

PETIT SEMINAIRE HIGHER SECONDARY SCHOOL, PUDUCHERRY

15. NERVOUS SYSTEM

X std

SELF – EVALUATION

BIOLOGY

I. Choose the best answer :

1. Bipolar neurons are found in **retina of eye**.
 a) retina of eye b) cerebral cortex c) embryo d) respiratory epithelium
2. Site for processing of vision, hearing, memory, speech, intelligence and thought is **brain**.
 a) kidney b) ear c) brain d) lungs
3. In reflex action, the reflex arc is formed by **receptor, spinal cord, muscle**.
 a) brain, spinal cord, muscle c) muscle, receptor, brain
 b) receptor, muscle, spinal cord d) receptor, spinal cord, muscle
4. Dendrites transmit impulse **towards** cell body and axon transmit impulse **away from** cell body.
 a) away from, away from c) towards, towards
 b) towards, away from d) away from, towards
5. The outer most of the three cranial meninges is **duramater**.
 a) arachnoid membrane b) piamater c) duramater d) myelin sheath
6. There are **12** pairs of cranial nerves and **31** pairs of spinal nerves.
 a) 12,31 b) 31, 12 c) 12, 13 d) 12, 21
7. The neurons which carries impulse from the central nervous system to the muscle fibre:
efferent neuron.
 a) afferent neurons b) association neurons c) efferent neurons d) unipolar neurons
8. Which nervous band connects the two cerebral hemispheres of brain? **Corpus callosum**
 a) thalamus b) hypothalamus c) corpus callosum d) pons
9. Node of Ranvier is found in **axons**.
 a) muscles b) axons c) dendrites d) cyton
10. Vomiting centre is located in **Medulla Oblongata**.
 a) medulla oblongata b) stomach c) cerebrum d) hypothalamus
11. Nerve cells do not possess **sarcolemma**.
 a) neurilemma b) sarcolemma c) axon d) dendrites
12. A person who met with an accident , lost control of body temperature, water balance, and hunger. Which of the following part of brain is supposed to be damaged? **Hypothalamus**
 a) medulla oblongata b) cerebrum c) pons d) hypothalamus

II. Fill in the blanks :

01. **Neuron** is the longest cell in our body.
02. Impulses travels rapidly in **multipolar** neurons.
03. A change in the environment that causes an animal to react is called **Stimulus**.
04. **Dendrite** carries the impulse towards the cell body.
05. The two antagonistic component of autonomic nervous system are **Sympathetic nerves** and **Para-sympathetic nerves**.
06. A neuron contains all cell organelles except **centrioles**.
07. **Cerebro spinal fluid** maintains the constant pressure inside the cranium.
08. **Gyri** and **Sulci** increases the surface area of cerebrum.
09. The part of human brain which acts as relay center is **Thalamus**.

III. State whether True or False. If False, write the Correct statement :

01. Dendrons are the longest fibres that conducts impulses away from the cell body. **FALSE**
Correct Statement : Dendrons are the longest fibres that conducts impulses **towards** the cell body.
02. Sympathetic nervous system is a part of central nervous system. **FALSE**
Correct Statement : Sympathetic nervous system is a part of **Autonomic** nervous system.
03. Hypothalamus is the thermoregulatory centre of human body. **TRUE**
04. Cerebrum controls the voluntary actions of our body. **FALSE**
Correct Statement : **Cerebellum** controls the voluntary actions of our body.
05. In the central nervous system, myelinated fibres form the white matter. **TRUE**
06. All the nerves in the body are covered and protected by meninges. **FALSE**
Correct Statement : The **Brain** and **Spinal cord** are covered and protected by meninges.
07. Cerebro spinal fluid provides nutrition to brain. **TRUE**
08. Reflex arc allows the rapid response of the body to a stimulus. **TRUE**
09. Pons helps in regulating respiration. **TRUE**

IV. Match the following :

Sl.No.	Column I	Column II
A	Nissil's granules	Cyton
B	Hypothalamus	Forebrain
C	Cerebellum	Hindbrain
D	Schwann cell	Peripheral Nervous System

V. Understand the assertion statement. Justify the reason given and choose the correct choice :

- Assertion is correct and reason is wrong
- Reason is correct and the assertion is wrong
- Both assertion and reason are correct
- Both assertion and reason are wrong

01. **Assertion** : Cerebrospinal fluid is present throughout the Central Nervous System.

