**Chapter 2**

**Multiple Choice**

1. ___ are one of the cell types composing the nervous system.
   A) Soma
   B) Neurons
   C) Mitochondria
   D) Myelin
   Ans: b

2. William, a philosophy major, asked Ian the psychology major what type of cell contributes the most to Ian's "being" who he is. Without hesitation, Ian replied:
   A) Nerves
   B) Brain cells
   C) Neurons
   D) Somatic cells
   Ans: c

3. Cells that convey environmental information; carry out the functions underlying thought, emotion, and movements; and transmit commands out to the body's organs and muscles are called:
   A) Neurons
   B) Dendrites
   C) Supporting cells
   D) Phagocytes
   Ans: a

4. ___ neurons control movements and actions of organs.
   A) Phasic
   B) Inter-
   C) Motor
   D) Sensory
   Ans: c

5. Neurons make up only about _____% of the cells in the brain and about _____ of its volume.
   A) 25, one-third
   B) 10, one-half
   C) 90, three-quarters
   D) 33, one-third
   Ans: b

6. Ninety percent of the cells in the brain are:

A) Neurons
B) Glial cells
C) Axonic cells
D) Dendritic cells
Ans: b

7. The most important supporting cells of the brain are the:
A) Neurons
B) Glia
C) Neurofilaments
D) Schwann cells
Ans: b

8. About how many neurons are found in the human brain?
A) 10 million
B) 1 billion
C) 100 billion
D) 10 trillion
Ans: c

9. ___ have a branched structure and receive stimulation from other neurons.
A) Dendrites
B) Axons
C) Glial cells
D) Soma
Ans: a

10. The dendrites of a neuron:
A) Transmit information to the cell body
B) Provide the life processes of the cell
C) Transmit neural impulses to the terminal buttons
D) Release neurotransmitters
Ans: a

11. The part of a neuron that contains the nucleus is called the:
A) Axon
B) Soma
C) Dendrite
D) Mitochondrion
Ans: b

12. The largest part of a neuron is the:
A) Soma
B) Axon

C) Terminal
D) Dendritic process
Ans: a

13. The soma of a neuron contains the:
A) Glial material
B) Neurotransporters
C) Neural receptors
D) Nucleus
Ans: d

14. The part of a neuron that transmits information over long distances is the:
A) Soma
B) Axon
C) Dendrite
D) Synapse
Ans: b

15. Axons can be anywhere from ___ to more than ___ in length.
A) 3 centimeters, 1 meter
B) 1 meter, 2 meters
C) 1 millimeter, 50 meters
D) 0.1 millimeter, 1 meter
Ans: d

16. ___ can be long enough to provide a direct connection between the spinal cord and the toes of a giraffe.
A) Interneurons
B) Projection neurons
C) Axons
D) Dendrites
Ans: c

17. The axon of a neuron:
A) Ends in swellings known as terminals
B) Controls the life processes of the cell
C) Insulates the brain's electrical signals
D) Contains the cell's nucleus
Ans: a

18. The swellings on the ends of axonal branches are called:
A) Dendritic spines
B) Nodes of Ranvier
C) Terminals

D) Myofilaments
Ans: a

19. The connection point between two neurons is called the:
    A) Terminal
    B) Axon
    C) Soma
    D) Synapse
    Ans: d

20. If you could surgically remove a single neuron from the brain and place it on a slide, what structure(s) would you have to destroy?
    A) Soma
    B) Axon
    C) Synapses
    D) Dendrites
    Ans: c

21. Sensory neurons:
    A) Control muscles and produce movement
    B) Send messages away from the brain toward the periphery
    C) Gather information from the environment and convey it into the central nervous system
    D) Have cell bodies covered with myelin
    Ans: c

22. In motor neurons, the axon and the dendrites branch out from the soma in several directions, giving this type of neuron the designation of a ___ neuron.
    A) multi-fibered motor
    B) unipolar
    C) bipolar
    D) multipolar
    Ans: d

23. A ___ neuron gives rise to an axon and to the dendritic processes from opposite ends of the soma.
    A) motor
    B) unipolar
    C) bipolar
    D) multipolar
    Ans: c

24. A ___ neuron's soma gives rise to a short stalk that divides into two branches.
    A) unifibered
    B) unipolar
    C) bipolar

