell body also contain Nissl's granules and are called dendrites.

These fibres transmit impulses towards the cell body.

The axon is a long fibre, the distal end of which is branched.

Each branch terminates as a bulb-like structure called **synaptic knob** which possess synaptic vesicles containing chemicals called **neurotransmitters**.

The axons transmit nerve impulses away from the cell body to a synapse or to a neuro-muscular junction.



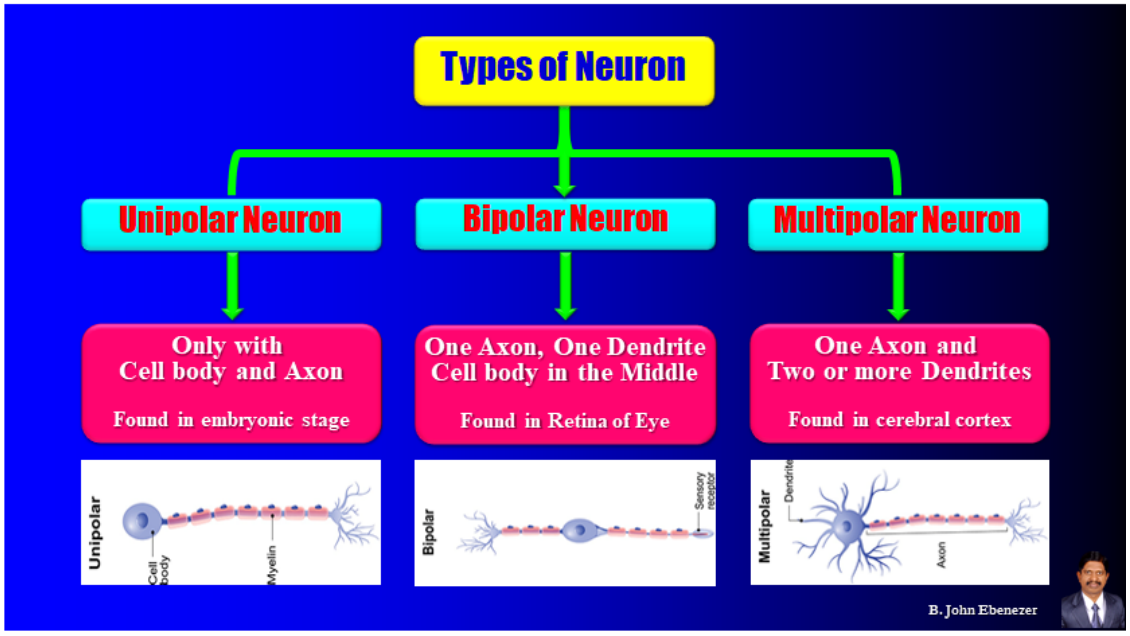
4. Describe the classification of neurons based on the number of axon and dendrites.

Based on the number of axon and dendrites, the neurons are divided into three types,

Unipolar (cell body with one axon only; found usually in the embryonic stage).

Bipolar (with one axon and one dendrite, found in the retina of eye) and

Multipolar (with one axon and two or more dendrites; found in the cerebral cortex).



5. How will you classify the neurons based on the type of axons? Mention their locations.

There are two types of axons, namely, myelinated and nonmyelinated axons.

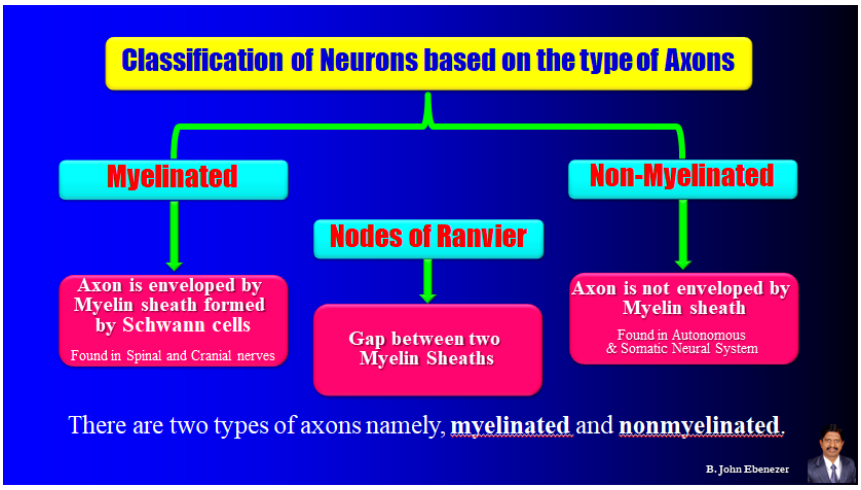
The myelinated nerve fibres are enveloped with Schwann cells, which form a myelin sheath around the axon.

