

# 21 Neural Control and Coordination

**Question:** Given below are two statements :

Statement I :- The nose contains mucus – coated receptors which are specialised for receiving the sense of smell and are called olfactory receptors.

Statement II :- Wall of the eye ball has three layers. The external layer is called choroid (dense connective tissue), middle layer is sclera (thin pigmented layer) and internal layer is retina (ganglion cells, bipolar cells and photoreceptor cells).

In the light of the above statements, choose the correct answer from the options given below:

**NEET 2023 Manipur**

☒ A Statement I is true but statement II is false

☐ B Statement I is false but Statement II is true

☐ C Both Statement I and Statement II are true

☐ D Both Statement I and Statement II are false.

**Answer: A**

**Explanation**

Option A : Statement I is true but statement II is false

**Explanation :**

**Statement I :** This is correct. The olfactory receptors are specialized cells in the nasal cavity that are responsible for the sense of smell. They are coated with mucus which helps to dissolve odor molecules, making them easier to detect.

**Statement II :** This statement is incorrect due to a mix-up in the description of the layers. The wall of the eyeball indeed has three layers but they are as follows:

1. The external layer is the sclera, which is a dense, tough white connective tissue that gives the eye its shape and protects the inner components.
2. The middle layer is the choroid, which is a thin pigmented layer that provides oxygen and nourishment to the outer layers of the retina.
3. The internal layer is the retina, which contains photoreceptor cells (rods and cones), bipolar cells, and ganglion cells, and is responsible for detecting light and transmitting these signals to the brain through the optic nerve.

**Question:** Match List I with List II with respect to human eye.

	List I		List II
(A)	Fovea	(I)	Visible coloured portion of eye that regulates diameter of pupil.
(B)	Iris	(II)	External layer of eye formed of dense connective tissue.
(C)	Blind spot	(III)	Point of greatest visual acuity or resolution.
(D)	Sclera	(IV)	Point where optic nerve leaves the eyeball and photoreceptor cells are absent.

Choose the correct answer from the options given below:

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**A** A-IV, B-III, C-II, D-I

**B** A-I, B-IV, C-III, D-II

**C** A-II, B-I, C-III, D-IV

**D** A-III, B-I, C-IV, D-II

**Answer: D**

### Explanation

Option (B) is the correct answer because

(i) Fovea is the point of greatest visual acuity or resolution.

(ii) Iris is the visible coloured portion of the eye that regulates diameter of pupil.

(iii) Blind spot is the point where optic nerve leaves the eye-ball and photoreceptor cells are absent.

(iv) Sclera is the external layer of eye formed of dense connective tissue.

**Question:** The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are:

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**A** Corpora quadrigemina and hippocampus

**B** Brain stem and epithalamus

**C** Corpus callosum and thalamus

**D** Limbic system and hypothalamus

**Answer: D**

**Explanation**

The limbic system, which includes structures such as the amygdala and hippocampus, plays a significant role in regulating emotions, including fear, pleasure, and anger. The hypothalamus, another component of the limbic system, is involved in various functions, including the regulation of sexual behavior and responses to pleasure and excitement. Therefore, option D is correct.

Option (A), (B) and (C) are not correct because corpora quadrigemina is a part of the midbrain and consists of four round swellings. Corpus callosum is a tract of nerve fibres that connects right and left cerebral hemispheres. Thalamus is a major coordinating centre in the forebrain for sensory and motor signalling. Midbrain, pons and medulla oblongata together form the brain stem.

2022

## MCQ (Single Correct Answer)

**Q.1.** Match List-I with List - II :

	List - I		List - II
(a)	Multipolar neuron	(i)	Somatic neural system
(b)	Bipolar neuron	(ii)	Cerebral cortex
(c)	Myelinated nerve fibre	(iii)	Retina of Eye
(d)	Unmyelinated nerve fibre	(iv)	Spinal nerves

Choose the correct answer from the options given below :

**A** (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

**B** (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

**C** (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)

**D** (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)

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**Ans. (A)**

**Explanation**

Option (a) is the correct answer because

(a) Multipolar neurons are present in cerebral cortex.

- (b) Bipolar neurons are found in the retina of the eye.
- (c) Myelinated nerve fibres are found in spinal and cranial nerves
- (d) Unmyelinated nerve fibres are commonly found in autonomous and somatic neural systems.

**Q.2.** Select the incorrect statement regarding synapses :

- A** The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.
- B** Electrical current can flow directly from one neuron into the other across the electrical synapse.
- C** Chemical synapses use neurotransmitters
- D** Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.

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**Ans. (D)**

### **Explanation**

Option (d) is the correct answer as impulse transmission across an electrical synapse is always faster than that across a chemical synapse.

→ Chemical synapses use chemicals for transmission which are known as neurotransmitters.

→ The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

→ In an electrical synapse, the transmission of the impulse occurs in the form of an electrical current from one neuron to the next neuron.

## TOPIC 1

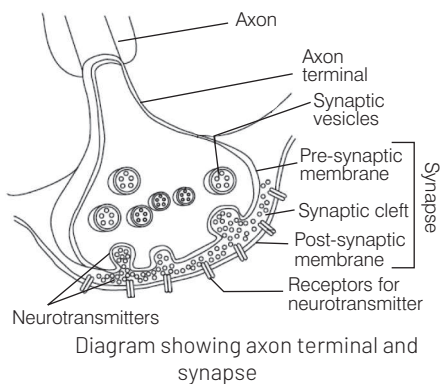
### Structure of the Nervous System

- 01** Receptor sites for neurotransmitters are present on  
[NEET 2017]

- (a) membranes of synaptic vesicles
- (b) pre-synaptic membrane
- (c) tips of axons
- (d) post-synaptic membrane

**Ans. (d)**

The post-synaptic membrane of the synapse of a neuron contains the receptors for neurotransmitters.



