

Chapter 7 The Nervous System

OVERVIEW

The purpose of this chapter is to teach the anatomy and physiology of the nervous system and to present select concepts associated with pathophysiology or disease issues of the nervous system. The amount of anatomy and the complexity of the physiology make this a difficult system for students to understand the big picture.

This chapter begins with an organizational chart of the nervous system. This chart is intended to break the nervous system's anatomy into reasonable chunks and help students see how structures are interrelated. The chapter explains the physiology of the system by outlining a pathway for a common daily activity. Pathways will continue to be used to explain how senses relate to central nervous system anatomy in Chapter 8: Nervous System—Senses.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

COMPETENCY CORRELATION GRID

Learning Outcome	CAAHEP Competencies	ABHES Competencies
7.1 Use medical terminology related to the nervous system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions
7.2 Describe the organization of the nervous system in regard to structure and function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

7.3 Describe the anatomy of a neuron.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.4 Differentiate multipolar, bipolar, and unipolar neurons in terms of anatomy, location, and direction of nerve impulses.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.5 Describe neuroglial cells and state their function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.6 Describe the meninges covering the brain and spinal cord.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.7 Explain the importance of cerebrospinal fluid, including its production, circulation, and function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.8 Describe the major landmarks and subdivisions of the brain and state their functions.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.9 Describe the spinal cord.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.10 Describe the anatomy of a nerve and its connective tissues.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.11 List the cranial nerves in order, stating their function and whether they are sensory, motor, or both.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.12 Describe the attachment of nerves to the spinal cord.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.13 Compare the parasympathetic and sympathetic divisions of the autonomic nervous system in terms of anatomy and function.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.14 Describe a resting membrane potential.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

7.15 Compare and contrast a local potential and an action potential.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.16 Describe a specific reflex and list the components of its reflex arc.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.17 Explain the difference between short-term and long-term memory.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.18 Differentiate between Broca's area and Wernicke's area in regard to their location and function in speech.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.19 Explain the function of the nervous system by writing a pathway for a sensory message sent to the brain to be processed for a motor response.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.20 Explain the nutritional requirements of the nervous system.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.21 Explain the effects of aging on the nervous system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.22 Describe common diagnostic tests used to diagnose disorders of the nervous system.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
7.23 Describe nervous system disorders and relate abnormal function to the pathology.	I.C.6. Identify common pathology related to each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 7

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSIGNMENTS/ ASSESSMENTS
7.1 Use medical terminology related to the nervous system.		<i>WkBk Word Roots and Combining Forms</i>	<i>WkBk Review Questions:</i>

			<ul style="list-style-type: none"> Word Deconstruction: 1-5
7.2 Describe the organization of the nervous system in regard to structure and function.	<p>I. Overview</p> <p>II. Anatomy of the nervous system</p> <p>Chapter Figure: 7.2 (Organization of the nervous system)</p>	<p>Talking Point: It is very easy to get lost in the anatomy of this system. Encourage students to come back to this organizational chart (Figure 7.2).</p>	<p>WkBk Review Questions:</p> <ul style="list-style-type: none"> MS: 1
7.3 Describe the anatomy of a neuron.	<p>A. Anatomy of a neuron</p> <ol style="list-style-type: none"> Dendrites Body Axon <p>Chapter Figure: 7.3 (Generic neuron)</p>	<p>WkBk Coloring book:</p> <ul style="list-style-type: none"> Neuron <p>Figure 7.1 (Myelinated multipolar neuron)</p>	<p>Spot Check: 6</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none"> Completion: 4
7.4 Differentiate multipolar, bipolar, and unipolar neurons in terms of anatomy, location, and direction of nerve impulses.	<ol style="list-style-type: none"> Types of neurons <ol style="list-style-type: none"> Multipolar neurons Bipolar neurons Unipolar neurons <p>Table: 7.1 (Comparison of basic</p>	<p>WkBk Lab exercises and activities:</p> <ul style="list-style-type: none"> Types of neurons <p>Figure 7.1 (Myelinated multipolar neuron)</p>	<p>Spot Check: 1</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none"> MS: 2

	neuron types)		
7.5 Describe neuroglial cells and state their function.	<p>B. Neuroglia</p> <ol style="list-style-type: none"> 1. Oligodendrocytes 2. Ependymal cells 3. Astrocytes 4. Microglia 5. Schwann cells 6. Satellite cells <p>Chapter Figures: 7.4 (Neuroglia of the CNS) 7.5 (Schwann cell)</p> <p>Table: 7.2 (comparison of neuroglia)</p>	<p>WkBk Concept maps Figure 7.6 (Neuroglia concept map)</p>	<p>Spot Check: 2</p> <p>Quiz: 1 (Covers LOs 7.3-7.5. See Individual Outcome 7.5)</p> <p>WkBk Review Questions:</p> <ul style="list-style-type: none"> • MS: 3
7.6 Describe the meninges covering the brain and spinal cord.	<p>C. Anatomy of the central nervous system</p> <ol style="list-style-type: none"> 1. Meninges <p>Chapter Figure: 7.6 (The meninges)</p>	<p>WkBk Coloring book: Figure 7.5 (Spinal cord and meninges)</p> <p>WkBk Concept maps Figure 7.8 (Meninges concept map)</p>	
7.7 Explain the importance of cerebrospinal	2. Cerebrospinal fluid	Talking Point: Notice there are lateral	Spot Check: 3

fluid, including its production, circulation, and function.	<p>a. Buoyancy b. Protection c. Stability d. Nutrients</p> <p>Chapter Figure: 7.7 (Ventricles of the brain)</p>	<p>ventricles and then ventricle 3 and ventricle 4. Mention that there are two lateral ventricles. One is called ventricle 1 and the other is ventricle 2.</p>	<p>WkBk Review Questions:</p> <ul style="list-style-type: none"> MS: 4
7.8 Describe the major landmarks and subdivisions of the brain and state their functions.	<p>3. Brain</p> <p>a. Cerebrum</p> <p>i. frontal lobe ii. Parietal lobe iii. Temporal lobe iiii. Occipital lobe</p> <p>b. Diencephalon</p> <p>i. Thalamus ii. Hypothalamus</p> <p>c. Brainstem</p> <p>i. medulla oblongata ii. Pons iii. Midbrain iiii. Reticular</p>	<p>WkBk Coloring Book:</p> <ul style="list-style-type: none"> Brain <p>Figure 7.2 (The brain, lateral view) Figure 7.3 (The brain, midsagittal view)</p> <p>WkBk Concept maps Figure 7.7 (Brain concept map)</p> <p>Talking Point: How do we know what each part of the brain does and how it works? Much research left to be done. Much of the mapping we do know has been done on brain surgery patients while they are conscious.</p> <p>Talking Point: As you talk about each brain part, discuss a brief function as well.</p> <p>Talking Point: There are YouTube videos that</p>	<p>WkBk Review Questions:</p> <ul style="list-style-type: none"> Matching: 6-10 Critical Thinking: 3

