

CLASS - 10

DATE - 21.10.2024

SUBJECT - BIOLOGY

TEACHER - Nidhi Rana

CHAPTER - 10 NERVOUS SYSTEM.

All living organisms respond to stimuli, hence they require a rapid communication system (internally). Coordination in mammals is achieved through endocrine system and nervous system. Nervous system consists of nerve cells and tissues that convey the information between sensory cells and organs. It controls and coordinates different systems of the body.

Functions of nervous system -

- 1) It controls and coordinates various body activities - both voluntary and involuntary.
- 2) It enables us to think, remember, and to reason out.
- 3) It keeps us informed about the outside world through sense organs and react to it.

All outside stimuli are perceived by nervous system through sense organs.

Structure of Neuron - Nerve Cell

Our nervous system consists of brain, spinal cord, sense receptors and nerves. Brain and spinal cord are made up of nerve cells called neurons. Neuron is the basic unit of Nervous system - its structural and functional unit.

Each neuron is made up of 3 distinct regions
- cell body, dendrites and axon.

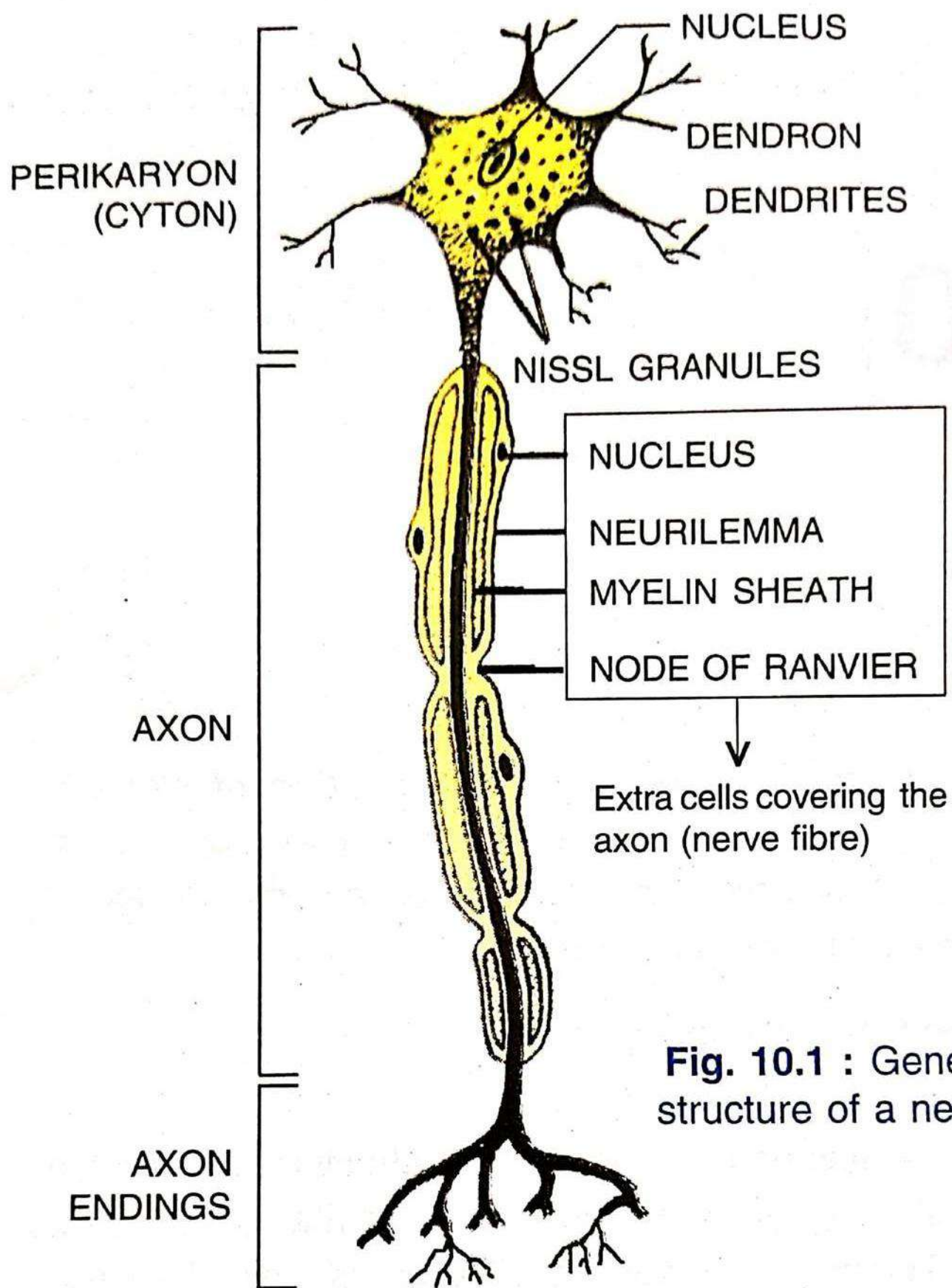


Fig. 10.1 : Generalised structure of a nerve cell.

Cell body - Perikaryon or Cyton - containing all the cell organelles like - nucleus, cytoplasm etc. only centrosome is absent

Dendrites - highly branched extensions of the cytoplasm of cell body. Fine branches help them to reach the tiniest part of body from where they conduct impulses to cytons.

Axon - single long thin fibre/process from cell body enclosed in myelin sheath which is covered by an outermost thin sheath called neurolemma.

Nodes of Ranvier are the non myelinated gaps between the segments of myelin sheath/ ^{medullary} sheath.