D) multipolar
Ans: b

25. Motor neurons are typically ___ while sensory neurons are typically either ___ or ___ neurons.
    A) unipolar, multipolar, bipolar
    B) multipolar, unipolar, bipolar
    C) bipolar, unipolar, bipolar
    D) bipolar, multipolar, unipolar
    Ans: b

26. A(n) ___ would be found bridging between a sensory neuron and a motor neuron in the spinal cord.
    A) glial neuron
    B) projection
    C) interneuron
    D) multipolar
    Ans: c

27. Many business deals involve a "middle man" who communicates between buyer and seller. The "middle man" between a sensory neuron and a motor neuron is a(n):
    A) Synapse
    B) Projection neuron
    C) Glial cell
    D) Interneuron
    Ans: d

28. The most common type of neuron in the brain is the ___.
    A) motor neuron
    B) unipolar neuron
    C) interneuron
    D) multipolar neuron
    Ans: c

29. The cell membrane of a neuron is a double layer made up of:
    A) Protein and connective tissue
    B) Protein and lipid (fat)
    C) Lipid (fat) and connective tissue
    D) Intracellular material and extracellular material
    Ans: b

30. Which of the statements about cell membranes is *not* correct?
    A) They contain specialized protein channels.
    B) They are made of two layers of lipids.
    C) Many millennia ago they were free-living single-celled organisms.
    D) They define cell boundaries.

Ans: c

31. The lipids that compose the cell membrane are arranged with “heads” and “tails” such that:
    A) The “heads” are in contact with extracellular and intracellular fluid and the “tails” oriented away from these fluids
    B) The “tails” are in contact with extracellular and intracellular fluid and the “heads” oriented away from these fluids
    C) Half of all “heads” and “tails” are in contact with extracellular fluid
    D) Both “heads” and “tails” are in contact with intracellular fluid
    Ans: a

32. The seawater-like solution inside neurons and bathing their outside are known respectively as:
    A) Extracellular and intracellular
    B) Intracellular and extracellular
    C) Cellular and extracellular
    D) Intramembrane and extramembrane
    Ans: b

33. The fact that the cell membrane is highly permeable to some substances and much less so to other substances is one variable underlying the cell being ___.
    A) potentialized
    B) polarized
    C) hyperpolarized
    D) viable
    Ans: b

34. One function of the specialized protein channels in a cell membrane is to:
    A) Selectively allow substances to enter or leave the cell
    B) Provide oxygen and nutrients for the cell
    C) Package neurotransmitters
    D) Form an impermeable barrier to all substances foreign to the cell
    Ans: a

35. When it is said that the cell membrane has a difference in electrical charge between its inside and the outside, this means the membrane is:
    A) Potentialized
    B) Polarized
    C) Hyperpolarized
    D) Viable
    Ans: b

36. When a neuron is at rest, the inside of the neuron:
    A) Is negatively charged with respect to the outside
    B) Is positively charged with respect to the outside

C) Is not charged
D) Converts potential energy into chemical energy
Ans: a

37. The ___ is the difference in electrical potential between the inside and outside of an inactive neuron.
A) action potential
B) resting potential
C) threshold of excitation
D) reaction potential
Ans: b

38. The resting membrane potential is:
A) A function of anions concentrated inside the cell
B) Positive inside with respect to outside
C) The result of a freely permeable membrane
D) The difference in electrical charge inside and outside the inactive neuron
Ans: d

39. ___ are atoms that have gained or lost one or more electrons.
A) Ions
B) Polarizations
C) Electrolytes
D) Positrons
Ans: a

40. Sodium ions are most concentrated in the ___ fluid.
A) intracellular
B) extracellular
C) intracellular and extracellular
D) polarized
Ans: b

41. Potassium ions are most concentrated in the ___ fluid.
A) intracellular
B) extracellular
C) intracellular and extracellular
D) non-polarized
Ans: a

42. Chloride ions and anions are most concentrated in the:
A) Intracellular fluid
B) Extracellular fluid
C) Extracellular and intracellular fluid, respectively
D) Depolarized fluid

Ans: c

43. The condition in which ions of a similar charge repel each other and thus spread evenly through a solution is called:
    A) Electrostatic pressure
    B) The resting potential
    C) Repulsion
    D) The rate of diffusion
    Ans: a

