

Chapter 2: Structure and Function of the Nervous System

MULTIPLE CHOICE

LEARNING OUTCOMES

1. Understand the structure of neurons and synapses
2. Explain the role of ion channels in changing neuronal membrane potential
3. Describe the impact of depolarization on the resting potential, and on the likelihood of subsequent action potentials
4. Describe the influence of myelin and voltage-gated ion channels on action potentials
5. Understand electrical and chemical transmission at the synapse, including the use and removal of neurotransmitters after binding
6. Explain the roles of different types of glial cells, including astrocytes, oligodendrocytes, Schwann cells, and microglial cells
7. Define and recognize differences between the central nervous system, peripheral nervous system, sympathetic system, parasympathetic system, cerebral cortex, gray and white matter, and corpus callosum
8. Understand the functions of the spinal cord, brainstem, and cerebellum
9. Understand the functions of the thalamus, hypothalamus, and pituitary gland
10. Understand the functions of the limbic system and basal ganglia
11. Define and describe anatomical structures and principles that include gyri, sulci, Brodmann areas, lobes, topography, and association cortices
12. Explain the developmental process of the nervous system and the mechanisms behind neurogenesis

1. The two main classes of cell in the nervous system are
 - a. dendrites and axons.
 - b. axons and neurons.
 - c. neurons and glial cells.
 - d. glial cells and dendrites.

ANS: C DIF: Easy REF: The Structure of Neurons
OBJ: LO 1 MSC: Remembering

2. In the nervous system, these cells provide structural support and insulation for neurons.
 - a. glia
 - b. dendrites
 - c. mitochondria
 - d. Purkinje cells

ANS: A DIF: Easy REF: The Structure of Neurons
OBJ: LO 1 MSC: Remembering

3. Two main types of projections extend from the cell body of a neuron. _____ receive inputs from other neurons, while _____ send information to other neurons.
 - a. synapses ; glia
 - b. dendrites ; axons
 - c. glia ; synapses
 - d. axons ; dendrites

ANS: B DIF: Medium REF: Neuronal Signaling
OBJ: LO 1 | LO 2 MSC: Applying

10. The nodes of Ranvier are
- vesicles of neurotransmitters, stored in presynaptic neurons.
 - points along axons where sodium–potassium pumps are found.
 - vesicles of calcium ions, stored in postsynaptic neurons.
 - points along axons that are not surrounded by myelin.

ANS: D DIF: Easy REF: Neuronal Signaling
OBJ: LO 4 MSC: Remembering

11. The ease with which a cell membrane will permit ions to cross it is referred to as
- the concentration gradient.
 - permeability.
 - the action potential.
 - conductivity.

ANS: B DIF: Easy REF: Neuronal Signaling
OBJ: LO 2 MSC: Remembering

12. If you inserted a micropipette into a neuron without harming the cell, and pumped in a small quantity of calcium ions, each of which carried two positive charges, how would this affect the membrane potential?
- The membrane potential would become depolarized relative to the resting potential.
 - The membrane potential would become hyperpolarized relative to the resting potential.
 - There would be no change because calcium does not contribute to the resting potential.
 - There would be no change because the sodium–potassium pump would remove excess calcium from the cell.

ANS: A DIF: Medium REF: Neuronal Signaling
OBJ: LO 2 | LO 3 | LO 4 MSC: Applying

13. Ouabain is a toxin that works by permanently inhibiting the activity of sodium–potassium pumps embedded in neuronal membranes. How would ouabain administration affect the resting potential of a neuron?
- The magnitude of the resting potential would shift toward zero.
 - The resting potential would hyperpolarize toward a more negative value.
 - The resting potential would reverse to a positive, rather than a negative, value.
 - Application of ouabain would not affect the resting potential.

