

18 Neural Control and Coordination



18.2. Human Neural System

- In a man, abducens nerve is injured. Which one of the following functions will be affected?
(A) Movement of the eyeball
(B) Movement of the tongue
(C) Swallowing
(D) Movement of the neck [AIPMT 2005]
- One of the examples of the action of the autonomous nervous system is:
(A) swallowing of food
(B) pupillary reflex
(C) peristalsis of the intestines
(D) knee-jerk response [AIPMT 2005]
- Injury to vagus nerve in humans is not likely to affect:
(A) tongue movements
(B) gastrointestinal movements
(C) pancreatic secretion
(D) cardiac movements [AIPMT 2004]
- Which cranial nerves have the highest number of branches?
(A) Vagus nerve (B) Trigeminal nerve
(C) Facial nerve (D) None of these [AIPMT 1999]
- Sympathetic nervous system induces:
(A) heartbeat
(B) secretion of digestive juices
(C) secretion of saliva
(D) All of the above [AIPMT 1997]
- In humans, visceral organs are innervated by:
(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 [AIPMT 1996]

- Sympathetic nerves in mammals arise from:
(A) sacral nerves
(B) cervical nerves
(C) thoraco-lumbar nerves
(D) 3rd, 7th, 9th, and 10th cranial nerves. [AIPMT 1995]
- Afferent nerve fibres carry impulses from:
(A) effector organs to CNS
(B) receptors to CNS
(C) CNS to receptors
(D) CNS to muscles. [AIPMT 1992]
- One function of parasympathetic is:
(A) contraction of hair muscles
(B) stimulation of sweat glands
(C) acceleration of heartbeat
(D) constriction of pupil [AIPMT 1990]
- Which of the following cranial nerves can regulate heartbeat?
(A) X (B) IX
(C) VIII (D) VII [AIPMT 1989]

18.3. Neuron as Structural and Functional Unit of Neural System

- Match List-I with List-II:

List-I	List-II
(a) Schwann cells	(i) Neurotransmitter
(b) Synaptic knob	(ii) Cerebral cortex
(c) Bipolar neurons	(iii) Myelin sheath
(d) Multipolar neurons	(iv) Retina

Choose the correct answer from the options given below:

- | | | | |
|-----------|-------|------|-------|
| (a) | (b) | (c) | (d) |
| (A) (iii) | (i) | (iv) | (ii) |
| (B) (i) | (iv) | (ii) | (iii) |
| (C) (iv) | (iii) | (ii) | (i) |
| (D) (ii) | (iii) | (i) | (iv) |
- [Re-NEET 2024]
- Select the incorrect statement regarding synapses:
(A) Electrical current can flow directly from one neuron into the other across the electrical synapse.
(B) Chemical synapses use neurotransmitters.

- (C) Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.
 (D) The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse. [NEET 2022]

13. Nissl's bodies are mainly composed of:

- (A) nucleic acids and SER
 (B) DNA and RNA
 (C) proteins and lipids
 (D) free ribosomes and RER [NEET 2018]

14. Receptor sites for neurotransmitters are present on:

- (A) membranes of synaptic vesicles
 (B) pre-synaptic membrane
 (C) tips of axons
 (D) post-synaptic membrane. [NEET 2017]

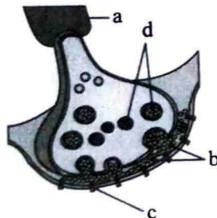
15. Myelin sheath is produced by:

- (A) Schwann cells and Oligodendrocytes
 (B) Astrocytes and Schwann cells
 (C) Oligodendrocytes and Osteoclasts
 (D) Osteoclasts and Astrocytes [NEET 2017]

16. The most abundant intracellular cation is:

- (A) Na^+ (B) Ca^{2+}
 (C) H^+ (D) K^+ [NEET 2013]

17. The figure shows an axon terminal and synapse. Select the option giving correct identification of labels a-d.



- (A) a - Action potential, c - Neurotransmitter
 (B) b - Neurotransmitter, d - Receptor capsules
 (C) c - Receptor, d - Synaptic vesicles
 (D) a - Axon terminal, b - Serotonin complex [NEET Karnataka 2013]

