Neural Control and Coordination

CHAPTER 21

NCERT FOCUS

ANSWERS

Topic 1

1. (a) Polarisation of the membrane of a nerve fibre, when neuron is not conducting any impulse, the axonal membrane is comparatively more permeable to potassium ions (K^+) and nearly impermeable to Na^+. The axoplasm inside the axon contains high concentration of K^+ and negatively charged proteins and low concentration of Na^+. In contrast, fluid outside the axon contains low concentration of K^+, a high concentration of Na^+ and thus, forms concentration gradient. The ionic gradients are maintained by sodium potassium pump which transports $3Na^+$ outwards for $2K^+$ into the cell. As a result, outer surface of axonal membrane possesses positive charge while its inner surface becomes negatively charged, therefore, is said to be polarised.

(b) Depolarisation of the membrane of a nerve fibre : During depolarisation, the activation gate of Na^+ channels open and the K^+ channels remain closed. Na^+ rush into the axon. Entry of sodium ions leads to depolarisation (reversal of polarity) of the nerve membrane, so that the nerve fibre contents become electropositive with respect to the extracellular fluid.

(c) Conduction of a nerve impulse along a nerve fibre: Nervous system transmits information as a series of nerve impulses. A nerve impulse is the movement of an action potential as a wave through a nerve fibre. Action potentials are propagated, that is, self-generated along the axon. The events that set up an action potential at one spot on the nerve fibre also transmit it along the entire length of the nerve fibre. The action potential then moves to the neighbouring region of the nerve fibre till it covers the whole length of the fibre.

(d) Transmission of a nerve impulse across a chemical synapse : 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 burst to 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.

Topic 2

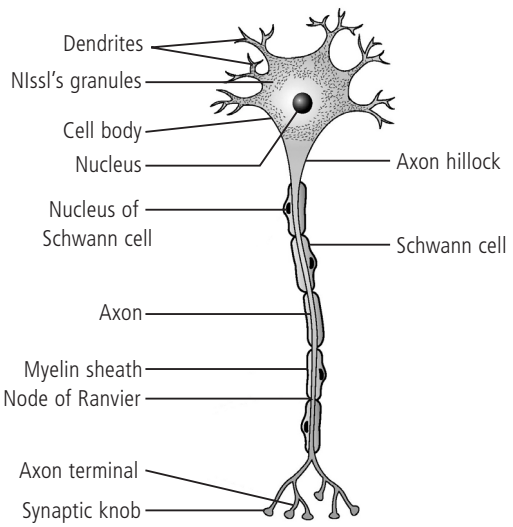
1. (a) CNS : It lies along the mid-dorsal axis of the body. It is a hollow, dorsally placed structure and comprises of brain and spinal cord. It is a centre of information processing and control.

PNS : Nerves arising from the central nervous system constitute the peripheral nervous system. It carries information to and from the CNS. It includes spinal nerves and cranial nerves.

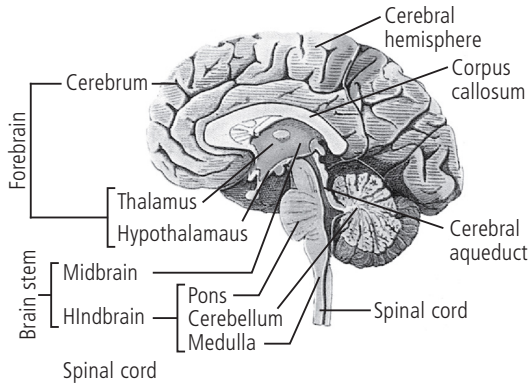
(b) Resting potential : Outside the plasma membrane of a nerve fibre is the extracellular fluid which is positively charged with respect to the cell contents inside the plasma membrane. A resting nerve fibre shows a potential difference between inside and outside of this plasma membrane. This difference in the electrical charges across the plasma membrane is called the 'resting potential'. A membrane with resting potential across it, is said to be electrically polarised.

Action potential : Action potential is another name of nerve impulse. The contents inside a cell at the excited state becomes positively charged with respect to extracellular fluid outside it. This change in polarity across the plasma membrane is known as an action potential. The membrane with reversed polarity across it is said to be depolarised.

2. **(a)** Structure of a neuron is diagrammatically shown below:



(b) The sagittal section of the human brain is diagrammatically shown below :



3. (a) Pineal gland present in diencephalon of forebrain acts as a master clock, which maintains biological rhythm.

(b) Cerebrum (cerebral hemispheres).

4. (a) The differences between afferent neurons and efferent neurons are as follows :

	Afferent neurons	Efferent neurons
(i)	They conduct impulses from the receptors to CNS.	They conduct impulses from CNS to the effectors.
(ii)	They are sensory in nature.	They are motor in nature.

(b) (i) Differences between myelinated and non-myelinated axons are as follows:

	Myelinated axons	Non-myelinated axons
(i)	Axons have Schwann cells which form myelin sheath.	Myelin sheath is absent.
(ii)	Nodes of Ranvier are present at intervals.	Nodes of Ranvier are absent.
(iii)	Voltage-gated ion channels are concentrated at the nodes; depolarisation occurs only in the nodes.	Voltage-gated ion channels are spread all over the axon; depolarisation occurs all along the length of nerve fibre.
(iv)	Ion exchange can occur only at the nodes.	Ion exchange occurs all over the surface.
(v)	Action potential does not propagate over internodes and jumps from node to node.	Action potential propagates all along the axon.
(vi)	Nerve impulse conduction is saltatory.	Nerve impulse conduction is smooth.
(vii)	They carry nerve impulses much faster than non medullated nerve fibres.	These carry nerve impulses much slower than medullated nerve fibres.
(viii)	They are present in the white matter of brain and spinal cord and in cranial and spinal nerves.	These are present in autonomic nerves.

(c) The differences between cranial nerves and spinal nerves are as follows :

	Cranial nerves	Spinal nerves
(i)	The nerves that arise from or join the brain are called cerebral or cranial nerves.	Spinal nerves arise from the spinal cord.
(ii)	There are 12 pairs of cranial nerves in humans.	There are 31 pairs of spinal nerves in humans.
(iii)	They are numbered I to XII in Roman numerals.	They are classified into five groups : cervical 8 pairs, thoracic 12 pairs, lumbar 5 pairs, sacral 5 pairs and coccygeal 1 pair.

BEST SELLING BOOKS FOR CLASS 11

Visit www.mtg.in for complete information