ANS: A DIF: Difficult REF: Neuronal Signaling
OBJ: LO 2 MSC: Applying

14. The term *concentration gradient* refers to a difference in the
- number of two different ion types within the neuron.
 - number of ions found on opposite sides of the cell membrane.
 - permeability of the membrane to one kind of ion compared to another.
 - permeability of the membrane at rest compared to during an action potential.

ANS: B DIF: Medium REF: Neuronal Signaling
OBJ: LO 1 | LO 2 MSC: Remembering

15. At the resting state, a higher concentration of _____ is found outside a neuron and a higher concentration of _____ is found inside a neuron.
- K^+ ; Na^+
 - Na^+ ; K^+
 - dopamine ; serotonin
 - serotonin ; dopamine

ANS: B DIF: Easy REF: Neuronal Signaling
OBJ: LO 1 | LO 2 MSC: Remembering

16. The value of the membrane potential to which an axon must be depolarized to initiate an action potential is called the _____ potential for that neuron.
- graded
 - resting
 - threshold
 - refractory

ANS: C DIF: Easy REF: Neuronal Signaling
OBJ: LO 3 MSC: Remembering

17. The poison tetraethylammonium (TEA) interferes with normal neural communication. The toxin binds to and blocks voltage-gated potassium channels in the neuron cell membrane. Which of the following best describes the effects of TEA on the action potential?
- The depolarization phase of the action potential fails to occur.
 - The repolarization phase of the action potential is blocked.
 - The refractory period of the action potential is shortened.
 - The action potential fails to be regenerated at the nodes of Ranvier.

ANS: B DIF: Difficult REF: Neuronal Signaling
OBJ: LO 4 MSC: Applying

18. The Hodgkin–Huxley cycle describes how the depolarization of the membrane causes voltage-gated sodium channels to _____, allowing _____ sodium ions to enter the cell. This change in sodium concentration then causes _____ of the cell.
- close ; fewer ; further depolarization
 - close ; fewer ; repolarization
 - open ; more ; further depolarization
 - open ; more ; repolarization

ANS: C DIF: Medium REF: Neuronal Signaling
OBJ: LO 2 | LO 3 | LO 4 MSC: Understanding

19. The primary reason why neurons are refractory for a short period after firing action potentials, and the reason underlying the absolute refractory period, is that the
- voltage-gated sodium channels are inactivated.
 - voltage-gated potassium channels are inactivated.
 - sodium–potassium pump has to remove sodium ions from inside the cell.
 - sodium–potassium pump has to retrieve potassium ions from outside the cell.

ANS: A DIF: Easy REF: Neuronal Signaling
OBJ: LO 4 MSC: Remembering

20. In myelinated axons, action potentials are generated
- at the nodes of Ranvier only.
 - along the entire length of the axons.
 - underneath the myelinated portions of the axons only.
 - only at the axon hillocks and axon terminals.

ANS: A DIF: Medium REF: Neuronal Signaling
OBJ: LO 4 MSC: Understanding

21. The term *saltatory conduction* refers to the fact that
- action potentials travel faster when extracellular salt concentration is high.
 - action potentials evoked by strong stimuli travel faster than those evoked by weaker stimuli.
 - action potentials occur only at the nodes of Ranvier of axons.

d. action potentials are generated only by myelinated portions of axons.

ANS: C DIF: Easy REF: Neuronal Signaling
OBJ: LO 4 MSC: Remembering

22. The most important function of myelin in the nervous system is to
- form the blood–brain barrier.
 - trigger the release of neurotransmitters from axon terminals.
 - produce cerebrospinal fluid in the cerebral ventricles.
 - facilitate conduction of action potentials in axons.

ANS: D DIF: Easy REF: Neuronal Signaling
OBJ: LO 4 MSC: Remembering

23. The primary benefit that the nervous system gains from myelination is
- generation of currents actively (action potentials) rather than passively (electrotonic conduction).
 - decreased membrane resistance.
 - increased resting potentials.
 - faster neural communication.