	<p>formation</p> <p>d. Cerebellum</p> <p>Chapter Figures:</p> <p>7.8 (The brain)</p> <p>7.9 (Functional regions of the cerebral cortex)</p> <p>7.10 (The limbic system)</p> <p>7.11 (The brainstem)</p> <p>7.12 (The cerebellum)</p> <p>Table:</p> <p>7.3 (Subdivisions of the brain)</p>	<p>show various animals with cerebellar damage.</p> <p>Talking Point: Discuss with students the characteristic of individuals with brainstem damage.</p>	
7.9 Describe the spinal cord.	<p>4. Spinal cord</p> <p>Chapter Figures:</p> <p>7.13 (The spinal cord)</p> <p>7.14 (Spinal cord cross section)</p> <p>7.15 (Ascending and descending tracts)</p>	<p>WkBk Coloring Book:</p> <ul style="list-style-type: none"> • Spinal cord and spinal nerves <p>Figure 7.4 (The spinal cord and spinal nerves)</p> <ul style="list-style-type: none"> • Spinal cord and meninges <p>Figures 7.5 (Cross section of the spinal cord with meninges)</p>	
7.10 Describe the anatomy of a nerve and its	D. Anatomy of the	WkBk Lab Exercises and Activities:	WkBk Review Questions:

connective tissues.	peripheral nervous system 1. Anatomy of a nerve Chapter Figure: 7.16 (The anatomy of a nerve)	<ul style="list-style-type: none"> Nerve model Group Activity: Nerve model (See Individual Outcome 7.10)	<ul style="list-style-type: none"> MS: 5
7.11 List the cranial nerves in order, stating their function and whether they are sensory, motor, or both.	2. Cranial nerves Chapter Figure: 7.17 (Cranial nerves) Table: 7.4 (Cranial nerves)	Talking Point: Here is another mnemonic aid: Oh Once One Takes The Anatomy Final, Very Good Vacations Seem Heavenly “The” represents the trigeminal nerve. The trigeminal nerve is made of 3 branches. The word “the” has 3 letters in it.	Spot Check: 4, 5, 9 WkBk Review Questions: <ul style="list-style-type: none"> Matching: 1-5
7.12 Describe the attachment of nerves to the spinal cord.	3. Spinal nerves Chapter Figure: 7.18 (Spinal nerves) 7.19 (Dermatomes)	WkBk Coloring Book: <ul style="list-style-type: none"> Spinal cord and meninges Figure 7.5 (Cross section of the spinal cord with meninges) WkBk Concept maps Figure 7.9 (Nerves concept map)	Quiz: 2 (Covers LOs 7.4, 7.6, 7.7, 7.9, and 7.12. See Individual Outcome 7.12) WkBk Review Questions: <ul style="list-style-type: none"> MS: 9
7.13 Compare the parasympathetic and sympathetic divisions of the autonomic nervous system in terms of anatomy and function.	4. Autonomic nervous system a. Sympathetic division b. parasympathetic		Spot Check: 7 WkBk Review Questions: <ul style="list-style-type: none"> MS: 6

	division Chapter Figure: 7.20 (Sympathetic division of the autonomic nervous system) 7.21 (Parasympathetic division of the autonomic nervous system)		
7.14 Describe a resting membrane potential.	III. Physiology of the nervous system A. Nerve impulses Chapter Figure: 7.22 (Resting membrane potential)	WkBk Concept maps <ul style="list-style-type: none"> Resting membrane potential Figure 7.10 (Resting membrane potential concept map)	WkBk Review Questions: <ul style="list-style-type: none"> Completion: 1-3
7.15 Compare and contrast a local potential and an action potential.	1. Local potential <ul style="list-style-type: none"> a. graded b. decremental c. reversible d. excitatory or inhibitory 2. Action potential <ul style="list-style-type: none"> a. not graded b. not decremental 	WkBk Concept maps <ul style="list-style-type: none"> Local and action potentials Figure 7.11 (Local and action potentials concept map)	Spot Check: 8 WkBk Review Questions: <ul style="list-style-type: none"> Critical Thinking: 1

	c. not reversible Chapter Figure: 7.23 (Local potential) 7.24 (Action potential)		
7.16 Describe a specific reflex and list the components of its reflex arc.	B. Reflexes 1. Receptor 2. Afferent neuron 3. Integrating center 4. Efferent neuron 5. Effector Chapter Figure: 7.25 (A reflex arc for a withdrawal reflex)	Discussion Point: Reflexes (See Individual Outcome 7.16) WkBk Lab Exercises and Activities: <ul style="list-style-type: none"> Reflexes WkBk Concept maps <ul style="list-style-type: none"> Reflexes Figure 7.12 (Reflexes concept map)	Quiz: 3 (Covers LOs 7.4, 7.5, 7.12-7.14, 7.16 See Individual Outcome 7.16)
7.17 Explain the difference between short-term and long-term memory.	C. Memory 1. Immediate memory 2. Short-term memory 3. Long-term memory		Spot Check: 10 WkBk Review Questions: <ul style="list-style-type: none"> Critical Thinking: 2
7.18 Differentiate between Broca's area and Wernicke's area in regard to their location and function in speech.	D. Language 1. Wernicke's area 2. Broca's area		Spot Check: 11 WkBk Review Questions: <ul style="list-style-type: none"> MS: 7

7.19 Explain the function of the nervous system by writing a pathway for a sensory message sent to the brain to be processed for a motor response.	<p>E. Function of the nervous system</p> <p>2. Pathways</p> <p>Chapter Figure:</p> <p>7.26 (Miriam adds an ice cube to her glass of water)</p>	<p>WkBk Lab Exercises and Activities:</p> <ul style="list-style-type: none"> • Pathway 	
7.20 Explain the nutritional requirements of the nervous system.	F. Nutritional requirements of the nervous system		<p>WkBk Review Questions:</p> <ul style="list-style-type: none"> • Completion: 5
7.21 Explain the effects of aging on the nervous system.	<p>IV. Effects of aging on the nervous system</p> <p>A. Short-term memory</p> <p>B. Verbal skills</p> <p>C. Intellectual performance</p> <p>D. Reaction time</p>		<p>WkBk Review Questions:</p> <ul style="list-style-type: none"> • MS: 8
7.22 Describe common diagnostic tests used to diagnose disorders of the nervous system.	<p>V. Diagnostic tests for nervous system disorders.</p> <p>Table:</p> <p>7.5 (Common diagnostic tests for nervous system disorders)</p>		Spot check: 12
7.23 Describe nervous system disorders and	V. Nervous system	Talking Point: You could have students create	WkBk Review Questions:

relate abnormal function to the pathology..	<p>disorders</p> <p>A. Cerebral vascular accidents</p> <p>B. Alzheimer's disease</p> <p>C. Huntington's disease</p> <p>D. Parkinson's disease</p> <p>E. Multiple sclerosis</p> <p>F. Paralysis</p> <p>G. Hydrocephalus</p> <p>H. Epilepsy</p> <p>I. Cerebral palsy</p> <p>Figures:</p> <p>7.27 (Hydrocephalus)</p> <p>7.28 (Young child with cerebral palsy)</p> <p>Table:</p> <p>7.6 (Summary of diseases and disorders of the nervous system)</p>	<p>a chart made of columns to list the similarities and differences between Alzheimer's, Huntington's, and Parkinson's diseases.</p>	<ul style="list-style-type: none"> MS: 10 <p>Spot Check: 13</p> <p>Case Study: 1, 2, 3</p>
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INDIVIDUAL OUTCOMES

OUTCOME 7.3

Spot Check 6: What parts of the preganglionic and postganglionic neurons form the synapse at the ganglia?

