

Chapter 02 - Functional Neuroanatomy and the Evolution of the Nervous System

True / False

1. The cerebellum is involved in sophisticated processing of information, including executive functions.

- a. True
- b. False

ANSWER: True

2. The arachnoid layer of the meninges is found in both the central and peripheral nervous systems.

- a. True
- b. False

ANSWER: False

3. Nerves originating in the lumbar division of the spinal cord serve the lower back and legs.

- a. True
- b. False

ANSWER: True

4. The amygdala is involved in emotional behavior and is particularly important in the fear response.

- a. True
- b. False

ANSWER: True

5. The reticular formation extends from the medulla through the pons and into the midbrain.

- a. True
- b. False

ANSWER: True

6. The primary auditory cortex is found in the parietal lobe of the cerebral cortex.

- a. True
- b. False

ANSWER: False

7. The primary somatosensory cortex is located in the precentral gyrus of the frontal lobe.

- a. True
- b. False

ANSWER: False

8. All cranial nerves carry both sensory and motor information to and from the brain.

- a. True
- b. False

ANSWER: False

9. The parasympathetic nervous system transmits information from the brain to glands and organs in the body.

- a. True
- b. False

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ANSWER: True

10. From early versions of the hominin up until current *Homo sapiens*, the brain has more than quintupled in size.

- a. True
- b. False

ANSWER: False

11. The cerebellum is part of the diencephalon.

- a. True
- b. False

ANSWER: False

12. The thalamus and hypothalamus are the central structures in the limbic system.

- a. True
- b. False

ANSWER: False

Multiple Choice

13. Structures located relatively toward the tail of a four-legged animal are referred to as being _____.

- a. rostral
- b. caudal
- c. dorsal
- d. ventral

ANSWER: b

14. Structures located relatively toward the belly of a four-legged animal are referred to as being _____.

- a. rostral
- b. caudal
- c. dorsal
- d. ventral

ANSWER: d

15. Relative to its tail, a dog's ears are _____.

- a. rostral
- b. caudal
- c. dorsal
- d. ventral

ANSWER: a

16. Which of the following pairs of terms mean the same thing in a four-legged animal?

- a. Ventral—superior
- b. Dorsal—inferior
- c. Rostral—anterior

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d. Caudal—ipsilateral

ANSWER: c

17. An imaginary line that runs the length of the spinal cord to the front of the brain is known as the _____.

- a. sagittal slice
- b. proximal
- c. neuraxis
- d. plane of section

ANSWER: c

18. Where does the neuraxis bend in humans?

- a. In about the middle of the spinal cord
- b. At the base of the spinal cord
- c. Between the brain and spinal cord
- d. Between the subcortical and cortical areas of the brain

ANSWER: c

19. What is the location of a person's hand relative to their elbow?

- a. Proximal
- b. Distal
- c. Contralateral
- d. Ipsilateral

ANSWER: b

20. What is the location of a person's right arm relative to their left arm?

- a. Proximal
- b. Distal
- c. Ipsilateral
- d. Contralateral

ANSWER: d

21. What is the location of a person's right arm relative to their right leg?

- a. Proximal
- b. Distal
- c. Contralateral
- d. Ipsilateral

ANSWER: d

22. K.P. has been addicted to opiates for a number of years and continues to use despite experiencing significant health, interpersonal, and legal problems as a result of her addiction. Which structure is likely to be involved in maintaining K.P.'s addiction?

- a. Hypothalamus
- b. Putamen
- c. Amygdala

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d. Nucleus accumbens

ANSWER: d

23. Which layer of the cortex has many types of neurons, which merge into the white matter that lies below the cortical layers?

- a. Layer I
- b. Layers III
- c. Layers V
- d. Layer VI

ANSWER: d

24. After a metal bar was blown through Phineas Gage's brain, the once responsible, friendly, and polite man had difficulty holding a job and was profane and irritable. Which lobe of Gage's brain was damaged in the accident?

- a. Frontal
- b. Parietal
- c. Temporal
- d. Occipital

ANSWER: a

25. A comprehensive map of neural circuitry is referred to as the _____.

- a. connectome
- b. genome
- c. neurome
- d. microtome

ANSWER: a

26. Which gland produces hormones that are essential to digestion?

- a. The pineal
- b. The adrenals
- c. The islets of Langerhans
- d. The gonads

ANSWER: c

27. Most of the body's supply of which neurotransmitter is produced by the digestive system?

- a. Dopamine
- b. Glutamate
- c. Serotonin
- d. GABA

ANSWER: c

28. An anatomical section that divides the brain parallel to the midline and perpendicular to the ground is a _____.

- a. sagittal section
- b. coronal section
- c. horizontal section

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d. axial section

ANSWER: a

29. The plane of section that divides the brain from top to bottom is a _____.

- a. sagittal section
- b. coronal section
- c. horizontal section
- d. midsagittal section

ANSWER: c

30. Movement rhythms, such as the rhythms of walking, are generated by central pattern generators in the _____.

- a. prosencephalon
- b. frontal cortex
- c. spinal cord
- d. diencephalon

ANSWER: c

31. In order to assess the size of the lateral ventricles in patients with schizophrenia, Dr. Weinberger has decided to use a coronal or frontal section. In other words, he is looking at a plane of section that is _____.

