Test Bank

to accompany

Psychopharmacology, Fourth Edition

Meyer • Ferrar • Biezonski • Yates

Chapter 2
Structure and Function of the Nervous System

Multiple Choice

1. Neurons responsible for converting environmental stimuli into neural signals are known as
a. sensory neurons.
b. interneurons.
c. motor neurons.
d. pyramidal cells.
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.1 Name the different types of cells in the nervous system, including the major types of neurons and glial cells.
Bloom's Level: 1. Remembering

2. Neurons can be categorized by all of the following *except* by
a. which neurotransmitters they release.
b. their function (e.g., sensory versus motor).
c. the size of the action potentials they generate.
d. their morphology.
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.1 Name the different types of cells in the nervous system, including the major types of neurons and glial cells.
Bloom's Level: 2. Understanding

3. Neurons rely on _____ for protection, metabolic support, and insulation.
a. mitochondria
b. glial cells
c. axoplasm
d. dendritic spines
Answer: b
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.2 List the three major components of a neuron and describe their functions.
Bloom's Level: 1. Remembering

4. The _____ of the neuronal cell is/are found in the soma, while the _____ may be found throughout the cell.
a. mitochondria; dendrites
b. dendrites; axon
c. nucleus; mitochondria
d. nucleus; dendrites
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.2 List the three major components of a neuron and describe their functions.
Bloom's Level: 2. Understanding

5. Neurons exchange information primarily via
a. somas.
b. dendrites.
c. axons.
d. axon collaterals.
Answer: b
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.2 List the three major components of a neuron and describe their functions.
Bloom's Level: 1. Remembering

6. Dendritic spines serve to
a. increase the surface area of the dendrite.
b. insulate the axons.
c. insulate the dendrites.
d. protect the dendrites from degrading enzymes in the extracellular fluid.
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.2 List the three major components of a neuron and describe their functions.
Bloom's Level: 1. Remembering

7. The function of the axon is to transmit the _____, generated at the _____, to the terminals.
a. axoplasm; soma
b. action potential; axon hillock
c. action potential; dendrites
d. synaptic vesicles; axon hillock
Answer: b
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.2 List the three major components of a neuron and describe their functions.
Bloom's Level: 2. Understanding

8. In a myelinated axon, action potentials are regenerated
a. at the terminal buttons.
b. all along the axon.
c. at gaps in the myelin known as nodes of Ranvier.
d. at the axon hillock.
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.3 Describe the role of myelin in neurotransmission.
Bloom's Level: 2. Understanding

9. Which statement about the myelin sheath is *false*?
a. It is produced by glial cells.
b. It increases the speed of signal conduction along the axon.
c. It saves energy.
d. It is found on all neurons.
Answer: d
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.3 Describe the role of myelin in neurotransmission.
Bloom's Level: 2. Understanding

10. With regard to glial cells, _____ form the myelin sheath in the CNS, while _____ help maintain the ionic and chemical environment.
a. Schwann cells; astrocytes
b. oligodendroglia; astrocytes
c. oligodendroglia; microglia
d. Schwann cells; microglia
Answer: b
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.3 Describe the role of myelin in neurotransmission.
Bloom's Level: 2. Understanding

11. Epigenetic changes affect gene expression by _____ and by _____.
a. blocking translation; DNA methylation
b. breaking down chromatin; blocking transcription
c. DNA methylation; chromatin remodeling
d. remodeling transcription factors; blocking translation
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.4 Explain how epigenetic modifications can influence gene expression.
Bloom's Level: 2. Understanding

12. Axonal transport of proteins occurs along a track formed by
a. microtubules.
b. neurofilaments.
c. anterograde cytoskeleton.
d. retrograde cytoskeleton.

Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.5 Describe how the internal and external structural features of a neuron (e.g., cytoskeleton, membrane) give rise to its functions (e.g., axoplasmic transport, membrane potential).
Bloom's Level: 1. Remembering

13. Neuronal cell membranes are associated with all of the following proteins *except*
a. transporters.
b. ion channels.
c. microtubules.
d. enzymes.
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.5 Describe how the internal and external structural features of a neuron (e.g., cytoskeleton, membrane) give rise to its functions (e.g., axoplasmic transport, membrane potential).
Bloom's Level: 2. Understanding

14. Many ion channels are not normally open but must be gated or opened by some event. Which of the following is *not* a typical means by which ion channels open?
a. Binding of neurotransmitter to external binding site
b. Change in voltage across the membrane
c. Phosphorylation by an intracellular second messenger
d. Enzymatic reactions
Answer: d
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.5 Describe how the internal and external structural features of a neuron (e.g., cytoskeleton, membrane) give rise to its functions (e.g., axoplasmic transport, membrane potential).
Bloom's Level: 3. Applying

15. The primary immune response in the CNS comes from the action of
a. microglia.
b. astrocytes.
c. white blood cells.
d. oligodendroglia.
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.5 Describe how the internal and external structural features of a neuron (e.g., cytoskeleton, membrane) give rise to its functions (e.g., axoplasmic transport, membrane potential).
Bloom's Level: 1. Remembering

16. Mitochondria are responsible for generating _____ for the cell in the form of _____.
a. energy; ATP

b. energy; glucose
c. cytoplasm; ATP
d. cytoplasm; glucose
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 2. Understanding

17. _____ are long strands of DNA divided into smaller portions called _____, which code for specific proteins.
a. Chromosomes; genes
b. Genes; chromosomes
c. Transcription factors; genes
d. Genes; ribosomes
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 2. Understanding

18. Which statement about the process of transcription is true?
a. It is driven by ribosomes.
b. It occurs in the cytoplasm.
c. The nucleotide sequence of DNA is replicated by mRNA.
d. It results in the production of proteins.
Answer: c
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 2. Understanding

19. Proteins, such as receptors and enzymes, are synthesized in the cytoplasm of the soma in a process called
a. translation.
b. regulation.
c. transcription.
d. transport.
Answer: a
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 1. Remembering

20. Which of the following most accurately describes the steps involved in protein synthesis?
a. Transcription factors activate promoter region → translation by ribosomes → transcription by mRNA
b. Transcription factors activate promoter region → transcription by mRNA → translation by ribosomes

c. Translation by ribosomes → transcription factors activate promoter region → transcription by mRNA
d. Transcription by mRNA → transcription factors activate promoter region → translation by ribosomes
Answer: b
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 3. Applying

21. Within the exterior and interior of an individual neuron, there is a(n) _____ charge, called the _____ membrane potential.
a. chemical; action
b. electrical; action
c. electrical; resting
d. chemical; resting
Answer: c
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.1 Explain the mechanisms that give rise to resting membrane potential.
Bloom's Level: 2. Understanding

22. The _____ is best described as a result of the selective permeability of the neuronal membrane and the uneven distribution of ions inside and outside the cell.
a. action potential
b. threshold
c. local potential
d. resting membrane potential
Answer: d
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.1 Explain the mechanisms that give rise to resting membrane potential.
Bloom's Level: 2. Understanding

23. The Na^+–K^+ pump helps to maintain the _____ by pumping three Na^+ ions in for every two K^+ ions pumped out of the cell.
a. action potential
b. resting membrane potential
c. threshold
d. local potential
Answer: b
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.1 Explain the mechanisms that give rise to resting membrane potential.
Bloom's Level: 2. Understanding

24. At the equilibrium potential for potassium, the two forces acting on ions are in balance. These forces are the _____ and the _____.
a. Na^+–K^+ pump; threshold
b. Na^+–K^+ pump; electrostatic pressure

c. concentration gradient; action potential
d. concentration gradient; electrostatic pressure
Answer: d
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.1 Explain the mechanisms that give rise to resting membrane potential.
Bloom's Level: 2. Understanding