Answer: The synaptic knob of the preganglionic neuron synapses with the dendrite of the postganglionic neuron.

OUTCOME 7.4

Spot Check 1: Which type of neuron would make up the somatomotor division of the PNS?

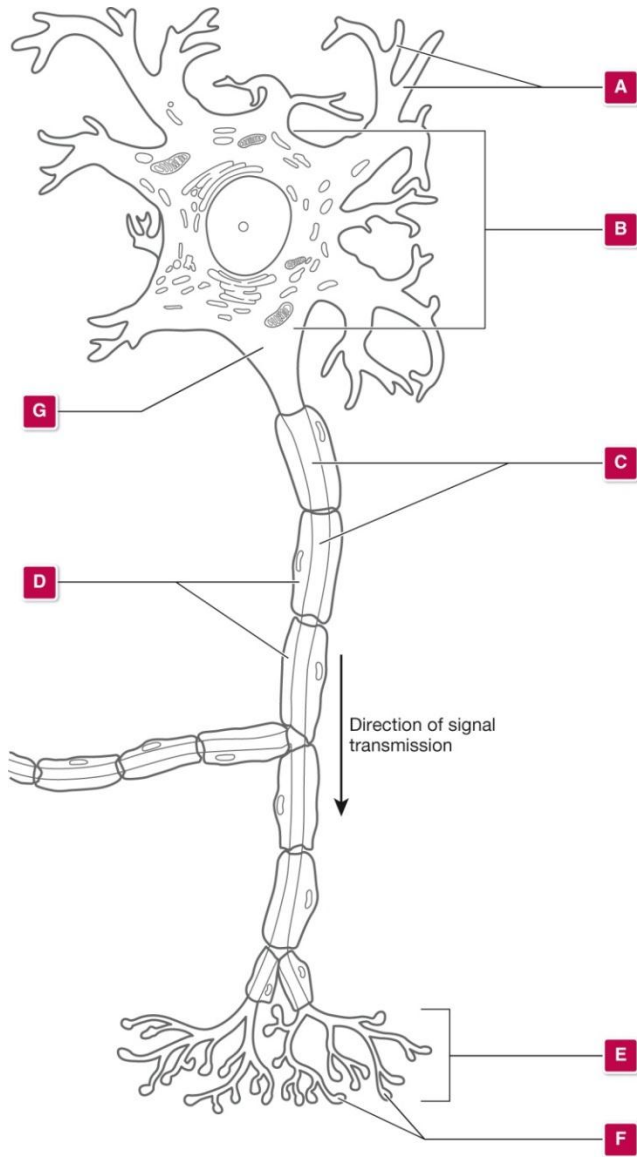
Answer: Multipolar.

OUTCOME 7.5

Spot Check 2: Encephalitis is often caused by an infection in the brain. It is difficult to treat with medication. Which neuroglial cell makes it difficult to treat encephalitis with drugs? Which neuroglial cell will fight the pathogen causing the infection?

Answer: Astrocytes prevent many medications from crossing the blood-brain barrier. Microglia will seek out and fight the pathogen.

Quiz: 1



IM Ch7

Use this figure to answer the following questions.

- | | |
|--|---|
| 1. Does this figure represent a multipolar, bipolar, or unipolar neuron? | <i>Multipolar</i> |
| 2. Would this neuron be afferent or efferent? | <i>Efferent</i> |
| 3. Identify structures marked A. | <i>Dendrites</i> |
| 4. Identify structures marked F. | <i>Synaptic knobs</i> |
| 5. What chemicals are released from F? | <i>Neurotransmitters</i> |
| 6. Where in the neuron are the chemicals produced? | <i>Ribosomes in the body</i> |
| 7. Identify C. | <i>Axon</i> |
| 8. Identify the neuroglial cell labeled D. | <i>Schwann cell</i> |
| 9. What is the function of the neuroglial cell marked D? | <i>Provide a myelin sheath to insulate the axon</i> |
| 10. Is this neuron part of the CNS or PNS? Explain. | <i>PNS. Schwann cells are not found in the CNS.</i> |

OUTCOME 7.7

Spot Check 3: What will happen to pH if the CSF removes excess hydrogen ions?

Answer: It will rise.

OUTCOME 7.10

Group Activity: Nerve model

This Workbook activity also works well with groups of students to creatively show nerve anatomy, including connective tissues, and how nerves connect to the spinal cord. Each group of students is to use household supplies to construct a model that includes:

- Two multipolar neurons
- Two unipolar neurons
- Myelin sheath on all neurons
- Two fascicles
- Endoneurium
- Perineurium
- Epineurium
- Two nerve roots
- One spinal nerve

OUTCOME 7.11

Spot Check 4: Which cranial nerve could be assessed by each of the following: asking the patient to smile, asking the patient to stick out her tongue, and asking the patient to move her head from side to side?

Answer: Smile-CN VII, Stick out tongue-CN XII, Move head from side to side-CN XI.

Spot Check 5: Which cranial nerves would contain bipolar neurons?