44. The force by which high concentrations of ions disperse away from each other and thus spread evenly through a solution is called:
    A) Electrostatic pressure
    B) Force of diffusion
    C) Repulsion
    D) The law of electrostatic repulsion
    Ans: b

45. ___ tend to exit a neuron based on weaker electrostatic pressure than their force of diffusion.
    A) Chloride ions
    B) Sodium ions
    C) Potassium ions
    D) Protein anions
    Ans: c

46. ___ would tend to move into the neuron based on both their electrostatic pressure and force of diffusion.
    A) Chloride ions
    B) Sodium ions
    C) Potassium ions
    D) Protein anions
    Ans: b

47. Much to your delight, your family puts in a backyard swimming pool and your dog sips from it as it is filled with fresh water. However, much to his dismay, you throw a blue dye tablet in the deep end. As the blue dye slowly disperses from the deep end, your dog drinks farther and farther from where the dye is being introduced. Your dog changes his drinking places because of the blue dye's:
    A) Electrostatic pressure.
    B) Diffusion gradient
    C) Force of diffusion
    D) Different polarization of dye versus water
    Ans: c

48. The sodium-potassium pump forces sodium ions ___ the cell and potassium ions___ the cell.

A) into, into
B) into, out of
C) out of; out of
D) out of, into
Ans: d

49. In a resting neuron, which force pushes potassium ions into the cell?
A) The sodium-potassium pump
B) Diffusion
C) The action potential
D) Saltatory conduction
Ans: a

50. The sodium-potassium pump forces ___sodium ions ___ the cell for every ___ potassium ions ___ the cell.
A) 3, into, 2, into
B) 2, into, 3, out of
C) 3, out of, 1, out of
D) 3, out of, 2, into
Ans: b

51. The sodium-potassium pump accounts for ___ of the neuron's energy expenditure.
A) 75%
B) 40%
C) 25%
D) 10%
Ans: b

52. While taking her GRE exam, LaFawnduh was concentrating so hard it almost hurt and the test left her feeling exhausted. A very large share of the energy LaFawnduh expended in her “mental efforts” was consumed by the ___ in her nervous system.
A) neurons
B) stress hormones
C) sodium-potassium pump
D) mitochondria
Ans: a

53. The ___ is the neuron's means of transmitting information over long distances.
A) depolarizing potential
B) repolarization
C) action potential
D) graded potential
Ans: c

54. The term *depolarization* refers to:
    A) A change in the resting neuron's polarity away from zero
    B) A change in the resting neuron's polarity toward zero
    C) Conduction of the graded potential
    D) Changes in conduction capability in myelinated axons
    Ans: b

55. The depolarization arriving at an axon from a dendrite is called a ___ potential because it can ___.
    A) action, transmit information
    B) graded, vary in speed
    C) graded, vary in magnitude
    D) ionic, trigger an action potential
    Ans: c

56. If the partial depolarization arriving at an axon is sufficiently large, typically ___ or more, it can cause normally closed sodium ion channels to open.
    A) 5mV
    B) 40mV
    C) 30mV
    D) 10mV
    Ans: d

57. When depolarization of the cell membrane reaches threshold, which of the following occurs?
    A) Opening of sodium ion channels
    B) Opening of chloride ion channels
    C) A negative shift in the resting potential
    D) Opening of potassium ion channels
    Ans: a

58. A brief, rapid reversal of the neuron's potential from –70mV to +30 or +40mV and back indicates:
    A) Sustained membrane reversal
    B) A hyperpolarization
    C) An action potential
    D) A refractory period
    Ans: c

59. The change in electrical charge from –70mV to the peak of the action potential is due to ___ and the change in electrical charge from the peak of +30 or +40mV back to –70mV is due to___.
    A) inflow of chloride ions, outflow of sodium ions
    B) inflow of potassium ions, outflow of sodium ions
    C) inflow of sodium ions, outflow of sodium ions
    D) inflow of sodium ions, outflow of potassium ions
    Ans: c

60. At the peak of the action potential, which of the following ionic movements restores the neuron to its resting potential?
    A) Sodium ions move into the cell.
    B) Potassium ions move into the cell.
    C) Protein anions move out of the cell.
    D) Potassium ions move out of the cell.
    Ans: d

61. An action potential from beginning to end lasts about:
    A) 1 second
    B) 1 millisecond
    C) 1 microsecond
    D) 10 milliseconds
    Ans: b