- 02** Myelin sheath is produced by  
[NEET 2017]

- (a) Schwann cells and Oligodendrocytes
- (b) Astrocytes and Schwann cells
- (c) Oligodendrocytes and Osteoclasts
- (d) Osteoclasts and Astrocytes

**Ans. (a)**

The myelin sheath is a greatly extended and modified plasma membrane

wrapped around the nerve axon in a spiral fashion. It is originated from Schwann cells in the peripheral nervous system and oligodendroglial cells in the central nervous system.

- 03** Destruction of the anterior horn cells of the spinal cord would result in loss of  
[CBSE AIPMT 2015]

- (a) sensory impulses
- (b) voluntary motor impulses
- (c) commissural impulses
- (d) integrating impulses

**Ans. (b)**

Destruction of the anterior horn cells of the spinal cord would result in loss of voluntary motor impulses. It is because the anterior horn cells (also called anterior grey column), which is the front column of grey matter in the spinal cord contains motor neurons that affect the axial muscles.

- 04** How do parasympathetic neural signals affect the working of the heart?  
[CBSE AIPMT 2014]

- (a) Reduce both heart rate and cardiac output
- (b) Heart rate is increased without affecting the cardiac output
- (c) Both heart rate and cardiac output increase
- (d) Heart rate decreases but cardiac output increases

**Ans. (a)**

Parasympathetic neural signal reduces both heart rate and cardiac output, through the post ganglionic fibres. These fibres are very short, and are cholinergic in nature.

- 05** When a neuron is in resting state, i.e. not conducting any impulse, the axonal membrane is

[CBSE AIPMT 2011]

- (a) equally permeable to both  $\text{Na}^+$  and  $\text{K}^+$  ions
- (b) impermeable to both  $\text{Na}^+$  and  $\text{K}^+$  ions
- (c) comparatively more permeable to  $\text{K}^+$  ions and nearly impermeable to  $\text{Na}^+$  ions
- (d) comparatively more permeable to  $\text{Na}^+$  ions and nearly impermeable to  $\text{K}^+$  ions

**Ans. (c)**

Neurons are excitable cells because their membrane are in a polarised state. Different types of selectively permeable channels are present on the neural membrane. When a neuron is not conducting any impulse, or in the resting stage, the axonal membrane is comparatively more permeable to potassium ion ( $\text{K}^+$ ) and nearly impermeable to sodium ion ( $\text{Na}^+$ ).

- 06** During the propagation of a nerve impulse, the action potential results from the movement of  
[CBSE AIPMT 2008]

- (a)  $\text{K}^+$  ions from extracellular fluid to intracellular fluid
- (b)  $\text{Na}^+$  ions from intracellular fluid to extracellular fluid
- (c)  $\text{K}^+$  ions from intracellular fluid to extracellular fluid
- (d)  $\text{Na}^+$  ions from extracellular fluid to intracellular fluid

**Ans. (d)**

During the nerve impulse when a stimulus of adequate strength is applied to a polarised membrane, the permeability of the membrane to  $\text{Na}^+$  is increased at the point of stimulation. As

a result the sodium ion channels permit the influx of  $\text{Na}^+$  by diffusion into the intracellular fluid from extracellular fluid.

- 07** During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge? [CBSE AIPMT 2007]

- (a) First negative, then positive and again back to negative
- (b) First positive, then negative and continue to be negative
- (c) First negative, then positive and continue to be positive
- (d) First positive, then negative and again back to positive

**Ans. (a)**

During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has first become negative charged, then positive and again negative by repolarisation.

- 08** Which one of the following pairs of structures distinguishes a nerve cell from other types of cell? [CBSE AIPMT 2007]

- (a) Perikaryon and dendrites
- (b) Vacuoles and fibres
- (c) Flagellum and medullary sheath
- (d) Nucleus and mitochondria

**Ans. (a)**

A nerve cell consists of cell body (perikaryon) containing the nucleus, Nissl granules, dendrites and an axon. These are specialised cells.

- 09** Which of the following statements is correct about node of Ranvier? [CBSE AIPMT 2002]

- (a) Axolemma is discontinuous
- (b) Myelin sheath is discontinuous
- (c) Both neurilemma and myelin sheath are discontinuous
- (d) Covered by myelin sheath

**Ans. (b)**

Neurons are the chief functional units of the nervous system. An ordinary neuron has a soma or cyton and a long thread and, called as axon which is enclosed in a multilayered myelin sheath. The myelin sheath is interrupted at the spaces between Schwann cells to form gaps. These gaps are called **nodes of Ranvier**. These nodes and the myelin sheath create condition that speed up the nerve impulses.

- 10** Which of the following is regarded as a unit of nervous tissue?

[CBSE AIPMT 1999]

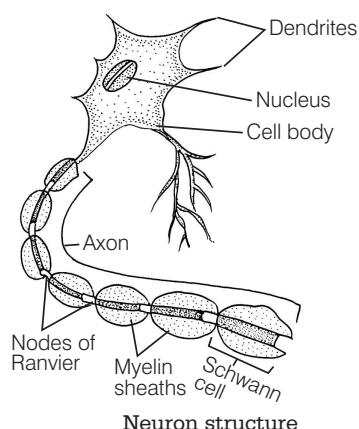
- (a) Myelin sheath
- (b) Axons
- (c) Dendrites
- (d) Neurons

**Ans. (d)**

The nervous tissue is made up of nerve cells (the repeating units) also called neurons.

Each neuron has a cell body or cyton and two kinds of cell processes

- (a) Dendrons, come out from cyton.
- (b) Axon, an elongated nerve fibre.



- 11** The junction between the axon of one neuron and the dendrite of the next is called [CBSE AIPMT 1999]

- (a) junction point
- (b) a synapse
- (c) a joint
- (d) constant bridge

**Ans. (b)**

The end to end position of the axon of one neuron and the dendrites of another neuron is called the **synapse**.

Most of the neurons do not actually touch other neurons with which they communicate, instead there is a minute space. This separating gap is called the **synaptic cleft**.