- a. perpendicular to the ground, dividing the brain from front to back
- b. perpendicular to the ground, dividing the brain from side to side
- c. parallel to the midline, dividing the brain from side to side
- d. parallel to the ground, dividing the brain from top to bottom

ANSWER: a

32. The correct ordering of the layers of the meninges from the skull to the brain is _____.

- a. pia mater, arachnoid layer, and dura mater
- b. arachnoid layer, pia mater, and dura mater
- c. dura mater, pia mater, and arachnoid layer
- d. dura mater, arachnoid layer, and pia mater

ANSWER: d

33. You just heard about a friend who has a tumor on the meninges of her right temporal lobe. This means that the tumor is _____.

- a. contralateral to the midline of the brain
- b. medial to the midline of the brain
- c. ventral to the midline of the brain
- d. lateral to the midline of the brain

ANSWER: d

34. Molly accidentally touched a pan that had just been removed from the oven and jerked her hand back. What reflex helped protect her from a bad burn?

- a. Withdrawal reflex
- b. Postural reflex

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- c. Patellar reflex
- d. Polysynaptic reflex

ANSWER: a

35. A subdural hematoma is a “bruise” that often occurs following a head injury and affects a layer of the membranes that cover the central nervous system (CNS) and the peripheral nerves. Given your knowledge of anatomical terms, which of the following is the likely location of this type of injury?

- a. The scalp
- b. The meninges
- c. The lateral ventricles
- d. The central canal of the spinal cord

ANSWER: b

36. Which layer of the meninges is described as a leather-like tissue that follows the contours of the skull bones?

- a. Pia mater
- b. Dura mater
- c. Arachnoid layer
- d. Subarachnoid space

ANSWER: b

37. What types of tissue protect the nerve fibers of the peripheral nervous system?

- a. Pia mater, arachnoid layer, and dura mater
- b. Pia mater only
- c. Connective tissue
- d. Arachnoid layer and dura mater only

ANSWER: c

38. The presence of a lymphatic system in the meninges suggests that _____.

- a. the brain is immune privileged
- b. the blood-brain barrier is redundant if the meninges is intact
- c. the immune system is unnecessary in the brain
- d. the meninges are involved in the brain’s immune response

ANSWER: d

39. The subarachnoid space is found between the arachnoid layer and the _____.

- a. pia mater
- b. dura mater
- c. skull bones
- d. lateral ventricles

ANSWER: a

40. Cerebrospinal fluid (CSF) is secreted by the _____.

- a. meninges
- b. subarachnoid space

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- c. choroid plexus
- d. ventricles

ANSWER: c

41. CSF is found in the _____.
- a. central and peripheral nervous systems
 - b. peripheral nervous system only
 - c. lateral and distal ventricles of the brain
 - d. ventricles, meninges, and central canal of the spinal cord

ANSWER: d

42. The primary purpose of CSF is to _____.
- a. nourish the cells of the brain and spinal cord
 - b. float the brain within the skull
 - c. remove toxins from the brain and excrete them from the body
 - d. synthesize chemical messengers

ANSWER: b

43. Newborn Harry has been diagnosed with hydrocephalus. How will doctors treat the disorder?
- a. Removal of the tumor that is compressing his brainstem
 - b. Severing the corpus callosum to stop abnormal electrical activity
 - c. Administration of antibiotics
 - d. Placement of a shunt drain CSF

ANSWER: d

44. What structures does CSF circulate through?
- a. The circulatory system
 - b. The lymphatic system
 - c. The central canal and the ventricles
 - d. The midbrain and hindbrain

ANSWER: c

45. In which condition is the circulation of CSF blocked?
- a. Hydrocephalus
 - b. Meningioma
 - c. Meningitis
 - d. Septicemia

ANSWER: a

46. How is the “Chun Gun” used?
- a. To administer drugs in the central canal
 - b. In the diagnosis of hydrocephalus
 - c. To destroy tumors using radiation
 - d. In placing ventricular shunts

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ANSWER: b

47. Why would your doctor want to do a spinal tap if she suspected that you had an infection of the brain?
- a. Because the CSF of the spinal cord is continuous with the CSF of the brain.
 - b. Because the spinal cord controls the immune protection of the CNS.
 - c. Because the peripheral and central nervous systems are connected.
 - d. Because the brain and spinal cord share the same blood supply.

ANSWER: a

48. The blood supply to the brain is provided by the _____.
- a. carotid and vertebral arteries
 - b. subclavian and axillary arteries
 - c. celiac artery
 - d. aorta

ANSWER: a

49. Which of the following is a component of the peripheral nervous system?
- a. The corpus callosum
 - b. The red nucleus
 - c. The sympathetic nervous system
 - d. The central canal

ANSWER: c

50. Which structure allows the left and right hemispheres to communicate?
- a. The corpus callosum
 - b. The red nucleus
 - c. The sympathetic nervous system
 - d. The central canal

ANSWER: a

51. Which layer of the meninges sticks closely to the brain?
- a. The dura mater
 - b. The arachnoid layer
 - c. The subarachnoid space
 - d. The pia mater

ANSWER: d

52. In which region of the vertebral column are the nerves that make up the spinal cord found?
- a. The entire length
 - b. The upper two-thirds
 - c. The lower two-thirds
 - d. The upper four-fifths

ANSWER: b

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53. What circulates through the central canal of the spinal cord?

- a. Blood
- b. Lymph
- c. CSF
- d. Plasma

ANSWER: c

54. The region consisting of the head, neck, and arms is served by nerves exiting the _____.

- a. sacral division of the spinal cord
- b. lumbar division of the spinal cord
- c. thoracic division of the spinal cord
- d. cervical division of the spinal cord

ANSWER: d

55. The correct order of the spinal divisions from rostral to caudal is _____.

- a. cervical, thoracic, lumbar, sacral, and coccygeal
- b. cervical, lumbar, thoracic, sacral, and coccygeal
- c. thoracic, cervical, lumbar, sacral, and coccygeal
- d. cervical, thoracic, lumbar, coccygeal, and sacral

ANSWER: a

56. A thoracic surgeon operates in the vicinity of the thoracic division of the spinal cord; that is, the structures located in the _____.