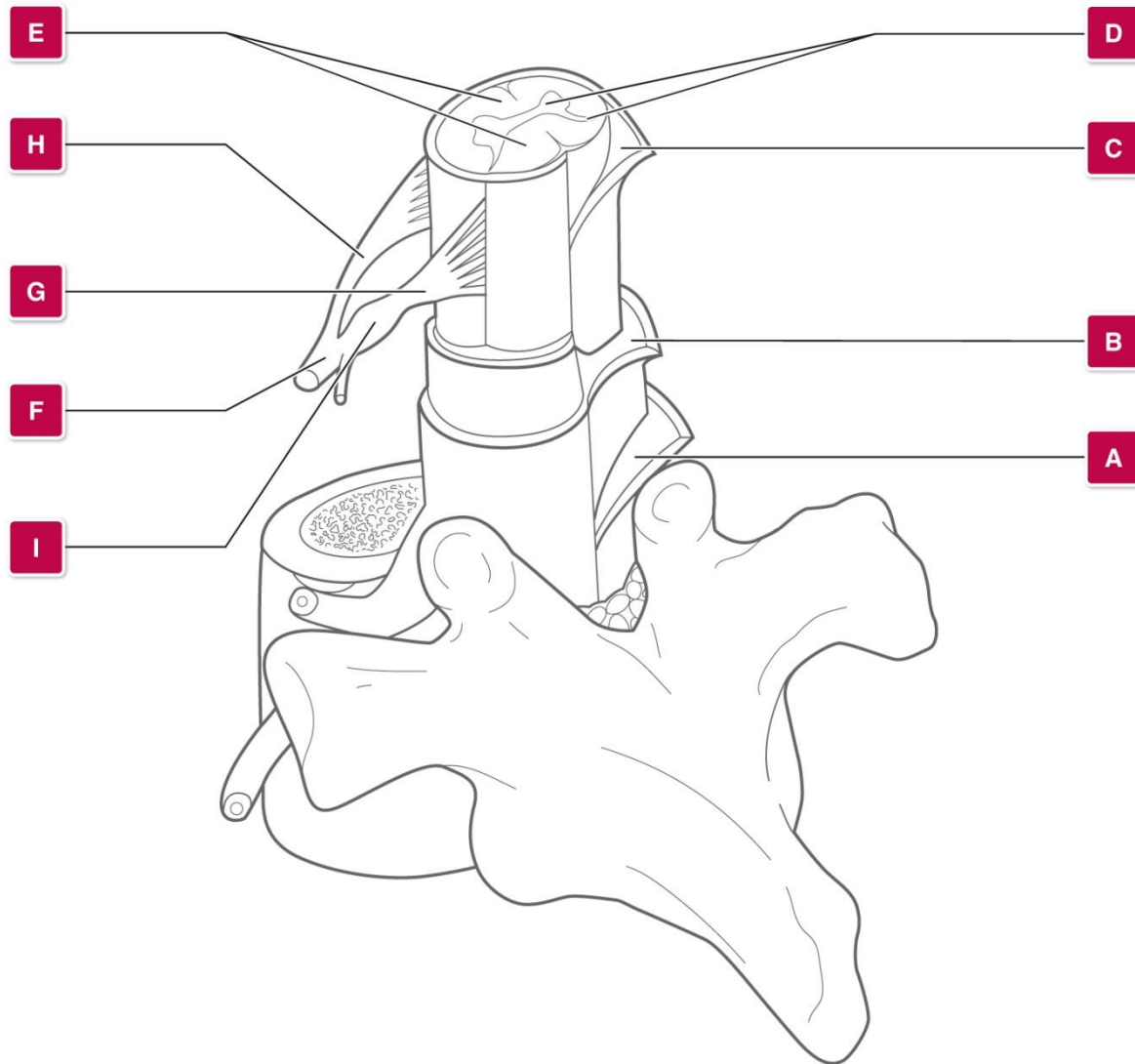
Answer: Olfactory, optic, and auditory.

Spot Check 9: What nerve would contain the afferent neuron in a pupillary light reflex?

Answer: The optic nerve.

OUTCOME 7.12

Quiz: 2



IM Ch7

Use the Figure to answer the following questions.

- | | |
|--|---|
| 1. Identify A. | <i>Dura mater</i> |
| 2. Identify B. | <i>Arachnoid layer</i> |
| 3. What can be found between A and B | <i>Cerebrospinal fluid</i> |
| 4. Identify E. | <i>Columns of the spinal cord</i> |
| 5. What happens in E. | <i>Messages travel to and from the brain.</i> |
| 6. Identify F. | <i>Spinal nerve</i> |
| 7. Identify I. Be specific. | <i>Dorsal nerve root</i> |
| 8. What direction do messages travel through I? | <i>Afferent, toward the spinal cord</i> |
| 9. What type of neuron can be found in I (multipolar, bipolar, or unipolar)? | <i>Unipolar</i> |
| 10. What is in the bump of I? | <i>Unipolar cell bodies.</i> |

OUTCOME 7.13

Spot Check 7: Compare the length of the preganglionic and postganglionic neurons in the sympathetic and parasympathetic divisions.

Answer: In the sympathetic division, the preganglionic neuron is short and the postganglionic neuron is long. In the parasympathetic division, the preganglionic neuron is long and the postganglionic neuron is short.

OUTCOME 7.15

Spot Check 8: Sound waves cause vibrations in the ear that mechanically disturb bipolar neurons. In terms of local and action potentials, why might you be able to hear a sound that your friend standing next to you cannot?

Answer: The local potential was at threshold when reaching the trigger zone resulting in an action potential for you, but it must have been subthreshold for your friend so no action potential resulted.

OUTCOME 7.16

Discussion Point: Remind students that a reflex is a method of protection. Ask what happens if something comes quickly at the eye. *The eye closes. Why? To prevent something from entering the eye.* Ask a student to sit on the edge of a table with his/her feet not touching the floor. Describe hitting the knee just below the patella and ask what will happen. *Most people know that the predictable response when testing the patellar reflex is extension of the knee.* Ask the students to discuss in their groups what is the body trying to protect itself from? When would this reflex naturally occur? What are the likely components of this reflex arc?

Quiz:3

Who am I?

- | | |
|---|------------------------------|
| 1. I am a type of neuron found in the somatomotor division. | <i>Multipolar neuron</i> |
| 2. I am a neuron whose body is in a dorsal root ganglion. | <i>Unipolar neuron</i> |
| 3. I am a neuron whose synaptic knobs form a synapse with another neuron in the sympathetic chain of ganglia. | <i>Preganglionic neuron</i> |
| 4. I am a neuron whose dendrites form a synapse with another neuron in the sympathetic chain of ganglia. | <i>Postganglionic neuron</i> |
| 5. I form myelin in the PNS. | <i>Schwann cell</i> |
| 6. I form myelin in the CNS. | <i>Oligodendrocyte</i> |
| 7. I line ventricles and my cilia help circulate cerebrospinal fluid. | <i>Ependymal cell</i> |
| 8. I restore a resting membrane potential. | <i>Sodium/Potassium pump</i> |
| 9. I am the effector in a somatic reflex arc. | <i>Skeletal muscle</i> |

10. I am the involuntary predictable response to a stimulus without conscious thought.

Reflex

OUTCOME 7.17

Spot Check 10: On the basis of how memories are formed, what is the best way to study for an exam on the nervous system?

Answer: Answers may vary, but should include repetition of input over time to give the dendrites a chance to grow and make new connections for long-term memory.

OUTCOME 7.18

Spot Check 11: Why does the pathway not include Wernicke's area in the temporal lobe?

Answer: Wernicke's area is for incoming language of which there is none in this example.

OUTCOME 7.22

Spot Check 12: What disorders of the nervous system could warrant the use of a nerve conduction study? Explain your answer.

Answer: Parkinson's disease, Huntington's disease, Paralysis, and Multiple Sclerosis could benefit from a nerve conduction study. This type of test determines the ability of nerves to send signals to the muscles for movement. All of these disorders are related to some type of muscle movement.

OUTCOME 7.23

Spot Check 13: Compare and contrast Alzheimer's disease, Huntington's disease, and Parkinson's disease.

Answer: Alzheimer's disease: This is progressive. There is brain degeneration. There isn't a cure.

Huntington's disease: This is progressive. There is brain degeneration. There isn't a cure. This is due to a defective gene.

Parkinson's disease: This is progressive. There is brain degeneration. There isn't a cure. This has been linked to genetics.

Huntington's and Parkinson's can be tested with a nerve conduction study. Alzheimer's is not.