- 12** Sympathetic nervous system induces [CBSE AIPMT 1997]

- (a) heartbeat
- (b) secretion of digestive juices
- (c) secretion of saliva
- (d) All of the above

**Ans. (a)**

Medulla of brain has two regions affecting heart rate (a) cardiac inhibitory centre, (b) cardiac accelerator centre. Sensory nerves originating from the

accelerator centre run parallel to the spinal cord and enter the sino-atrial node. Stimulation by these nerves, which are part of sympathetic nervous system cause an increase in heartbeat.

- 13** In humans, visceral organs are innervated by [CBSE AIPMT 1996]

- (a) sympathetic nerves and are under conscious control
- (b) parasympathetic nerves and are under conscious control
- (c) Both (a) and (b)
- (d) both sympathetic and parasympathetic nerves but are not under conscious control

**Ans. (d)**

Both sympathetic and parasympathetic nerve fibres innervate visceral organs and coordinate their activity antagonistically, but this is not under body's conscious control.

- 14** Afferent nerve fibres carry impulses from [CBSE AIPMT 1992]

- (a) effector organs to CNS
- (b) receptors to CNS
- (c) CNS to receptors
- (d) CNS to muscles

**Ans. (b)**

Afferent nerve fibres are formed of only sensory nerve fibres, conduct nerve impulses from sensory organs or receptors to central nervous system to produce sensation, e.g. optic nerve.

- 15** One function of parasympathetic nervous system is [CBSE AIPMT 1990]

- (a) contraction of hair muscles
- (b) stimulation of sweat glands
- (c) acceleration of heartbeat
- (d) constriction of pupil

**Ans. (d)**

Parasympathetic nervous system involves conservation of energy and brings about relaxation, comfort, pleasure etc, at the time of rest. Another function of this system is that during emergency or stress while SNS dilates pupil for more light, PNS constricts the pupil to its normal condition. Whereas, sympathetic nervous system involves expenditure of energy and increases the defence system of body against adverse conditions, so, it operates during stress, pain, fear and anger.



## TOPIC 2

### Physiology of the Nervous System and Reflex Arc

- 16** Which of the following is associated with decrease in cardiac output? [NEET (Oct.) 2020]

(a) Sympathetic nerves  
(b) Parasympathetic neural signals  
(c) Pneumotaxic centre  
(d) Adrenal medullary hormones

**Ans. (c)**

Parasympathetic neural signals (a component of autonomic nervous system) decreases the rate of heartbeat, speed of conduction of action potential and thereby the cardiac output.

- 17** Which of the following statements is not correct? [NEET (Odisha) 2019]

(a) An action potential in an axon does not move backward because the segment behind is in a refractory phase  
(b) Depolarisation of hair cells of cochlea results in the opening of the mechanically gated potassium-ion channels  
(c) Rods are very sensitive and contribute to daylight vision  
(d) In the knee-jerk reflex, stimulus is the stretching of muscle and response is its contraction

**Ans. (c)**

Option (c) is not correct because rods and cones are photoreceptor cells in our eyes. The rod cells contain a purple pigment rhodopsin that is useful in night vision or scotopic vision. Daylight (photopic) vision and colour vision are the functions of cones.

- 18** Which part of the brain is responsible for thermoregulation? [NEET (National) 2019]

(a) Hypothalamus  
(b) Corpus callosum  
(c) Medulla oblongata  
(d) Cerebrum

**Ans. (a)**

Hypothalamus is the thermoregulatory centre in the brain and it maintains the

constant body temperature of 37°C. The hypothalamus contains a number of centres, which control body temperature.

Corpus callosum is the thick band of nerve fibres that divide the cerebrum into left and right hemispheres.

Medulla oblongata is the component of hindbrain. It receives and integrates signals from spinal cord and sends them to cerebellum. Cerebrum is the large part of the brain and consists of two hemispheres.

- 19** Stimulation of a muscle fibre by a motor neuron occurs at [CBSE AIPMT 2014]

(a) the neuromuscular junction  
(b) the transverse tubules  
(c) the myofibril  
(d) the sarcoplasmic reticulum

**Ans. (a)**

Stimulation of a muscle fibre by a motor neuron occurs at neuromuscular junction (the area of contact between a nerve and muscle fibre). It is also called motor-end plate. At neuromuscular junction a neuron activates a muscle to contract during the excitation contraction coupling of vertebrate skeletal muscles.

- 20** Injury localised to the hypothalamus would most likely disrupt [CBSE AIPMT 2014]

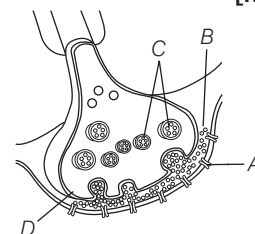
(a) short term memory  
(b) co-ordination during locomotion  
(c) executive function, such as decision making  
(d) regulation of body temperature

**Ans. (d)**

The hypothalamus performs many functions which are important for the survival and enjoyment of life. It serves as a link between 'mind' and 'body' and between the nervous and endocrine system. The hypothalamus is responsible for hormone production.

The hormone produced by this area govern body temperature thirst hunger, sleep, circadian rhythm, mood sex drive etc. This area of the brain also controls the functioning of pituitary gland. Thus, if any injury localised to the hypothalamus it will disrupt the complete regulation of body temperature and other activities.

- 21** A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D [NEET 2013]



(a) A-Receptor, C-Synaptic vesicles  
(b) B-Synaptic connection, D-K<sup>+</sup>  
(c) A-Neurotransmitter, B-Synaptic cleft  
(d) C-Neurotransmitter, D-Ca<sup>2+</sup>

**Ans. (a)**

A-Receptor, B-Synaptic cleft, C-Synaptic vesicles, D-Ca<sup>2+</sup>.

- 22** The human hindbrain comprises three parts, one of which is [CBSE AIPMT 2012]

(a) spinal cord  
(b) corpus callosum  
(c) cerebellum  
(d) hypothalamus

**Ans. (c)**

The hindbrain generally has its anterior roof enlarged to form a pair of cerebellar hemispheres.

