ANSWERS TO CHAPTER 8

CONTENT LEARNING ACTIVITY

Divisions of the Nervous System
1. Central nervous system; 2. Peripheral nervous system; 3. Afferent division; 4. Somatic motor nervous system; 5. Autonomic nervous system

Cells of the Nervous System
A. 1. Cell body; 2. Nissl bodies; 3. Dendrite; 4. Axon; 5. Collateral axon; 6. Myelin sheath
B. 1. Nucleus; 2. Collateral axon; 3. Terminal boutons (presynaptic terminal); 4. Schwann cell; 5. Axon; 6. Cell body; 7. Dendrites
C. 1. Multipolar; 2. Bipolar; 3. Unipolar

Neuroglia
1. Astrocytes; 2. Ependymal cells; 3. Microglia; 4. Oligodendrocytes; 5. Schwann cells

Myelin Sheaths
1. Cell processes; 2. CNS; 3. PNS; 4. Unmyelinated axons; 5. Myelinated axons; 6. Nodes of Ranvier

Organization of Nervous Tissue
1. Gray matter; 2. Cortex; 3. Nucleus; 4. Ganglion; 5. White matter; 6. Nerve tract; 7. Nerve

Propagation of Impulses
A. 1. Positive; 2. Resting membrane potential; 3. Sodium ions; 4. Potassium ions; 5. Sodium-potassium exchange pump; 6. Ion channels; 7. Sodium ions; 8. Potassium ions; 9. Potassium ions; 10. Proteins and ions
B. 1. Excitable; 2. Sodium ions; 3. Depolarization; 4. Local potential; 5. Threshold; 6. Positive; 7. Repolarization; 8. Action potential; 9. All-or-none

The Synapse
1. Presynaptic terminal; 2. Postsynaptic membrane; 3. Synaptic cleft; 4. Neurotransmitters; 5. Synaptic vesicles; 6. Hyperpolarized; 7. Acetylcholine and norepinephrine; 8. Acetylcholinesterase

Reflexes
A. 1. Sensory receptor; 2. Afferent neuron; 3. Association neuron; 4. Efferent neuron; 5. Effector organ
B. 1. Sensory receptor; 2. Afferent neuron; 3. Association neuron; 4. Efferent neuron; 5. Effector organ

Central Nervous System
1. Brain; 2. Spinal cord; 3. Brain

The Brainstem
1. Medulla oblongata; 2. Pyramids; 3. Pons; 4. Midbrain; 5. Colliculi; 6. Substantia nigra; 7. Reticular formation

Diencephalon
A. 1. Thalamus; 2. Pineal body; 3. Hypothalamus; 4. Infundibulum; 5. Mamillary bodies
B. 1. Hypothalamus; 2. Mamillary body; 3. Infundibulum; 4. Pituitary gland; 5. Pineal body; 6. Thalamus; 7. Corpus callosum

Cerebrum
A. 1. Longitudinal fissure; 2. Gyri; 3. Central sulcus; 4. Lateral fissure
B. 1. Frontal lobe; 2 Parietal lobe; 3. Occipital lobe; 4. Temporal lobe

Cerebral Cortex
A. 1. Primary sensory areas; 2. Primary somatic sensory cortex (general sensory area); 3. Association areas
B. 1. Primary motor cortex; 2. Premotor area; 3. Prefrontal area
C. 1. Wernicke's area; 2. Broca's area; 3. Aphasia
D. 1. Sensory memory; 2. Short-term memory; 3. Long-term memory; 4. Memory engrams
E. 1. Left cerebral hemisphere; 2. Corpus callosum; 3. Left cerebral hemisphere

Basal Nuclei, Limbic System and Cerebellum
1. Basal nuclei; 2. Limbic system; 3. Cerebellum; 4. Cerebellum; 5. Limbic system

Spinal Cord
A. 1. Posterior (dorsal) horn; 2. Anterior (ventral) horn; 3. Lateral horn; 4. Nerve tract; 5. Dorsal root; 6. Ventral root; 7. Dorsal root ganglia; 8. Spinal nerve
B. 1. Dorsal root; 2. Dorsal root ganglion; 3. Spinal nerve; 4. Ventral root; 5. White matter (nerve tracts); 6. Gray matter; 7. Anterior (ventral) horn; 8. Lateral horn; 9. Posterior (dorsal) horn