Reason : Cerebrospinal fluid has no such functions.

(a) Assertion is correct and reason is wrong.

02. **Assertion** : Corpus callosum is present in space between the duramater and piamater.

Reason : It serves to maintain the constant intracranial pressure.

d) Both Assertion and Reason are wrong.

VI. Short answer questions :

01. Define stimulus.

'Stimulus' refers to the **changes** in the **environmental** condition that are **detected** by **receptors** present in the body.

02. Name the parts of the hind brain.

Hind brain is formed of three parts i) **CEREBELLUM**, ii) **PONS** and iii) **MEDULLA OBLONGATA**.

03. What are the structures involved in the protection of brain?

The brain being delicate vital structure, is protected in bony (**Cranial**) cavity of the skull.

Brain is covered by three connective tissue membranes or meninges:

- Outer (tough) **DURAMATER**,
- Middle (spider) **ARACHNOID MEMBRANE**, &
- Inner (soft / tender) **PIAMATER**

04. Give an example for conditioned reflexes.

Playing a **harmonium**, by **striking** a particular **key** on **seeing** a music **note** is an example of conditioned reflex.

05. Which acts as a link between the nervous system and endocrine system?

Hypothalamus of the fore brain controls the **secretion of hormones** from **anterior Pituitary gland** and hence acts as a link between nervous and endocrine system.

06. Define reflex arc.

The **pathway** taken by **nerve impulse** to accomplish **reflex action** is called reflex arc.

VII. Differentiate between :

01. Voluntary and Involuntary actions.

Sl. No.	VOLUNTARY ACTIONS	INVOLUNTARY ACTIONS
1.	Actions performed with our will and control are called voluntary actions.	Actions performed without our control are called involuntary actions.
2.	They are controlled by the cerebellum	They are controlled by the Hypothalamus, Medulla and Spinal Cord .

02. Medullated and Non-medullated nerve fibre.

Sl. No.	MEDULLATED NERVE FIBRE	NON-MEDULLATED NERVE FIBRE
1.	The axon of the neuron is covered with myelin sheath .	The axon of the neuron is not covered with myelin sheath.
2.	It forms the white matter of the brain	It forms the grey matter of the brain

VIII. Long answer questions :

01. With a neat labelled diagram, explain the structure of a neuron.

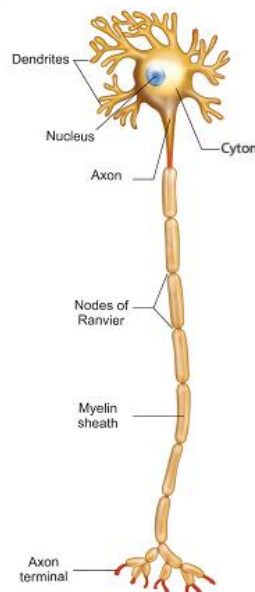
A neuron typically consists of three basic parts: CYTON, DENDRITES and AXON.

i) CYTON:

- Cyton is also called **cell body** or **Perikaryon**.
- It has a central **NUCLEUS** with **ABUNDANT CYTOPLASM** called **Neuroplasm**.
- The cytoplasm has **LARGE GRANULAR BODY** called **Nissl's granules** and the other cell organelles like **MITOCHONDRIA, RIBOSOMES, LYSOSOMES, and ENDOPLASMIC RETICULUM**.
- Neurons do not have the ability to divide.
- Several **Neurofibrils** are present in the Cytoplasm that help in **TRANSMISSION OF NERVE IMPULSES** to and from the cell body.

ii) DENDRITES:

- These are the numerous branched Cytoplasmic processes that project from the surface of the cell body.
- Dendrites conduct Nerve Impulses towards the cyton.
- The branched projections increase the surface area for receiving the signals from other nerve cells.