18. When a neuron is in resting state, i.e., not conducting any impulse, the axonal membrane is:

- (A) equally permeable to both Na^+ and K^+ ions
 (B) impermeable to both Na^+ and K^+ ions
 (C) comparatively more permeable to K^+ ions and nearly impermeable to Na^+ ions
 (D) comparatively more permeable to Na^+ ions and nearly impermeable to K^+ ions. [AIPMT Screening 2011]

19. During the propagation of a nerve impulse, the action potential results from the movement of:

- (A) K^+ ions from extracellular fluid to intracellular fluid
 (B) Na^+ ions from intracellular fluid to extracellular fluid

- (C) K^+ ions from intracellular fluid to extracellular fluid
 (D) Na^+ ions from extracellular fluid to intracellular fluid. [AIPMT Screening 2008]

20. Which one of the following pairs of structures distinguishes a nerve cell from other types of cell?

- (A) Vacuoles and fibres
 (B) Flagellum and medullary sheath
 (C) Nucleus and mitochondria
 (D) Perikaryon and dendrites. [AIPMT 2007]

21. Which one of the following does not act as a neurotransmitter?

- (A) Cortisone (B) Acetylcholine
 (C) Epinephrine (D) Nor epinephrine [AIPMT 2006]

22. Parkinson's disease (characterized by tremors and progressive rigidity of limbs) is caused by degeneration of brain neurons that are involved in movement and control and make use of neurotransmitter:

- (A) acetylcholine (B) nor epinephrine
 (C) dopamine (D) GABA [AIPMT 2005]

23. Four healthy people in their twenties got involved in injuries resulting in damage and death of few cells of the following.

Which of the cell, are least likely to be replaced by new cells?

- (A) Liver cells
 (B) Neurons
 (C) Malpighian layer of the skin
 (D) Osteocytes [AIPMT 2005]

24. In the resting state of the neural membrane, diffusion due to concentration gradients, if allowed, would drive:

- (A) K^+ into the cell
 (B) K^+ and Na^+ out of the cell
 (C) Na^+ into the cell
 (D) Na^+ out of the cell. [AIPMT 2004]

25. What used to be described as Nissl's granules in a nerve cell are now identified as:

- (A) cell metabolites (B) fat granules
 (C) ribosomes (D) mitochondria. [AIPMT 2003]

26. Which of the following statement is correct for node of Ranvier of nerve?

- (A) Neurilemma is discontinuous.
 (B) Myelin sheath is discontinuous.
 (C) Both neurilemma and myelin sheath are discontinuous.
 (D) Covered by myelin sheath. [AIPMT 2002]

27. Depolarization of axolemma during nerve conduction takes place because of:

- (A) equal amount of Na^+ and K^+ move out across axolemma
- (B) Na^+ move inside and K^+ move more outside
- (C) more Na^+ outside
- (D) none of the above

[AIPMT 2000]

28. Which of the following is regarded as a unit of nervous tissue?

- (A) Myelin sheath (B) Axons
- (B) Dendrites (D) Neurons

[AIPMT 1999]

29. The junction between the axon of one neuron and the dendrite of the next is called:

- (A) junction point (B) a synapse
- (C) a joint (D) constant bridge

[AIPMT 1999]

18.4. Central Neural System

30. Match List I with List II:

List I	List II
(a) Pons	(i) Provides additional space for Neurons, regulates posture and balance.
(b) Hypothalamus	(ii) Controls respiration and gastric secretions.
(c) Medulla	(iii) Connects different regions of the brain.
(d) Cerebellum	(iv) Neuro secretory cells

Choose the correct answer from the options given below:

- | | | | |
|-----------|-------|-------|------|
| (a) | (b) | (c) | (d) |
| (A) (iii) | (iv) | (ii) | (i) |
| (B) (i) | (iii) | (ii) | (iv) |
| (C) (ii) | (i) | (iii) | (iv) |
| (D) (ii) | (iii) | (i) | (iv) |

[NEET 2024]

31. Given below are two statements:

Statement I: The cerebral hemispheres are connected by nerve tract known as corpus callosum.

