

## CHAPTER 9 READING QUESTIONS

These reading questions are designed to help you focus your reading on the most important points in the chapter. They are arranged using chapter section headers so that the file can be easily edited to reflect the material covered in class.

### 9.1 EMERGENT PROPERTIES OF NEURAL NETWORKS

1. What is plasticity? What is the significance of plasticity in the human brain?

### 9.2 EVOLUTION OF NERVOUS SYSTEMS

2. What is a ganglion? What is a spinal reflex?

### 9.3 ANATOMY OF THE CENTRAL NERVOUS SYSTEM

#### *The CNS Develops from a Hollow Tube*

3. Outline the development of the CNS, highlighting the appearance of major structures.

(Fig. 9.2)

#### *The CNS Is Divided into Gray Matter and White Matter*

4. Compare and contrast gray matter and white matter. (Fig. 9.3c)

#### *Bone and Connective Tissue Support the CNS*

5. Name the bones that protect the brain and spinal cord. (Fig. 9.3)
6. What are meninges? List the three layers of meninges, moving from the bone toward the neural tissue. (Fig. 9.3b, c)
7. Describe the composition of the extracellular fluid that protects the CNS.

#### *The Brain Floats in Cerebrospinal Fluid*

8. Describe the composition of cerebrospinal fluid (CSF) and compare it to that of plasma. Identify the purposes of CSF.
9. When physicians need a sample of CSF, how do they acquire it?
10. Outline the secretion, circulation, and reabsorption of CSF. Identify all relevant structures. (Fig. 9.4)

#### ***The Blood-Brain Barrier Protects the Brain***

11. Why are brain capillaries less leaky than other capillaries? (Fig. 9.5)
12. What kinds of molecules can cross the blood-brain barrier?
13. Name two brain areas that lack a blood-brain barrier. What are the functions of these areas that require their contact with blood?

#### ***Neural Tissue Has Special Metabolic Requirements***

14. Describe the specialized metabolism of the CNS. What happens if the brain's oxygen and glucose requirements aren't met?

### **9.4 THE SPINAL CORD**

15. The spinal cord is divided into four regions. Name these regions. (Fig. 9.3a)
16. Draw a diagram or map to explain the relationships between the following terms: axons, brain, cell bodies, columns, dorsal horns, dorsal roots, dorsal root ganglia, efferent signals, gray matter, nuclei, sensory information, spinal reflexes, tracts (ascending, descending, propriospinal), ventral horns, ventral roots, and white matter. (Figs. 9.6, 9.7)

### **9.5 THE BRAIN**

17. List the major divisions of the brain. (Fig. 9.8)

### ***The Brain Stem Is the Oldest Part of the Brain***

18. Describe the brain stem. (Fig. 9.8f)
19. What are cranial nerves? How many pairs of cranial nerves are there? How are they described? (Tbl. 9.1)
20. What is the reticular formation?

### **Medulla**

21. Briefly describe the anatomy and physiology of the medulla oblongata. Distinguish between somatosensory and corticospinal tracts, describe what happens in the pyramids, and list the functions controlled by nuclei in the medulla. (Fig. 9.8f)

### **Pons**

22. Where is the pons located, and what are its main functions?

### **Midbrain**

23. Where is the midbrain (mesencephalon) located, and what are its functions?

### ***The Cerebellum Coordinates Movement***

24. Where is the cerebellum located, and what is its function?

### ***The Diencephalon Contains the Centers for Homeostasis***

25. Describe the diencephalon. Where is it located? What are its two main sections? What two endocrine structures are located in the diencephalon? (Fig. 9.9)
26. Describe the structure and identify the function of the thalamus. Why is it called a relay station? Can it modify information that passes through it?
27. Where is the hypothalamus located? What are its functions? Describe its input and output. (Tbl. 9.2)

### ***The Cerebrum Is the Site of Higher Brain Functions***

28. The two hemispheres of the cerebrum are connected at the \_\_\_\_\_  
\_\_\_\_\_. (Figs. 9.8c, 9.9)
29. Name the four lobes found in each hemisphere of the brain. (Fig. 9.8b, c, e)
30. What is the adaptive significance of the intricate folding of the surface of the cerebrum?

### **Gray Matter and White Matter**

31. What three major regions comprise the cerebral gray matter? (Fig. 9.10)
32. Describe the anatomical arrangement of cortical neurons. (Fig. 9.10b)
33. The basal ganglia are involved with \_\_\_\_\_.
34. Describe the role of the limbic system and name its major anatomical areas. (Fig. 9.11)
35. Describe white matter in the cerebrum. (Fig. 9.10a)

### **9.6 BRAIN FUNCTION**

36. Identify three systems that influence output by the motor systems of the body. (Fig. 9.12)

### ***The Cerebral Cortex Is Organized into Functional Areas***

37. In each of the following sentences, supply the name of the functionally specialized areas of the cerebral cortex indicated by the description. (Fig. 9.13)

\_\_\_\_\_ translate input into perception.