The gaps between two adjacent myelin sheaths are called nodes of Ranvier.

Myelinated nerve fibres are found in spinal and cranial nerves.

Non-myelinated nerve fibre is enclosed by a Schwann cell that does not form a myelin sheath around the axon.

Non-myelinated nerve fibre is found in autonomous and the somatic neural systems.

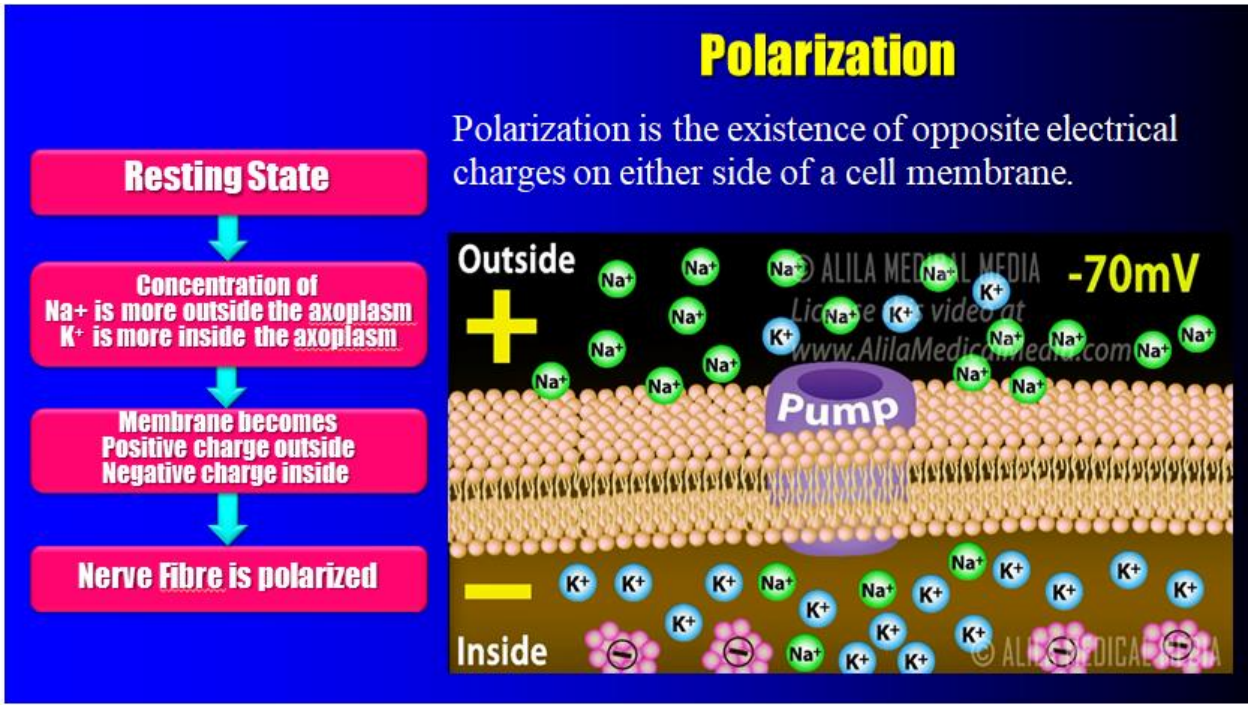


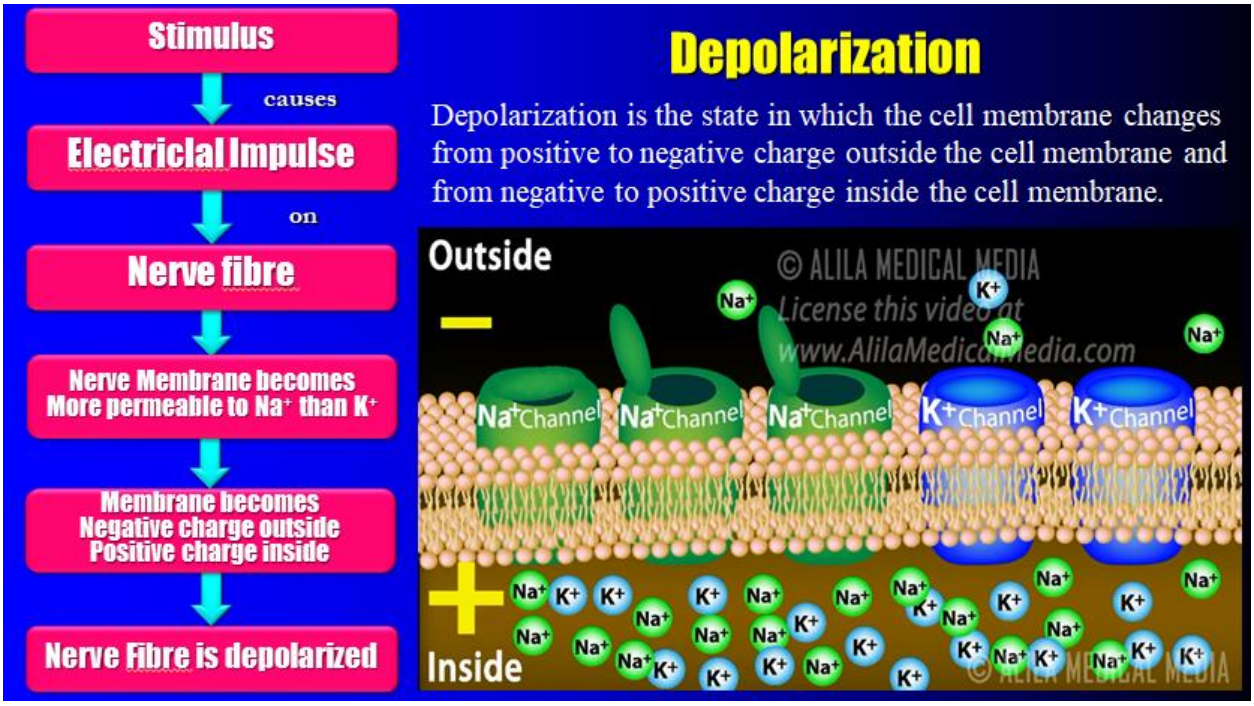
6. **Describe the following:**

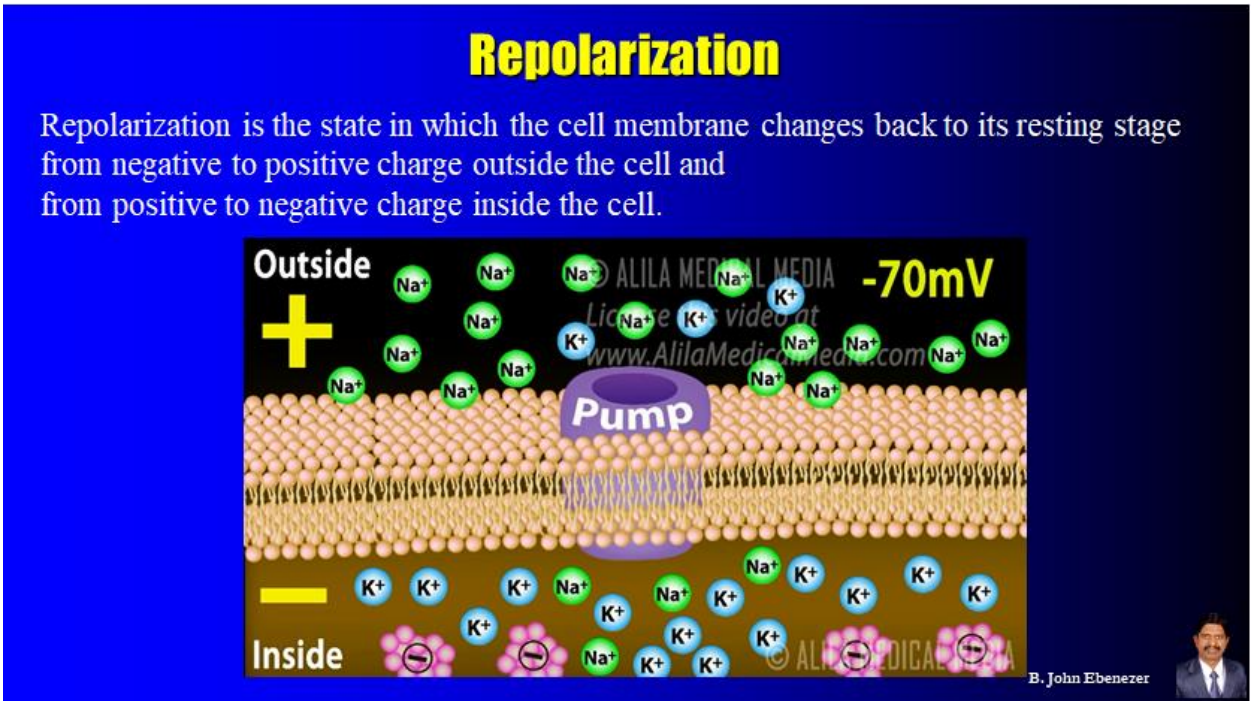
Polarization

Depolarization

Repolarization







Polarization is the existence of opposite electrical charges on either side of a cell membrane.

Depolarization is the state in which the cell membrane changes from positive to negative charge outside the cell membrane and from negative to positive charge inside the cell membrane.