Statement II: The brain stem consists of the medulla oblongata, pons and cerebrum.

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

- (A) Both Statement I and Statement II are incorrect.
- (B) Statement I is correct but Statement II is incorrect.
- (C) Statement I is incorrect but Statement II is correct.
- (D) Both Statement I and Statement II are correct.

[NEET 2024]

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

- (A) Brain stem and epithalamus
- (B) Corpus callosum and thalamus
- (C) Limbic system and hypothalamus
- (D) Corpora quadrigemina and hippocampus

[NEET 2023]

33. Which part of the brain is responsible for thermoregulation?

- (A) Hypothalamus (B) Corpus callosum
- (C) Medulla oblongata (D) Cerebrum

[NEET National 2019]

34. Which of the following regions of the brain is incorrectly paired with its function?

- (A) Medulla oblongata-Homeostatic control
- (B) Cerebellum-Language comprehension
- (C) Corpus callosum-Communication between the left and right cerebral cortices
- (D) Cerebrum-Calculation and contemplation

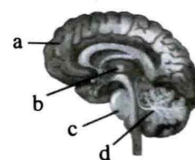
[AIPMT Cancelled 2015]

35. Injury localised to the hypothalamus would most likely disrupt:

- (A) short term memory
- (B) coordination during locomotion
- (C) executive function, such as decision making
- (D) regulation of body temperature.

[AIPMT 2014]

36. A sagittal section of human brain is shown here. Identify at least two labels from a-d.



- (A) c-Mid brain, d-Cerebellum
- (B) a-Cerebrum, c-Pons
- (C) b-Corpus callosum, d-Medulla
- (D) a-Cerebral hemispheres, b-Cerebellum

[NEET Karnataka 2013]

37. The human hindbrain comprises three parts, one of which is:

- (A) spinal cord (B) corpus callosum
- (C) cerebellum (D) hypothalamus

[AIPMT Screening 2012]

38. The nerve centres which control the body temperature and the urge for eating are contained in:

- (A) hypothalamus (B) pons
- (C) cerebellum (D) thalamus.

[AIPMT Screening 2010]

39. Third ventricle of brain is also known as:

- (A) metacoel (B) rhinocoel
- (C) paracoel (D) diacoel

[AIPMT 1990]

SOLUTIONS

1. (A) The abducens nerve is the sixth paired cranial nerve. It has a purely somatic motor function – providing innervation to the lateral rectus muscle of the eye ball and it is responsible for outward gaze. On the other hand, movement of the tongue is controlled by the hypoglossal nerve. Swallowing is controlled by glossopharyngeal nerves and movement of the neck is controlled by the facial nerve.

Related Theory

- Six cranial nerves innervate motor, sensory and autonomic structures in the eyes. The six cranial nerves are the optic nerve (CN II), oculomotor nerve (CN III), trochlear nerve (CN IV), trigeminal nerve (CN V), abducens nerve (CN VI), and facial nerve (CN VII).

Mnemonics

- 12 pair of cranial nerves found in human body can be learned as:

Oh Oh Oh To Touch And Feel a Velvet Gives Very Amazing Happiness

Oh	– Olfactory nerve
Oh	– Optic nerve
Oh	– Oculomotor nerve
To	– Trochlear nerve
Touch	– Trigeminal nerve
And	– Abducens nerve
Feel a	– Facial nerve
Velvet	– Vestibular/Auditory nerve
Gives	– Glossopharyngeal nerve
Very	– Vagus nerve
Amazing	– Accessory nerve (or spinal accessory nerve)
Happiness	– Hypoglossal nerve

2. (C) The autonomic nervous system regulates involuntary physiological processes including heart rate, blood pressure, respiration, digestion, and sexual arousal. It contains three anatomically distinct divisions: sympathetic, parasympathetic and enteric. A reflex action, also known as a reflex, is an involuntary and nearly instantaneous movement in response to a stimulus. A reflex does not require any thought input. Peristalsis of intestine is related with autonomic nervous system whereas knee-jerk response, pupillary reflex and swallowing of food are reflex action.