25. The term "hyperpolarization" refers to
a. an excitatory postsynaptic potential.
b. the opening of sodium channels.
c. movement of the resting membrane potential closer to threshold.
d. movement of the resting membrane potential farther from threshold.
Answer: d
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.2 Describe how local inhibitory and excitatory postsynaptic potentials lead to states of hyperpolarization and depolarization, respectively.
Bloom's Level: 1. Remembering

26. Excitatory postsynaptic potentials are caused by _____ channels opening, while inhibitory postsynaptic potentials are caused by _____ channels opening.
a. Na^+; Cl^- or K^+
b. K^+; Cl^- or Na^+
c. Ca^{2+}; K^+ or Cl^-
d. Cl^-; K^+ or Ca^{2+}
Answer: a
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.2 Describe how local inhibitory and excitatory postsynaptic potentials lead to states of hyperpolarization and depolarization, respectively.
Bloom's Level: 2. Understanding

27. Action potentials are first generated at the axon hillock because this is where _____ are located.
a. non-gated K^+ channels
b. voltage-gated Na^+ channels
c. transporters
d. Na^+–K^+ pumps
Answer: b
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock.
Bloom's Level: 2. Understanding

28. Postsynaptic potentials are a type of _____ potential.
a. action
b. local
c. resting

d. equilibrium
Answer: b
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock.
Bloom's Level: 2. Understanding

29. Which statement about local potentials is *false*?
a. They are generated on the dendrites and cell body.
b. They occur only if threshold is reached.
c. They move passively along the membrane.
d. They are integrated at the axon hillock.
Answer: b
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock.
Bloom's Level: 3. Applying

30. Summation of local potentials can lead to a(n) _____ at the axon hillock if the _____ is reached.
a. equilibrium potential; threshold
b. local potential; equilibrium potential
c. action potential; equilibrium potential
d. action potential; threshold
Answer: d
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock.
Bloom's Level: 2. Understanding

31. During the _____ period, no additional action potentials can be created.
a. absolute refractory
b. conduction
c. integration
d. relative refractory
Answer: a
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock
Bloom's Level: 1. Remembering

32. The absolute refractory period occurs because _____ channels cannot be opened, and the relative refractory period occurs because _____.
a. voltage-gated Na^+; voltage-gated K^+ channels cannot be opened
b. voltage-gated K^+; voltage-gated Na^+ channels remain open
c. voltage-gated Na^+; voltage-gated K^+ channels remain open

d. voltage-gated Na^+; Na^+–K^+ pumps are activated
Answer: c
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.4 Describe how the integration of sufficient excitatory postsynaptic potentials at the axon hillock can trigger an action potential.
Bloom's Level: 2. Understanding

33. Which statement about action potentials is *false*?
a. They are considered all-or-none.
b. Extreme excitation will result in a very large action potential.
c. They can move via saltatory conduction in myelinated axons.
d. They are generated at the axon hillock.
Answer: b
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.4 Describe how the integration of sufficient excitatory postsynaptic potentials at the axon hillock can trigger an action potential.
Bloom's Level: 3. Applying

34. Local anesthetics, such as lidocaine, have their effects by
a. blocking the Na^+–K^+ pump.
b. preventing the generation of EPSPs and IPSPs.
c. blocking voltage-gated Ca^{2+} channels.
d. blocking voltage-gated Na^+ channels.
Answer: d
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.5 Explain how the distribution of ions between the interior and exterior of the neuron interacts with voltage-gated ion channels to generate action potentials; describe how drugs can influence this process.
Bloom's Level: 2. Understanding

35. A person eats a meal that includes mussels. Soon after eating the person experiences trouble breathing. This person most likely ingested saxitoxin, which has its effect by _____ channels.
a. blocking voltage-gated Na^+
b. opening voltage-gated Na^+
c. blocking voltage-gated Cl^-
d. blocking voltage-gated Cl^-
Answer: a
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.5 Explain how the distribution of ions between the interior and exterior of the neuron interacts with voltage-gated ion channels to generate action potentials; describe how drugs can influence this process.
Bloom's Level: 3. Applying