ANS: D DIF: Easy REF: Neuronal Signaling
OBJ: LO 4 MSC: Remembering

24. Which of the following statements best describes the immediate consequence of neurotransmitter molecules binding to postsynaptic receptors?
- Voltage-gated channels in the cell membrane open and permit ion flow through the membrane.
 - The activity of the sodium–potassium pumps increases.
 - Calcium absorption into the axon terminal cell is triggered.
 - Neurotransmitter-containing vesicles bind to the inside of the axon terminal membrane.

ANS: A DIF: Medium REF: Synaptic Transmission
OBJ: LO 2 | LO 5 MSC: Understanding

25. The role of calcium ions (Ca^{2+}) in synaptic transmission is to
- bind neurotransmitter molecules to the postsynaptic membrane.
 - mediate the release of neurotransmitter molecules from the presynaptic neuron.
 - repolarize the postsynaptic cell after transmission has been completed.
 - increase the activity of the sodium–potassium pumps in the presynaptic cell.

ANS: B DIF: Easy REF: Synaptic Transmission
OBJ: LO 5 MSC: Remembering

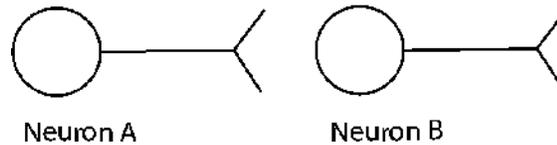
26. Which of the following sequences of steps best represents the order of events that occur during synaptic transmission?
- binding of neurotransmitter at the postsynaptic membrane -> diffusion of neurotransmitter across the synapse -> release of neurotransmitter from the presynaptic cell
 - diffusion of neurotransmitter across the synapse -> binding of neurotransmitter at the postsynaptic membrane -> release of neurotransmitter from the presynaptic cell
 - release of neurotransmitter from the presynaptic cell -> binding of neurotransmitter at the postsynaptic membrane -> diffusion of neurotransmitter across the synapse
 - release of neurotransmitter from the presynaptic cell -> diffusion of neurotransmitter across the synapse -> binding of neurotransmitter at the postsynaptic membrane

ANS: D DIF: Medium REF: Synaptic Transmission

OBJ: LO 5

MSC: Understanding

27. Consider the synapse shown schematically here. If neuron A causes neuron B to become hyperpolarized relative to B's resting state,



- a. neuron B is more likely to fire its own action potential.
- b. neuron B is less likely to release neurotransmitter molecules from its own axon terminal.
- c. neuron B is more likely to absorb extracellular potassium through voltage-gated channels.
- d. neuron B is less likely to absorb extracellular sodium through the sodium-potassium pump.

ANS: B

DIF: Medium

REF: Synaptic Transmission

OBJ: LO 5

MSC: Understanding

28. A gap junction is

- a. the point where a neurotransmitter vesicle binds to the presynaptic membrane.
- b. a connection between two sections of a G protein that plays a role in second-messenger cascades.
- c. a transmembrane channel that connects the cytoplasm of two cells at an electrical synapse.
- d. more likely to be found on the amino acids than on the biogenic amines.

ANS: C

DIF: Easy

REF: Synaptic Transmission

OBJ: LO 5

MSC: Remembering

29. Which of the following is a catecholamine?

- a. gamma-aminobutyric acid (GABA)
- b. glutamate
- c. serotonin
- d. norepinephrine

ANS: D

DIF: Medium

REF: Synaptic Transmission

OBJ: LO 5

MSC: Remembering

30. The effect of a particular neurotransmitter on postsynaptic neurons

- a. is always either excitatory or inhibitory.
- b. depends on the properties of the postsynaptic neuron.
- c. may be modulated by the presence or absence of another neurotransmitter.
- d. Both *b* and *c* are true.