Related Theory

- The path taken by the nerve impulses in a reflex is called a reflex arc. In higher animals, most sensory neurons do not pass directly into the brain, but synapse in the spinal cord. This characteristic allows reflex actions to occur relatively quickly by activating spinal motor neurons without the delay of routing signals through the brain, although the brain will receive sensory input while the reflex action occurs.

Caution

- Students should remember that autonomic nervous system is regulated by CNS while reflex action is controlled by spinal nerves.

3. (A) Vagus nerve (cranial nerve X) is the longest cranial nerve which runs from the brain through the neck and thorax to the abdomen. It is a mixed nerve that contains parasympathetic fibres. This nerve controls the visceral sensations and visceral movements, such as heart beat, movement of tongue sound production, respiratory movements, peristalsis, etc.

Mnemonics

- Afferent and efferent nerves can be memorised as:

SAME

Sensory – Afferent

Motor – Efferent.

4. (A) The vagus nerve has the highest number of branches, which are as follows:

In the jugular fossa: meningeal, auricular branches.

In the neck: pharyngeal, superior laryngeal, recurrent laryngeal nerves; superior cardiac branches.

In the thorax: inferior cardiac nerve, anterior bronchial branches, posterior bronchial branches, esophageal branches.

In the abdomen: gastric, celiac and hepatic branches.

The vagus nerve is made up of somatic and visceral afferent fibres, as well as general and particular visceral efferent fibres.

Related Theory

- The trigeminal nerve is the most complex nerve and is important for sensation in the face, as well as aiding in chewing and biting food. It only has main branches. As a result of its complexity, it is only classified into three branches.
- The facial nerve is primarily in charge of coordinating facial expression muscles as well as taste sense. It only has five major branches. It is a local nerve and so only found in one area.

5. (A) The sympathetic nervous system is well known for its role in responding to danger or stress. In certain instances, the sympathetic nervous system acts to increase heart rate, carry more blood to parts of the body that require more oxygen, or perform other actions to assist in getting out of danger.

6. (D) Both sympathetic and parasympathetic nerve fibres innervate visceral organs and coordinate their antagonistic activity, but this is not under conscious control of the human.

Related Theory

- The visceral neural system is a component of the peripheral nervous system that includes the entire network of nerves, fibres, ganglia, and plexuses through which impulses travel from the central nervous system to the viscera and vice-versa.

7. (C) In mammals, sympathetic nerves emerge from the thoracic-lumbar area. A chain of 21 sympathetic ganglia on either side of the spinal cord represents it. It receives preganglionic sympathetic fibres from the spinal cord, which make these exit along with

thoracic and lumbar regions. It is a component of the nervous system that causes the heart to beat faster, blood vessels to constrict, and blood pressure to rise.

8. (B) In the nervous system, afferent neurons carry impulses from the receptors or sense organs to CNS (central nervous system).
9. (D) Parasympathetic nervous system is opposite to that of the sympathetic nervous system (SNS). If the sympathetic nervous system accelerates an action, the parasympathetic nervous system slows it. The parasympathetic nervous system is responsible for all the activities that take place when the body is at rest. During a period of flight and fight, the pupils dilate to allow us to see more clearly and make faster decisions. During rest, it causes the pupil to constrict.
10. (A) X cranial nerve (vagus nerve) is a mixed nerve that arises from the side of medulla. It controls the visceral sensations and movements of larynx, lungs, heart, stomach and intestines.
11. (A) Schwann cells produce the myelin sheath around neuronal axons in the peripheral nervous system. Synaptic knobs release neurotransmitters to transmit nerve impulses across synapses. Bipolar neurons are found in the retina of the eye, where they transmit visual information. Multipolar neurons are commonly found in the cerebral cortex and are responsible for complex processing.
12. (C) A nerve impulse is conveyed from one neuron to another via synapses, synapses are junctions between neurons. A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron that are separated by a space known as a synaptic cleft. Electrical synapses and chemical synapses are the two types of synapses. The membranes of pre- and post-synaptic neurons are relatively close together at electrical synapses. Through these synapses, electrical current can travel directly from one neuron to the other. The transmission of an impulse across electrical synapses is remarkably similar to the transmission of an impulse through a single axon. Electrical synaptic impulse transmission is always faster than chemical synapse impulse transmission. Chemical synapse occurs when a presynaptic neuron releases neurotransmitters that bind to a postsynaptic neuron to transmit information from one neuron to another.
13. (D) Nissl's granules are found in the cell body on the nerve cell, are composed of RER that bear free ribosomes and help in the synthesis of proteins.