Spinal Pathways
1. Ascending pathways; 2. Descending pathways; 3. Lower motor neurons; 4. Upper motor neurons

Meninges
1. Dura mater; 2. Dural sinus; 3. Epidural space; 4. Arachnoid mater; 5. Pia mater; 6. Subarachnoid space

Ventricles and Cerebrospinal Fluid
1. Lateral ventricle; 2. Third ventricle; 3. Fourth ventricle; 4. Cerebral aqueduct; 5. Central canal; 6. Choroid plexus; 7. Arachnoid granulations

Peripheral Nervous System
1. Cranial; 2. Spinal; 3. Afferent; 4. Efferent

Cranial Nerves
1. Olfactory (I); 2. Optic (II); 3. Oculomotor (III); 4. Trigeminal (V); 5. Facial (VII); 6. Vestibulocochlear (VIII); 7. Vagus (X); 8. Hypoglossal (XII)

Spinal Nerves
1. Plexuses; 2. Cervical; 3. Phrenic; 4. Brachial; 5. Radial; 6. Lumbosacral; 7. Femoral; 8. Ischiadic (sciatic)

Autonomic Nervous System
1. Somatic motor nervous system; 2. Autonomic nervous system; 3. Preganglionic neuron; 4. Autonomic ganglion

Sympathetic and Parasympathetic Divisions
A. 1. Lateral; 2. Sympathetic chain ganglia; 3. Collateral ganglia; 4. Brainstem nuclei; 5. Terminal ganglia
B. 1. Sympathetic division; 2. Parasympathetic division; 3. Sympathetic division; 4. Parasympathetic division

Quick Recall

1. Sensory input, integration, homeostasis, mental activity, control of skeletal muscles.
2. Somatic motor nervous system: voluntary, innervates skeletal muscle; Autonomic nervous system: involuntary, innervates smooth muscle, cardiac muscle, and glands.
3. Multipolar neurons: several dendrites and one axon, includes motor neurons; bipolar neurons: one dendrite and one axon, found in the eye and nose; unipolar neurons: a single process that functions as an axon and a dendrite, includes most sensory neurons.
4. Astrocytes: participate with the endothelium basement membrane to form a permeability barrier between blood and brain cells; ependymal cells: produce cerebrospinal fluid; microglia: help remove bacteria; oligodendrocytes: form myelin sheaths around axons in the CNS; Schwann cells: form myelin sheaths around axons in the PNS
5. Cell membrane is more permeable to potassium ions than to sodium ions, and the sodium-potassium exchange pump transports sodium ions out and potassium ions into the cell.
6. Presynaptic terminal, synaptic cleft, and postsynaptic membrane
7. Brainstem, diencephalon, cerebrum, and cerebellum
8. Frontal lobe: voluntary motor function, motivation, aggression, mood, and olfactory reception; parietal lobe: reception and evaluation of most sensory information such as touch, balance, and taste; occipital lobe: reception and integration of visual input; temporal lobe: evaluates olfactory and auditory input and plays an important role in memory
9. Dura mater, arachnoid mater, and pia mater
10. Motor, sensory, and parasympathetic
11. Cervical plexus: phrenic nerve; brachial plexus: axillary, radial, musculocutaneous, ulnar, and median nerves; lumbosacral plexus: obturator, femoral, tibial, and common fibular nerves. The last two are bound together to form the ischiadic (sciatic) nerve.

Word Parts

1. afferent
2. efferent
3. neuroglia; microglia
4. dendrite; oligodendrocyte
5. ganglion; preganglionic; postganglionic
6. neuron; neuroglia; neurolemmocytes

Mastery Learning Activity

1. A. The somatic motor nervous system regulates skeletal muscle; the autonomic nervous system regulates the activities of smooth muscle, cardiac muscle and glands. The central nervous system refers to the brain and spinal cord, and the afferent division transmits action potentials from the periphery to the CNS.