- a. neck
- b. torso
- c. lower back
- d. genitals and legs

ANSWER: b

57. As a result of an accident that occurred while playing football, Michael must wear a device known as a cervical collar until his injuries heal. Michael must have injured his _____.

- a. entire back
- b. midback
- c. neck
- d. lower back

ANSWER: c

58. Julie's physician tells her that she damaged a disk in the lumbar region of her spinal cord. It is likely that Julie sought medical advice due to pain she experienced in her _____.

- a. neck
- b. upper back
- c. shoulder
- d. lower back

ANSWER: d

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59. Injuries to the lower back from lifting heavy objects are the cause of damage to which region of the spinal cord?
- a. Sacral
 - b. Lumbar
 - c. Thoracic
 - d. Cervical

ANSWER: b

60. Spinal neurons that pass motor information to the body's muscles may be found in _____.
- a. the white matter of the spinal cord
 - b. the dorsal horns of the spinal cord
 - c. the ventral horns of the spinal cord
 - d. both the dorsal and ventral horns of the spinal cord

ANSWER: c

61. Axons carrying sensory information to the brain may be found in _____.
- a. the ventral white matter of the spinal cord
 - b. the dorsal white matter of the spinal cord
 - c. both the ventral and dorsal white matter of the spinal cord
 - d. the lateral gray matter of the spinal cord only

ANSWER: b

62. The knee jerk reflex, in which your foot kicks in response to a tap on your knee, is also known as a _____.
- a. withdrawal reflex
 - b. postural reflex
 - c. patellar reflex
 - d. polysynaptic reflex

ANSWER: c

63. You've just heard that someone's spinal cord has been injured at L2 (lumbar nerve 2). Given what you've learned in this chapter, which of the following will likely be true?
- a. The person will be totally paralyzed from the neck down.
 - b. The person will be totally paralyzed from just below the arms.
 - c. The person may be unable to move or feel anything from around the waist down.
 - d. The person may be unable to move or feel anything from around the chest down.

ANSWER: c

64. A person whose spinal cord has been damaged and is unable to move or feel from their shoulders down has _____.
- a. paraplegia
 - b. hemiplegia
 - c. quadriplegia
 - d. monoplegia

ANSWER: c

65. The myelencephalon and metencephalon are located in the _____.

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- a. hindbrain
- b. midbrain
- c. forebrain
- d. cerebellum

ANSWER: a

66. Another name for the midbrain is the _____.

- a. myelencephalon
- b. metencephalon
- c. mesencephalon
- d. diencephalon

ANSWER: c

67. The brainstem is composed of the _____.

- a. hindbrain only
- b. midbrain only
- c. hindbrain and midbrain
- d. hindbrain, midbrain, and forebrain

ANSWER: c

68. When, in embryological development, do the three bulges of the hindbrain, midbrain, and forebrain form?

- a. At conception
- b. At two weeks gestation
- c. At four weeks gestation
- d. At six weeks gestation

ANSWER: c

69. The most caudal portion of the brain that is a gradual swelling of tissue above the cervical spine is the _____.

- a. medulla
- b. cerebellum
- c. pons
- d. reticular formation

ANSWER: a

70. Jonathan has been diagnosed with a tumor located in his medulla. Jonathan was likely experiencing symptoms related to _____.

- a. balance and motor coordination
- b. breathing, heart rate, and blood pressure
- c. control of aggression
- d. decision making

ANSWER: b

71. The pons and cerebellum make up which division of the brain?

- a. Telencephalon

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- b. Diencephalon
- c. Mesencephalon
- d. Metencephalon

ANSWER: d

72. Which of the following structures is in the brainstem?

- a. The central sulcus
- b. The corpus callosum
- c. The medulla
- d. The hypothalamus

ANSWER: c

73. The medulla contains nuclei responsible for which of the following functions?

- a. Balance and motor coordination
- b. Heart rate and respiration
- c. Visual reflexes
- d. Auditory reflexes

ANSWER: b

74. The cochlear and vestibular nuclei are located in the _____.

- a. midbrain
- b. medulla
- c. pons
- d. cerebellum

ANSWER: c

75. Lucy is experiencing problems with maintaining both her muscle tone and her balance. Her physician is likely to look for the source of her problems in the _____.

- a. vestibular system and the cerebellum
- b. reticular formation
- c. red nucleus and the cerebellum
- d. cochlear nucleus and the inferior colliculi

ANSWER: a

76. The reticular formation is involved with regulation of _____.

- a. appetite
- b. heart rate
- c. sexual activity
- d. consciousness

ANSWER: d

77. The reticular formation is a _____.

- a. pathway between the telencephalon and diencephalon
- b. bundle of axons in the mesencephalon

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- c. structure involved in balance
- d. collection of brainstem nuclei

ANSWER: d

78. The locus coeruleus is located in the _____.

- a. medulla
- b. pons
- c. midbrain
- d. cerebellum

ANSWER: b

79. The reticular formation plays an important role in the perception of _____.

- a. vision
- b. pain
- c. hearing
- d. smell

ANSWER: b

80. Which structures are important to the regulation of mood, states of arousal, and sleep?

- a. The vestibular nucleus and the cochlear nucleus
- b. The raphe nuclei and the locus coeruleus
- c. The red nucleus and the substantia nigra
- d. The periaqueductal gray and the red nucleus