Related Theory

→ Nissl's bodies (chromatin granules) are basophilic and stained by crystal violet are present in the perikaryon and dendrites but not the axon hillock. They are more prominent in motor

than in sensory neurons. They consist of rough endoplasmic reticulum, and free ribosomes containing RNA concerned in production of proteins necessary for cell metabolism and structural maintenance. Some neurons synthesize peptide neurotransmitters.

14. (D) Receptors of neurotransmitter are present on post-synaptic membrane. While neurotransmitters are released from synaptic vesicles, via pre-synaptic membrane.
15. (A) Myelin sheath is a modified plasma membrane around the axon of a nerve cell, in a spiral fashion. In peripheral nervous system, Schwann cell forms myelin sheath, while in central nervous system, oligodendrocytes produce myelin sheath.

Related Theory

→ The main function of myelin sheath include protecting the nerves from other electrical impulses, and speeding the transmission of nerve impulse time. Unmyelinated nerves must send a wave down the entire length of the nerve. In large organisms, this presents a problem, as the signal takes a long time to reach the end of the nerve. Due to saltatory conduction, the individual myelin sheaths cause the signal to leap from one node of Ranvier to the next. This mode of propagating a signal down the axon also saves energy, as the sodium and potassium pumps that regulate the action potential are not needed under the myelin sheath.

Mnemonics

→ Structure involved in synthesis of Myelin sheath in different nervous system can be learned as:

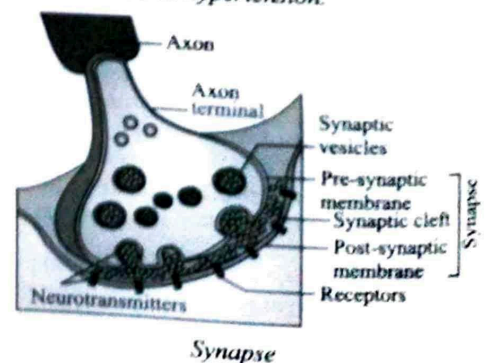
COPS: Central Nervous system – Oligodendrocytes
Peripheral Nervous system – Schwann cell.

16. (D) Potassium ion (K^+) is the major intracellular cation. Sodium ion (Na^+) is the major extracellular cation. Calcium ion (Ca^{2+}) plays a major role in signal transduction. Hydrogen ion (H^+) is found in all aqueous solutions of acidic environment.

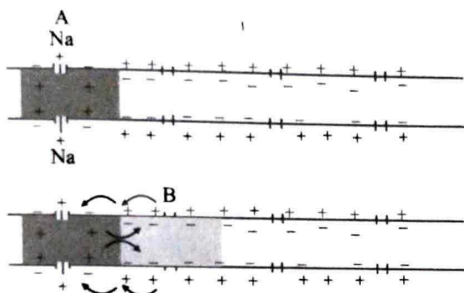
Related Theory

→ Chloride ions (Cl^-) are the principle anions found outside cells in the body. They serve as counterions (ions necessary to balance electrical charge) for Na^+ in the extracellular fluid and for H^+ in gastric juice. Like Na^+ , Cl^- are ingested mainly as table salt. Like Na^+ and K^+ , Cl^- ions are involved in maintaining acid-base and fluid balances. It is difficult to separate the effect of too much Cl^- from that of too much Na^+ . Both seem to be involved in hypertension.

