

Chapter 2: The Nervous System

MULTIPLE CHOICE

1. Which of the following is an accurate statement regarding neurons and glia cells?
- Neurons control behavior; glia cells support the function of neurons
 - Glia cells control behavior; neurons support the function of glia cells
 - Neurons are restricted to the brain; glia cells are restricted to the periphery
 - Glia cells are restricted to the brain; neurons are restricted to the periphery

ANS: A PTS: 1 REF: Cells in the Nervous System

2. What is the function of neuronal dendrites?
- They produce the myelin sheath.
 - They send neurotransmitters to other neurons.
 - They contain the neuron's genetic material.
 - They receive information from other neurons.

ANS: D PTS: 1 REF: Cells in the Nervous System

3. What is the function of a neuron's axon?
- It produces the myelin sheath.
 - It sends neurotransmitters to other neurons.
 - It contains the neuron's genetic materials.
 - It receives information from other neurons.

ANS: B PTS: 1 REF: Cells in the Nervous System

4. The small space between the axon terminal and postsynaptic terminal is called the ____.
- soma
 - synaptic cleft
 - nucleus
 - receptor

ANS: B PTS: 1 REF: Cells in the Nervous System

5. Dr. Mitchum is exploring the role of sensory neurons (which convey sensory information to the central nervous system) in detecting incremental changes in temperature. Which type of neuron is Dr. Mitchum studying?
- afferent neuron
 - efferent neuron
 - intra neuron
 - interneuron

ANS: A PTS: 1 REF: Cells in the Nervous System
TOP: Cells in the Nervous System

6. Dr. Goulard is investigating mechanisms of preserving the function of motor neurons (which convey motor information from the central nervous system) in amyotrophic lateral sclerosis. Which type of neuron is Dr. Goulard studying?
- afferent neuron
 - efferent neuron
 - intra neuron
 - interneuron

ANS: B PTS: 1 REF: Cells in the Nervous System
TOP: Cells in the Nervous System

7. Which cell type produces a material called *myelin*?
- a. neurons
 - b. oligodendrocytes
 - c. astrocytes
 - d. microglial cells

ANS: B PTS: 1 REF: Cells of the Nervous System

8. Which cell type plays a role in forming the blood-brain barrier?
- a. neurons
 - b. oligodendrocytes
 - c. astrocytes
 - d. microglial cells

ANS: C PTS: 1 REF: Cells of the Nervous System

9. Which cell type removes cellular waste?
- a. neurons
 - b. oligodendrocytes
 - c. astrocytes
 - d. microglial cells

ANS: D PTS: 1 REF: Cells of the Nervous System

Anatomical Terminology

During your Anatomy and Physiology lab, your Professor asks you to examine a model of the human brain. Your lab partner is not familiar with the terminology that your professor is using. Help your lab partner by telling him where to look at the model.

10. “Examine the anterior portion of the brain.” Where do you tell your lab partner to look?
- a. Toward the front of the brain
 - b. Toward the rear of the brain
 - c. Toward the midline of the brain
 - d. Toward the side of the brain

ANS: A PTS: 1
REF: The Nervous System: Control of Behavior and Physiological Functions

11. “Examine the dorsal portion of the brain.” Where do you tell your lab partner to look?
- a. Toward the top of the brain
 - b. Toward the rear of the brain
 - c. Toward the bottom of the brain
 - d. Toward the side of the brain

ANS: A PTS: 1
REF: The Nervous System: Control of Behavior and Physiological Functions

12. “Examine the posterior portion of the brain.” Where do you tell your lab partner to look?
- a. Toward the front of the brain
 - b. Toward the rear of the brain
 - c. Toward the bottom of the brain
 - d. Toward the side of the brain

ANS: B PTS: 1
REF: The Nervous System: Control of Behavior and Physiological Functions

13. “Examine the lateral portion of the brain.” Where do you tell your lab partner to look?
- a. Toward the back of the brain
 - b. Toward the bottom of the brain
 - c. Toward the midline of the brain
 - d. Toward the sides of the brain

ANS: D PTS: 1
REF: The Nervous System: Control of Behavior and Physiological Functions