36. The _____ and _____ nervous system are components of the peripheral nervous system and relay information about the internal and external environment, respectively.
a. cranial nerves; somatic

b. autonomic nervous system; sympathetic
c. sympathetic nervous system; parasympathetic
d. autonomic nervous system; somatic
Answer: d
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 2. Understanding

37. Which of the following is *not* part of the peripheral nervous system?
a. Sympathetic nervous system
b. Parasympathetic nervous system
c. Spinal cord
d. Cranial nerves
Answer: c
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 1. Remembering

38. What kind of information is carried by the ventral horn of the spinal cord?
a. Sensory information from muscles and skin
b. Proprioceptive information from joints and muscles
c. Motor information for voluntary movements
d. Motor and sensory information
Answer: c
Textbook Reference: Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 2. Understanding

39. The sympathetic nervous system is responsible for _____ functions and uses _____ as its neurotransmitter(s).
a. energy conservation; acetylcholine only
b. energy conservation; acetylcholine and norepinephrine
c. fight-or-flight; acetylcholine only
d. fight-or-flight; acetylcholine and norepinephrine
Answer: d
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 2. Understanding

40. The tissue layers that lie just below the bones of the spinal cord and brain and that aid in protecting them are called the
a. pons.
b. substantia nigra.
c. cerebellar peduncles.
d. meninges.
Answer: d

Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.2 Describe the structural features of the CNS that provide protection from injury and exchange nutrients and waste products between the brain and its blood supply.
Bloom's Level: 1. Remembering

41. The _____ of the spinal cord is made up of myelinated axons that carry signals in the ascending direction, to the brain, and the descending direction, for cortical control of muscle contraction.
a. dura mater
b. white matter
c. gray matter
d. arachnoid
Answer: b
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.3 Describe the cellular components that make up the gray and white matter of the spinal cord, and how these components transmit information between the brain and the periphery.
Bloom's Level: 2. Understanding

42. The neural network that regulates motivation and emotion is the
a. limbic system.
b. medulla.
c. thalamus.
d. hypothalamus.
Answer: a
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.4 Describe the main biological functions of, and the primary structures within, the following anatomical subdivisions of the CNS: myelencephalon, metencephalon, mesencephalon, diencephalon, telencephalon.
Bloom's Level: 1. Remembering

43. Nuclei located in the _____ are responsible for the contraction and dilation of the pupil of the eye.
a. metencephalon
b. telencephalon
c. mesencephalon
d. diencephalon
Answer: c
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.4 Describe the main biological functions of, and the primary structures within, the following anatomical subdivisions of the CNS: myelencephalon, metencephalon, mesencephalon, diencephalon, telencephalon.
Bloom's Level: 1. Remembering

44. You are about to cross a busy city street in with lots of traffic and other distractions. Which brain areas help you to focus on important stimuli (oncoming traffic) and disregard unimportant stimuli (e.g., sounds of construction in the distance)?
a. The dorsal and median raphe nuclei
b. The limbic system and cingulate
c. The white matter, with inputs from myelinated axons
d. The thalamus, with inputs to the cortex
Answer: d
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.4 Describe the main biological functions of, and the primary structures within, the following anatomical subdivisions of the CNS: myelencephalon, metencephalon, mesencephalon, diencephalon, telencephalon.
Bloom's Level: 4. Analyzing

45. Clusters of cell bodies in the CNS are called _____, and their associated bundles of axons are called _____.
a. nuclei; tracts
b. ganglia; tracts
c. nuclei; nerves
d. ganglia; nerves
Answer: a
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.4 Describe the main biological functions of, and the primary structures within, the following anatomical subdivisions of the CNS: myelencephalon, metencephalon, mesencephalon, diencephalon, telencephalon.
Bloom's Level: 2. Understanding

46. Which brain structure regulates the body's respiration and heart rate?
a. Thalamus
b. Medulla
c. Corpus callosum
d. Cerebellum
Answer: b
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.5 Name the lobes of the cerebral cortex and discuss the functions associated with each.
Bloom's Level: 1. Remembering