ANSWER: b

81. Alcohol interferes with skilled movements primarily through its action in the _____.

- a. reticular formation
- b. hypothalamus
- c. cerebellum
- d. medulla

ANSWER: c

82. The vast majority of all information passing to and from higher structures of the brain must pass through the _____.

- a. cerebellum
- b. reticular formation
- c. medulla
- d. vestibular nuclei

ANSWER: c

83. Which of the following structures is found in humans but not in other animals?

- a. The periaqueductal gray
- b. The superior colliculi
- c. The neostriate nucleus
- d. The substantia nigra

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ANSWER: c

84. Contemporary understanding of the cerebellum suggests that it _____.
a. is involved solely in vegetative functions like breathing
b. plays a crucial role in maintaining the blood-brain barrier
c. has become largely redundant due to cortical development
d. can use past experience to correct and automate behavior

ANSWER: d

85. The dorsal portion of the midbrain is also known as the _____.
a. tegmentum
b. tectum
c. cerebral aqueduct
d. reticular formation

ANSWER: b

86. Which structure, located in the midbrain, passes motor information between the cerebellum and spinal cord?
a. The dentate nucleus
b. The nucleus accumbens
c. The red nucleus
d. The viscerosensory nuclei

ANSWER: c

87. The cerebral aqueduct links the _____.
a. third and fourth ventricles
b. two lateral ventricles
c. fourth ventricle and the spinal canal
d. fourth ventricle and the subarachnoid space

ANSWER: a

88. Which structure participates in our experience of pain?
a. The red nucleus
b. The substantia nigra
c. The periaqueductal gray
d. The superior colliculi

ANSWER: c

89. Nora is outside when she hears a dog barking. She is able to locate where the dog is because of activity in the _____.
a. superior colliculi
b. inferior colliculi
c. periaqueductal gray
d. substantia nigra

ANSWER: b

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90. The basal ganglia, substantia nigra, and red nucleus are important for which of the following functions?

- a. Memory
- b. Motor control
- c. Cognition
- d. Emotion

ANSWER: b

91. Several visual reflexes are managed by the _____.

- a. red nucleus
- b. periaqueductal gray
- c. superior colliculi
- d. inferior colliculi

ANSWER: c

92. Frederico has been working inside but decides to take a break from his studies by going for a walk outside. When he steps out into the sunny afternoon, his pupils constrict thanks to activity in the _____.

- a. superior colliculi
- b. periaqueductal gray
- c. red nucleus
- d. inferior colliculi

ANSWER: a

93. The diencephalon contains which of the following structures?

- a. The thalamus and hypothalamus
- b. The thalamus and the basal ganglia
- c. The inferior and superior colliculi
- d. The substantia nigra and the basal ganglia

ANSWER: a

94. Before proceeding to the cerebral cortex, input from all sensory systems except smell converges on the _____.

- a. hypothalamus
- b. thalamus
- c. amygdala
- d. hippocampus

ANSWER: b

95. Which sensory system bypasses the thalamus?

- a. Olfaction
- b. Taste
- c. Touch
- d. Temperature

ANSWER: a

96. Katie has a tumor that is disrupting her ability to maintain her body temperature. Near which of the following

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structures is Katie's tumor most likely to be located?

- a. Hypothalamus
- b. Periaqueductal gray
- c. Locus coeruleus
- d. Raphe nuclei

ANSWER: a

97. Major regulatory functions, including eating, drinking, sex, biorhythms, and temperature control, are managed primarily by the _____.

- a. hypothalamus
- b. thalamus
- c. amygdala
- d. hippocampus

ANSWER: a

98. The release of hormones by the pituitary gland is regulated primarily by the _____.

- a. hypothalamus
- b. thalamus
- c. amygdala
- d. hippocampus

ANSWER: a

99. The caudate nucleus, globus pallidus, putamen, and subthalamic nucleus are found in the _____.

- a. hypothalamus
- b. reticular formation
- c. basal ganglia
- d. limbic system

ANSWER: c

100. Anatomists often group the nucleus accumbens, which participates in our sense of pleasure and reward, with the _____.

- a. reticular formation
- b. vestibular system
- c. cranial nerve nuclei
- d. basal ganglia

ANSWER: d

101. Which structure, located in the midbrain, is involved in both movement and reward seeking?

- a. Raphe nucleus
- b. Locus coeruleus
- c. Red nucleus
- d. Substantia nigra

ANSWER: d

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102. Degeneration of the basal ganglia is a feature of which of the following conditions, which is noted for its interference with initiating movement?

- a. Alzheimer's disease
- b. Parkinson's disease
- c. Schizophrenia
- d. Autism

ANSWER: b

103. The structures of the limbic system are particularly important in _____.

- a. motivated behavior, emotion, and learning
- b. sensation and perception
- c. motor control and sensory regulation
- d. regulation of hunger and thirst

ANSWER: a

104. The hippocampus is important in which of the following functions?

- a. Learning and memory
- b. Motor control
- c. Recognition of biological danger
- d. Regulation of hunger and thirst

ANSWER: a

105. Stephen's surgery for epilepsy has made it very difficult for him to learn the names of new people he meets. What structure is most likely to have been affected?

- a. Hippocampus
- b. Locus coeruleus
- c. Hypothalamus
- d. Nucleus accumbens

ANSWER: a

106. Damage to the hippocampus is associated with _____.

- a. Parkinson's disease
- b. schizophrenia
- c. inability to form procedural memories
- d. anterograde amnesia

ANSWER: d

107. The amygdala is especially important in _____.

- a. language
- b. motor control
- c. fear, rage, and aggression
- d. regulation of hunger and thirst

ANSWER: c

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108. Students in a biological psychology laboratory were investigating the ability of rats to form associations between tones and electrical shock. Lesions to which of the following structures would make it very difficult for the rats to learn to fear tones?