ANS: D

DIF: Medium

REF: Synaptic Transmission

OBJ: LO 5

MSC: Understanding

31. Which of the following is NOT a mechanism for removing a neurotransmitter from the synaptic cleft?

- a. diffusion of the neurotransmitter away from the synapse
- b. active reuptake of the neurotransmitter back into the presynaptic terminal
- c. enzymatic breakdown of the neurotransmitter in the synaptic cleft
- d. transport of the neurotransmitter by ion channels into neighboring glial cells

ANS: D

DIF: Medium

REF: Synaptic Transmission

OBJ: LO 5

MSC: Understanding

32. Many drugs produce their effects by facilitating or interfering with neurotransmitters at synapses. Which of the following drugs would most likely increase the effect of serotonin?

- a. a drug that binds to directly coupled serotonin receptors but does not change membrane permeability
- b. a drug that prevents the activity of an enzyme that breaks down serotonin molecules in the synaptic cleft
- c. a drug that blocks the effect of Ca^{2+} ions
- d. a drug that blocks the effect of a conditional neurotransmitter that normally facilitates the effect of serotonin

ANS: B DIF: Difficult REF: Synaptic Transmission
 OBJ: LO 5 MSC: Applying

33. The morphology of the brain of Albert Einstein revealed an unusual Sylvian fissure—the division that separates the _____ lobe from the _____ lobes.
- a. occipital ; frontal and parietal
 - b. temporal ; frontal and parietal
 - c. frontal ; temporal and occipital
 - d. parietal ; temporal and occipital

ANS: B DIF: Easy REF: The Cerebral Cortex
 OBJ: LO 11 MSC: Remembering

34. The thick outer membrane that encloses the brain within the skull is the
- a. gray matter.
 - b. white matter.
 - c. myelin sheath.
 - d. dura mater.

ANS: D DIF: Easy REF: Overview of Nervous System Structure
 OBJ: LO 7 MSC: Remembering

35. The difference between gray matter and white matter is that *gray matter* refers to _____, whereas *white matter* refers to _____.
- a. protruding rounded surfaces ; fissures and invaginations
 - b. fissures and invaginations ; protruding rounded surfaces
 - c. cell bodies ; axons and glial cells
 - d. axons and glial cells ; cell bodies

ANS: C DIF: Easy REF: Overview of Nervous System Structure
 OBJ: LO 7 MSC: Remembering

36. Gray matter is to white matter as _____ are to _____.
- a. gyri ; sulci
 - b. glial cells ; neurons
 - c. cell bodies ; axon tracts
 - d. oligodendrocytes ; Schwann cells

ANS: C DIF: Medium REF: Overview of Nervous System Structure
 OBJ: LO 7 MSC: Understanding

37. Neurons in two different regions of Brodmann's cytoarchitectonic map always
- a. use different types of neurotransmitters to communicate.
 - b. differ in cell morphology and organization.
 - c. lie inside different lobes of the cerebral cortex.
 - d. are separated by fissures in the cortex.

ANS: B DIF: Easy REF: The Cerebral Cortex
 OBJ: LO 11 MSC: Remembering

38. The two main divisions of the central nervous system are the
- a. forebrain and brainstem.
 - b. white matter and gray matter.
 - c. brain and spinal cord.
 - d. cerebral hemispheres and cerebellum.

ANS: C DIF: Easy REF: Overview of Nervous System Structure
OBJ: LO 7 MSC: Remembering

39. All of the following are advantages of a folded cerebral cortex EXCEPT
- the need for blood vasculature in the cortex is eliminated.
 - neural conduction time between areas is reduced.
 - neurons are brought into closer three-dimensional relationships.
 - more cortical surface can be packed into the skull.

ANS: A DIF: Medium REF: The Cerebral Cortex
OBJ: LO 7 MSC: Understanding

40. The most caudal lobe of the cerebral cortex is the _____ lobe.
- frontal
 - temporal
 - occipital
 - parietal

ANS: C DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 7 | LO 11 MSC: Understanding

41. The temporal lobe likely bears this name because
- it is the brain's center for temporal processing.
 - its functions are particularly susceptible to the effects of aging.
 - it lies beneath the area of the scalp where hair grays with age.
 - its neurons fire more quickly than neurons in other brain regions.