47. Which statement about the visual field is true?
a. The left half of the visual field of each eye goes to the right occipital lobe and the right half of the visual field of each eye goes to the left occipital lobe.
b. The right half of the visual field of each eye goes to the right occipital lobe and the left half of the visual field of each eye goes to the left occipital lobe.
c. The left half of the visual field of each eye goes to both occipital lobes and the right half of the visual field of each eye goes to only the right occipital lobe.

d. The left half of the visual field of each eye goes to the right occipital lobe and the right half of the visual field of each eye goes to both occipital lobes.
Answer: a
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.5 Name the lobes of the cerebral cortex and discuss the functions associated with each.
Bloom's Level: 2. Understanding

48. A _____ section of the brain is cut parallel to the face.
a. sagittal
b. coronal
c. horizontal
d. caudal
Answer: b
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 1. Remembering

49. A toxic plant that is frequently used as a recreational drug by teenagers is _____, which produces a(n) _____ effect on the parasympathetic nervous system.
a. elderberry; anticholinergic
b. elderberry; cholinergic
c. jimsonweed; anticholinergic
d. jimsonweed; cholinergic
Answer: a
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: Not aligned
Bloom's Level: 2. Understanding

Short Answer/Essay

50. Name four types of glial cells and provide at least one function of each type.
Answer: Schwann cells and oligodendroglia produce the myelin sheath on peripheral and central nervous system neurons, respectively. Astrocytes regulate the extracellular environment of the neurons, regulate CNS blood flow, and provide physical support and nutritional assistance. Microglia act as phagocytes to remove cellular debris and provide immune function.
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.1 Name the different types of cells in the nervous system, including the major types of neurons and glial cells.
Bloom's Level: 3. Applying

51. Write a coherent and informative paragraph using the following terms: transcription factor, promoter region, transcription, translation.
Answer: Changes in synaptic activity increase or decrease the production of particular proteins by activating transcription factors in the nucleus. Transcription factors are nuclear proteins that

direct protein production. Transcription factors such as CREB bind to the promoter region of the gene adjacent to the coding region, modifying its rate of transcription. Transcription occurs in the nucleus, where messenger RNA (mRNA) makes a complimentary copy of the active gene. After moving from the nucleus to the cytoplasm, mRNA attaches to organelles called ribosomes, which decode the "recipe" and link the appropriate amino acids together to form the protein. This process is called translation.
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.4 Explain how epigenetic modifications can influence gene expression.
Bloom's Level: 3. Applying

52. Briefly describe the role of chromatin remodeling in the epigenetic modification of gene expression.
Answer: Chromatin is a complex of DNA, histone proteins, and nonhistone proteins. When histone tails are acetylated, charges open up the chromatin, creating an active state that allows transcription factors to bind to the promoter region of a gene to enhance transcription. The inactive state of chromatin is caused by methylation of histone tails, which pulls the chromatin tighter and prevents the binding of transcription factors, reducing transcription of the gene.
Textbook Reference: 2.1 Cells of the Nervous System
Learning Objective: 2.1.4 Explain how epigenetic modifications can influence gene expression.
Bloom's Level: 3. Applying

53. How are local potentials and action potentials similar, and how are they different?
Answer: Similarities: Both involve Na^+ and K^+ channels. Differences: Local potentials are graded, decremental, produced by opening of ligand-gated ion channels, involve depolarization or hyperpolarization, and spatial and temporal summation. Action potentials are "all-or-none," nondecremental, produced by opening of voltage-gated channels, involve depolarization only, and the intensity of stimulus is coded by rate of firing.
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.3 Explain how local potentials from simultaneous inputs are integrated at the axon hillock and 2.2.4 Describe how the integration of sufficient excitatory postsynaptic potentials at the axon hillock can trigger an action potential.
Bloom's Level: 4. Analyzing