iii) AXON:

- The axon is a SINGLE, ELONGATED, SLENDER PROJECTION. The end of axon terminates as fine BRANCHES which terminate into KNOB like swellings called **Synaptic knob**.
- The plasma membrane of axon is called **Axolemma**, while the cytoplasm is called **Axoplasm**.
- Axon carries IMPULSES away from the cyton.
- The axons may be covered by a protective SHEATH called **Myelin sheath** which is further covered by a layer of **Schwann cells** called **Neurilemma**.
- Myelin sheath breaks at intervals by DEPRESSIONS called **Nodes of Ranvier**.
- The region between the NODES is called as **Internode**.
- Myelin sheath acts as INSULATOR and ensures RAPID TRANSMISSION OF NERVE IMPULSES.

iv) SYNAPSE:

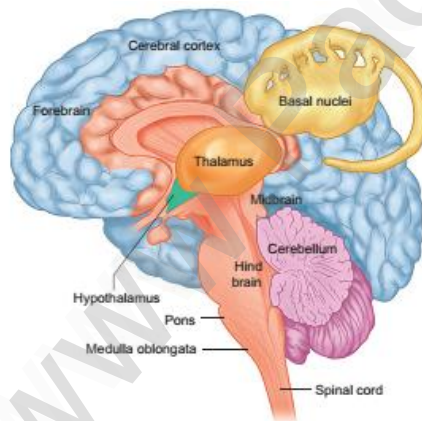
- A junction between synaptic knob of axon of one neuron and Dendron of next neuron is called Synaptic Junction.
- Information from one neuron can pass to another neuron through these junctions with the release of chemicals known as Neurotransmitters from the synaptic knob.

Q2. Illustrate the structure and functions of brain.

A human brain is formed of three main parts:

(a) **Forebrain** (b) **Midbrain** and (c) **Hindbrain**.

(a) **FOREBRAIN:** The forebrain is formed of **Cerebrum** and **Diencephalon**. The latter consists of dorsal **Thalamus** and ventral **Hypothalamus**.

**CEREBRUM:**

- It is the largest portion forming nearly two-third of the brain.
- The cerebrum is longitudinally divided into two halves – right and left **Cerebral Hemispheres** by a deep cleft called **Median Cleft**.
- The two Cerebral hemispheres are interconnected by thick band of nerve fibres called **Corpus Callosum**.
- The outer portion of each cerebral hemisphere is formed of **grey matter** and is called **Cerebral Cortex**.

- v) The inner or deeper part is formed of **white matter** and is called **Cerebral Medulla**.
- vi) The cortex is extremely folded forming elevations called **gyri** with depression between them termed as **sulci** that increase its surface area.
- vii) The cerebrum is also responsible for the **thinking, intelligence, consciousness, memory, imagination, reasoning** and **willpower**.

THALAMUS:

Thalamus present in cerebral medulla is a major conducting centre for sensory and motor signalling. It acts as a **Relay centre**.

HYPOTHALAMUS:

- i) It lies at the base of the thalamus.
- ii) It controls **involuntary functions** like hunger, thirst, sleep, sweating, sexual desire, anger, fear, water balance, blood pressure etc.
- iii) It acts as a **thermoregulatory** (temperature control) center of the body.
- iv) It controls the secretion of hormones from anterior pituitary gland and is an important link between nervous system and endocrine system.

(b) MIDBRAIN:

- i) It is located between thalamus and hind brain.
- ii) It consists of four rounded bodies called Corpora Quadrigemina that control **visual** and **auditory** (hearing) reflexes.

(c) HINDBRAIN:

It is formed of three parts **Cerebellum, Pons** and **Medulla Oblongata**.

CEREBELLUM:

- i) It is the **second largest part** of the brain formed of two large sized hemispheres and middle **Vermis**.
- ii) It coordinates **voluntary movements** and also maintains **body balance**.