14. A plane that shows brain structures as seen from the side is referred to as a ____.
- a. coronal plane
 - b. sagittal plane
 - c. frontal plane
 - d. horizontal plane

ANS: B PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

15. A plane that shows brain structures as seen from the front (or frontal plane) is referred to as a ____.
- a. coronal plane
 - b. sagittal plane
 - c. transverse plane
 - d. horizontal plane

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

16. A plane that shows brain structures as seen from above is referred to as a ____.
- a. coronal plane
 - b. sagittal plane
 - c. frontal plane
 - d. horizontal plane

ANS: D PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

17. The nervous system consists of two systems: ____.
- a. the peripheral nervous system and the frontal nervous system
 - b. the tangential nervous system and the frontal nervous system
 - c. the peripheral nervous system and the central nervous system
 - d. the tangential nervous system and the central nervous system

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

18. Which nervous system delivers voluntary motor signals from the central nervous system to muscles throughout the body and conveys sensory information from the body to the central nervous system?
- a. sympathetic nervous system
 - b. somatic nervous system
 - c. parasympathetic nervous system
 - d. autonomic nervous system

ANS: B PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

19. Which nervous system prepares the body for rigorous activity by increasing heartbeat, inhibiting digestion, and opening airways?
- a. sympathetic nervous system
 - b. somatic nervous system
 - c. parasympathetic nervous system
 - d. central nervous system

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

20. After encountering a ferocious dog while walking back from your psychopharmacology lecture, your heart races. After the dog turns in the other direction you began to relax and your heart beat slows down. What nervous system is primarily responsible for initiating your more relaxed state?
- a. sympathetic nervous system
 - b. somatic nervous system
 - c. parasympathetic nervous system
 - d. central nervous system

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

21. Which structure is part of the forebrain?
- a. medulla
 - b. cerebellum
 - c. thalamus
 - d. pons

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

22. The autonomic nervous system is controlled by the ____.
- a. medulla
 - b. limbic system
 - c. thalamus
 - d. basal ganglia

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

23. Narcotics and central nervous system depressants suppress medullary functions. Why might these drugs be fatal at high doses?
- a. May suppress breathing
 - b. May cause rapid heart rate
 - c. May increase risk of stroke
 - d. May cause hyperemia

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

24. It is 5 PM and Jane is dreaming of leaving work so that she can sink her teeth into a juicy hamburger. Which of Jane's brain structures is most contributing to her feeling of hunger?
- a. basal ganglia
 - b. cerebellum
 - c. medulla
 - d. hypothalamus

ANS: D PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

25. Tania sees a dark shadow outside her window and feels frightened. What brain structure contributes most to her feeling of fear?
- a. basal ganglia
 - b. pons
 - c. limbic system
 - d. hypothalamus

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

26. The nucleus accumbens is also called the brain's ____ center.
- a. reward
 - b. command
 - c. motor control
 - d. perception

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

27. Which lobe of the cerebral cortex processes auditory information and supports language comprehension and production?
- a. occipital lobe
 - b. temporal lobe
 - c. parietal lobe
 - d. frontal lobe

ANS: B PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

28. Which lobe of the cerebral cortex is primarily responsible for processing visual information?
- a. occipital lobe
 - b. temporal lobe
 - c. parietal lobe
 - d. frontal lobe

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

29. Which lobe of the cerebral cortex processes touch information from the body?
- a. occipital lobe
 - b. temporal lobe
 - c. parietal lobe
 - d. frontal lobe

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

30. Which lobe of the cerebral cortex supports decision making and movement?
- a. occipital lobe
 - b. temporal lobe
 - c. parietal lobe
 - d. frontal lobe

ANS: D PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

31. Which tract crosses from one hemisphere of the brain to the opposite side of the body, sending motor information to the limbs, hands, and feet?
- a. medial corticospinal tract
 - b. lateral corticospinal tract
 - c. dorsal spinocerebellar tract
 - d. cuneocerebellar tract

ANS: B PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

32. Which brain structures act to stabilize voluntary movements?
- a. hippocampus, thalamus, and amygdala
 - b. hippocampus, thalamus, and substantia nigra
 - c. basal ganglia, thalamus, and substantia nigra
 - d. basal ganglia, thalamus, and amygdala

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

33. The first drugs to treat schizophrenia, called *antipsychotic drugs*, caused Parkinson-like symptoms. Why?
- Antipsychotic drugs disrupt neurons in the substantia nigra.
 - Antipsychotic drugs damage neurons in the thalamus.
 - Antipsychotic drugs cause demyelination of the corticospinal tracts.
 - Antipsychotic drugs increase the number of dopamine receptors.