- a. The red nucleus
- b. The amygdala
- c. The substantia nigra
- d. The hypothalamus

ANSWER: b

109. Cyndia is watching a video in which rhesus monkeys are being tested. One by one, each monkey is shown a realistic rubber snake, and each monkey except one responds with obvious fear. Cyndia suspects that the monkey who does not respond fearfully has a lesion in the _____.

- a. hypothalamus
- b. hippocampus
- c. amygdala
- d. nucleus accumbens

ANSWER: c

110. Which structure is involved in the cognitive control of emotions?

- a. Nucleus accumbens
- b. Subthalamic nucleus
- c. Anterior cingulate cortex
- d. Globus pallidus

ANSWER: c

111. Which structure connects the hippocampus to mammillary bodies and other parts of the brain?

- a. Anterior cingulate cortex
- b. Septum
- c. Tractus solitarius
- d. Fornix

ANSWER: d

112. The ventral striatum is another name for the _____.

- a. caudate nucleus
- b. subthalamic nucleus
- c. lenticular nucleus
- d. nucleus accumbens

ANSWER: d

113. Jessica was playing poker while on a vacation in Las Vegas and, in a fit of exuberance, bet all of her money on one hand. Unfortunately, it turned out to be a losing hand. If we were using functional magnetic resonance imaging (fMRI) to observe Jessica's reactions to losing, which structure might have shown especially increased activation when she was thinking about how much money she expected to win?

- a. Her ACC
- b. Her PCC

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- c. Her amygdala
- d. Her hippocampus

ANSWER: a

114. Which part of the brain is also referred to as “the fifth lobe?”

- a. The orbitofrontal cortex
- b. The dorsolateral prefrontal cortex
- c. The insula
- d. The fusiform face area

ANSWER: c

115. Lesions of which structure usually produce rage and attack behaviors?

- a. Hippocampus
- b. Amygdala
- c. Septal area
- d. Thalamus

ANSWER: c

116. The “hills” of the cerebral cortex are known as _____.

- a. gyri
- b. sulci
- c. fissures
- d. ganglia

ANSWER: a

117. The “valleys” between ridges of cerebral cortex are known as _____.

- a. gyri
- b. sulci
- c. nuclei
- d. ganglia

ANSWER: b

118. A particularly large sulcus is known as a _____.

- a. gyrus
- b. fasciculus
- c. fissure
- d. lemniscus

ANSWER: c

119. In general, the degree of cortical convolution in the brain predicts a species’ _____.

- a. cognitive abilities
- b. physical size
- c. identity as an herbivore, a carnivore, or an omnivore
- d. identity as nocturnal or diurnal

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ANSWER: a

120. How many distinct layers are typically found in the cerebral cortex?

- a. Two
- b. Four
- c. Six
- d. Eight

ANSWER: c

121. Which of the cortical layers is made up of the nerve fibers of cells forming connections with other layers but contains no cell bodies?

- a. Layer I
- b. Layer II
- c. Layers III
- d. Layer IV

ANSWER: a

122. Granule cells are usually found in cortical _____.

- a. layer I
- b. layers II and IV
- c. layers III and V
- d. layer VI

ANSWER: b

123. Pyramidal cells are usually found in cortical _____,

- a. layer I
- b. layers II and IV
- c. layers III and V
- d. layer VI

ANSWER: c

124. Output from the cortex to other parts of the nervous system usually originates in which of the cortical layers?

- a. II and IV
- b. III and V
- c. II and III
- d. V and VI

ANSWER: b

125. Korbinian Brodmann's system for dividing the cerebral cortex into 52 areas is based on _____.

- a. divisions of the surface by sulci and fissures
- b. regular units covering one square inch
- c. the function of the underlying cortex of each area
- d. the distribution of cell bodies in the six layers of cortex

ANSWER: d

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126. Although the human cerebral cortex performs many higher order cognitive functions, _____.
a. its volume is similar to the cortex of cats and dogs
b. its functions are quite different from the functions performed by the cortex of other mammals
c. it receives proportionally less blood than does any other part of the brain
d. it makes up only a thin layer of tissue covering the cerebral hemispheres

ANSWER: d

127. The caudal boundary of the frontal lobe is formed by the _____.
a. longitudinal fissure
b. lateral sulcus
c. calcarine fissure
d. central sulcus

ANSWER: d

128. The most rostral lobes of the cerebral cortex are the _____.
a. frontal lobes
b. parietal lobes
c. temporal lobes
d. occipital lobes

ANSWER: a

129. At the very back of the cerebral cortex are the _____.
a. frontal lobes
b. parietal lobes
c. temporal lobes
d. occipital lobes

ANSWER: d

130. The primary somatosensory cortex is located within the _____.
a. frontal lobe
b. parietal lobe
c. temporal lobe
d. occipital lobe

ANSWER: b

131. The postcentral gyrus contains the primary _____.
a. somatosensory cortex
b. motor cortex
c. auditory cortex
d. visual cortex

ANSWER: a

132. The primary visual cortex is located in the _____.

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- a. frontal lobe
- b. parietal lobe
- c. temporal lobe
- d. occipital lobe

ANSWER: d

133. The primary auditory cortex is located in the _____.

- a. frontal lobe
- b. parietal lobe
- c. temporal lobe
- d. occipital lobe

ANSWER: c

134. The primary motor cortex is located in the precentral gyrus of the _____.

- a. frontal lobe
- b. parietal lobe
- c. temporal lobe
- d. occipital lobe

ANSWER: a

135. Following a serious head injury, Robert began to make a series of impulsive decisions that led to negative consequences, such as quitting his job and leaving his wife for a woman he had just met in a bar. It is most likely that Robert's injury affected his _____.