\_\_\_\_\_ direct movement.

\_\_\_\_\_ integrate information and direct voluntary behaviors.

38. Describe cerebral lateralization. Which skills generally are associated with the left side of the brain, and which ones are associated with the right side? (Fig. 9.14)
39. What are some noninvasive imaging techniques currently available for evaluating brain function?

### ***The Spinal Cord and Brain Integrate Sensory Information***

40. Describe the general flow of sensory information to the brain. (Figs. 9.7, 9.12a)
41. The primary somatic sensory cortex in the \_\_\_\_\_ lobe receives information from \_\_\_\_\_. The pathways carry information about \_\_\_\_\_. (Fig. 9.13)
42. The special senses of vision, hearing, taste, and olfaction each have different brain regions devoted to processing their sensory input. Supply the correct information to complete the sentences below. (Fig. 9.13)

The visual cortex in the \_\_\_\_\_ lobe receives information from the \_\_\_\_\_.

The auditory cortex in the \_\_\_\_\_ lobe receives information from the \_\_\_\_\_.

The olfactory cortex, a small region in the \_\_\_\_\_ lobe, receives information from the \_\_\_\_\_.

The gustatory cortex in the \_\_\_\_\_ lobe receives information from the \_\_\_\_\_.

### ***Sensory Information Is Processed into Perception***

43. What is perception? (Fig. 9.15)

### ***The Motor System Governs Output from the CNS***

44. List and describe the three major types of motor output.
45. Voluntary movements initiated by the cognitive system originate in the \_\_\_\_\_ and \_\_\_\_\_. The information carried in the descending motor pathways can be influenced by the \_\_\_\_\_, the \_\_\_\_\_, and the \_\_\_\_\_. Pathways cross to the opposite side of the body. (Fig. 9.13)
46. Visceral and neuroendocrine responses are coordinated primarily in the hypothalamus and brain stem. Which functions are coordinated by the brain stem? Which functions are coordinated by the hypothalamus?

### ***The Behavioral State System Modulates Motor Output***

47. Many neurons in the behavioral state system are found in regions of the brain outside the cerebral cortex, including the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
48. What are diffuse modulatory systems? How are they generally classified? How do they regulate brain function? (Fig. 9.16)
49. What role does the reticular activating system play in regulating levels of consciousness?

### ***Why Do We Sleep?***

50. Is sleep a passive state or an active state? Why? What research seems to support this position?
51. Name the two major phases of sleep and describe them. (Fig. 9.17)
52. Why do we sleep? What are some of the ideas being explored to answer this question?

### ***Physiological Functions Exhibit Circadian Rhythms***

53. What are some of the physiological functions that exhibit circadian rhythms?
54. How does our circadian “clock” work? Where is it located?

### ***Emotion and Motivation Involve Complex Neural Pathways***

55. Where is the center of emotion in the human brain? (Fig. 9.18)
56. Generally speaking, what are the CNS components that might be involved in a pathway for an emotion? What are some of the physical results of emotions? (Fig. 9.18)
57. What is motivation? Give examples of some motivated behaviors.
58. What are three properties shared by motivational drives?

### ***Moods Are Long-Lasting Emotional States***

59. Define moods.
60. Describe depression. What are some current therapies for depression?

### ***Learning and Memory Change Synaptic Connections in the Brain***

61. What have scientists discovered about the underlying basis for cognitive function?

### ***Learning Is the Acquisition of Knowledge***

62. Distinguish between associative learning and nonassociative learning.
63. Distinguish between the types of nonassociative learning known as habituation and sensitization.

### ***Memory Is the Ability to Retain and Recall Information***

64. What are memory traces? Where are they located?
65. What is parallel processing? What is its role in learning?
66. How do we know the hippocampus plays an important role in learning and memory?
67. Distinguish between short-term and long-term memory. (Fig. 9.19)
68. What is working memory?

69. Describe the process of memory consolidation. (Fig. 9.19)
70. Distinguish between the reflexive and declarative types of long-term memory. Which brain regions are involved in each? (Tbl. 9.4)
71. What is Alzheimer's disease? How is it diagnosed? How is it treated?

***Language Is the Most Elaborate Cognitive Behavior***

72. Why is language considered a complex behavior? What inputs and outputs must be coordinated? (Fig. 9.20)
73. Language ability is found primarily in the \_\_\_\_\_ cerebral hemisphere, even in most left-handed people or ambidextrous people.
74. The ability to communicate through speech has been divided into two processes. Name these two processes.
75. Damage to Wernicke's area results in \_\_\_\_\_ aphasia. Describe this condition.
76. Damage to Broca's area results in \_\_\_\_\_ aphasia. Describe this condition.
77. Mechanical forms of aphasia occur as a result of damage to which brain region(s)? Describe what the resulting condition(s) might be.

***Personality Is a Combination of Experience and Inheritance***

78. If humans all have similar brain structure, what makes us different from one another?
79. What is schizophrenia? How is it diagnosed? How is it treated?