Case Study:

1. Could Bill and Nora's newborn daughter be diagnosed with cerebral palsy? Explain your answer.

Answer: Yes, their child most likely has cerebral palsy. Cerebral palsy can occur during birth if there is a lack of oxygen.

2. What other conditions (covered in this chapter) could accompany that diagnosis?

Answer: Seizures, mental retardation, and spastic muscle movement.

3. If the baby is diagnosed with cerebral palsy, will the baby's symptoms progress as she develops?

Answer: In the case of cerebral palsy, the condition is permanent. The symptoms do not progress.

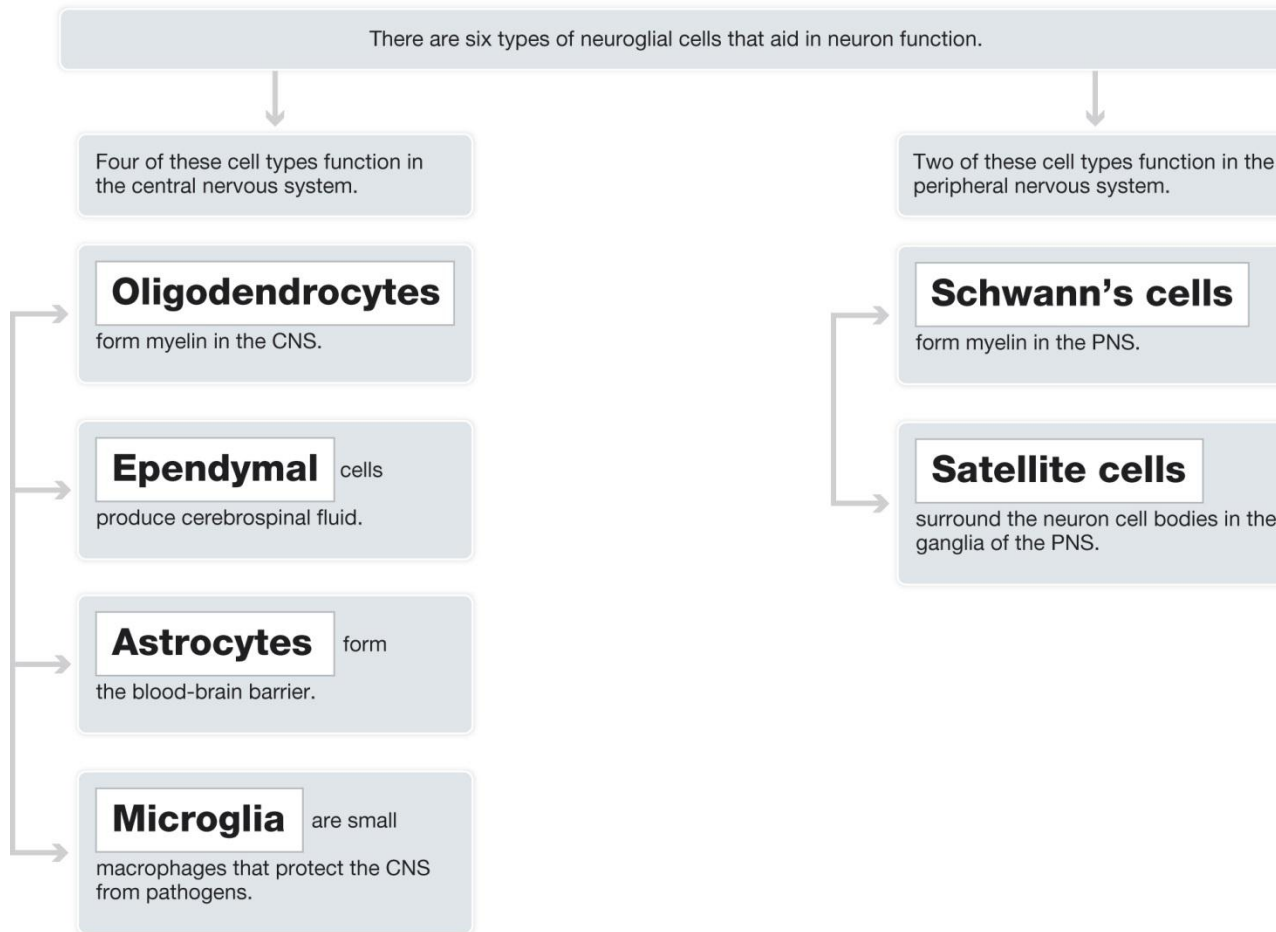
ANSWER KEYS

Chapter Review Questions

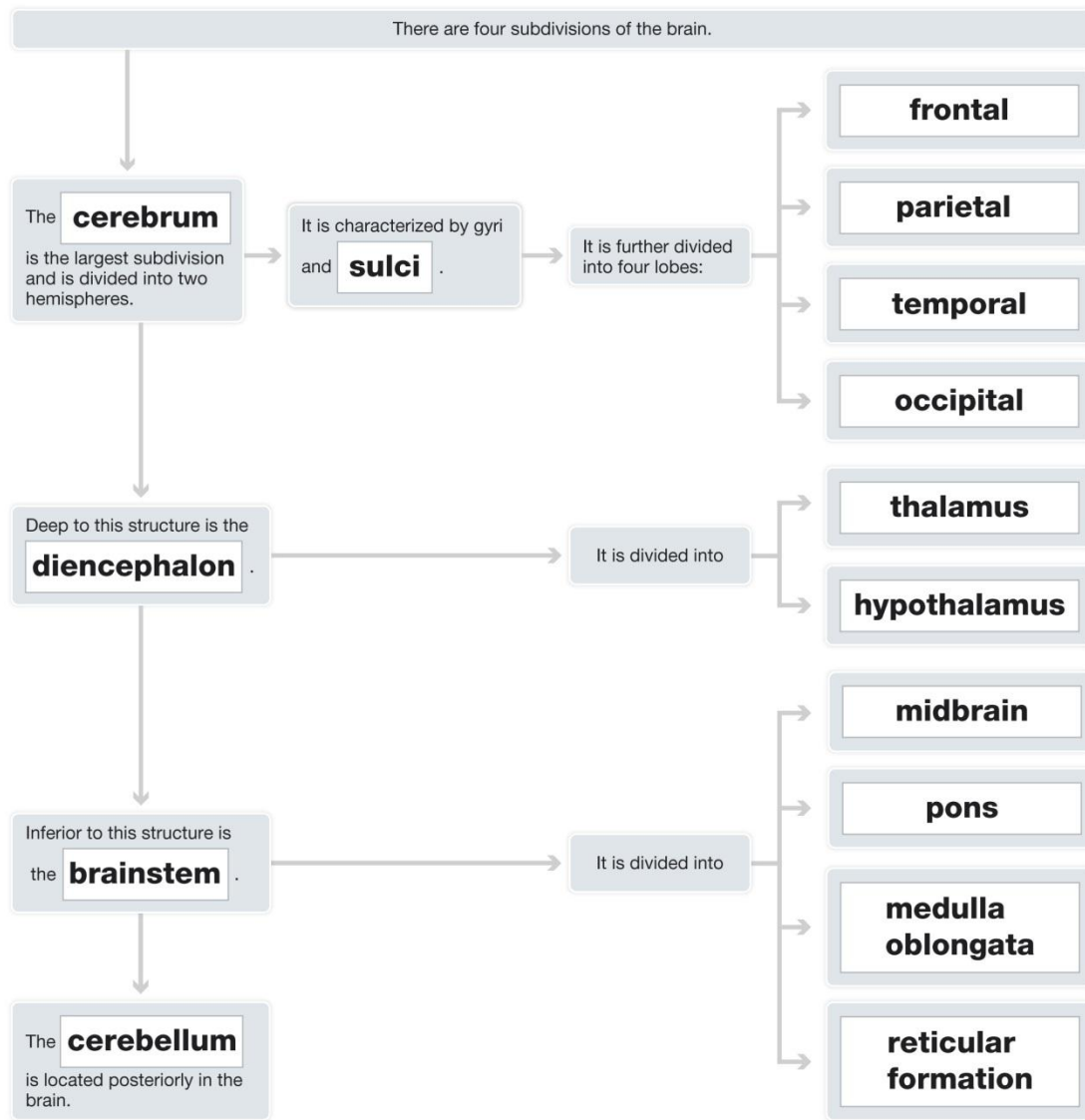
1. A
2. D
3. B
4. A
5. C
6. C
7. C
8. B
9. D
10. B
11. C
12. B
13. C
14. D
15. B
16. C
17. A
18. B
19. A
20. A
21. C
22. C
23. D

