Biology

Chapter 18 - Neural Control and Coordination

1. Briefly describe the structure of the following:

(a) Brain

Ans: The skull protects the human brain. There are three layers of meninges in the skull, one is the dura mater, the next is the arachnoid, and the third (which is directly attached to the brain) is the pia mater. There are three major parts to the brain:

(i) Forebrain: The forebrain consists of the cerebral cortex, hypothalamus, and thalamus.

(ii) Midbrain: Located between the thalamus and hypothalamus of the frontal lobes, it is the brain's intermediate portion.

(iii)Hindbrain: It consists of the pons, cerebellum, and medulla.

2. Compare the following:

(a) Central neural system (CNS) and Peripheral neural system (PNS)

Ans: The difference between central neural system (CNS) and Peripheral Nervous System is given below:-

Central neural system (CNS)	Peripheral neural system (PNS)
The central nervous system coordinates the body's functions.	The body's main coordination centre is not here.
It is found inside the skull.	It is not situated inside the skull.
The brain and spinal cord are composed here.	Nerves to do with the central nervous system are included here.

(b) Resting potential and action potential

Ans: The difference between resting potential and action potential is given below:-

Resting potential	Action potential
The difference in electrical potential across a nerve fibre at no time when no nerve impulses are being conducted across the fiber.	During nerve conduction, it is the potential difference between nerve fibres.
Neurons are electronegative on the inside and electropositive on the outside.	Neurons are electropositive internally and electronegative externally.
Pumps that use sodium act as active sodium pump.	The sodium pump does not operate.

3. Explain the following processes:

(a) Polarization of the membrane of a nerve fibre

Ans: The membrane becomes polarized when its resting potential changes. The K^+ and negatively charged proteins in the axoplasm are higher than the Na^+ concentration inside the axon when in resting condition. Thus, potassium ions move faster from the inside to the exterior than sodium ions. A positively charged membrane becomes negatively charged inside and a positively charged membrane becomes negative. An example of this would be polarized nerves or polarized membranes.

(b) Depolarization of the membrane of a nerve fibre

Ans: An action potential occurs when a nerve fibre receives an electrical stimulus. As sodium ions pass through the membrane, potassium ions are less permeable. Consequently, the nerve fibre becomes positively charged inside, and negatively charged outside. This depolarization of the membrane is referred to as depolarization.

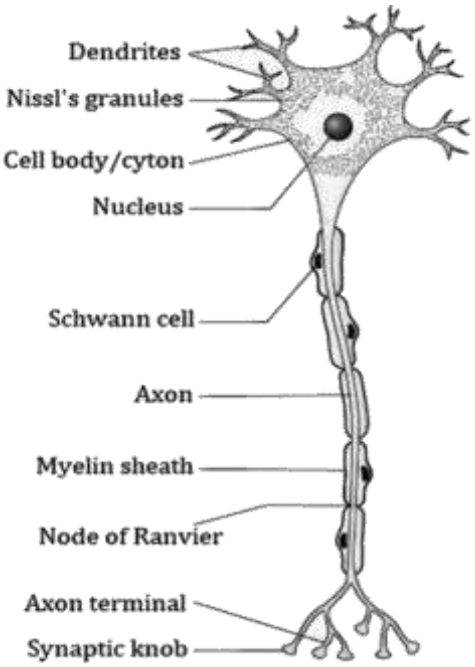
(c) Transmission of a nerve impulse across a chemical synapse

Ans: On chemical synapses, there is a fluid-filled space between pre- and postsynaptic neurons, called a synaptic cleft. After receiving an impulse, synaptic vesicles move toward the plasma membrane and fuse with the plasma membrane in the synaptic cleft, where they release their neurotransmitters. A number of receptors are present on the postsynaptic membrane, which bind to released neurotransmitters. Postsynaptic neurons form new potentials in response to ion channels opened by this binding. An excitatory or inhibitory potential can be developed.