ANS: C DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

42. The central sulcus is an anatomical landmark that separates the _____ lobe from the _____ lobe.
- temporal ; frontal
 - frontal ; parietal
 - parietal ; occipital
 - occipital ; temporal

ANS: B DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

43. The term *cytoarchitectonics* refers to
- how cells in one brain region appear morphologically and how they are arranged with respect to each other.
 - how assemblies of neurons function together and how they communicate with neighboring ganglia.
 - how different brain regions differ in volume and how they interact to produce complex cognitive phenomena.
 - how the brains of different animals differ from each other in gross anatomy and the evolutionary bases of these differences.

ANS: A DIF: Medium REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

44. Of the following choices, the most anterior portion of the frontal lobes—the prefrontal cortex—is most critical to
- processing information about pain, touch, and temperature.
 - executive functions.
 - the “what” visual pathway.
 - the “where” visual pathway.

ANS: B DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

45. Communication between the two hemispheres of the brain occurs mainly through the
- basal ganglia.
 - cingulate gyrus.
 - corpus callosum.
 - limbic system.

ANS: C DIF: Easy REF: Overview of Nervous System Structure
OBJ: LO 7 MSC: Remembering

46. The corpus callosum
- permits communication between the two cerebral hemispheres.
 - is the area of the cortex in which information about touch, pain, temperature, and limb position is processed.
 - separates the temporal lobe from the frontal and parietal lobes.
 - is a fluid-filled chamber that cushions and supports the brain.

ANS: A DIF: Easy REF: Overview of Nervous System Structure
OBJ: LO 7 MSC: Remembering

47. The primary visual cortex, or V1, is located in
- the striate cortex.
 - Brodmann area 17.
 - the calcarine fissure.
 - all of the above.

ANS: D DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

48. The neocortex typically contains _____ cortical layers, with _____ typically being the input layer.
- 10 ; layer IV
 - 10 ; layer I
 - 6 ; layer IV
 - 6 ; layer I

ANS: C DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

49. The frontal lobe is _____ to the occipital lobe, whereas the temporal lobe is _____ to the parietal lobe.
- posterior ; superior
 - anterior ; inferior
 - superior ; caudal
 - inferior ; rostral

ANS: B DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

50. All of the following terms refer to the same cortical region that processes visual input EXCEPT
- striate cortex.
 - area V1.
 - Heschl's gyrus.
 - Brodmann area 17.

ANS: C DIF: Medium REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

51. Cerebrospinal fluid (CSF) is produced in the lateral and third ventricles by the
- dura mater.
 - substantia nigra.
 - globus pallidus.
 - choroid plexus.

ANS: D DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 7 MSC: Remembering

52. A patient reports that she is functionally blind after a focal brain injury, even though her eyes and optic nerves are completely intact. Of the structures listed here, the most probable location for the brain injury is the
- a. inferior colliculus.
 - b. lateral geniculate nucleus.
 - c. superior temporal lobe.
 - d. postcentral gyrus.

ANS: B DIF: Difficult REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Applying

53. The part of the thalamus that is most important in relaying information to the primary visual cortex is the
- a. lateral geniculate nucleus.
 - b. superior colliculus.
 - c. medial geniculate nucleus.
 - d. inferior colliculus.

ANS: A DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Remembering

54. The primary auditory cortex is organized using a tonotopic map, which means that there is an orderly representation of
- a. loudness.
 - b. frequency.
 - c. duration.
 - d. spatial location.