Repolarization is the state in which the cell membrane change back to its resting stage i.e from negative to positive charge outside the cell and from positive to negative charge inside the cell.

7. Explain the transmission of nerve impulses with a neat and labeled diagram showing axon terminal and synapse.

A nerve impulse is transmitted from one neuron to another through junctions called synapses.

A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron, which may or may not be separated by a gap called synaptic cleft.

There are two types of synapses, namely, electrical synapses and chemical synapses.

At electrical synapses, the membranes of pre- and post-synaptic neurons are in very close proximity.

Electrical current can flow directly from one neuron into the other across these synapses.

Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon.

Impulse transmission across an electrical synapse is always faster than that across a chemical synapse.

Electrical synapses are rare in our system.

At a chemical synapse, the membranes of the pre- and post-synaptic neurons are separated by a fluid-filled space called **synaptic cleft**

Chemicals called neurotransmitters are involved in the transmission of impulses at these synapses.

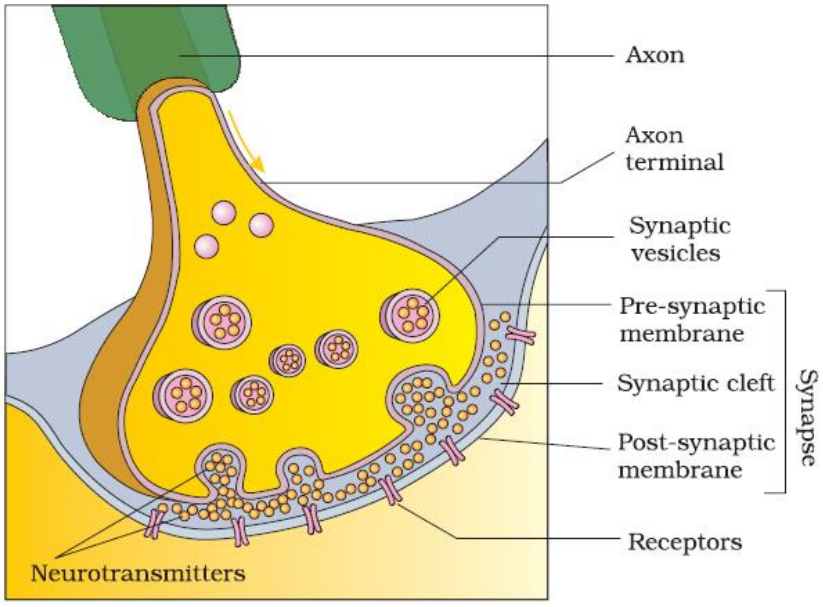
The axon terminals contain vesicles filled with these neurotransmitters.