17. (C)



18. (C) Resting state is the condition in which there is no propagation of impulse. As the impulse passes from one part of the neuron to other the conductivity of the ions in the previous part decreases and the ion channels start closing. During this stage, K^+ ion channels are opened as they are slow workers and also called as lazy channels. They take more time to close and hence they remain open. Na^+ channels gets closed as the impulse passes off. Due to the presence of opened K^+ channels, the permeability of K^+ is more and as the Na^+ channels are closed the membrane is impermeable to Na^+ . So, the resting state of axon have more K^+ inside and more Na^+ outside.



Diagrammatic Representation of Impulse Conduction Through an Axon (at points A and B)

Related Theory

- The resting membrane potential of a neuron is about -70 mV ($\text{mV}=\text{millivolt}$) - this means that the inside of the neuron is 70 mV less than the outside. At rest, there are relatively more sodium ions (Na^+) outside the neuron and more potassium ions (K^+) inside that neuron.
19. (D) During the propagation of nerve impulse, the permeability of the membrane to Na^+ ions is increased at the point of stimulation (polarised membrane). As a result, the sodium ion channels permit the influx of Na^+ by diffusion.

Related Theory

- K^+ is the major intracellular cation. Na^+ is the major extracellular cation. Cl^- are the principal anions found outside cells in the body. They serve as counter ions for Na^+ the extracellular fluid and for H^+ in gastric juice.
20. (D) A nerve cell consists of cell body (perikaryon) containing the nucleus, Nissl's granules, dendrites and an axon. These are specialised cells meant for the transmission of the nerve impulses.

Mnemonics

- Parts of neuron can be memorised as:
Daisy Nanny Can Now Speak Assamese Marathi Nepali And Sindhi
 Daisy - Dendrites
 Nanny - Nissl's Granules
 Can - Cell body
 Now - Nucleus
 Speak - Schwann Cells
 Assamese - Axon
 Marathi - Myelin Sheath

Nepali - Node of Ranvier
 And - Axon Terminal
 Sindhi - Synaptic Knob

21. (A) Cortisone a steroid, promotes the synthesis and storage of glucose and is important in the normal response to stress, suppresses inflammation and regulates deposition of fat in the body. Acetylcholine, epinephrine and nor-epinephrine are neurotransmitters.

Related Theory

Neurotransmitters are often referred to as the body's chemical messengers. These molecules are used by the nervous system to transmit messages between neurons, or from neurons to muscles. Communication between two neurons happens in the synaptic cleft. Here, electrical signals that have travelled along the axon are briefly converted into chemical ones through the release of neurotransmitters, causing a specific response in the receiving neuron.

22. (C) Parkinson's disease is a degenerative, progressive disorder that affects nerve cells in deep parts of the brain called the basal ganglia and the substantia nigra. Nerve cells in the substantia nigra produce the neurotransmitter dopamine and are responsible for relaying messages that plan and control body movement.

Related Theory

Dopamine plays important roles in executive functions, motor control, motivation, arousal, reinforcement, and reward through signaling cascades that are exerted via binding to dopaminergic receptors.

Caution

Students usually don't know that dopamine system is linked to motivation. Serotonin is involved in emotions, which can affect your overall mood.

23. (B) Nerve cells are unable to divide because they lack centrioles, which plays important role in cell division. Centrioles help to arrange the microtubules that move chromosomes during cell division to ensure each daughter cell receives the appropriate number of chromosomes. While all other cells in our body have capacity to regenerate/self-repair.

Related Theory

Our brain is evolved to process complex tasks at a higher pace than other living beings. The brain achieves this with the help of whole nervous system, which is based on inter-neuronal connections, so adding an extra neuron would mess up these connections and alter both the functionality and the "stored" information. New cells in the nervous system wouldn't do any good. Thus, we lack regenerative capacity of neurons.

24. (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 through the concentration gradient Na^+ enters the fibre.
25. (C) Nissl's granules are the substances found in the neurons which are large granular type of body.

These granules are very useful for protein synthesis also help to transport these proteins to the cyton.