62. The action potential spreads through an axon by:
    A) Depolarizing adjacent membrane to threshold, triggering another action potential
    B) Inflow of potassium ions and outflow of sodium ions
    C) A non-decremental of graded potential
    D) A decremental of graded potential
    Ans: a

63. When an axon transmits action potentials:
    A) Nothing physically moves down the axon
    B) Electricity flows from one end of the axon to the other
    C) Neurochemicals flow from one end of the axon to the other
    D) The sodium-potassium pump pushes ions down the axon
    Ans: a

64. Graded potentials decreased in size as they spread; the term for this is:
    A) Non-decremental
    B) All or none
    C) Decremental
    D) Graded polarization
Ans: c

65. Partial depolarizations die out over a short distance; these depolarizations are known as:
    A) Small scale potentials
    B) Micro potentials
    C) Graded potentials
    D) Nano potentials
    Ans: c

66. Sarah threw rocks of different sizes into a pond. Just as ripple size was a function of size of rock,

graded potentials ___ as a function of stimulus intensity.
A) vary in inverse magnitude
B) vary along an exponential continuum
C) vary in magnitude
D) are a graded percentage
Ans: c

67. Electricity flowing in power lines drops in voltage over distance, requiring your power company to use transformers to boost the voltage. This loss over distance is similar to the behavior of ___ potentials.
A) hyperpolarizing
B) non-decremental
C) action
D) graded
Ans: d

68. An action potential occurs at a specific strength for that neuron, regardless of the stimulus intensity; this is known as the:
A) Principle of mass action
B) All-or-none law
C) Rate law
D) Law of equipotentiality
Ans: b

69. Which of the following concepts does the all-or-none law describe?
A) All dendrites must be hyperpolarized before a neuron fires.
B) All neurons in a nerve fire or none of them fires.
C) The size of an action potential does not depend on the stimulus that started it.
D) The frequency at which a neuron fires is independent of the intensity of the stimulus.
Ans: c

70. Local anesthetics work via ___ while general anesthetics have the effect of ___.
A) attaching to and blocking potassium ion channels, opening sodium ion channels
B) attaching to and blocking sodium ion channels, opening potassium ion channels
C) opening TDT channels, blocking TDT channels
D) opening chloride ion channels, blocking potassium ion channels
Ans: b

71. When you feel the lingering numbness of the “local” the dentist gave you, the biopsychology student knows the effects are due to the chemical anesthetic effects of:
A) Blocking sodium ion channels
B) Preventing neurotransmitter release
C) Producing hyperpolarizations on an afferent neuron
D) Producing prolonged refractory periods
Ans: a

72. Most local anesthetics work by ___; some general anesthetics have the effect of ___.
    A) preventing neurons from depolarizing, increasing the hyperpolarization of neurons
    B) putting axons to sleep, putting the brain to sleep
    C) preventing concentration gradients, increasing electrical gradients
    D) increasing the polarization of neurons, preventing depolarizing
    Ans: a

73. Bob was given a general anesthetic; he knew that while most local anesthetics work by ___, this general anesthetic possibly ___.
    A) opening chloride ion channels, opened potassium ion channels
    B) blocking sodium ion channels, blocked potassium ion channels
    C) blocking sodium ion channels, opened chloride ion channels
    D) blocking sodium ion channels, opened potassium ion channels
    Ans: d

74. Tetrodotoxin is a deadly poison because it blocks:
    A) Sodium ion channels
    B) Potassium ion channels
    C) TDT channels
    D) Chloride ion channels
    Ans: a

75. Various toxins from snakes, scorpions, and fish are called ___ because of their sites of action.
    A) neural blockers
    B) neuroantagonists
    C) neurotoxins
    D) nociceptors
    Ans: c

76. As the snake that bit him slithered away, Captain Jones remembered that a poisonous species could kill by blocking either his ___ or his ___.
    A) sodium ion channels, calcium ion channels
    B) potassium ion channels, chloride ion channels
    C) calcium ion channels, chloride ion channels
    D) sodium ion channels, potassium ion channels
    Ans: d

77. Medical researchers are interested in the toxins of cone snails for potential new treatments for ___ as well as ___.
    A) pain, cancer
    B) addictions, pain relief
    C) pain, epilepsy
    D) epilepsy, addictions