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

34. Megan is walking to the student center, lost in deep thought, when her friend Roman runs up behind her, tapping her on the shoulder. Megan, startled by Roman, jumps and gasps for air. Which brain structure is responsible for Megan's startle reflex?
- pons
 - cerebellum
 - basal ganglia
 - hippocampus

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

35. Working memory is part of your ____.
- short-term memory
 - sensory memory
 - reference memory
 - long-term memory

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

36. Second-grade teacher Ms. Frascella calls upon her star pupil, Jeremy, to recite the capitals of all 50 states. Which type of memory will Jeremy use to recall this information?
- short-term memory
 - sensory memory
 - working memory
 - long-term memory

ANS: D PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

37. Mabel was recently diagnosed with Alzheimer's disease. She is beginning to show significant impairment of her long-term memory. Damage to which brain structure likely caused this impairment?
- amygdala
 - cerebellum
 - hippocampus
 - thalamus

ANS: C PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

38. After a recent bicycle accident, 11 year old Todd cannot do things that were once routine, such as riding a bike. Damage to which of Todd's brain structure disrupted Todd's procedural memory required for riding his bike?
- basal ganglia
 - amygdala
 - pons
 - hypothalamus

ANS: A PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

39. Activity within which brain structures support arousal in the cerebral cortex, thus indirectly aiding in memory formation?
- a. dentate gyrus
 - b. reticular formation
 - c. limbic system
 - d. pyramidal system

ANS: B PTS: 1

REF: The Nervous System: Control of Behavior and Physiological Functions

40. Ted is studying for his neuropsychology exam. How is cerebral blood flow to Ted's prefrontal cortex likely to respond to his studying?
- a. Blood flow will remain constant.
 - b. Blood flow will decrease.
 - c. Blood flow will increase.
 - d. Blood flow will show variable changes.

ANS: C PTS: 1 REF: Blood Flow in the Brain

41. What is the role of nitric oxide in the brain?
- a. increases blood flow and increases oxygen levels
 - b. decreases blood flow, but increases oxygen levels
 - c. increases blood flow, but decreases oxygen levels
 - d. decreases blood flow and decreases oxygen levels

ANS: A PTS: 1 REF: Blood Flow in the Brain

42. What term is used to describe a decrease in cerebral blood flow that may potentially cause cell death if severe or persistent enough?
- a. infarct
 - b. excitotoxicity
 - c. ischemia
 - d. hyperemia

ANS: C PTS: 1 REF: Blood Flow in the Brain

43. Peter's physician, Dr. Ma, is concerned that he suffered a stroke after he complains of loss of feeling in his left arm. Which diagnostic test will help Dr. Ma visualize Peter's circulatory system to determine if he suffered a stroke?
- a. CAT scan
 - b. PET scan
 - c. fMRI
 - d. angiogram

ANS: D PTS: 1 REF: Blood Flow in the Brain

44. The brain is supplied with blood through two major arteries: ____.
- a. the dorsal scapular artery and the vertebral artery
 - b. the dorsal scapular artery and the carotid artery
 - c. the carotid artery and the femoral artery
 - d. the carotid artery and the vertebral artery

ANS: D PTS: 1 REF: Blood Flow in the Brain

45. The brain contains cerebrospinal fluid-filled cavities called ____.
- a. periaqueductal gray areas
 - b. arterioles
 - c. ventricles
 - d. meninges

ANS: C PTS: 1 REF: Cerebrospinal Fluid

46. Which is a function of cerebrospinal fluid?
- a. It transports oxygen.
 - b. It produces immune cells.
 - c. It serves as a protective cushion.
 - d. It clears myelin.