When an impulse (action potential) arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards the membrane where they fuse with the plasma membrane and release their neurotransmitters in the synaptic cleft.

The released neurotransmitters bind to their specific **receptors**, present on the post-synaptic membrane.

This binding opens ion channels allowing the entry of ions which can generate a new potential in the post-synaptic neuron.

The new potential developed may be either excitatory or inhibitory.



8. Name the parts of human brain.

The human brain is divided into three major parts:

(i) Forebrain, (ii) Midbrain, and (iii) Hindbrain

9. Name the parts of forebrain. What forms the major part of the human brain?

The forebrain consists of cerebrum, thalamus and hypothalamus. Cerebrum forms the major part of the human brain.

10. What divides the cerebrum into left and right cerebral hemispheres?

A deep cleft divides the cerebrum longitudinally into two halves, which are termed as the Left and Right Cerebral hemispheres.

11. What is corpus callosum?

The cerebral hemispheres are connected by a tract of nerve fibres called corpus callosum.

12. What is cerebral cortex?

The layer of cells which covers the cerebral hemisphere is called cerebral cortex.

13. How is the human brain protected? Name the three cranial meninges.

The human brain is well protected by the skull. Inside the skull, the brain is covered by cranial meninges consisting of

Dura mater is the outer layer

Arachnoid is a very thin middle layer

Piamater is an inner layer which is in contact with the brain tissue.

14. Where is hypothalamus located? What is its function?

Hypothalamus lies at the base of the thalamus.

The hypothalamus contains a number of centres.

They control

Body temperature

Appetite and

Drinking

Hypothalamus also contains several groups of neurosecretory cells. They secrete hormones called hypothalamic hormones.

15. Why is the cerebral cortex referred to as grey matter? What does it control?

The cerebral cortex is referred to as the **grey matter** due to its greyish appearance.

The neuron **cell bodies** are concentrated here giving the grey colour.

It is involved in muscle control, and sensory perception such as seeing and hearing, memory, emotions, speech, decision making, and self-control.

16. What is white matter? Mention its function.

White matter is found in the **subcortical** region of the cerebrum.

It contains **axons** which are surrounded by myelin sheath.

Myelin gives the white matter its color.

It protects the nerve fibers from injury.

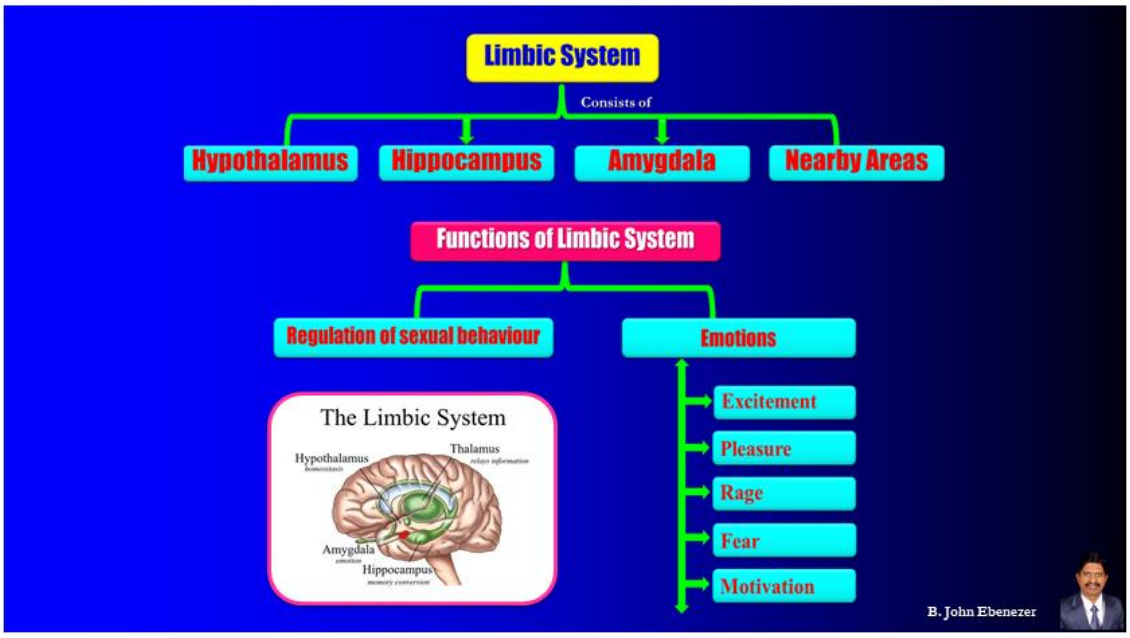
It improves the speed and transmission of electrical impulses along the axons.