Ans: c

78. Medical researchers are focusing on the toxins of cone snails for several novel treatments because of the toxin's effects on:
    A) Sodium ion channels
    B) Potassium ion channels
    C) Neurotransmitter receptors
    D) All of the above
    Ans: d

79. After learning about the suffering of people with untreatable chronic pain, Amanda was encouraged by what researchers are learning about:
    A) New alternative mind-body interventions
    B) Neuro-feedback
    C) Cone snail toxins
    D) Genetically modified botulinum toxin
    Ans: c

80. You will find very few sushi bars that will serve fugu because:
    A) Few non-Japanese diners like the taste
    B) It is far too expensive for most sushi shops to offer as regular fare
    C) It can kill if carelessly prepared
    D) It is a source of botulinum toxin
    Ans: c

81. Next time you are enjoying your sushi, try to avoid thinking about the ___ diners who have died from eating fugu.
    A) few dozen
    B) urban legends of
    C) few thousand
    D) few million
    Ans: c

82. The gourmet diner who wants to play Russian roulette with his or her dinner might choose to dine on ___.
    A) fugu
    B) sushi
    C) umami
    D) focaccia
    Ans: a

83. Which statement characterizes the absolute refractory period?
    A) The neuron cannot fire again because the potassium channels are unable to open.
    B) The neuron cannot fire again because the sodium channels are unable to open.
    C) The neuron can fire again but only to a stronger than threshold stimulus.

D) The neuron can fire again but only at a much slower rate.
Ans: b

84. Which statement characterizes the relative refractory period?
    A) The neuron cannot fire again because the potassium channels are unable to open.
    B) The neuron cannot fire again because the sodium channels are unable to open.
    C) The neuron can fire again but only to a stronger than threshold stimulus.
    D) The neuron can fire again but only at a much slower rate.
    Ans: c

85. Implication(s) of the absolute refractory period:
    A) A limit on how frequently action potentials can occur
    B) An action potential will produce additional action potentials only in front of it
    C) A narrow range of rates of firing for neurons
    D) All of the above
    Ans: d

86. Which of the following explains a neuron's means of encoding various intensities of stimuli?
    A) Passive conduction
    B) Decremental conduction
    C) All-or-none law
    D) Rate law
    Ans: d

87. After Debbie's car accident, as the doctor asked her if it hurt here or if it hurt when he pressed this hard, Debbie understood why she could tell the differences in amount of pressure the doctor used; her sensory neurons coded the different pressures via:
    A) Different magnitude action potentials
    B) Differences in threshold
    C) Different neurotransmitters
    D) Different rates of firing in neurons
    Ans: d

88. When you call your sleeping dog, his eyelids flutter; you call louder and his ears perk up; you call even louder and he wakes up. This is because:
    A) Different types of stimuli produce responses in different neurons
    B) Different stimulus intensities activate different neurons
    C) Greater stimulus intensities activate glial cells as well as neurons
    D) Greater stimulus intensities produce higher rates of action potentials
    Ans: d

89. In the psychology office, the more urgent the memorandum, the more likely it will be assigned to the secretary who can type the fastest. As urgency of memo relates to the work being done by the person who types the fastest rate of words per minute, so does stimulus intensity relate to:

A) Rate of neurotransmitter release
B) Rate of neuronal firing per second
C) Speed of action potential
D) Magnitude of action potential
Ans: b

90. The speed of neural conduction is most similar to the speed of:
A) Light
B) Sound
C) Electrical current
D) A person walking or running
Ans: b

91. Just as many people want to mistakenly compare the brain's "information processing" capability and speed to that of a computer, the speed of neural impulses is often erroneously compared to the:
A) Speed of light
B) Speed of sound
C) Speed of electrical current
D) The average reaction time for an average adult human
Ans: c

92. The conduction speed of neurons is largely a function of:
A) Axon length and axon diameter
B) Axon diameter and number of ion channels
C) Axon diameter and myelination
D) Axon length and myelination
Ans: c

93. With a bigger fire, a larger diameter water hose will be needed to put out more water per second. Likewise, ___ axons have evolved to provide less resistance to the conduction of neural potentials.
A) shorter
B) thinner
C) thicker
D) denser
Ans: c