4. Draw labelled diagrams of the following:

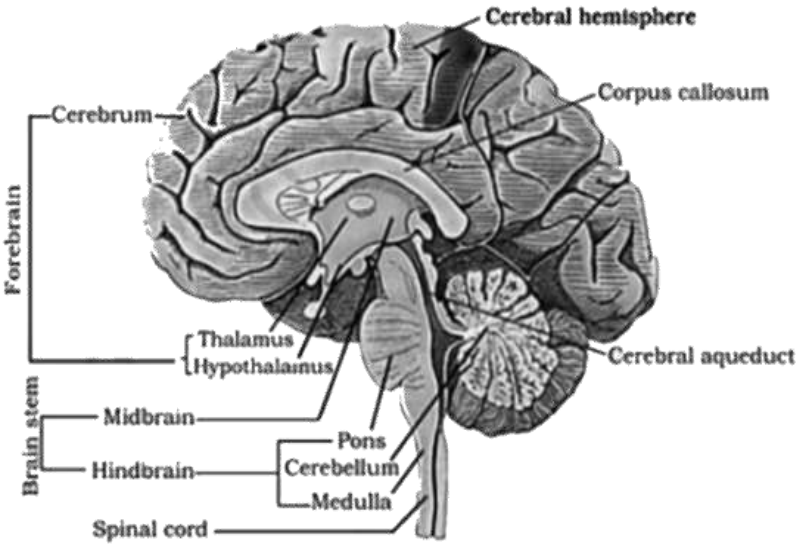
(a) Neuron

Ans:



(b) Brain

Ans:



5. Write short notes on the following:

(a) Neural coordination

Ans: A neural system facilitates the interaction and complementing of the activities of two or more organs. Interconnected and interdependent are all of the body's physiological functions. Coordinating and integrating all the organ's functions, the brain and endocrine system work together. Brain systems provide fast coordination by organising a network of interconnected points. Hormones enable chemical integration by the endocrine system.

(b) Forebrain

Ans: Among the three parts of the cortex are cerebrum, thalamus, and

hypothalamus.

→ The brain's main structure is the cerebrum. Left and right cerebral hemispheres are separated by a fissure in the cerebrum. Connecting the hemispheres is the corpus callosum. Cells that cover the cerebral hemisphere make up the cerebral cortex, which is a layer of pronounced folds. It is referred to as grey matter because of its greyish coloration. Several portions of the cerebral cortex have no obvious sensory or motor function. A variety of complex activities are performed by association areas, including intercessory associations, memory, and communication. In the cerebral hemisphere-interior section, the fibers of the tract are protected by the myelin sheath. White matter is named as a result of their impenetrable appearance. Intercessory associations, memory, and communication are all tasks that the association areas are accountable for. The myelin sheath, which makes up the interior section of the cerebral hemisphere, protects the tract fibres. They give the layer an impenetrable white appearance, thus the name "white matter."

→ Thalamus: There is a region within the cerebrum wrapped around the middle of the forebrain named the Thalamus. Sensory and motor signalling are coordinated at this centre.

→ Hypothalamus: In the hypothalamus there are numerous centres that regulate body temperature, urges for eating, and thirst. In addition to controlling growth and sexual behaviour, it is connected with the pituitary gland.

(c) Midbrain

Ans: The midbrain: From the forebrain to the hindbrain, the midbrain lies between the thalamus and the hypothalamus. This section of the brain passes through a canal known as the cerebral aqueduct.

(d) Hindbrain

Ans: In the hindbrain, you will find pons, cerebellum, and medulla.

There are many neurons in the cerebellum, so its surface is very convoluted in order to accommodate those extra neurons.

In the brain, the medulla and spinal cord are connected.

Medulla is home to centers that regulate respiratory functions, cardiovascular reflexes, and gastric secretions.

(e) Synapse

Ans: The synaptic cleft is a gap between postsynaptic cells and presynaptic cells that divides the synaptic membranes. Synapses are of two different types: chemical and electrical.

6. Give a brief account of:

(a) Mechanism of synaptic transmission

Ans: A synapse is a point where two neurons meet. It exists between one neuron's axon terminal and the dendrite of the next neuron, divided by a cleft.

Synaptic transmission occurs in two ways.