Its floor is thickened to form the pons anteriorly and the medulla oblongata posteriorly.

- 23** The nerve centres which control the body temperature and the urge for eating are contained in [CBSE AIPMT 2010]

(a) hypothalamus  
(b) pons  
(c) cerebellum  
(d) thalamus

**Ans. (a)**

Hypothalamus is the part of the sides and floor of the brain derived from the forebrain. It lies at the base of thalamus. The hypothalamus contains a number of centres, which control body temperature, urge for eating and drinking. It also contains several groups of neurosecretory cells, which secrete hormones called as hypothalamic hormones.

**24** Which part of human brain is concerned with the regulation of body temperature?

[CBSE AIPMT 2009]

- (a) Medulla oblongata
- (b) Cerebellum
- (c) Cerebrum
- (d) Hypothalamus

**Ans. (d)**

In human brain, **hypothalamus** is a centre for hunger, thirst, sweating, sleep, fatigue, temperature, anger, pleasure, love, hate and satisfaction.

**Medulla oblongata** is the centre for heartbeat, respiration, digestion, blood pressure, involuntary functions, and urination etc. **Cerebellum** regulates posture and balance.

**Cerebrum** is the centre for intelligence, emotion, will power, memory, consciousness, imagination, etc.

**25** Which one of the following statements is correct?

[CBSE AIPMT 2006]

- (a) Neurons regulate endocrine activity, but not *vice versa*
- (b) Endocrine glands regulate neural activity and nervous system regulates endocrine glands
- (c) Neither hormones control neural activity nor the neurons control endocrine activity
- (d) Endocrine glands regulate neural activity, but not *vice versa*

**Ans. (a)**

The autonomous nervous system regulates the secretion of glands whereas, the glands do not regulate the nervous system.

**26** Which one of the following do not act as a neurotransmitter?

[CBSE AIPMT 2006]

- (a) Acetylcholine
- (b) Epinephrine
- (c) Norepinephrine
- (d) Cortisone

**Ans. (d)**

Cortisone does not act as a neurotransmitter. Cortisone is a corticosteroid that is itself biologically inactive and is formed naturally in the adrenal gland (adrenal cortex) from the active hormone cortisol. Cortisol promotes the synthesis and storage of glucose and is important in the normal response to stress, suppresses inflammation and regulates deposition of fat in body.

**Acetylcholine** is a neurotransmitter secreted from the nerve endings.

**Epinephrine** and **norepinephrine** are secreted from the medulla of adrenal gland and these also act as neurotransmitter.

**27** One of the examples of the action of the autonomous nervous system is

[CBSE AIPMT 2005]

- (a) knee-jerk response
- (b) pupillary reflex
- (c) swallowing of food
- (d) peristalsis of the intestine

**Ans. (d)**

Peristalsis of the intestine is related with autonomous nervous system whereas, knee-jerk response, pupillary reflex and swallowing of food are related to reflex action.

**28** Four healthy people in their twenties got involved in injuries resulting in damage and death of a few cells of the following. Which of the cells are least likely to be replaced by new cells?

[CBSE AIPMT 2005]

- (a) Osteocytes
- (b) Malpighian layer of the skin
- (c) Liver cells
- (d) Neurons

**Ans. (d)**

Neuron cells are least likely to be replaced by new cells. These cells are specialised to conduct electrochemical current.

Nerve cells do not have the capability of division as they are restricted at  $G_0$ -phase of the cell cycle.

**29** In the resting state of the neural membrane, diffusion due to concentration gradients, if allowed, would drive

[CBSE AIPMT 2004]

- (a)  $K^+$  into the cell
- (b)  $K^+$  and  $Na^+$  out of the cell
- (c)  $Na^+$  into the cell
- (d)  $Na^+$  out of the cell

**Ans. (c)**

In the resting nerve fibre, the cytoplasm inside the axon has a high concentration of  $K^+$  and a low concentration of  $Na^+$  in contrast to the fluid outside the axon. Thus, if diffusion occurs then through concentration gradient  $Na^+$  enters the fibre.

**30** What used to be described as Nissl's granules in a nerve cell are now identified as

[CBSE AIPMT 2003]

- (a) ribosomes
- (b) mitochondria
- (c) cell metabolites
- (d) fat granules

**Ans. (a)**

Main cell body of neuron is called as cyton or soma. It contains a large and centrally located nucleus, mitochondria, Golgi bodies, rough endoplasmic reticulum, lysosomes, fat globules. Besides these soma also contains Nissl's granules or neurofibrils. These are masses of ribosomes and rough endoplasmic reticulum and are engaged in the process of protein synthesis.

**31** Which cells do not form layer and remain structurally separate?

[CBSE AIPMT 2001]

- (a) Epithelial cells
- (b) Muscle cells
- (c) Nerve cells
- (d) Gland cells

**Ans. (c)**

Only nerve cells do not form layers, they also remain structurally separate from each other (though communicate with each other through synapse).

Nerve cells or neurons are the cells specialised to conduct an electrochemical current, nerve tissue is made up of these cells and supporting cells.

**32** An action potential in the nerve fibre is produced when positive and negative charges on the outside and the inside of the axon membrane are reversed, because

[CBSE AIPMT 2000]

- (a) more potassium ions enter the axon as compared to sodium ions leaving it
- (b) more sodium ions enter the axon as compared to potassium ions leaving it
- (c) all potassium ions leave the axon
- (d) all sodium ions enter the axon

**Ans. (b)**

When a nerve fibre is stimulated, its membrane becomes more permeable to sodium ions. Hence, more sodium ions enter the axon than potassium ions leaving it. As a result, the positive and negative charges on the outside and inside of the membrane are reversed. The membrane with reversed polarity is called depolarised.