94. The cells that produce myelin in the central nervous system are called:
A) Ranvier cells
B) Astrocytes
C) Oligodendrocytes
D) Schwann cells
Ans: c

95. The cells that produce myelin in the peripheral nervous system are called:

A) Ranvier cells
B) Node cells
C) Oligodendrocytes
D) Schwann cells
Ans: d

96. The gaps in the myelin sheaths on axons are known as:
A) Synapses of myelin
B) Nodes of Schwann
C) Oligodendrocytes
D) Nodes of Ranvier
Ans: d

97. Which of the following statements about neuronal conduction in myelinated neurons is *not* correct?
A) Energy is saved by myelination.
B) Thicker myelination on axons results in a slower conduction of action potentials.
C) Conduction speed is much faster in myelinated axons.
D) Myelinated axons use saltatory conduction.
Ans: b

98. In a myelinated neuron, the action potential:
A) Travels more slowly than in an unmyelinated neuron
B) Jumps from synapse to synapse
C) Is conducted down the uninsulated parts of the dendrites
D) Travels faster than in an unmyelinated neuron
Ans: d

99. The effect of myelination on an axon's conduction speed is the equivalent of increasing an axon's diameter by:
A) 10 times
B) 25 times
C) 100 times
D) 2.5 times
Ans: c

100. Saltatory conduction occurs only in:
A) Myelinated dendrites
B) Myelinated axons
C) Unmyelinated dendrites
D) Unmyelinated neurons
Ans: b

101. Where can sodium ions enter a myelinated axon?
A) At the soma

B) Through the myelin sheath
C) At the nodes of Ranvier
D) At the point at which the axon divides and branches
Ans: c

102. The fact that action potentials occur only at the nodes of Ranvier is the basis for:
A) Increased energy consumption in myelinated neurons
B) Saltatory conduction
C) Slower conduction speed in myelinated neurons
D) Faster conduction speeds in unmyelinated neurons
Ans: b

103. As Shaniqua slowly lost motor function and suffered increasing sensory deficits, she could almost picture her ___ being destroyed by the ___.
A) glial cells, antibodies
B) myelin, macrophages
C) myelin, multiple sclerosis
D) axons, multiple sclerosis
Ans: c

104. As the action potential is conducted down the axon it:
A) Increases in size
B) Decreases in size
C) Remains constant in size
D) Decreases conduction velocity
Ans: c

105. A movement of the resting membrane potential from -70 mV to -65 mV would be termed a(n):
A) Hyperpolarization
B) Hypopolarization
C) Action potential
D) Subthreshold depolarization
Ans: b

106. A movement of the resting membrane potential from -70 mV to -90 mV would be termed a(n):
A) Hyperpolarization
B) Depolarization
C) Action potential
D) Threshold depolarization
Ans: a

107. Myelinated axons consume less energy because:
A) Action potentials occur faster
B) The sodium potassium pumps have less work to do

C) Graded potentials do not consume energy
D) The sodium potassium pumps are more efficient on these neurons
Ans: b

108. A disease that destroys myelin is:
A) Alzheimer's disease
B) Multiple sclerosis
C) Parkinson's disease
D) Neuropathy
Ans: b

109. Loss of myelin from neurons would be expected to:
A) Speed up neuronal conduction
B) Greatly impair neuronal conduction
C) Increase the amplitude of the action potential
D) Prevent the removal of dead nerve cells in the brain
Ans: b

110. Glial cells:
A) Guide new neurons in fetal development
B) Stimulate the development of synapses
C) Clean up cellular debris
D) All of the above
Ans: d

111. Glial cells are now known to release neurotransmitters such as ___as part of a modulating effect upon ___ activity.
A) glutamate, presynaptic
B) glutamate, postsynaptic
C) GABA, presynaptic
D) GABA, postsynaptic
Ans: a

112. All of the following are functions of glial cells *except*:
A) Insulating axons
B) Removing debris
C) Supplying neurons with protein production sites
D) Guiding the movement of neurons during prenatal development
Ans: c

113. Who first observed that individual neurons were in chemical contact with each other?
A) Golgi
B) Loewi
C) Cajal

D) Ranvier
Ans: b

114. The gap between two adjacent neurons was first observed by___ and is called the ___.
A) Golgi, synapse
B) Loewi, synaptic cleft
C) Cajal, synaptic cleft
D) Ranvier, synapse
Ans: c