WORKBOOK CONCEPT MAPS:

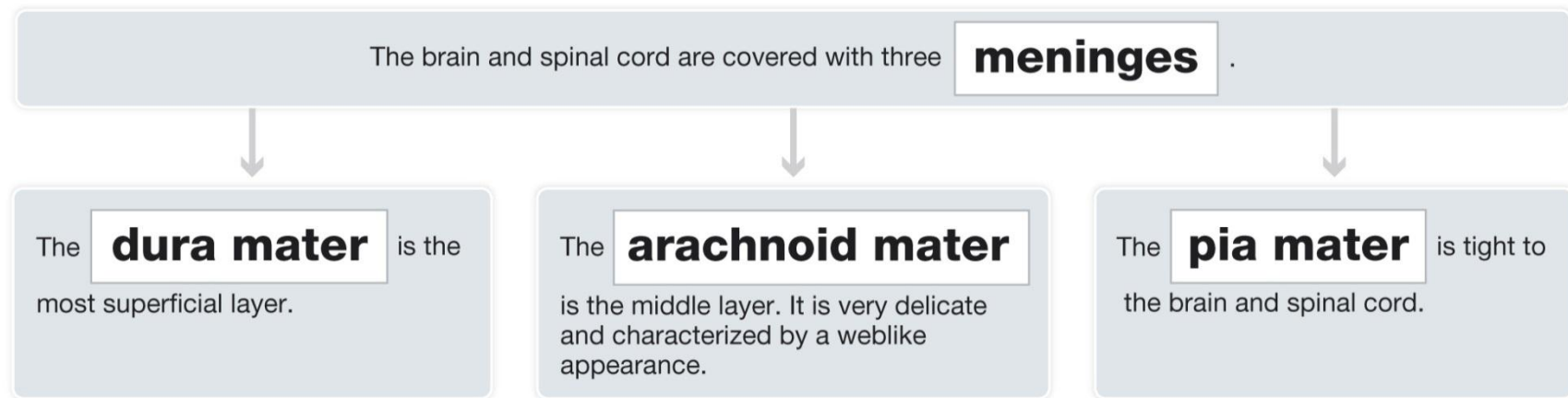
Neuroglia



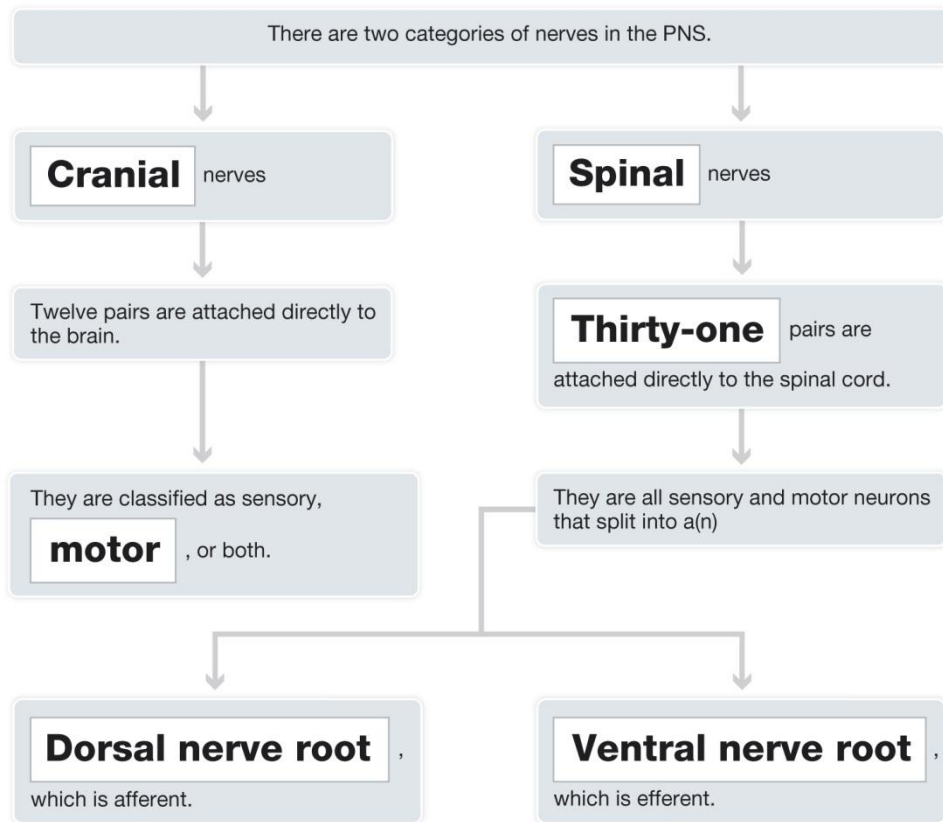
Brain



Meninges



Nerves



Resting membrane potential

Resting membrane potential is achieved when the outside of the neuron has a(n) **positive** charge (due to high concentrations of **Na⁺**) and the inside of the neuron has a(n) **negative** charge.