**33** Which cranial nerve has the highest number of branches?

[CBSE AIPMT 1999]

- (a) Facial nerve (b) Trigeminal  
(c) Vagus nerve (d) None of these

**Ans. (c)**

Vagus nerve has five branches

- (a) Superior laryngeal nerve  
(b) Recurrent laryngeal nerve  
(c) Cardiac nerve  
(d) Pneumogastric nerve  
(e) Depresser nerve

**34** The Nissl's granules of nerve cell are made up of [CBSE AIPMT 1997]

- (a) ribosomes (b) protein  
(c) DNA (d) RNA

**Ans. (a)**

Nissl's granules (or Nissl's bodies) are the groups of ribosomes and rough endoplasmic reticulum. These are actively involved in the synthesis of proteins.

**35** The roof of the cranium of frog is formed by [CBSE AIPMT 1997]

- (a) parasphenoid (b) alisphenoid  
(c) frontoparietal (d) orbitosphenoid

**Ans. (c)**

Dorsal part of the cranium is formed of two large and flat frontoparietals which are articulated together by a mid dorsal sagittal suture together and are collectively called frontoparietal. Endo-frontoparietal consists of a frontal bone (in front) and a parietal bone (behind). But now it has been proved that it is only the frontal bone, the parietals are not present in frog due to the absence of neck.

**36** The sympathetic nerves, in mammals arise from [CBSE AIPMT 1995]

- (a) sacral nerves  
(b) cervical nerves  
(c) thoraco-lumbar nerves  
(d) III, VII, IX and X cranial nerves

**Ans. (c)**

Sympathetic nerves arise from thoracic and lumbar spinal segments.

**37** Respiratory centre is situated in [CBSE AIPMT 1994, 99]

- (a) cerebellum  
(b) medulla oblongata  
(c) hypothalamus  
(d) cerebrum

**Ans. (b)**

Normally, the breathing process (inspiration and expiration) is controlled involuntarily by a breathing centre located in the **medulla oblongata**. The ventral portion of the breathing centre (inspiratory centre) increases the rate and depth of inspiration while the dorsal and lateral portions of the centre (expiratory centre) inhibit inspiration and stimulate expiration.

**38** CNS is mostly made of [CBSE AIPMT 1993]

- (a) motor neurons and sensory neurons  
(b) sensory neurons and association neurons  
(c) association neurons  
(d) motor neurons and association neurons

**Ans. (c)**

Central nervous system is mostly made up of association neurons.

**39** Ivan Pavlov performed experiments on

- (a) simple reflexes  
(b) conditioned reflexes  
(c) cardiac reflexes  
(d) origin of life

**Ans. (b)**

Conditional reflexes are those responses which can be initiated to a stimulus other than the one which normally initiates that response.

Conditional reflexes were first demonstrated by a Russian physiologist I Pavlov (1929). He conducted '**Bell experiment on dog**'. He rang a bell every time he offered food to a dog, finally he noticed that merely ringing bell can substitute sight or smell of food to initiate salivation.

**40** Vagus nerve is [CBSE AIPMT 1992, 97]

- (a) X (b) IX  
(c) VII (d) V

**Ans. (a)**

Vagus nerve is Xth cranial nerve. It is mixed in nature having both sensory and motor fibres.

**41** Third ventricle of brain is also known as [CBSE AIPMT 1990]

- (a) metacoel (b) rhinocoel  
(c) paracoel (d) diacoel

**Ans. (d)**

Inside diencephalon there is a narrow cavity called 3rd ventricle of brain or **diacoel**, which is connected anteriorly with lateral ventricles (also called **paracoel**) of cerebral hemisphere (called 1st and 2nd ventricle) by a common aperture called **foramen of Monro**.

While it is connected posteriorly with 4th ventricle of medulla oblongata through a narrow longitudinal canal called iter/aqueduct of Sylvius.

**42** Which of the following cranial nerves can regulate heartbeat? [CBSE AIPMT 1989]

- (a) X (b) IX (c) VIII (d) VII

**Ans. (a)**

Xth cranial nerve is vagus or pneumogastric nerve which originates from lateral side of medulla oblongata behind IX cranial nerve. It is a mixed nerve, its sensory fibres innervate to receptor present in the wall of visceral organs. Whereas, its motor fibres innervates to muscles in the wall of visceral organs-like heart, alimentary canal, trachea, lungs, kidneys, genital tracts etc. It also regulates heartbeat.

## TOPIC 3 Sensory Organs

**43** Match the following columns and select the correct option from the codes given below.

[NEET (Oct.) 2020]

Column I	Column II
A. Rods and cones	1. Absence of photoreceptor cells
B. Blind spot	2. Cones are densely packed
C. Fovea	3. Photoreceptor cells
D. Iris	4. Visible coloured portion of the eye

Codes

- A B C D  
(a) 3 1 2 4  
(b) 2 3 1 4  
(c) 3 4 2 1  
(d) 2 4 3 1

**Ans. (a)**

The option (a) is correct match which is as follows. Rods and cones are photoreceptor cells of eye.

Blind spot is the area where there is absence of any photoreceptor cells in the eye.

Fovea is the area in the eye where cones are densely packed.

Iris is the visible coloured portion of the eye.

- 44** Match the following columns and select the correct option.

[NEET (Sep.) 2020]

Column I	Column II
A. Organ of Corti	1. Connects middle ear and pharynx
B. Cochlea	2. Coiled part of the labyrinth
C. Eustachian tube	3. Attached to the oval window
D. Stapes	4. Located on the basilar membrane

- A B C D  
 (a) 3 1 4 2  
 (b) 4 2 1 3  
 (c) 1 2 4 3  
 (d) 2 3 1 4

**Ans. (b)**

Option (b) is correct because organ of Corti is located on the basilar membrane. The coiled portion of the labyrinth is called cochlea. The Eustachian tube connects the middle ear cavity with the pharynx. The middle ear contains ossicle called stapes that is attached to the oval window of the cochlea.

- 45** Which of the following receptors are specifically responsible for maintenance of the balance of body and posture?