function of myelin sheath - insulates the axon i.e. prevents the mixing of impulses in adjacent fibres.

Axon endings - swollen bulb like ends that store certain chemicals called neurotransmitters

Synapse or Synaptic clefts

Synapse is the point of contact between the terminal branches of axon of a neuron with the dendrites of another neuron separated by a fine gap. Thus it is the functional region between two neurons where the information from one neuron is transmitted to another neuron but there is no protoplasmic connection between the two neurons. Axon terminals are closely placed near the dendrites of another neuron but are not connected.

Transmission of Nerve Impulse.

At the synapse nerve impulse jumps from axon ending of one neuron to dendrite of another neuron. It is a chemical process involving a neurotransmitter. As the impulse reaches the terminal end of axon, a neurotransmitter - Acetylcholine is released. This neurotransmitter sets a new impulse in the dendrites of adjacent neuron. Neurotransmitter is soon broken down by an enzyme to make synapse ready for next transmission.

- 1) Polarised state - Normally the outer surface of neuron carries positive charge. This state is called polarised state. It is due to Na^+ ions outside the axon membrane.
- 2) Excited state - On being stimulated, the axon membrane at that spot becomes more permeable to Na^+ ions which move inwards. Hence the interior of neuron becomes positively charged while the outer surface becomes negatively charged. This is the state of depolarisation.
- 3) This point of depolarisation becomes a stimulus for the next neighbouring area of the membrane, which in turn becomes depolarised.
- 4) Repolarisation - The previous area becomes repolarised due to active transport of Na^+ ions again to the outside. This transport is achieved by using "sodium pump" using energy through ATP.