They are made up of rough endoplasmic reticulum (RER) with rosettes of free ribosomes.



Related Theory

Nissl's granules are present in the cytoplasm of the cell body of the neurons and dendrites along with other cell organelles like Golgi apparatus, endoplasmic reticulum, mitochondria, nucleus, etc. These granules give a slight coloured appearance to the cytoplasm of the cell body.

26. (B) Nodes of Ranvier are microscopic gaps found within myelinated axons. Their function is to speed up propagation of action potentials along the axon via saltatory conduction. Thus, the Nodes of Ranvier are the gaps between the myelin insulation of Schwann cells which insulate the axon of neuron.



Related Theory

The nodes of Ranvier allow for ions to diffuse in and out of the neuron, propagating the electrical signal down the axon. Since the nodes are spaced out, they allow for saltatory conduction, where the signal rapidly jumps from node to node. This rapid rate of conduction is called saltatory conduction.

27. (B) Depolarisation of a nerve cell membrane occurs during the passage of an action potential along the axon where the nerve is transmitting an impulse. Na^+ channel activation gates open during depolarization, but K^+ channel activation gates remain closed. Na^+ enters the axon. The entry of sodium ions causes depolarization (polarity reversal) of the neuronal membrane, causing the contents of the nerve fibre to become electropositive with respect to the extracellular fluid.
28. (D) Neurons are the structural and functional units of the nervous system. It is a tiny structure made up of three major components: the cell body, dendrites, and axon. The cell body contains cytoplasm as well as cell organelles and granular entities known as Nissl's granules. Dendrites are short fibres that branch repeatedly and protrude out of the cell body and contain Nissl's granules. These fibres carry impulses to the cell body. The axon is a long fibre with a branching distal end. Each branch ends in a bulb-like structure known as a synaptic knob, which contains synaptic vesicles that contain chemicals known as neurotransmitters. Axons carry nerve impulses from the cell body to a synapse or a neuromuscular junction.
29. (B) A synapse is the junction between the axon of one neuron and the dendrite of the next. The membranes of a pre-synaptic neuron and a post-synaptic neuron may or may not be separated by a gap called synaptic cleft in a synapse. There are two types of synapses based on the nature of information transfer: chemical synapses and electrical synapses.
30. (A) Pons consists of fibre tracts that interconnect different regions of the brain. Hypothalamus contains several groups of neuro secretory cells,

which secrete hormones called hypothalamic hormones. The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions. Cerebellum has a convoluted surface to provide additional space for neurons, and it regulates posture and balance.

31. (B) The left and right cerebral hemispheres are connected by a tract of nerve fibres called corpus callosum.

Mid brain, pons and medulla oblongata are the three major regions that make up the brain stem. Brain stem forms the connections between the brain and spinal cord. Cerebrum forms the major part of the human forebrain.

32. (C) The limbic system is involved in emotional and behavioral responses, including the regulation of sexual behavior, while the hypothalamus plays a crucial role in regulating hormones and physiological responses associated with sexual behavior, as well as emotions such as pleasure and rage. The brain stem and epithalamus are involved in regulating basic physiological functions such as breathing and sleep, while the corpus callosum and thalamus are involved in sensory processing and communication between the two hemispheres of the brain. The corpora quadrigemina and hippocampus are involved in visual and auditory processing and memory, respectively.
33. (A) Hypothalamus is the thermoregulatory centre of the brain and it maintains constant body temperature. Corpus callosum is the thick band of nerve fibre that connect the two brain hemispheres, permitting communication between the right and left sides of the brain. Medulla oblongata is the component of the 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.



Mnemonics

The brain can be divided into three major parts: forebrain, midbrain, and hindbrain. This easy mnemonic will aid in remembering the different parts of the brain. Examine it out.

Forebrain:

HTC mobiles

H – Hypothalamus

T – Thalamus

C – Cerebrum

Midbrain:

CC IN mail

C – Cerebral aqueduct

C – Corpora quadrigemina

Hindbrain:

Physics Chemistry Maths

Physics – Pons varolii

Chemistry – Cerebellum

Maths – Medulla Oblongata

34. (B) Language comprehension, speech and written words is affiliated with cerebral cortex of the brain. The cerebellum coordinates voluntary movements such as posture, balance, coordination, and speech, resulting in smooth and balanced muscular activity. It is also important for learning motor behaviours.