(1) Chemical Transmission- A neurotransmitter (acetylcholine) is released across the synaptic cleft when a nerve impulse reaches the end plate of an axon. This substance is produced in the neuron's cell body and delivered to the axon terminal. Acetylcholine diffuses over the cleft and attaches to receptors on the surface of the next neuron's membrane. This results in membrane depolarization and the initiation of an action potential.

(2) Electrical transmission- An electric current is created in the neuron in this sort of transmission. This electric current causes an action potential, which results in nerve impulse transmission across the nerve fibre. This technique of nerve conduction is quicker than the chemical method of transmission.

7. Explain the following:

(a) Role of Na+in the generation of action potential.

Ans: Ionization of Na+ is responsible for the action potential. By diffusion into the inside of the axoplasm, the Na+channels, which are normally closed, become opened and allow the inflow of Na+ions. After the membrane has depolarized, its electrical potential moves from 70 mV toward zero.

8. Differentiate between:

(a) Myelinated and unmyelinated axons

Ans : Differences between Myelinated and unmyelinated axons:-

Myelinated axons	Non myelinated .
These are whitish in color.	The color of these seems greyish.
Myelin sheaths are found.	It lacks a myelin sheath.
At intervals, Ranvier nodes can be found.	There are no nodes of Ranvier.
Neural impulses travel faster.	Nerve impulses are transmitted more slowly.
A node is the only place where ions can be exchanged.	A large amount of ion exchange occurs on the surface.

(b) Dendrites and axons

Ans: Differences between Dendrites and axons:-

Dendrites	Axons
The axons arise from the cytons present anteriorly.	At their posterior position, these are extensions of cytons.
Cellular impulses are transmitted through these pathways.	Cells use them to conduct impulses away from their bodies.
There is no myelin sheath in dendrites.	The axons may or may not be myelinated.
Dendrites become receptors at their terminals.	There are many terminal arborization at the end of each axon.

(c) Thalamus and Hypothalamus

Ans: Differences between Thalamus and Hypothalamus:-

Thalamus	Hypothalamus
The diencephalon is represented by it.	It is a part of the diencephalon located at the bottom.
Sensory and motor signaling are coordinated by this center.	Among other things, it regulates body temperature, thirst, hunger, etc.
The gland does not secrete any hormones.	A number of hormones are produced by this gland.

(d) Cerebrum and Cerebellum
Ans: Differences between Cerebrum and Cerebellum:-

Cerebrum	Cerebellum
This part of the brain is located in the front.	It is located in the hindbrain.
The cerebral hemispheres are divided into two.	A median vermis forms the middle between the cerebellar hemispheres.
Voluntary movements are initiated by it.	Maintaining posture and equilibrium is achieved by it.

9**. Answer the following:**

(a) Which part of the human brain is the most developed?
Ans: Cerebrum

(b) Which part of our central neural system acts as a master clock?
Ans: Hypothalamus

10. Distinguish between
a) Afferent neurons and Efferent neurons
Ans:

Afferent neurons	Efferent nerve cells
They transmit impulses toward the central nervous system.	Impulses are conducted away from the central nervous system by these fibers.
It stimulates the senses and evokes them.	It causes the effectors to respond.
Their nature is sensory.	In nature, they have motor functions.
Information is taken from the receptors.	The effectors receive the information..

b) Impulse conduction in a myelinated nerve fibre and an unmyelinated nerve fibre
Ans:

Impulse conduction in myelinated nerve fibre	Impulse conduction in a unmyelinated nerve fibre
If a node of Ranvier lacks a myelin coating, depolarisation occurs.	The nerve fibres are depolarized along their entire length.
There is a jump between different nodes of Ranvier regarding action potential.	Fibers carry action potential along their entire length.
The pace of conduct is faster.	The pace of conduct is slower.
It requires less energy.	Energy is required in greater amounts.
A blind spot does not form an image.	At the yellow spot, an image is formed.

c) Cranial nerves and Spinal nerves
Ans:

Cranial nerves	Spinal nerves
These originate from the brain.	They are nerves that originate in the head and originate in the spinal cord.
The brain is composed of 12 pairs of cranial nerves.	31 spinal nerves make up the spine.
Brain and body are connected by them.	Parts of the spinal cord are connected to them.
Depending on their nature, they could be sensory, motor, or mixed.	In nature, they are mixed.