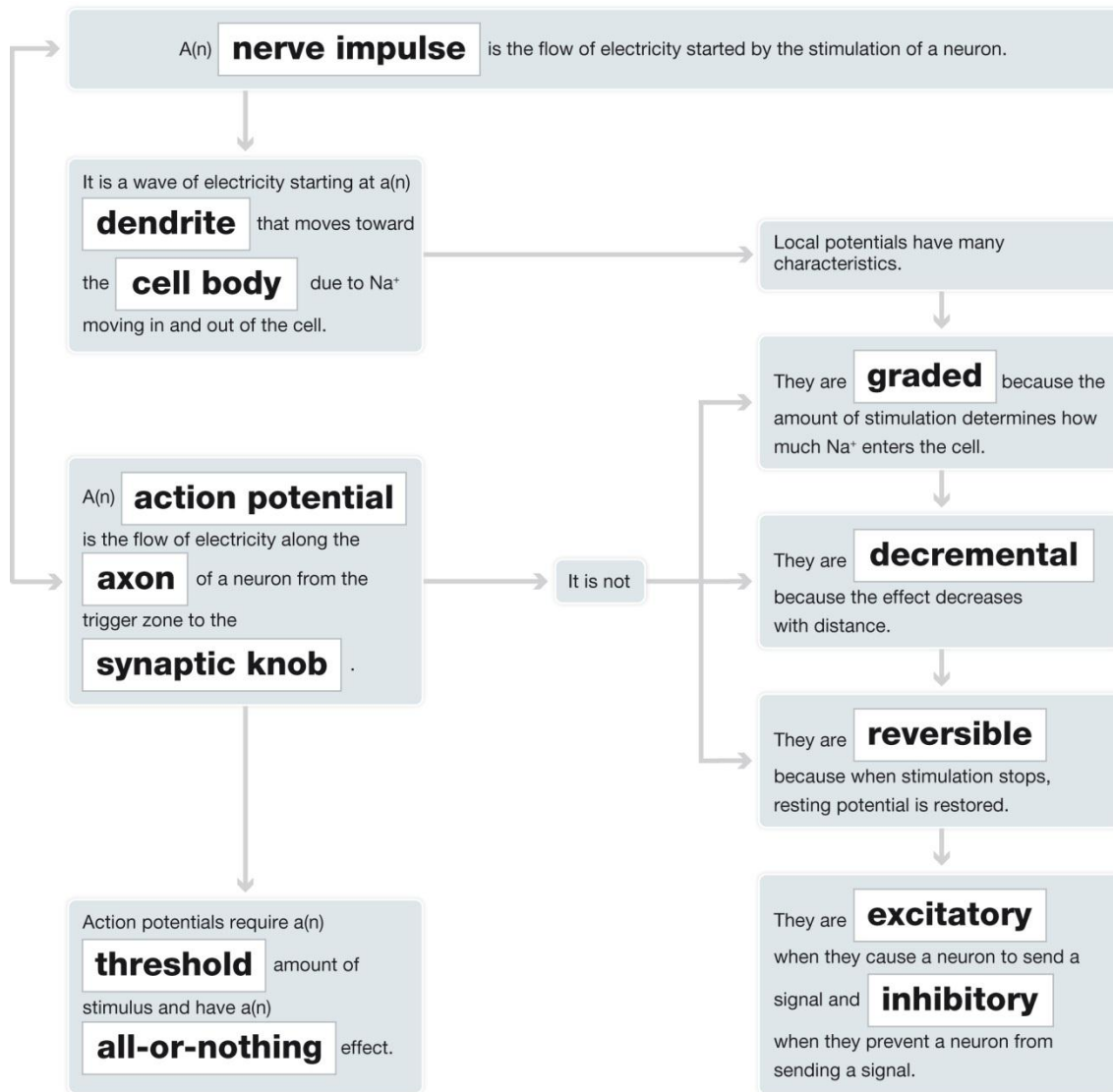
Polarization is the difference in these charges on either side of the neuron's cellular membrane.

Depolarization will occur when the charges of the membrane change due to the opening of Na⁺ channels allowing Na⁺ to flow into the cell by facilitated diffusion.

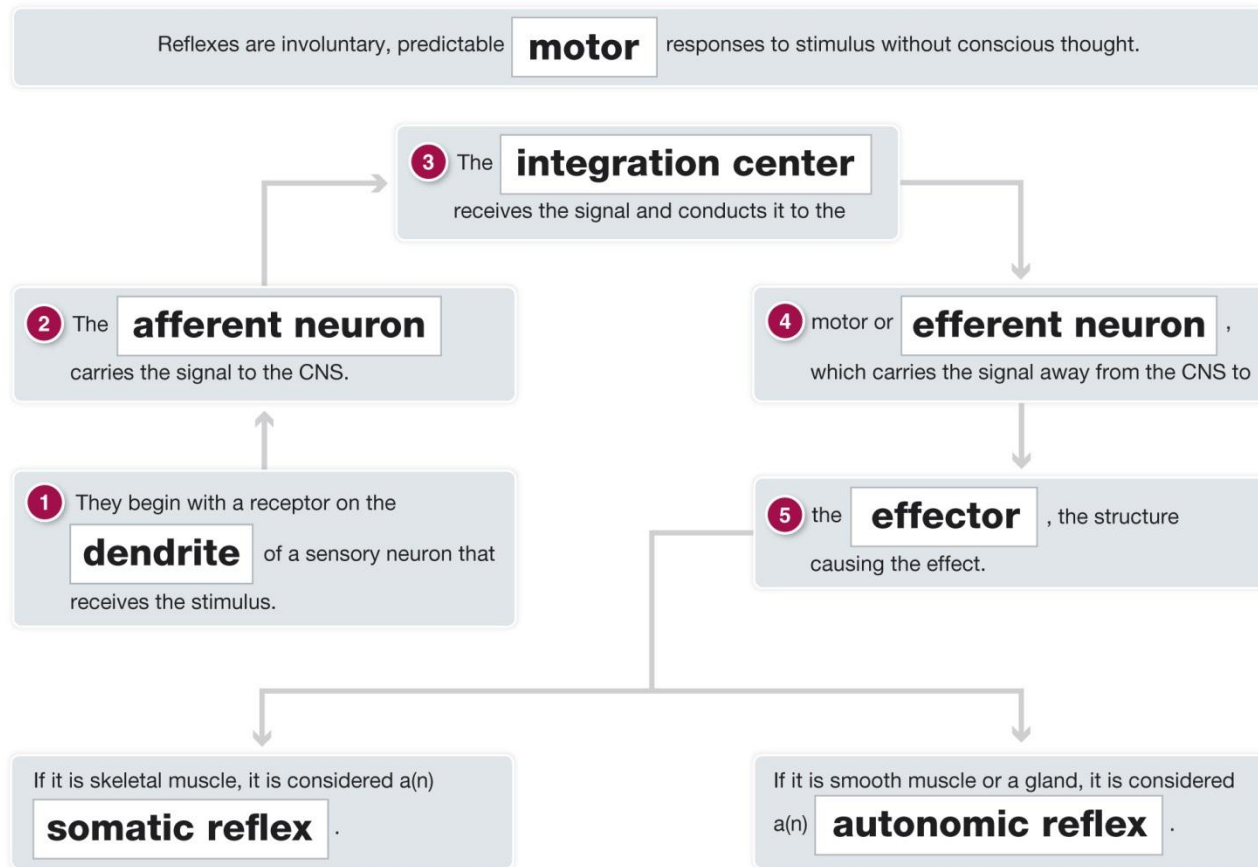
The **sodium-potassium** pump will restore a(n) **resting membrane potential** by pumping the Na⁺ out of the cell.