[NEET (Odisha) 2019]

- (a) Basilar membrane and otoliths  
 (b) Hair cells and organ of Corti  
 (c) Tectorial membrane and macula  
 (d) Crista ampullaris and macula

**Ans. (d)**

The inner ear contains crista ampullaris and macula as the specific receptors of the vestibular apparatus responsible for maintenance of balance of the body and posture.

- 46** Which of the following statements is correct? [NEET (National) 2019]

- (a) Cornea consists of dense connective tissue of elastin and can repair itself

(b) Cornea is convex, transparent layer which is highly vascularised

(c) Cornea consists of dense matrix of collagen and is the most sensitive portion of the eye

(d) Cornea is an external, transparent and protective proteinaceous covering of the eyeball

**Ans. (c)**

The statement that cornea consists of dense matrix of collagen and is the most sensitive portion of the eye is correct.

Rest statements are incorrect. The correct information about the statements is as follows

The outer layer of the wall of eyeball, sclera, consists of a dense connective tissue containing mainly collagen and some elastic fibre. Cornea is convex, transparent layer which is non-vascularised. The cornea is the clear part of eye's protective covering.

- 47** The transparent lens in the human eye is held in its place by

[NEET 2018]

- (a) smooth muscles attached to the iris  
 (b) ligaments attached to the iris  
 (c) ligaments attached to the ciliary body  
 (d) smooth muscles attached to the ciliary body

**Ans. (c)**

The lens in the human eye is held in place by the suspensory ligaments attached to the ciliary body. The function of other components are as follows

The smooth muscles attached to the ciliary body helps to control the shape of lens.

Smooth muscles of iris help in regulating the diameter of pupil.

Pactinate ligament attached to iris is involved in the drainage of aqueous humor because it contains spaces between the fibres.

- 48** Photosensitive compound in human eye is made up of

[NEET 2016, Phase I]

- (a) opsin and retinal  
 (b) opsin and retinol  
 (c) transducin and retinene  
 (d) guanosine and retinol

**Ans. (a)**

Photosensitive pigment rhodopsin in human eye is made up of opsin protein and retinal [aldehyde form of vitamin-A (retinol)]. These pigments are present in the rod cells of retina layer of eye.

- 49** Choose the correct statement.

[NEET 2016, Phase II]

- (a) Nociceptors respond to changes in pressure  
 (b) Meissner's corpuscles are thermoreceptors  
 (c) Photoreceptors in the human eye are depolarised during darkness and become hyperpolarised in response to the light stimulus  
 (d) Receptors do not produce graded potentials

**Ans. (c)**

The photosensitive compounds (Rhodopsin) in the human eye is composed of opsin (a protein) and retinal (an aldehyde of vitamin-A, i.e. retinol).

It is present in the rod cells (Photoreceptors). Light induces dissociation of retinol, from opsin thus changing the structure of opsin. This creates potential differences in the photoreceptors and they become hyperpolarised.

However, during darkness rhodopsin is resynthesised from opsin and retinine to restore the dark vision and photoreceptors are depolarised.

The correct form of other statements are

- (a) Nociceptors are sensory nerve cells that respond to potentially damaging chemical or mechanical stimuli and send them to brain and spinal cord.  
 (b) Meissner's receptors are tactile receptors receiving the stimuli of pressure.  
 (d) Receptors always produce graded potentials.

- 50** In mammalian eye, the 'fovea' is the center of the visual field, where

[CBSE AIPMT 2015]

- (a) high density of cones occur, but has no rods  
 (b) the optic nerve leaves the eye  
 (c) only rods are present  
 (d) more rods than cones are found

**Ans. (a)**

At the posterior pole of the eye lateral to the blind spot, there is a yellowish pigmented spot called macula lutea with a central pit called the fovea. It is a thinned-out portion of the retina where only the cones are densely packed. It is the point where the visual acuity (resolution) is the highest.



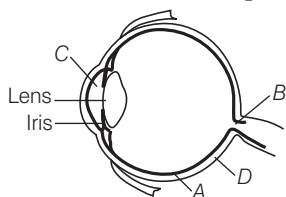
- 51** Which one of the following statements is not correct?  
[CBSE AIPMT 2014]

- (a) Retinal is the light absorbing portion of visual photopigments
- (b) In retina the rods have the photopigment rhodopsin, while cones have three different photopigments
- (c) Retinal is a derivative of vitamin-C
- (d) Rhodopsin is the purplish red protein present in rods only

**Ans. (c)**

Retinal pigment of epithelium shields the retina from excess incoming light. It supplies omega-3 fatty acid and glucose to the retina. The former is used for building photoreceptive by membranes the latter used for energy retinal is supplied by the visual vitamin-A cycle.

- 52** Parts A, B, C and D of the human eyes are shown in the diagram. Select the option, which gives correct identification along with its functions/characteristics  
[NEET 2013]



- (a) A-Retina-contains photoreceptors-rods and cones
- (b) B-Blind spot-has only a few rods and cones
- (c) C-Aqueous chamber-reflects the light, which does not pass through the lens
- (d) D-Choroiditis anterior part forms ciliary body

**Ans. (a)**

A-Retina—Contains photoreceptors - rods and cones. The daylight vision is function of cones and twilight vision is related to rods.

B-Blind spot—Photoreceptor cells are not present in this part.

C-Aqueous chamber contains a thin watery fluid called aqueous humour.

D-Sclera is the external layer of eye having dense connective tissue.

- 53** Which part of the human ear plays no role in hearing as such but is otherwise very much required?  
[CBSE AIPMT 2012]

- (a) Eustachian tube
- (b) Organ of Corti
- (c) Vestibular apparatus
- (d) Ear ossicles

**Ans. (c)**

The inner ear contains a complex system called vestibular apparatus which is located above the cochlea. It has no role in hearing but is influenced by gravity and movements. Its specific receptors called crista and macula are responsible for maintenance of balance of the body and posture.