54. Give a detailed, step-by-step description of the stages of an action potential, including a description of and explanation for the refractory periods.
Answer: The summation of all EPSPs and IPSPs occurring at any single moment in time occurs at the axon hillock. If the threshold is reached (usually approximately a change from –70 mV to –50 mV), voltage-gated Na^+ channels open, allowing large amounts of Na^+ to enter the axon to produce the massive depolarization known as the action potential. At the peak of the action potential (+40 mV), voltage-gated Na^+ channels close and cannot be opened until they reset at the resting potential, so no action potential can occur during this time (this is called the absolute refractory period). As the cell becomes more positive inside, voltage-gated K^+ channels open and K^+ exits from the cell, bringing the membrane potential back toward resting levels. The overshoot by K^+ causes the cell to be more polarized than normal, so it is more difficult (although still possible) to reach the threshold to generate another action potential relative

refractory period). The action potential moves down the length of the axon by sequential opening of voltage-gated Na^+ channels.
Textbook Reference: 2.2 Electrical Transmission within a Neuron
Learning Objective: 2.2.4 Describe how the integration of sufficient excitatory postsynaptic potentials at the axon hillock can trigger an action potential.
Bloom's Level: 3. Applying

55. Compare and contrast the sympathetic and parasympathetic divisions of the autonomic nervous system.
Answer: The sympathetic nervous system predominates when energy expenditure is necessary, such as during times of stress, excitement, and exertion. This system increases heart rate and blood pressure, stimulates secretion of adrenaline, and increases blood flow to skeletal muscles, among other effects. The parasympathetic division predominates at times when energy reserves can be conserved and stored for later use; this system increases salivation, digestion, and storage of glucose and other nutrients and also slows heart rate and decreases respiration.
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 3. Applying

56. Discuss the anatomical differences between the sympathetic and parasympathetic divisions of the autonomic nervous system, including their points of origin in the central nervous system.
Answer: The cell bodies of sympathetic neurons are in the ventral horn at the thoracic and lumbar regions. Their axons project for a relatively short distance before they synapse with a cluster of cell bodies called sympathetic ganglia. The preganglionic fibers release acetylcholine onto cell bodies in the ganglia. The postganglionic cells project their axons for a relatively long distance to the target tissues and release norepinephrine. The cell bodies of the parasympathetic neurons are located either in the brain (cranial nerves) or in the ventral horn of the spinal cord at the sacral region. Preganglionic neurons travel long distances to synapse on cells in the parasympathetic ganglia that are close to individual target organs. Both preganglionic and postganglionic fibers release acetylcholine.
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.1 Identify and describe the major divisions of the nervous system.
Bloom's Level: 3. Applying

57. Describe the HPA axis and the neuroendocrine stress response, including the idea of negative feedback.
Answer: Stress causes the secretion of corticotropin-releasing factor (CRF) by the paraventricular nucleus of the hypothalamus into the blood vessels ending in the anterior pituitary. The binding of CRF in that gland causes the release of adrenocorticotropic hormone (ACTH) into the general blood circulation. ACTH subsequently binds to the adrenal cortex to increase the secretion of cortisol and other glucocorticoids, all of which contribute to the mobilization of energy to cope with stress or exertion. Cortisol feeds back to the hypothalamus (and hippocampus) to shut down HPA activation and return cortisol levels to normal.
Textbook Reference: 2.3 Organization of the Nervous System

Learning Objective: 2.3.4 Describe the main biological functions of, and the primary structures within, the following anatomical subdivisions of the CNS: myelencephalon, metencephalon, mesencephalon, diencephalon, telencephalon.
Bloom's Level: 3. Applying

58. Name and briefly describe the functions of the four lobes of the cerebral cortex.
Answer: The frontal lobe is responsible for movement and executive function. The other three lobes are sensory in function: parietal (somatosensory—touch, temperature, pain); occipital (vision); and temporal (audition).
Textbook Reference: 2.3 Organization of the Nervous System
Learning Objective: 2.3.5 Name the lobes of the cerebral cortex and discuss the functions associated with each.
Bloom's Level: 2. Understanding