- a. occipital lobe
- b. frontal lobe
- c. parietal lobe
- d. temporal lobe

ANSWER: b

136. Clare's head injury has left her with serious problems in planning and executive cognitive functions, such as being able to remember a new friend's telephone number long enough to put it in her cell phone. It is likely that Clare's injury damaged her _____.

- a. amygdala
- b. primary visual cortex
- c. dorsolateral prefrontal cortex
- d. PCC

ANSWER: c

137. The two cerebral hemispheres are connected by the _____.

- a. anterior commissure and the corpus callosum
- b. anterior and medial commissures
- c. medial commissure and the corpus callosum
- d. arcuate fasciculus and the corpus callosum

ANSWER: a

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138. The functions of the frontal lobe include _____.
a. decision making and planning
b. processing of sound and visual recognition of objects
c. generating movement and perceiving body position
d. primary visual processing and perception of movement

ANSWER: a

139. A patient who demonstrates uncharacteristically poor judgment and is unable to maintain a typical attention span may have experienced damage to the _____.
a. frontal lobe
b. parietal lobe
c. temporal lobe
d. occipital lobe

ANSWER: a

140. Extreme antisocial behavior has been correlated with damage to the _____.
a. hippocampus
b. orbitofrontal cortex
c. primary visual cortex
d. corpus callosum

ANSWER: b

141. Damage to which of the following areas results in problems producing speech?
a. Broca's area
b. Wernicke's area
c. The orbitofrontal cortex
d. The cingulate cortex

ANSWER: a

142. For the vast majority of the population, which of the following functions are localized to the left hemisphere?
a. Language
b. Spatial abilities
c. Intuition
d. Artistic and musical abilities

ANSWER: a

143. Which of the following peripheral nerves enter and exit the brain itself?
a. Cervical
b. Thoracic
c. Cranial
d. Lumbar

ANSWER: c

144. How many pairs of cranial nerves do humans typically have?

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- a. 6
- b. 8
- c. 10
- d. 12

ANSWER: d

145. Which of the following cranial nerves provides input and feedback from the heart, liver, and digestive tract?

- a. The trochlear nerve (IV)
- b. The abducens nerve (VI)
- c. The hypoglossal nerve (XII)
- d. The vagus nerve (X)

ANSWER: d

146. Which of the following cranial nerves do we use to produce facial expressions?

- a. The trigeminal nerve (V)
- b. The facial nerve (VII)
- c. The trochlear nerve (IV)
- d. The spinal accessory nerve (XI)

ANSWER: b

147. Which of the following statements accurately describes the ability of cranial nerves to carry sensory and motor information?

- a. Half of the cranial nerves carry sensory information and the other half of the cranial nerves carry motor information.
- b. All cranial nerves carry both sensory and motor information.
- c. Some cranial nerves carry just sensory information, while all of the others carry both sensory and motor information.
- d. Some cranial nerves carry sensory information, others carry motor information, and still others carry both sensory and motor information.

ANSWER: d

148. Efferent spinal nerves arise from which root of the spinal cord?

- a. Lateral
- b. Ventral
- c. Dorsal
- d. Medial

ANSWER: b

149. Damage to a mixed nerve is likely to produce impairments in _____.

- a. both sensation and motor control
- b. sensation only
- c. motor control only
- d. neither sensation nor motor control

ANSWER: a

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150. Dorsal root ganglia _____.
a. are located in the ventral horns of the spinal cord
b. contain the cell bodies of efferent nerves
c. are located in the dorsal horns of the spinal cord
d. contain the cell bodies of afferent nerves

ANSWER: d

151. Which spinal nerves in adult humans are myelinated?
a. All
b. None
c. All efferent
d. All afferent

ANSWER: c

152. The collection of afferent nerves located just outside the spinal cord is the _____.
a. spiral ganglion
b. dorsal root ganglion
c. pseudoganglion
d. ventral root ganglion

ANSWER: b

153. The dull, aching feeling that often follows injury is probably carried by _____.
a. myelinated efferent nerves
b. unmyelinated efferent nerves
c. myelinated afferent nerves
d. unmyelinated afferent nerves

ANSWER: d

154. The autonomic nervous system directly controls _____.
a. the skeletal muscles
b. the heart, lungs, and other organs
c. the reticular formation
d. temperature regulation

ANSWER: b

155. Biofeedback training allows people to consciously control processes normally managed by the _____.
a. frontal lobe
b. reticular formation
c. somatic nervous system
d. autonomic nervous system

ANSWER: d

156. Internal stimuli, such as the arrival of food in the digestive system, normally activate _____.
a. the somatic nervous system

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- b. the parasympathetic nervous system
- c. the sympathetic nervous system
- d. both the parasympathetic and sympathetic nervous systems

ANSWER: b

157. Which nervous system(s) control the body's "fight or flight" responses?

- a. The somatic
- b. The parasympathetic
- c. The sympathetic
- d. Both the parasympathetic and sympathetic

ANSWER: c

158. Salivation and digestion are inhibited during activation of _____.

- a. the somatic nervous system
- b. the parasympathetic nervous system
- c. the sympathetic nervous system
- d. both the parasympathetic and sympathetic nervous systems