- 54** The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eyes is a derivative of  
[CBSE AIPMT 2011]

- (a) vitamin-C
- (b) vitamin-D
- (c) vitamin-A
- (d) vitamin-B

**Ans. (c)**

There are two types of photoreceptor cells of retina, namely rods and cones. The rods contain a purplish red protein called the **rhodopsin** (visual purple), which is a derivative of vitamin-A.

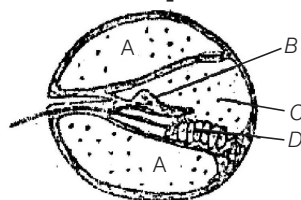
- 55** Cornea transplant in human is almost never rejected. This is because  
[CBSE AIPMT 2008]

- (a) its cells are least penetrable by bacteria
- (b) it has no blood supply
- (c) it is composed of enucleated cells
- (d) it is a non-living layer

**Ans. (b)**

Cornea is a transparent portion that forms the anterior one-sixth of the eyeball. The cornea admits and helps to focus light waves as they enter the eye. It is avascular, i.e., has no blood supply therefore, cornea transplant in human is almost never rejected.

- 56** Given below is a diagrammatic cross section of a single loop of human cochlea. [CBSE AIPMT 2008]

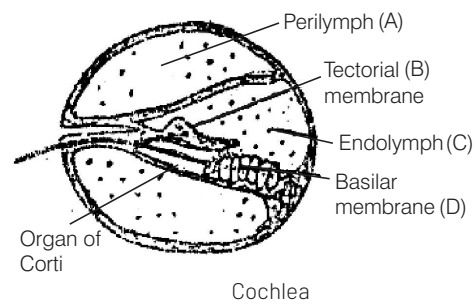


Which one of the following options correctly represents the names of three different parts?

- (a) B—Tectorial membrane, C—Perilymph, D— Secretory cells
- (b) C—Endolymph, D—Sensory hair cells, A— Serum
- (c) D—Sensory hair cells, A—Endolymph, B— Tectorial membrane
- (d) A—Perilymph, B—Tectorial membrane, C— Endolymph

**Ans. (d)**

Cochlea is the main hearing organ, which is connected with saccule by short ductus reunions leading from the saccule. It consists of three fluid filled chambers or canals the upper scala vestibuli, lower scala tympani and middle scala media. Both scala vestibuli and scala tympani are filled with perilymph (A) while scala media is filled with endolymph.(C) The tectorial membrane (B) overhangs the sensory hair in scala media.



- 57** Which one of the following is the correct difference between rod cells and cone cells of our retina?  
[CBSE AIPMT 2008]

	Rod cells	Cone cells
(a) Visual acuity	High	Low
(b) Visual pigment contained	Iodopsin	Rhodopsin
(c) Overall function	Vision in poor light	Colour vision and detailed vision in bright light
(d) Distribution	More concentrated in centre of retina	Evenly distributed all over retina

**Ans. (a)**

The rods contain the rhodopsin (visual purple) pigment and enable the animals to see in darkness. Therefore, present in large number in nocturnal animals. The cones contain the iodopsin (visual violet) pigment and chiefly concerned with distinction in colour and light vision during day time.

**58** Bowman's glands are located in the  
[CBSE AIPMT 2007]

- (a) proximal end of uriniferous tubules
- (b) anterior pituitary
- (c) female reproductive system of cockroach
- (d) olfactory epithelium of our nose

**Ans. (d)**

Many olfactory glands (Bowman's glands) occur below the olfactory epithelium that secrete mucus over the epithelium to keep it moist.

**59** What is the intensity of sound in normal conversation?  
[CBSE AIPMT 2001]

- (a) 10-20 dB
- (b) 35-60 dB
- (c) 70-90 dB
- (d) 120-150 dB

**Ans. (b)**

The intensity of sound in normal conversation is around 35-60 dB. The word noise is originated from the Latin word nausea and is defined as unwanted or unpleasant sound that causes discomfort.

Intensity of some noise sources is as follows

Source	Intensity (dB)
Breathing	10
Broadcasting studio	20
Trickling clock	30
Library	30-35
Normal conversation	35-60
Telephone	60
Office noise	60-80
Alarm clock	70-80
Traffic	50-90
Motor cycle	105
Jet fly (over 1000')	100-110
Train whistle (50')	110
Air craft (100')	110-120
Commercial jet air craft (100')	120-140
Space rocket (launching)	170-180

**60** Characteristic feature of human cornea is that [CBSE AIPMT 2001]

- (a) it is secreted by conjunctiva and glandular tissue
- (b) it is lacrimal gland which secretes tears
- (c) blood circulation is absent in cornea
- (d) in old age it become hard and white layer deposits on it which causes the cataract

**Ans. (c)**

Human eye is about 1 inch in diameter and is covered and protected by the **sclera**, which is made up of tough connective tissue. The front of eye is transparent thus allows the light to enter the eye. This portion of the eye's outer layer is called **cornea**. It lacks a blood supply.

It derives nutrients via aqueous humour from cell body. Cornea not only allows light to enter the eye but also bend it as well. This makes it a characteristic feature of human eye, i.e. cornea.

**61** When we migrate from dark to light, we fail to see for some time but after a time visibility becomes normal. It is an example of  
[CBSE AIPMT 2001]

- (a) accommodation
- (b) adaptation
- (c) mutation
- (d) photoperiodism

**Ans. (b)**

It takes some time for rhodopsin to split into scotopsin and retinal (bleaching) and release of transmitter passing nerve impulse via bipolar and ganglion cells to the optic nerves. This is a case of adaptation. It differs from accommodation which is a reflex mechanism by which the focus of the eye change to make the images of distant and near objects sharp on the retina.

**62** In the chemistry of vision in mammals, the photosensitive substance is called  
[CBSE AIPMT 1997]

- (a) sclerotin
- (b) retinal
- (c) rhodopsin
- (d) melanin

**Ans. (c)**

Rods of the retina contain the light-sensitive pigment rhodopsin which is formed by a combination of the protein molecule called scotopsin and a small light absorbing molecule called retinene (retinal).