17. What is a limbic system? What are its functions?

The limbic system is a complex set of structures that lies on both sides of the thalamus, just under the cerebrum.

It includes hypothalamus, hippocampus, amygdala, and several other nearby areas.

It is involved in the regulation of sexual behaviour, emotions such as excitement, pleasure, rage, fear and motivation.



18. Where is midbrain located? Describe its structure and functions.

The midbrain is located between the thalamus of the forebrain and pons of the hindbrain.

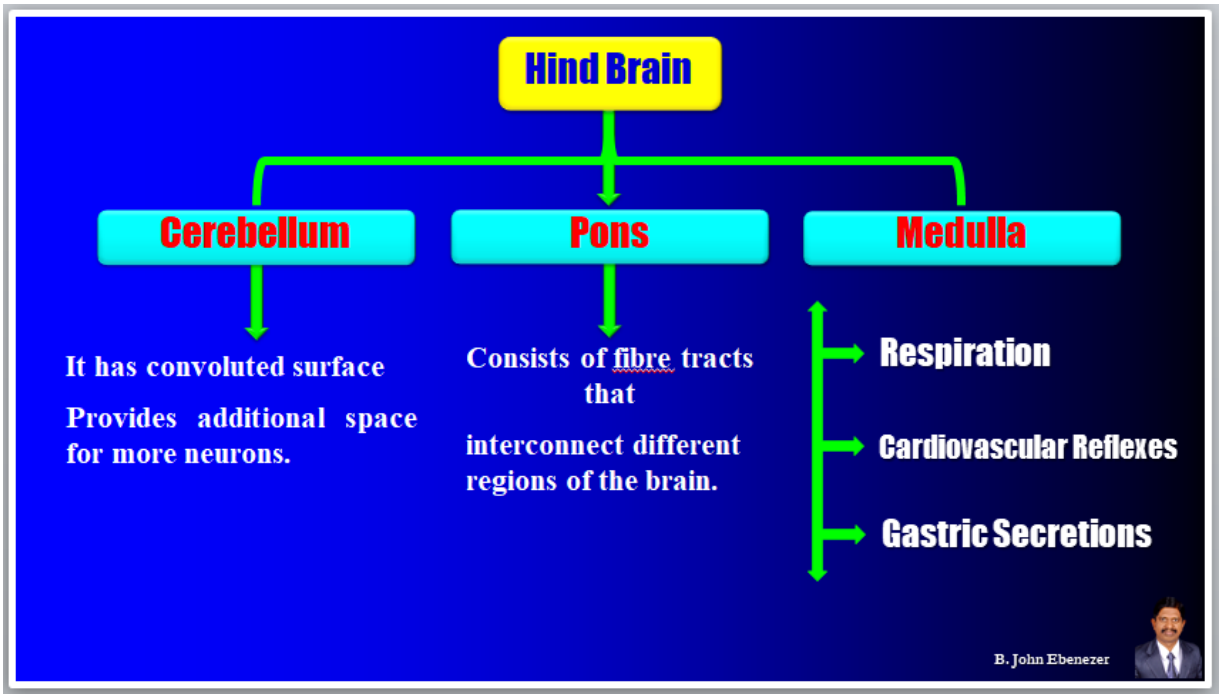
A canal called the cerebral aqueduct passess through the midbrain

The dorsal portion of the midbrain consists of four round swellings (lobes) called **corpora quadrigemina**.