PONS:

- i) It is a **bridge** of nerve fibre that connects the lobes of cerebellum.
- ii) It relays signals between the cerebellum, spinal cord, midbrain and cerebrum.
- iii) It controls **respiration** and **sleep cycle**.

MEDULLA OBLONGATA:

- i) Medulla oblongata is the **posterior most** part of the brain that connects spinal cord and various parts of brain.
- ii) It has **cardiac centres, respiratory centres, vasomotor centres** to control **heartbeat, respiration** and **contractions of blood vessels** respectively.
- iii) It also regulates **vomiting** and **salivation**.

- Q3. What will you do if someone pricks your hand with a needle? Elucidate the pathway of response with a neat labelled diagram.

If someone pricks our hand with a needle, we will immediately pull our hand to protect ourselves. This is an example of a reflex action.

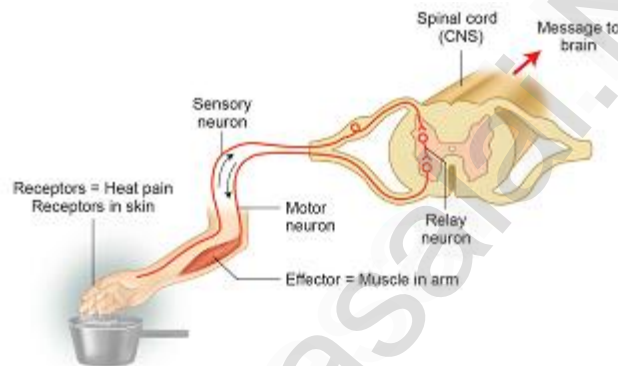
REFLEX ACTION:

A reflex is any response that occurs **automatically without consciousness**. Most of the reflex actions are monitored and controlled by the spinal cord. Hence, they are also known as **spinal reflexes**.

REFLEX ARC:

The pathway taken by nerve impulse to accomplish reflex action is called **reflex arc**.

- i) When we are pricked by a needle, the **stimulus** is the prick which is sensed by **receptors** in our hand. This stimulus (pain) in turn **triggers** an impulse in **sensory neuron**.
- ii) The sensory neuron transmits or conveys the message to the **spinal cord**.



- iii) Spinal cord interprets the stimulus and the impulse is passed on to the relay neuron which in turn transmits it to a **motor neuron**.
- iv) Motor neurons carry command from spinal cord to our **arm**.
- v) Muscle in our **arm contracts** and we **withdraw** our hand immediately from the needle. In this example, muscle is an **effector** organ which has responded to the pain.

- Q4. Describe the structure of spinal cord.

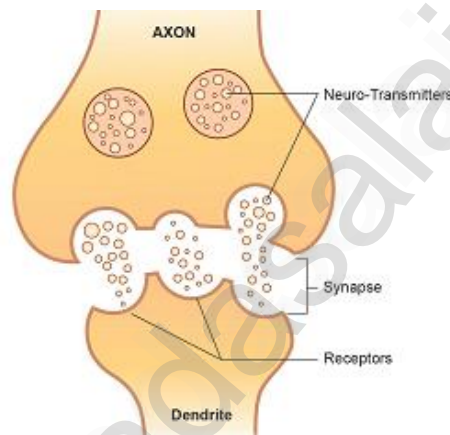
SPINAL CORD:

- i) Spinal cord is a cylindrical structure lying in the neural canal of the vertebral column. It is also covered by **Meninges**. It extends from the lower end of medulla oblongata to the first **lumbar** vertebra.
- ii) The posterior most region of spinal cord tapers into a thin fibrous thread like structure called **Filum terminale**.
- iii) Internally, the spinal cord contains a **Cerebrospinal fluid** filled cavity known as the **Central canal**.
- iv) The grey matter of spinal cord is '**H**' shaped. The upper end of letter '**H**' forms posterior horns and lower end forms anterior horns.
- v) A bundle of fibres pass into the posterior horn forming **dorsal** or **afferent** root. Fibres pass outward from the anterior horn forming **ventral** or **efferent** root. These two roots join to form **Spinal nerves**.
- vi) The white matter is external and have bundle of nerve tracts.
- vii) Spinal cord conducts sensory and motor impulses to and from the brain. It controls reflex actions of the body.