ANS: C PTS: 1 REF: Cerebrospinal Fluid

47. What is the function of the blood-brain barrier?
- a. It provides protective cushion.
 - b. It allows substances to easily access the brain.
 - c. It prevents harmful substances from entering brain.
 - d. It converts carbon dioxide into oxygen.

ANS: C PTS: 1 REF: The Blood–Brain Barrier

48. Dr. Pearson wants to design a drug that easily passes through the blood-brain barrier. As an expert in psychopharmacology, you suggest that Dr. Pearson ensure that the chemical structure that he designs is small, as well as ____.
- a. lipid soluble and uncharged
 - b. water soluble and uncharged
 - c. lipid soluble and charged
 - d. water soluble and charged

ANS: A PTS: 1 REF: The Blood–Brain Barrier

49. Drug X passes through the blood-brain barrier via active transport. What does this mean?
- a. Drug X diffuses through the blood-brain barrier.
 - b. Drug X uses osmosis to pass through the blood-brain barrier.
 - c. Drug X directly attaches to neurons to pass through the blood-brain barrier.
 - d. Drug X uses channels to pass through the blood-brain barrier.

ANS: D PTS: 1 REF: The Blood–Brain Barrier

50. The primary features of the central nervous system are produced during the ___ trimester of pregnancy.
- a. first
 - b. second
 - c. third
 - d. fourth

ANS: A PTS: 1
REF: The Nervous System: Rapid Development After Fertilization

51. Expecting mom Giselle reads about her pregnancy on the website *Mommy-and-Me*. She learns that her unborn baby developed noticeable ridges and grooves (termed gyri and sulci) within the cerebral cortex. During which gestational period do these gyri and sulci first become most apparent?
- a. 12 to 18 weeks into a pregnancy
 - b. 18 to 24 weeks into a pregnancy
 - c. 24 to 30 weeks into a pregnancy
 - d. 30 to 36 weeks into a pregnancy

ANS: C PTS: 1
REF: The Nervous System: Rapid Development After Fertilization

58. The type of RNA used to trigger protein synthesis is called ____ RNA.
- transfer
 - nucleic
 - ribosomal
 - messenger

ANS: D PTS: 1

REF: Genes and the Development and Physiological Processes of Cells

59. Dr. Leighton is performing a literature search to learn more about a process termed *gliosis*. What is she likely to find out?
- Astrocytes facilitate axonal regrowth after injury.
 - Astrocytes hinder axonal regrowth after injury.
 - Astrocytes produce new myelin for injured axons.
 - Astrocytes strip injured axons of old myelin.

ANS: B PTS: 1 REF: Glial Scars and Recovery from Brain Injury

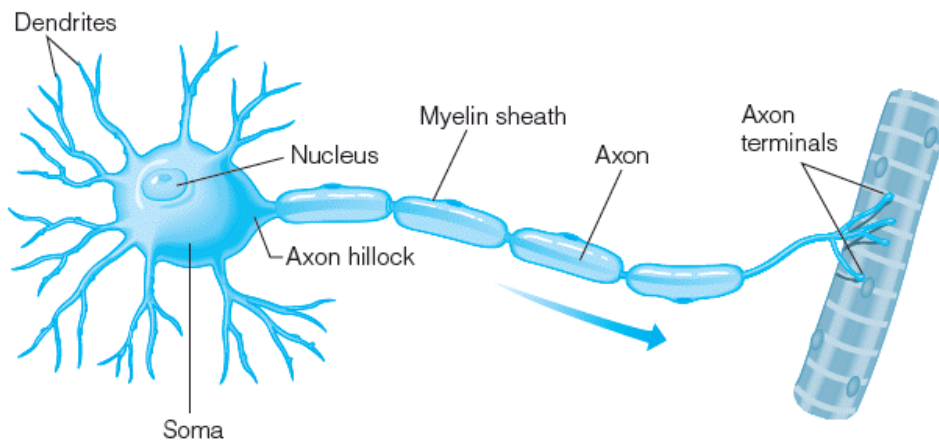
60. Dr. Ambroise is developing a drug to help promote axonal regeneration following brain injury. What might be an effective mechanism of action for Dr. Ambroise's drug?
- Inhibit BDNF production.
 - Block uptake of neurotrophin-3.
 - Break down proteoglycans.
 - Increase production of semaphorin 3.