ANS: B DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

55. Following a focal brain injury, a patient shows great difficulty in discriminating tones that differ in frequency. Which area of the cortex is most likely affected?
- a. the superior temporal lobe
 - b. the inferior temporal lobe
 - c. the anterior parietal lobe
 - d. the posterior parietal lobe

ANS: A DIF: Medium REF: The Cerebral Cortex
OBJ: LO 11 MSC: Applying

56. The volume of cortex that is not sensory or motor has traditionally been termed _____ cortex.
- a. extrastriate
 - b. cognitive
 - c. association
 - d. equipotential

ANS: C DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

57. All of the structures listed here are major components of the basal ganglia EXCEPT the
- a. globus pallidus.
 - b. amygdala.
 - c. caudate nucleus.
 - d. putamen.

ANS: B DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 10 MSC: Remembering

58. As a result of a brain injury to the medial temporal lobes and neighboring subcortical structures, a patient exhibits a number of cognitive and behavioral changes. Of the options here, which is the LEAST likely to be affected?
- a. memory
 - b. emotional processing
 - c. learning
 - d. somatosensation

ANS: D DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 10 MSC: Applying

59. This brain structure is often called the gateway to the cortex because almost all sensory inputs synapse here before continuing to their primary cortical sensory areas.
- a. hypothalamus
 - b. hippocampus
 - c. thalamus
 - d. amygdala

ANS: C DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Remembering

60. Which of the following functions is NOT mediated primarily by the hypothalamus?
- a. endocrine system regulation
 - b. maintenance of homeostatic states in the body
 - c. relay of sensory information from the body to the cortex
 - d. hormone control

ANS: C DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Understanding

61. As a result of a brain injury to this diencephalic structure, a patient is experiencing disruptions in maintaining homeostasis of bodily states and endocrine control.
- a. thalamus
 - b. hypothalamus
 - c. hippocampus
 - d. cingulate gyrus

ANS: B DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Applying

62. Injury to the hypothalamus would most likely interfere with
- a. hormone regulation.
 - b. motor control.
 - c. memory.
 - d. olfactory sensation.

ANS: A DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 9 MSC: Understanding

63. The brainstem includes all of the following components EXCEPT the
- a. medulla.
 - b. midbrain.
 - c. hypothalamus.
 - d. pons.

ANS: C DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 8 MSC: Remembering

64. The specialized structures that comprise the midbrain control functions such as
- a. hormone regulation.
 - b. visual reflexes.
 - c. memory.
 - d. emotional processing.

ANS: B DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 8 MSC: Remembering

65. A patient has great difficulty in maintaining his posture, walking, and coordinating his movements. His brain injuries probably involve the
- a. cerebellum.
 - b. corpus callosum.
 - c. superior colliculus.
 - d. third ventricle.

ANS: A DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 8 MSC: Applying

66. Parts of the brain where metabolic activity is relatively high are characterized by

- a. elevated regional blood flow.
- b. increased cerebrospinal fluid production.
- c. a high degree of myelination.
- d. greater concentrations of calcium ions.

ANS: A DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

67. The dorsal portions of the gray matter in the spinal cord carry
- a. motor information.
 - b. sensory information.
 - c. motor and sensory information from the dorsal surface of the body.
 - d. sensory and motor information to the cerebellum.

ANS: B DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 8 MSC: Remembering

68. This type of early cell line is the precursor to the cells that will compose the nervous system.
- a. blastula
 - b. gastrula
 - c. endoderm
 - d. ectoderm

ANS: D DIF: Medium REF: Development of the Nervous System
OBJ: LO 12 MSC: Remembering

69. Which of the following statements regarding the prenatal development of the human nervous system is correct?
- a. The brain develops from ectoderm cells, whereas the spinal cord develops from mesoderm cells.
 - b. Ectoderm cells are the precursors of the entire nervous system.
 - c. Glial cells are derived from endoderm cells, whereas neurons are derived from ectoderm cells.
 - d. Mesoderm cells are the precursors for all parts of the human nervous system.