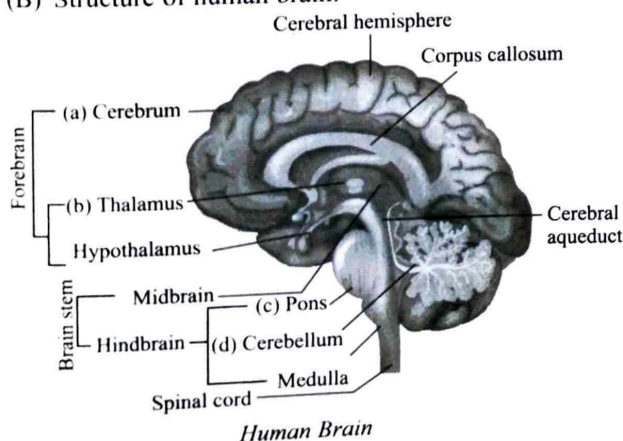
Related Theory

- In cerebrum, Broca's area is located in the left hemisphere and is associated with speech production and articulation. Wernicke's area is a critical language area in the posterior superior temporal lobe connects to Broca's area via a neural pathway. Wernicke's area is primarily involved in the language comprehension.



Caution

- To avoid mistake, students should remember that cerebrum is the largest part of the brain and performs functions like interpreting touch, vision and hearing, as well as speech, reasoning, emotions, learning, and fine control of movement. Cerebellum is located under the cerebrum. It controls voluntary movement, intelligence and memory.
35. (D) Injury to hypothalamus would compromise its functioning. Major functions of hypothalamus includes: regulation of daily activities like eating or drinking, control of the body temperature and energy maintenance, process of memorizing stress control. It also modulates the endocrine system through its connections with the pituitary gland.
- Short-term working memory is stored in prefrontal cortex. Cerebellum controls coordination during locomotion. The decision making is controlled by Prefrontal Cortex (PFC) and hippocampus.
36. (B) Structure of human brain:



37. (C) Hindbrain consists of three parts: Pons varolii, Cerebellum and Medulla oblongata. The medulla oblongata controls the body's autonomic functions such as heartbeat, breathing, and digestion. Pons control sleep cycles, regulating respiration, involved in sensations, such as the sense of taste, hearing and balance, etc. Spinal cord forms the CNS of the brain, from which spinal nerves arises. Cerebrum is a part of forebrain which is composed of two cerebral hemispheres, joined together by bands of fibre called corpus callosum. The hypothalamus is a small region of the forebrain which functions in releasing hormones, regulating body temperature.



Related Theory

- The brain consists of two types of tissues: Grey matter and White matter. Grey matter mainly consists of various types of cells, which make up the bulk of the brain. White matter is primarily composed of axons, which connect various grey matter areas of the brain with each other.
38. (A) Hypothalamus is the thermoregulatory centre. It also contains hunger and thirst centre. Pons is a group of nerves that function as a connection between the cerebrum and cerebellum. Cerebellum coordinates voluntary movements such as posture, balance, coordination, and speech, resulting in smooth and balanced muscular activity. It is also important for learning motor behaviours. Thalamus function as relaying of sensory signals, including motor signals to the cerebral cortex and the regulation of consciousness, sleep, and alertness.
39. (D) The third ventricle is a narrow, funnel-shaped structure that lies in the center of the brain. Diacoel is the cavity of the developing diencephalon that later gives rise to the third ventricle of the brain.



Caution

- Students usually get confused between the names of ventricles of brain. Remember that the paracoel is the name given to the first and second ventricles found in the cerebral hemispheres. The rhinocoel is the ventricle of the rabbit's olfactory lobe in the brain. The diacoel is the name given to the third ventricle in the diencephalon. The metacoel is the fourth ventricle located between the brainstem and the cerebellum.