ANSWER: c

159. Which of the following is a consequence of sympathetic nervous system activity?

- a. Increased heart rate
- b. Increased digestion
- c. Increased salivation
- d. Decreased blood pressure

ANSWER: a

160. Sexual activity involves _____.

- a. the parasympathetic nervous system only
- b. the sympathetic nervous system only
- c. both the parasympathetic and sympathetic nervous systems
- d. neither the parasympathetic nor the sympathetic nervous system

ANSWER: c

161. Constriction of blood vessels near the skin's surface occurs during activity in _____.

- a. the somatic nervous system
- b. the sympathetic nervous system
- c. the parasympathetic nervous system
- d. both the sympathetic and parasympathetic nervous systems

ANSWER: b

162. The neurons associated with the parasympathetic nervous system are located in which divisions of the spinal cord?

- a. Lumbar and sacral divisions
- b. Thoracic and lumbar divisions
- c. Brain and sacral division

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d. Brain and lumbar division

ANSWER: c

163. The brain structure with the most direct responsibility over the autonomic nervous system is the _____.

- a. amygdala
- b. cingulate cortex
- c. hippocampus
- d. hypothalamus

ANSWER: d

164. Scientists describe evolution as _____.

- a. natural selection
- b. descent with modification
- c. abrupt change
- d. random mutations

ANSWER: b

165. Which of the following statements offers the best definition of evolution?

- a. Evolution describes descent with modifications from a common ancestor.
- b. Evolution describes how humans evolved from chimpanzees.
- c. Evolution describes the origin of life from the Big Bang.
- d. Evolution describes the transmission of dominant and recessive traits to offspring.

ANSWER: a

166. The process by which some genes become more prevalent in subsequent generations due to reproductive success is known as _____.

- a. natural selection
- b. descent
- c. abrupt change
- d. genetics

ANSWER: a

167. Researchers studying two species of frogs found that one species seemed to be more numerous in ponds with lots of fishes, whereas the other species was more numerous in ponds with relatively fewer fishes. Using your understanding of the evolutionary concept of fitness, choose the statement that best describes the situation.

- a. It is only a matter of time before one of these species becomes more numerous in both ponds because certain traits are reproduced more successfully than others regardless of environment.
- b. It is likely that the two species differ in a trait that makes one better suited to ponds with lots of fishes and one better suited to ponds with fewer fishes.
- c. Both species are likely to become extinct in the near future, as neither can successfully cohabit with fishes.
- d. Over time the numbers of the two species will become more equal, regardless of the type of pond they inhabit.

ANSWER: b

168. When industrialization covered British trees with soot, moths with darker coloring became more numerous. When pollution was reduced again, lighter colored moths became more numerous. This situation illustrates the process of _____.

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- a. artificial selection
- b. epigenetics
- c. fitness
- d. mutation

ANSWER: c

169. The process by which favorable traits become more common and unfavorable traits become less common due to differences in reproductive success is called _____.

- a. genetic modification
- b. fitness
- c. natural selection
- d. epigenetics

ANSWER: c

170. The first animals with simple nerve nets probably evolved about _____.

- a. 4.5 billion years ago
- b. 3.5 billion years ago
- c. 700 million years ago
- d. 250 million years ago

ANSWER: c

171. Animals with the first rudimentary brains probably evolved about _____.

- a. 4.5 billion years ago
- b. 3.5 billion years ago
- c. 700 million years ago
- d. 250 million years ago

ANSWER: d

172. The first hominin brain probably developed about _____.

- a. 700 million years ago
- b. 250 million years ago
- c. 10 million years ago
- d. 7 million years ago

ANSWER: d

173. True brains and spinal cords occur in _____.

- a. chordates
- b. mollusca
- c. crustacean
- d. hemichordates

ANSWER: a

174. Chordate nervous systems differ from nonchordate nervous systems in that _____.

- a. chordate nervous systems run along the ventral, or front, side of the animal

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- b. chordate nervous systems run along the dorsal, or back, side of the animal
- c. nonchordate nervous systems have brains rather than ganglia
- d. nonchordate nervous systems provide faster reactions to sensory information

ANSWER: b

175. An advantage of the location of the chordate spinal cord is that it is _____.

- a. easier to defend
- b. has no ganglia
- c. not encased in bone
- d. completely independent of the brain

ANSWER: a

176. The first *Homo sapiens* appeared between _____.

- a. 4 million and 5 million years ago
- b. 1 million and 2 million years ago
- c. 300,000 and 500,000 years ago
- d. 100,000 and 200,000 years ago

ANSWER: d

177. In terms of evolution, brain development among hominin species _____.

- a. occurred very quickly
- b. occurred very slowly and unevenly
- c. occurred very slowly and gradually
- d. has appeared to speed up in the last century

ANSWER: a

178. Compared with early examples of *Homo erectus*, modern humans have _____.

- a. much larger brains
- b. smaller brains
- c. brains that are about the same size
- d. less convoluted brains

ANSWER: a

179. Agriculture, urbanization, and literacy appear to have produced _____.

- a. large amounts of additional growth in human brain size
- b. modest amounts of additional growth in human brain size
- c. no apparent changes in human brain size
- d. possible reductions in human brain size

ANSWER: c

180. Factors that may limit human brain size include _____.

- a. the brain's requirements for calcium
- b. gender differences in brain size
- c. the brain's need for fatty acids

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d. difficulties in childbirth

ANSWER: d

181. What is the function of a mixed nerve?

- a. Transmitting afferent data to the CNS
- b. Transmitting efferent data from the CNS
- c. Carrying both afferent and efferent data to and from the CNS
- d. Summing information from multiple systems

ANSWER: c

182. The ability of an organism with one genetic makeup to reproduce more successfully than organisms with other types of genetic makeup is called _____.