ANS: B DIF: Difficult REF: Development of the Nervous System
OBJ: LO 12 MSC: Understanding

70. The ³H-thymidine labeling method is especially useful in determining when particular cells in the nervous system emerge because
- a. only cells that are fully myelinated at the time of injection are radioactively labeled.
 - b. only glial cells absorb the marker and are radioactively labeled.
 - c. only cells that are fully mature at the time of injection are radioactively labeled.
 - d. only cells that are undergoing cell division at the time of injection are radioactively labeled.

ANS: D DIF: Easy REF: Development of the Nervous System
OBJ: LO 12 MSC: Understanding

71. _____ refers to the process of rapid cell division that occurs early in development of the nervous system.
- a. Neurulation
 - b. Neuronal proliferation
 - c. Neuronal migration
 - d. Neural determination

ANS: B DIF: Easy REF: Development of the Nervous System
OBJ: LO 12 MSC: Remembering

72. The cells in the brain that guide migrating neurons to their final locations are called

- a. microglia.
- b. radial glia.
- c. oligodendrocytes.
- d. ventricular cells.

ANS: B DIF: Easy REF: Development of the Nervous System
 OBJ: LO 12 MSC: Remembering

73. _____ is the idea that the columnar organization in the adult cortex is derived during development from the cells dividing in the ventricular region.

- a. Topographic mapping
- b. The sensory homunculus
- c. The radial unit hypothesis
- d. The ventricular zone hypothesis

ANS: C DIF: Easy REF: Development of the Nervous System
 OBJ: LO 12 MSC: Remembering

TRUE/FALSE

1. The cell body of a neuron contains the same machinery found in most cells, including a nucleus, ribosomes, and mitochondria.

ANS: T DIF: Easy REF: The Structure of Neurons
 OBJ: LO 1 MSC: Remembering

2. Dendrites, which are large treelike processes extending from a neuron, are said to be presynaptic.

ANS: F DIF: Easy REF: Neuronal Signaling
 OBJ: LO 1 MSC: Remembering

3. Action potentials are electrical signals that are conducted down the axon of a neuron.

ANS: T DIF: Easy REF: Neuronal Signaling
 OBJ: LO 1 | LO 3 MSC: Remembering

4. The term *selective permeability* refers to the fact that a cell membrane will allow some ions to pass through more readily than others.

ANS: T DIF: Easy REF: Neuronal Signaling
 OBJ: LO 1 | LO 2 MSC: Remembering

5. The resting potential of a neuron is typically +40 to +90 millivolts (mV).

ANS: F DIF: Easy REF: Neuronal Signaling
 OBJ: LO 1 | LO 3 MSC: Remembering

6. The *equilibrium potential* is the membrane voltage at which there is no net flow of ions in or out.

ANS: T DIF: Easy REF: Neuronal Signaling
 OBJ: LO 1 | LO 2 | LO 3 MSC: Remembering

7. Hyperpolarization makes the inside of a cell more positive and more likely to generate an action potential.

ANS: F DIF: Easy REF: Neuronal Signaling
 OBJ: LO 2 | LO 3 | LO 4 MSC: Remembering

8. The amplitude of an action potential is directly proportional to the size of the initial depolarization that produced it.

ANS: F DIF: Easy REF: Neuronal Signaling
OBJ: LO 2 | LO 3 MSC: Remembering

9. If the sum of the excitatory postsynaptic potentials (EPSPs) causes a postsynaptic neuron to reach its threshold, then the postsynaptic neuron will generate an action potential.

ANS: T DIF: Easy REF: Neuronal Signaling
OBJ: LO 3 MSC: Understanding

10. Communication between two neurons is always achieved through chemical, and not electrical, mechanisms.

ANS: F DIF: Easy REF: Synaptic Transmission
OBJ: LO 5 MSC: Remembering

11. Neural inputs that target the cortex and originate in the thalamus are referred to as *corticothalamic*.

ANS: F DIF: Easy REF: The Bigger Picture
OBJ: LO 11 MSC: Remembering

12. Sulci are the protruding rounded surfaces of the cortex, and gyri are the fissures and invaginations between the sulci.