ANS: C PTS: 1 REF: Glial Scars and Recovery from Brain Injury

ESSAY

1. Draw a diagram of a neuron, identifying its major structures. Write a brief description of the role of each structure in facilitating neuronal communication. Include in your answer a discussion of the synapse and how it bridges interneuronal communication.

ANS:



Motor neuron

Note: The myelin sheath is not actually a neuronal structure, but is part of the oligodendrocyte's membrane (one of the three glial cell types) which ensheaths the neuron's axon.

Neurons have four major components: a soma, dendrites, axon, and axon terminal. The soma is the body of the neuron. It also contains the nucleus, which holds DNA. Overall, components within the soma support a neuron's basic physiological processes. Generally, a neuron has many dendrites that branch off from the soma. The dendrites of a neuron receive information from other neurons. Small stems called *dendritic spines* grow along the length of dendritic branches. The membranes of dendrites and dendritic spines contain proteins called *receptors* that neurotransmitters can activate. When activated, receptors cause changes in the functioning of the neuron. The overall coverage of dendrites for a neuron is called the *receptive zone*; the more dendrites a neuron has, the more input it can receive from other neurons. Axons send neurotransmitters to other neurons. Most neurons have only one axon, which branches from the soma, usually opposite from the dendrites. An axon begins at a part of the soma called the *axon hillock* and ends with multiple branches containing axon terminals. These branches are called *axon collaterals*. An axon terminal contains and releases neurotransmitters at a part of a dendrite called a *postsynaptic terminal*. The postsynaptic terminal contains receptors for neurotransmitters. The small space between the axon terminal and postsynaptic terminal is called the *synaptic cleft*. The term synapse refers to the components that comprise this connection, and these include the axon terminal, postsynaptic terminal, and the synaptic cleft.

PTS: 1 REF: Cells in the Nervous System

2. Describe what is meant by the term *glial scar*. What roadblocks to recovery from traumatic brain injury does the glial scar present? In addition, discuss current experimental therapeutic strategies for combating promoting axonal regeneration after brain injury.

ANS:

An important challenge in brain injury recovery consists of a natural response to injury called a *glial scar* or *gliosis* (Silver & Miller, 2004). A glial scar consists of reactive astrocytes—that is, astrocytes that swell in response to injury. The resulting glial scar from traumatic brain injury segregates damaged tissue from healthy tissue. The action serves to repair the blood–brain barrier. In doing so, however, glial scars prevent neurons in damaged tissue from regaining connections to other structures in the nervous system.

Regaining connectivity after injury involves the sprouting of severed axons. Because of the barrier created, the glial scars caused regenerating axon terminals to divert from the damaged tissue. These conditions result in misaligned patterns of growth, including retractions into balls called *dystrophic end bulbs*.

Astrocytes in glial scars prevent axon growth through an inhibitory extracellular matrix. The inhibitory extracellular matrix consists of chemicals that inhibit axon growth, including proteoglycans, secreted protein semaphorin 3, and ephrin-B2. Each molecule prevents the growth or penetration of axons into damaged tissue (Silver & Miller, 2004).

Experimental treatments for traumatic brain injury recovery focus on ways to improve axon regeneration into damaged brain areas. One approach uses the enzyme chondroitinase to break down proteoglycans. Related approaches seek to reduce other inhibitory components in the inhibitory extracellular matrix.

Other treatments focus on improving the availability of growth material for axons. These strategies often involve neural growth factors, such as neurotrophin-3 and brain-derived neural growth factor. The delivery of neural growth factors promotes the growth of axons into damaged tissue.

Finally, researchers have combined both of the preceding strategies to reduce inhibitory extracellular matrix components while promoting the growth of axons. For example, Tropea and colleagues (2003) assessed the effects of each approach on damaged retinal neurons that terminate in the superior colliculus. The application of either chondroitinase or BDNF promoted the regrowth of these neurons into the superior colliculus. Yet far greater neuronal growth was demonstrated by using both chondroitinase and BDNF.

PTS: 1 REF: Glial Scars and Recovery from Brain Injury