The result is **repolarization**.

Local and action Potentials



Reflexes



Workbook Chapter Review Questions

Word Deconstruction:

In the textbook, you built words to fit a definition using combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE: Dermatitis: dermat/ itis --inflammation of the skin

1. Poliomyelitis: Polio/ myel/ itis, inflammation of the gray matter of the spinal cord
2. Gangliectomy: Gangli/ ectomy, excision of a ganglion
3. Neurodynia: Neuro/ dynia, nerve pain
4. Encephalitis: Encephal/ itis, inflammation of the brain
5. Cephalocele: Cephalo/ cele, protrusion of the cranial contents

Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

1. How is the nervous system organized?
 - a. The nervous system is divided into the central nervous system and the autonomic nervous system.
 - b. The cerebrum is composed of three lobes.
 - c. ***The hypothalamus is part of the diencephalon.***
 - d. ***The peripheral nervous system is composed of afferent and efferent neurons.***
 - e. The autonomic division is composed of afferent neurons only.

2. How are neurons classified?

a. Bipolar neurons are sensory.

b. Multipolar neurons are sensory.

c. Unipolar neurons are efferent.

d. Unipolar neurons are motor.

e. Bipolar neurons are afferent.

3. What is (are) the function(s) of neuroglial cells?

a. Astrocytes fight pathogens.

b. Ependymal cells prevent medications from reaching the brain.

c. Schwann cells form myelin in the PNS.

d. Satellite cells regulate the composition of the CSF.

e. Microglia regulate the environment of ganglia in the PNS.

4. Agnes is suspected of having meningitis. Her physician performed a lumbar puncture. Why is this a good idea?

a. Cerebrospinal fluid may contain the pathogen.

b. The lumbar area contains an enlargement of the cord, so it will be easier to hit.

c. The cauda equina is located in the lumbar region.

d. Cerebrospinal fluid can be found in the subdural space.

e. Cerebrospinal fluid circulates over the entire brain and spinal cord, so it will likely pick up a pathogen if it is in the CNS.

5. How is the anatomy of a nerve organized?

a. Epineurium surrounds a neuron.

b. Neuron axons are bundled in fascicles.

c. Endoneurium surrounds a fascicle.

d. Perineurium surrounds a nerve.

e. Epineurium surrounds a nerve.

6. How does the sympathetic division compare to the parasympathetic division?
 - a. The preganglionic neuron is longer in the sympathetic division than in the parasympathetic division.
 - b. The postganglionic neuron is shorter in the parasympathetic division than in the sympathetic division.**
 - c. They both have neurons coming off the cord in the same place.
 - d. They both are part of the autonomic nervous system.**
 - e. They both involve afferent neurons.
7. How do Broca's area and Wernicke's area compare?
 - a. They are both in the frontal lobe.
 - b. They are both in the temporal lobe.
 - c. They are both in the cerebrum.**
 - d. Problems in either area are called aphasia.**
 - e. They both function for language.**
8. What can you expect to typically see concerning the nervous system in an 80-year-old?
 - a. Short-term memory is diminished.**
 - b. Reaction times are slow.**
 - c. Verbal skills are diminished.**
 - d. Long-term memory is absent.
 - e. The same effects as those in a 70-year-old.
9. What happens at the spinal cord?
 - a. Bipolar neurons enter the cord through the dorsal root.
 - b. Preganglionic neurons exit the cord through the ventral root.**
 - c. Postganglionic neurons have no connection to the cord.**
 - d. Unipolar neuron cell bodies are found in the gray matter of the spinal cord.
 - e. Multipolar neuron cell bodies are found in the dorsal root ganglia.
10. What happens in Alzheimer's disease?
 - a. Insoluble proteins called tangles form in neurons in the brain.**
 - b. Groups of dead cells called plaques form in the brain.**

c. The onset of symptoms may be years after the disease process began.

d. There is a loss of cognitive function called dementia.

e. A definite diagnosis can be made only after death.

Matching:

For each of the cranial nerves, pick one answer from each column to match the function, the name, and the type (whether it is sensory, motor, or both). For example (using the choices below), the answers for CN I would be: c, i, o.

	Functions	Names	Sensory, Motor, or Both
<u>g, i, q</u> 1. CN VII	a. Eye movement	h. Oculomotor	o. Sensory
<u>a, h, p</u> 2. CN III	b. Vision	i. Olfactory	p. Motor
<u>f, m, q</u> 3. CN IX	c. Smell	j. Facial	q. Both
<u>d, l, q</u> 4. CN V	d. Chewing	k. Optic	
<u>e, n, o</u> 5. CN VIII	e. Hearing and equilibrium	l. Trigeminal	
	f. Taste and swallowing	m. Glossopharyngeal	
	g. Taste and facial expression	n. Auditory	

Matching:

Match the part of the brainstem to the function. Some answers may be used more than once.

w 6. Is responsible for sleep-wake cycle t. Medulla oblongata

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- | | |
|--|------------------------|
| ___ <u>t</u> ___ 7. Regulates heart rate | u. Midbrain |
| ___ <u>v</u> ___ 8. Serves as a bridge to the cerebellum | v. Pons |
| ___ <u>u</u> ___ 9. Has colliculi for vision and hearing | w. Reticular formation |
| ___ <u>t</u> ___ 10. Has pyramids where motor messages cross | |

Completion:

Fill in the blanks to complete the following statements.

1. In a resting membrane potential, ___K+___ ions are on the inside of the cell and ___Na+___ ions are on the outside of the cell.
2. When sodium rushes inside the cell, the membrane becomes ___depolarized___.
3. The ___sodium/potassium pump___ restores a resting membrane potential.
4. Acetylcholine is carried down an axon to the ___synaptic knob___, where it is released.
5. ___Fat___ is needed in the diet of children for proper myelination of developing neurons.

Critical Thinking:

1. A woman enters the room. You are standing next to your friend. You comment on the woman's perfume. Your friend says, "What perfume? I don't smell anything." Explain how one person can smell the perfume and the other person cannot in terms of local and action potentials.

The perfume molecules initiated a local potential at the dendrites. For me there was a threshold amount of stimulus to generate an action potential at the trigger zone so I could smell the perfume. There must have been a subthreshold amount of stimulus so no action potential was generated for my friend.

2. Considering what you have learned about how memory works at the cellular and molecular levels, what would be the best method of studying for your A&P final exam? Explain.

Studying often would be best. Each time the neurons are stimulated, chemical changes take place to cause dendrites to grow and make new connections. Stimulate more often – more connections are made.

3. Why might a surgeon hesitate before performing surgery on a patient who has recently come out of a coma? Explain in terms of anatomy and physiology. Coma is a result of disturbance with the reticular formation. Sedation also affects the reticular formation. If it has just recovered from the coma you may not want to suppress it again so soon.

Case Study:

1. Yes, cerebral palsy can be caused by an injury during birth, infection or illness during fetal development, or lack of oxygen to the fetus at any given time.
2. Paralysis and seizures
3. No, symptoms of cerebral palsy vary greatly but do not progress as the child develops.