- a. genetic modification
- b. fitness
- c. natural selection
- d. epigenetics

ANSWER: b

183. Which gland is involved in the regulation of metabolism?

- a. The pineal
- b. The adrenals
- c. The thyroid
- d. The gonads

ANSWER: c

184. The brain floats in CSF so that _____.

- a. it is cushioned to protect it from impact or sudden changes in movement
- b. it can efficiently eliminate wastes from the brain into the CSF drainage
- c. it can receive oxygen and glucose from the CSF bathing it
- d. it can both eliminate wastes and take in oxygen and glucose

ANSWER: a

185. Which structure is particularly important in coordination of skilled movements?

- a. Hypothalamus
- b. Red nucleus
- c. Globus pallidus
- d. Cerebellum

ANSWER: d

186. Which structure is particularly important in regulating body homeostasis?

- a. Hypothalamus
- b. Hippocampus
- c. Amygdala
- d. Cerebellum

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ANSWER: a

187. Which of the following is a collection of structures in the forebrain that participates in learning, emotion, and memory?

- a. The medulla
- b. The limbic system
- c. The reticular formation
- d. The cerebellum

ANSWER: b

188. Which lobe is essential to visual processing?

- a. Frontal
- b. Parietal
- c. Occipital
- d. Temporal

ANSWER: c

189. A spinal nerve root on the right ventral side of the cord carries what type of information?

- a. Sensory information from the right side of the body
- b. Motor information to the right side of the body
- c. Sensory information from the left side of the body
- d. Motor information to the left side of the body

ANSWER: b

190. Activity in the sympathetic nervous system increases _____.

- a. heart rate
- b. digestion
- c. salivation
- d. peripheral blood flow

ANSWER: a

Completion

191. CSF moves from its place of synthesis in the _____ of the ventricles, through the third and fourth ventricles and then into the _____ of the spinal cord. Finally, it flows into the _____ within the meninges.

ANSWER: choroid plexus; central canal; subarachnoid space

192. The _____ lobe participates in a number of higher-level cognitive processes, such as the planning of behavior, attention, and judgment. The _____ lobe is crucial to hearing, and the _____ lobe is crucial to vision.

ANSWER: frontal; temporal; occipital

193. Afferent fibers carry _____ information, and efferent fibers carry _____ information.

ANSWER: sensory; motor

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194. _____ sections are parallel to the midline, _____ sections divide the brain from front to back, and _____ sections divide the brain from top to bottom.

ANSWER: Sagittal, coronal, horizontal

195. The _____ contributes to muscle coordination, muscle tone, balance, and some types of learning.

ANSWER: cerebellum

196. The _____ nervous system is active during periods of arousal, stress, and emergency and prepares the body for “fight-or-flight.” The _____ nervous system is active during times of calm and participates in the storage of nutrients and the repair of the body

ANSWER: sympathetic, parasympathetic

Essay

197. Actor Christopher Reeve damaged his cervical spinal cord during a tragic horseback riding accident. Based on your knowledge of the structure and functions of the spinal cord, what challenges did Reeve face as a result of his accident?

ANSWER: Answers will focus on the nerves that radiate from the spine below the cervical level, and discuss that these nerves carry motor and sensory information for all four limbs. Students will likely include discussion of Reeve as a quadriplegic and may also explain that cranial nerves would be unaffected, as they exit above the cervical spine.

198. Why is the enteric nervous system referred to as “the second brain?”

ANSWER: Answers may include the number of neurons (equivalent to the spinal cord) and the importance of gut-brain interactions in healthy and disordered behaviors.

199. How has understanding of the role of the cerebellum changed as neuroscience has advanced?

ANSWER: Students should note that the traditional view of the cerebellum emphasized its role in coordinating voluntary movements, maintaining muscle tone, and regulating balance. More contemporary views see the cerebellum as responsible for much more than balance and motor coordination, including sophisticated processing of information required by executive functions and emotional processing. The neudentate of the dentate nucleus, which is located in the cerebellum, is found only in humans and is involved in language.

200. Explain the justification for frontal lobotomies as well as the factors that led to the procedure falling out of favor.

ANSWER: Answers will vary, but should begin by noting that lobotomy was based in the observation that chimpanzees with frontal lobe damage experienced a reduction in negative emotions. Portuguese neurologist Egaz Moniz advocated the use of frontal lobotomies with human patients to reduce negative outbursts. During the 1940s and 1950s, more than 10,000 frontal lobotomies were performed to reduce fear and anxiety in mental patients and in some people without major disorders despite the fact that there were numerous negative side effects. Lobotomies were largely discontinued when major antipsychotic medications were discovered.

201. A major evolutionary step was the process of cephalization (getting a head), with chordates having a single brain rather than a series of ganglia. What advantages does a brain confer to an animal that is not possible with ganglia?

ANSWER: This answer should discuss the survival advantage of a single brain over a series of ganglia. The one brain allows integration of information from anywhere on the body and allows for a response that involves the entire body, so escape from a threat can be more effective.

202. The autonomic nervous system has two branches: sympathetic and parasympathetic. Activation of one branch typically suppresses activity of the other. If you eat a large meal, and then suddenly need to run, you will activate each system. Describe the likely chain of events that will transpire and include which system will take precedence.

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ANSWER: Students often have personal experience with this and know that the sympathetic system will predominate, so the meal will be regurgitated. They will usually explain that sympathetic activation will suppress parasympathetic and that the body will also eliminate the meal from the system to allow the parasympathetic system to diminish while the sympathetic system is active.