05. How nerve impulses are transferred from one neuron to next neuron?

NERVE IMPULSES:

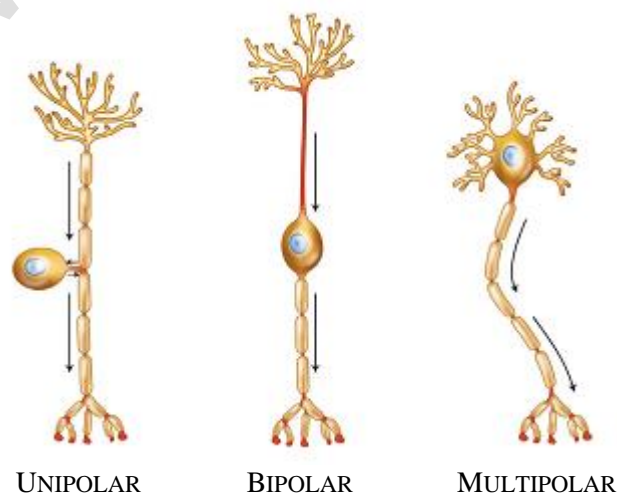
- i) All the information from the environment are detected by the receptors located in our sense organs such as the eyes, the nose, the skin etc.
- ii) Information from the receptors is transmitted as **electrical impulse** and is received by the dendritic tips of the neuron.
- iii) This impulse travels from the dendrite to the cell body and then along the axon to its terminal end.
- iv) On reaching the axonal end, it causes the nerve endings to release a chemical (**neurotransmitter**) which diffuses across a **synapse** and starts a similar electrical impulse in the dendrites of the next neuron, then to their cell body to be carried along the axon.
- v) In this way, the electrical signal reaches the brain or spinal cord.
- vi) The response from brain (or spinal cord) is similarly passed on to the effector organs such as the muscle or gland cell that undergoes the desired response.



vii) The flow of nerve impulses from **axonal end** of one neuron to dendrite of another neuron through a synapse is called **synaptic transmission**.

viii) **NEUROTRANSMITTERS:** Neurotransmitters are the chemicals which allow the transmission of nerve impulse from the axon terminal of one neuron to the Dendron of another neuron or to an effector organ. The important neurotransmitter released by neurons is called **Acetylcholine**.

06. Classify neurons based on its structure.



❖ Structurally the neurons may be of the following types:

- i) **UNIPOLAR NEURONS**: Only one nerve process arises from the cyton which acts as both axon and dendron.
- ii) **BIPOLAR NEURONS**: The cyton gives rise to two nerve processes of which one acts as an axon while another as a dendron.
- iii) **MULTIPOLAR NEURONS**: The cyton gives rise to many dendrons and an axon.

IX. Higher Order Thinking Skills :

- Q1. 'A' is a cylindrical structure that begins from the lower end of medulla and extend downwards. It is enclosed in bony cage 'B' and covered by membranes 'C'. As many as 'D' pairs of nerves arise from the structure 'A'.
 - (i) What is 'A'?
A refers to **Spinal cord**
 - (ii) Name (a) bony cage 'B' and (b) membranes 'C'
(a) bony cage 'B' refers to the **Vertebral column**
(b) membranes 'C' refers to **Meninges**
 - (iii) How much is 'D'?
'D' : **12 pairs of nerves**
- Q2. Our body contains a large number of cells 'L' which are the longest cells in the body. L has long and short branch called as 'M' and 'N' respectively. There is a gap 'O' between two 'L' cells, through which nerve impulse transfer by release of chemical substance 'P'.
 - (i) Name the cells L
'L' refers to **neurons**
 - (ii) What are M and N?
'M' : **Dendrites**
'N' : **Axon**
 - (iii) What is the gap O?
'O' : **Synapse**
 - (iv) Name the chemical substance P.
The chemical substance 'P' is **Acetyl choline**