**63** In frog, 'fenestra ovalis' is  
[CBSE AIPMT 1997]

- (a) the opening in the auditory capsule which separates the middle ear from internal ear
- (b) the air-filled cavity of the middle ear
- (c) the communication between the pharynx and the tympanic cavity

(d) the external opening of the tympanic cavity which is covered by the tympanic membrane

**Ans. (a)**

'Fenestra ovalis' is an oval aperture through which tympanic cavity is connected with auditory capsule which houses the internal ear.

**64** Cornea transplantation is outstandingly successful because  
[CBSE AIPMT 1996]

- (a) cornea is easy to preserve
- (b) cornea is not linked up with blood vascular and immune systems
- (c) the technique involved is very simple
- (d) cornea is easily available

**Ans. (b)**

Cornea is non-vascular, i.e. no blood supply so, its transplantation is outstandingly successful.

**65** Retina is most sensitive at  
[CBSE AIPMT 1993]

- (a) optic disc
- (b) periphery
- (c) macula lutea
- (d) fovea centralis

**Ans. (d)**

Retina is most sensitive at fovea centralis. It is with a depression, **fovea centralis** in its middle-N it is the area of **most distinct day vision**. Yellow spot or macula lutea or area centralis is a small area on retina which lies opposite to optical axis of the lens. Only cones are present in this area so, it most sensitive to day light vision.

**66** Function of iris is to  
[CBSE AIPMT 1993]

- (a) move lens forward and backward
- (b) refract light rays
- (c) bring about movements of eyelids
- (d) alter the size of pupil

**Ans. (d)**

Iris controls the amount of light that reaches the photosensors at the back of the eye. It consists of circular sphincters and radial dilators. The function of iris is to alter the size of pupil.

**67** Light rays entering the eye are controlled by [CBSE AIPMT 1993]

- (a) pupil
- (b) iris
- (c) cornea
- (d) lens

**Ans. (a)**

Pupil is the black hole in the centre of the iris. It is the area through which light enters the eyeball, i.e. pupil is the aperture that controls the light entering into the eye.

**68** Iris is part of [CBSE AIPMT 1992]

- (a) sclerotic
- (b) choroid/uvula
- (c) choroid and retina
- (d) sclerotic and choroid

**Ans. (c)**

Iris consists of two layers, outer one lies in continuation with choroid, while inner one is in continuation with retina.

**69** Sensitive pigmented layer of eye is [CBSE AIPMT 1989]

- (a) cornea
- (b) retina
- (c) sclerotic
- (d) iris

**Ans. (b)**

Retina consists of a pigmented layer and a nervous tissue layer, first there is the photoreceptor layer containing photosensitive cells, the rods and cones. Rod cells are sensitive towards light and are used for vision in dim light, having no ability to detect colour, whereas cones are used for bright light vision with the ability to make coloured images of the object.

Next is the intermediate layer containing short sensory bipolar neurons. Bipolar cells interpose synapse with the retinal ganglion cells, whose axons bundle together as the optic nerve.

**70** Acute vision is present in [CBSE AIPMT 1988]

- (a) vulture
- (b) shark
- (c) bat
- (d) frog

**Ans. (a)**

Acute vision is found in birds like vulture.

## TOPIC 4

### Disorders of the Nervous System and Sensory Organs/System

**71** Snow blindness in Antarctic region is due to [NEET (Sep.) 2020]

- (a) inflammation of cornea due to high dose of UV-B radiation
- (b) high reflection of light from snow
- (c) damage to retina caused by infrared rays
- (d) freezing of fluids in the eye by low temperature

**Ans. (a)**

Snow blindness in Antarctic region is due to inflammation of cornea due to high dose of UV-B radiation. It is a painful, temporary loss of vision due to overexposure to the sun's UV rays. It is also called 'photo keratitis' (photo = light, keratitis = inflammation of the cornea).

**72** In a man, abducens nerve is injured. Which one of the following functions will be affected? [CBSE AIPMT 2005]

- (a) Movement of the eye ball
- (b) Swallowing
- (c) Movement of the tongue
- (d) Movement of the neck

**Ans. (a)**

Abducens (abducent) nerve is a cranial nerve which originates from the ventral surface of medulla oblongata. It innervates the lateral rectus muscle of eyeball. It is a motor nerve and controls the movements of the eyeball. Hence, if abducens nerve is injured in a man, movement of eyeball will be affected.

**73** Parkinson's disease (characterised by tremors and progressive rigidity of limbs) is caused by degeneration of brain neurons that are involved

in movement control and make use of neurotransmitter

[CBSE AIPMT 2005]

- (a) acetylcholine
- (b) norepinephrine
- (c) dopamine
- (d) GABA

**Ans. (c)**

Abnormal release of neurotransmitter dopamine leads to Parkinson's disease in humans. It is caused by degeneration of brain neurons that are involved in control movement.

**74** Injury to vagus nerve in human is not likely to affect [CBSE AIPMT 2004]

- (a) tongue movements
- (b) gastrointestinal movements
- (c) pancreatic secretion
- (d) cardiac movements

**Ans. (a)**

Vagus nerve is a mixed cranial nerve which is, controlling much of the gut, ventilatory system and heart. It does not affect tongue movements. Tongue movement is controlled by glossopharyngeal nerve.

**75** A person suffering from the deficiency of the visual pigment rhodopsin is advised to take more [CBSE AIPMT 2000]

- (a) radish and potato
- (b) apple and grapes
- (c) carrot and ripe papaya
- (d) guava and ripe banana

**Ans. (c)**

Carrot and ripe papaya contain carotene from which vitamin-A is synthesised. Vitamin-A is necessary for the formation of rhodopsin.

The visual pigments in vertebrate eyes are located in the tips of specialised sensory cells called **rod cell** and **cone cells**. Rod cells contain rhodopsin and are responsible for black and white vision.