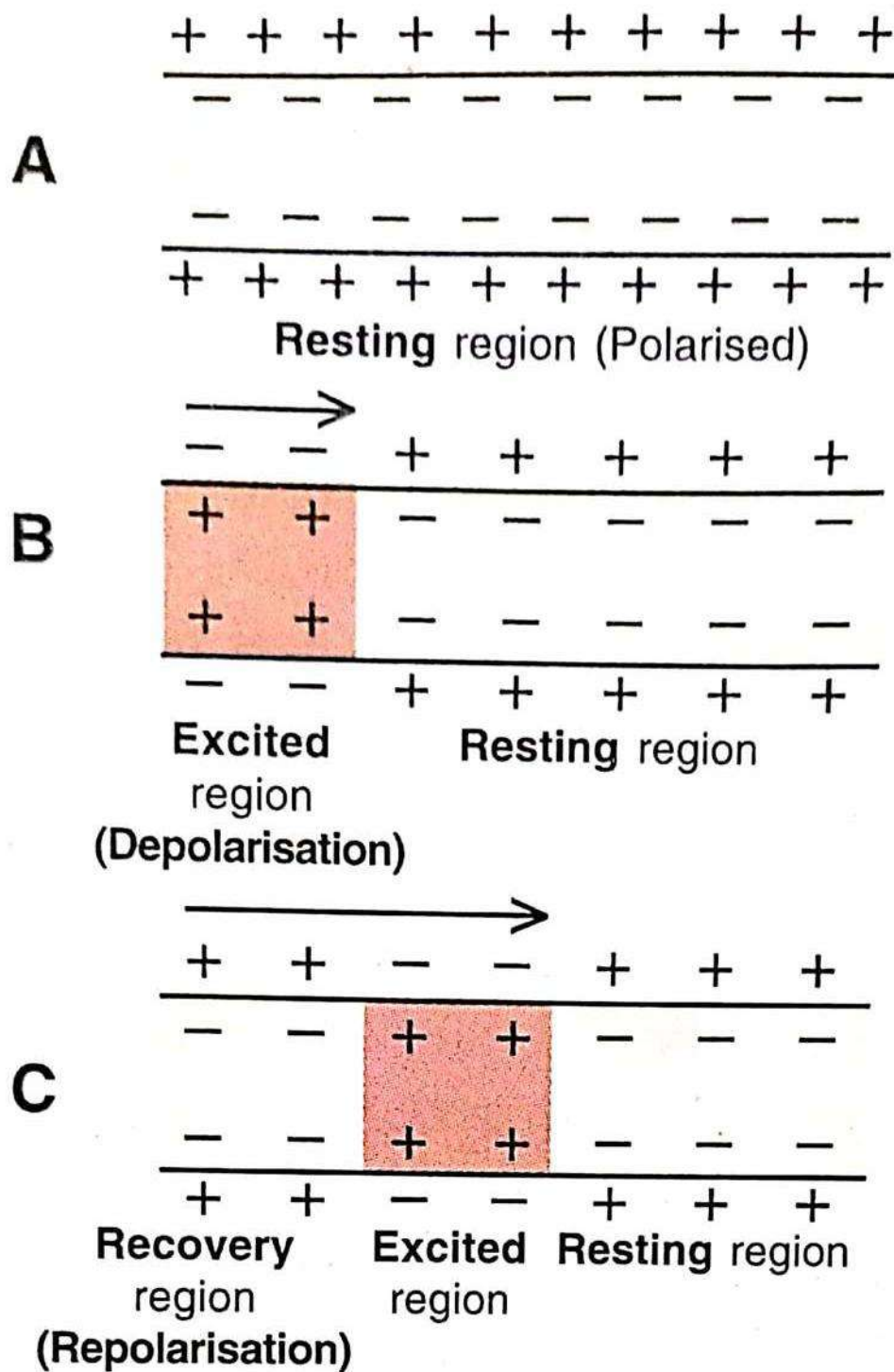


Fig. 10.2 : Conduction of nerve impulse through a nerve fibre

Types of Neurons :-

1. Sensory neuron conveys impulses from receptor (sense organ) to the main nervous system (brain or spinal cord)
2. Motor Neuron carry impulses from main nervous system to an effector (muscle or gland)
3. Association (connecting neuron) are located in brain and spinal cord that interconnect the sensory and motor neurons.

Nerve is a bundle of nerve fibres (axons) of separate neurons, enclosed in a tubular sheath. Three kinds of nerves -

- (i) Sensory Nerve contains only sensory fibres bringing impulses from the receptors (sense organs) to the brain or spinal cord Eg optic nerve
- (ii) Motor Nerve contain only motor fibres which carry impulses from the spinal cord and brain to effector organs like muscles and glands to bring them into action Eg nerve supplying eyeball muscles for rotating the eye.
- (iii) Mixed Nerve They carry both the sensory and motor fibres Eg. Spinal nerve.

Ganglion are aggregates of the nerve cells. (cell bodies) from which the nerve fibres may arise or enter into.