ANS: F DIF: Easy REF: The Cerebral Cortex
OBJ: LO 11 MSC: Remembering

13. The term *commissure* refers to the white matter tracts that connect the brain and spinal cord.

ANS: F DIF: Easy REF: Overview of Nervous System Structure
OBJ: LO 7 MSC: Remembering

14. The hippocampus is considered part of the neocortex.

ANS: F DIF: Easy REF: A Guided Tour of the Brain
OBJ: LO 10 MSC: Remembering

15. During development, a structure called the *blastula* begins to form when the neural plate invaginates via neural folds being pushed up at its border.

ANS: F DIF: Easy REF: Development of the Nervous System
OBJ: LO 12 MSC: Remembering

SHORT ANSWER

1. Describe the structure of a prototypical neuron. In your answer, provide definitions for the following terms: *soma*, *axon*, *dendrite*, *myelin*, and *synapse*.

ANS:
Answers will vary.

DIF: Medium REF: The Structure of Neurons OBJ: LO 1
MSC: Analyzing

2. Describe the chemical and electrical properties of an action potential. In your answer, describe the movement of Na^+ ions and K^+ ions across the cell membrane and the resulting changes in electrical potential.

ANS:
Answers will vary.

DIF: Difficult REF: Neuronal Signaling OBJ: LO 2 | LO 3 | LO 4
MSC: Analyzing

3. Explain the concept of electrochemical equilibrium. How does this concept allow us to understand the transmembrane potentials in neurons?

ANS:
Answers will vary.

DIF: Medium REF: Neuronal Signaling OBJ: LO 2 | LO 3
MSC: Analyzing

4. What are the major differences between electrotonic conduction and the action potential? Describe how these two processes play out in neural transmission.

ANS:
Answers will vary.

DIF: Medium REF: Neuronal Signaling OBJ: LO 2 | LO 3
MSC: Analyzing

5. How do two neurons communicate with each other? Describe the process of synaptic transmission, including both chemical and electrical synapses.

ANS:
Answers will vary.

DIF: Medium REF: Synaptic Transmission OBJ: LO 5
MSC: Analyzing

6. Describe the structure, and explain the function, of three types of glial cells.

ANS:
Answers will vary.

DIF: Medium REF: The Role of Glial Cells OBJ: LO 6
MSC: Analyzing

7. Histological methods have been used to classify the cerebral cortex into different cytoarchitectonic divisions, such as the Brodmann areas. Can we predict the function of a brain region based on cytoarchitectonics? Why or why not?

ANS:
Answers will vary.

DIF: Difficult REF: The Cerebral Cortex
MSC: Evaluating

OBJ: LO 11

8. Choose six of the following eight brain regions. For each region, briefly describe its location in the brain and one of its functions. Draw a picture to accompany your answer.
- frontal lobe
 - parietal lobe
 - temporal lobe
 - occipital lobe
 - basal ganglia
 - hypothalamus
 - thalamus
 - cerebellum

ANS:
Answers will vary.

DIF: Medium REF: A Guided Tour of the Brain
OBJ: LO 8 | LO 9 | LO 10 | LO 11 MSC: Analyzing

9. What are the advantages of a cerebral cortex with gyri and sulci? Why might the human cerebral cortex be more heavily folded than those of other mammals?

ANS:
Answers will vary.

DIF: Difficult REF: A Guided Tour of the Brain OBJ: LO 11
MSC: Evaluating

10. Describe the events following the fertilization of an egg that pertain to the development of the nervous system. In your answer, name the three main types of cell lines found in the blastula and describe what parts of the organism these cells become.

ANS:
Answers will vary.

DIF: Medium REF: Development of the Nervous System
OBJ: LO 12 MSC: Analyzing