Midbrain and hindbrain form the brain stem.

The midbrain controls motor movement, particularly **movements of the eye, and auditory and visual processing.**

19. Describe the structure and functions of hind brain with the help of a neat and labeled diagram.



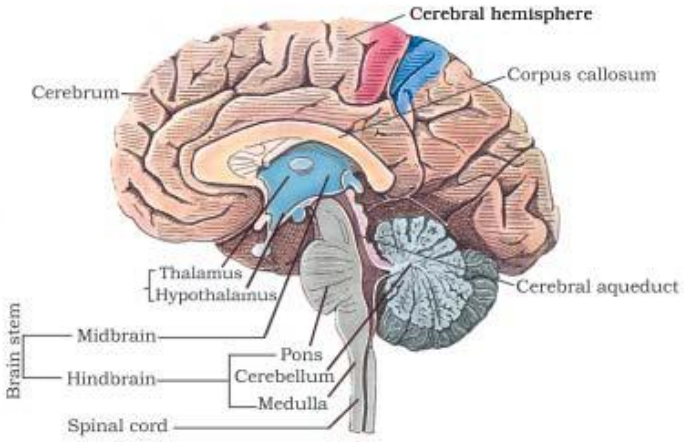
The hindbrain comprises **cerebellum, Pons** and **Medulla** (also called the medulla oblongata).

Cerebellum has very convoluted surface in order to provide the additional space for many more neurons.

Pons consists of fibre tracts that interconnect different regions of the brain.

The medulla of the brain is connected to the spinal cord.

The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions.



20. Differentiate between thalamus and hypothalamus.

Thalamus	Hypothalamus
It consists of grey matter only	It consists of white and grey matter
It does not secrete hormones	It secretes several hormones that control the activity of pituitary gland
It is located above the midbrain	It is located at the base of the thalamus
It has the center for sensations namely - cold, pain, heat	It has the center for sensations namely – regulating body temperature, homeostasis, blood pressure

21. Differentiate between cerebrum and cerebellum.

Cerebrum	Cerebellum
Cerebrum is the largest part of brain.	Cerebellum is the second largest part of the brain.
It is part of forebrain.	It is part of hindbrain.
It is divided into two cerebral hemispheres.	It is divided into three lobes namely – central vermis, two lateral cerebral hemispheres.
It is the center for intelligence and memory.	It is the center for posture and body equilibrium.

22. Differentiate between afferent neurons and efferent neurons.

Afferent neurons	Efferent neurons
Afferent neurons are sensory neurons	Efferent neurons are motor neurons
Conduction of sensory impulses from the receptors towards the central nervous system	Conduction of motor impulses from the central nervous system to the responsive or effector organs
Located in sense organs	Found in the brain and the spinal cord

23. Differentiate between impulse conduction in a myelinated nerve fibre and non-myelinated nerve fibre.

Impulse conduction in a myelinated nerve fibre	Impulse conduction in non-myelinated nerve fibre
Impulse is transmitted from node to node	Impulse travels across the length of the nerve fiber
Speed of impulse-conduction is 50 times faster than non-myelinated axon	Comparatively lower
Less amount of energy is expended during the transmission of an impulse	Excess energy is expended during the transmission of an impulse

24. Differentiate between cranial nerves and spinal nerves.

Cranial nerves	Spinal nerves
Human body has 12 pairs of cranial nerves	We have 31 pairs of spinal nerves
Cranial nerves emerge from the brain and extend to other parts of the body	They originate from the spinal cord, extending to other parts of the body
Cranial nerves can be mixed, motor or sensory	Spinal nerves are mixed nerves

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