2. A. Multipolar neurons have many short dendrites and one axon. Bipolar neurons have one dendrite and one axon, and unipolar neurons have a single process that functions as both an axon and a dendrite.

3. B. Oligodendrocytes form a myelin sheath around axons in the CNS, ependymal cells produce cerebrospinal fluid, astrocytes help form the blood-brain barrier.

4. E. Schwann cells form myelin sheaths in the PNS, while oligodendrocytes form myelin sheaths in the CNS.

5. D. Clusters of nerve cell bodies in the PNS are called ganglia; clusters of nerve cell bodies in the CNS are called nuclei.

6. D. In a resting cell, there are more sodium ions outside the cell than inside, and more potassium ions inside the cell than outside. The cell membrane is more permeable to potassium ions than to sodium ions. The sodium-potassium exchange pump actively transports sodium ions out of the cell and potassium ions into the cell.

7. D. All of the conditions listed are necessary for an action potential to occur.

8. D. Neurotransmitters are released from the presynaptic terminal, diffuse across the synaptic cleft, and bind to receptors on the postsynaptic membrane. The base of the axon is at the nerve cell body.

9. C. The medulla oblongata has control centers for all the functions listed.

10. B. The reticular formation is a group of nuclei scattered throughout the brainstem. The reticular formation is a major component of the reticular activating system, which plays an important role in arousing and maintaining consciousness and in regulating the sleep/wake cycle.

11. E. The thalamus is the major relay center for action potentials going to and from the cerebral cortex. Almost all sensory tracts, except for olfaction, synapse in the thalamus.

12. C. General sensory input terminates in the primary somatic sensory area. The primary motor area is concerned with the control of skeletal muscles. The association areas are immediately adjacent to primary sensory areas, and are involved in the process of recognition. The prefrontal area is the anterior portion of the frontal lobes and is involved in motivation and foresight to plan and initiate movements.

13. C. Wernicke's area is necessary for understanding and formulation of speech. Broca's area initiates the series of movements necessary for speech. Then the premotor area programs the movements and finally muscle movement is initiated in the primary motor area.

14. C. The corpus callosum is the largest of the commissures joining the two cerebral hemispheres.

15. D. Sensory, or afferent neurons, enter through the dorsal horn of the spinal cord; the cell bodies of these neurons are in the dorsal root ganglia, and afferent and efferent neurons join to form a spinal nerve.

16. B. Most nerve pathways in the spinal cord have names that indicate their function. The first half of the name indicates their origin, and the second half indicates their point of termination. "Cortico" indicates this pathways originates in the cerebral cortex, and "spinal" indicates it terminates in the spinal cord. Therefore, it is a descending pathway. All of the other pathways listed are ascending.

17. A. There are three layers of connective tissue called meninges, which cover the entire central nervous system. From outside to inside, they are the dura mater, arachnoid mater, and pia mater.

18. C. There are 12 pairs of cranial nerves and 31 pairs of spinal nerves.

19. D. A plexus is a collection of spinal nerves. Ganglia are collections of neuron cell bodies in the peripheral nervous system. Nuclei are collections of neuron cell bodies in the central nervous system.

20. B. The sympathetic nervous system prepares the body for activity. Blood flow to skeletal muscle increases, heart rate increases, and blood sugar levels increase. Meanwhile, processes not immediately necessary for activity are inhibited such as decreasing blood flow to digestive organs.

FINAL CHALLENGES

1. If one series of neurons had more neurons, it would have more synapses, which should slow down the rate of action potential propagation. Also, if one series were unmyelinated and the other myelinated, the unmyelinated series would be slower.

2. The cerebellum acts to match intended movements with actual movements. Thus, reduced cerebellar function results in an inability to point precisely to an object (such as one's nose). It also results in poor balance.

3. Parkinson's disease results in decreased activity of inhibitory neurons in the basal nuclei. Therefore, motor neurons become over-stimulated, resulting in tremors. The same excited state also results in exaggerated reflexes.

4. The phrenic nerve, which innervates the diaphragm, was injected.