Major Divisions of Nervous System :-

- i) Central Nervous System - Brain and Spinal Cord
- ii) Peripheral Nervous System - includes all the nerves.

Peripheral Nervous system further has 2 parts -

i) Somatic Nervous System - Consisting of Cranial and spinal nerves that conveys information to skeletal (Voluntary) muscles

ii) Autonomic Nervous System includes a pair of chains of ganglion and nerves that control the involuntary actions of the internal organs

Autonomic Nervous system further has 2 parts -

(i) Sympathetic Nervous System - that prepares the body for violent actions against abnormal conditions

(ii) Parasympathetic Nervous System - is concerned with reestablishing normal conditions after the violent act is over.

Let us discuss all the above in detail

THE BRAIN

Cranium/brain box - Brain is protected inside brain box of the skull

Coverings/meninges - Brain is protected by 3 membranous coverings called meninges which continue backwards on spinal cord.

Dura mater - outer most layer, tough fibrous membrane

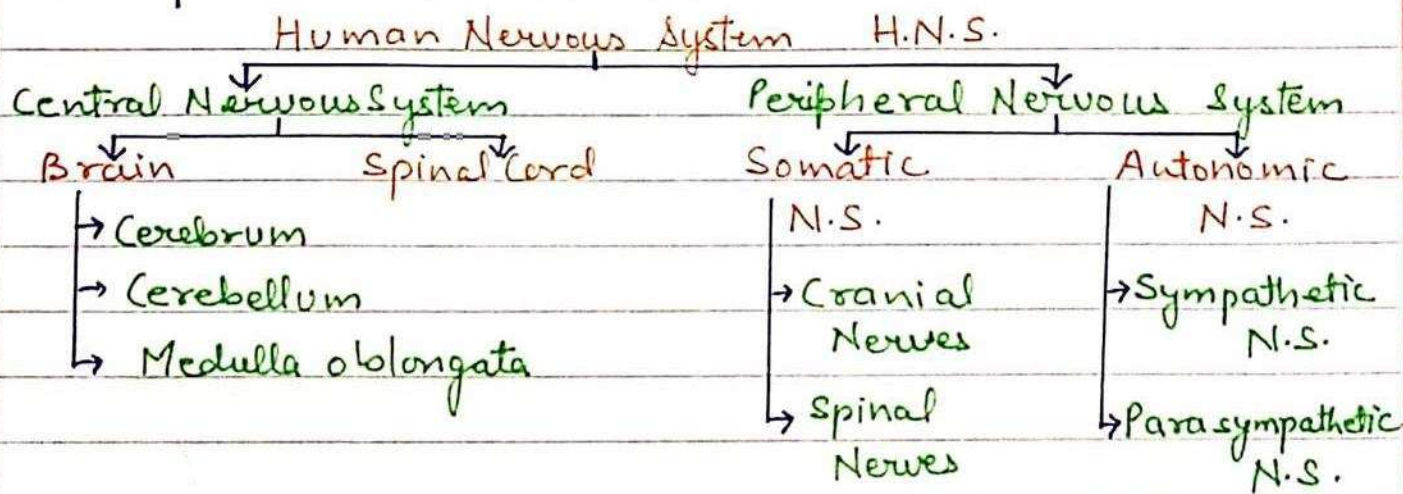
Arachnoid - thin delicate middle layer giving a web-like cushion

Pia mater - innermost highly vascular membrane richly supplied with blood.

Meningitis - Inflammation of meninges (may be due to infection) is called meningitis

Cerebro spinal fluid - Space between the protective coverings (meninges) is filled with a watery fluid called cerebrospinal fluid which acts like a cushion to protect the brain from shocks.

It is also present in the central spaces of brain and central canal of spinal cord. (cavities of brain and spinal cord)



Home Assignment

Q1. Draw a well labelled diagram of Neuron. in note book.

[i.e. D. Descriptive type Q.No 6. [Page No 137]
Review questions]

Q2. Answer the following Review questions in your note book

D Descriptive type

Q No 2 (b) and (c)

C. Short Answer type

Q No 4.