115. Who first observed that neurons communicate at the synapse via chemicals?
A) Golgi
B) Loewi
C) Cajal
D) Fugu
Ans: b

116. If you have ever awoken from sleep to scribble down a brilliant idea, you can probably relate to ___, whose own sleep was interrupted with notes with an insight about ___.
A) Cajal, synaptic structures
B) Golgi, chemical transmission at the synapse
C) Loewi, chemical transmission at the synapse
D) Cajal, chemical transmission at the synapse
Ans: c

117. Where are vesicles stored?
A) The soma
B) The axon terminals
C) The synapse
D) The synaptic cleft
Ans: b

118. After a few too many cups of coffee and having to find a restroom, Sal ironically remembered the meaning of the term *vesicle*, as in:
A) "Need to urinate"
B) "Full bladder"
C) "Little bladder"
D) "Need to release"
Ans: d

119. The axon terminals of neurons:
A) Supply the cell with nutrients and oxygen
B) Provide insulation
C) Send electrical impulses

D) Release neurotransmitters from vesicles
E) Ans: d

120. ___ are released from axon terminals and are detected by receptors on an adjacent neuron.
A) Hormones
B) Neurotransmitters
C) Neurotoxins
D) Pheromones
Ans: b

121. The release of neurotransmitter from axon terminals into the synaptic cleft depends on:
A) The inflow of chloride ions
B) The opening of nodes of Ranvier
C) Reversal of the sodium-potassium pump
D) The entry of calcium ions from the extracellular fluid
Ans: d

122. While wiping away a "milk moustache," Nathan thought that not only does milk do a body good, but ___ is necessary for ___.
A) calcium ion intake, neurotransmitter release
B) calcium ion outflow, neurotransmitter release
C) calcium ion intake, neurotransmitter docking
D) calcium ion intake, neurotransmitter reuptake
Ans: a

123. Theneurotransmitter fits into a very precisely shaped location on the postsynaptic neuron called a:
A) Ion channel
B) Receptor
C) Neurotransmitter cleft
D) Synaptic cleft
Ans: b

124. The relationship between a neurotransmitter and its receptor is akin to a:
A) Hand and a glove
B) Hammer hitting a nail
C) Bug hitting a windshield
D) Key fitting into a lock
Ans: d

125. The neurotransmitter docks with a receptor site and:
A) Opens ion channels directly or indirectly
B) Opens ion channels directly
C) Induces ionic exchange between neurons
D) Initiates an action potential

Ans: a

126. Neurotransmitters that open ion channels do so by docking on ___.
A) the ion channel
B) a chemical receptor
C) an electrical receptor
D) a protein
Ans: b

127. The change in a neuron's potential caused by the arrival of neurotransmitter is called:
A) The postsynaptic potential
B) The presynaptic reverse potential
C) Axonic integration
D) Neural potentiation
Ans: a

128. Excitatory is to inhibitory as ___ is to ___.
A) potassium, chloride
B) hypopolarizing, hyperpolarizing
C) potassium, sodium
D) diffusion, electrical gradient
Ans: b

129. The type of postsynaptic potential produced by a neurotransmitter depends on which neurotransmitter is released and:
A) The type of receptor
B) Whether the receptor is chemical or electrical
C) The number of receptors
D) The amount of neurotransmitter present in the synapse
Ans: a

130. When your Aunt Desirae skeptically asks you how a stimulant can slow down and calm a hyperactive child, you try not to be too smug when you answer that stimulants:
A) Act as depressants on hyperactive children
B) Act to depress overactive frontal areas of the brain
C) Exert placebo effects
D) Have no such effect
Ans: b

131. If the resting potential changed from -70 mV to -90 mV this would be termed a(n) ___; this would occur as part of an ___.
A) hyperpolarization, IPSP
B) depolarization, EPSP
C) action potential, EPSP

D) threshold depolarization, IPSP
Ans: a

132. If the resting potential were to change from -70 mV to -60 mV, this would be termed a(n) ___; this would occur as part of an ___.
A) hyperpolarization, EPSP
B) hypopolarization, EPSP
C) action potential, IPSP
D) threshold depolarization, EPSP
Ans: b

133. During an EPSP:
A) Sodium ions enter the cell
B) Sodium ions leave the cell
C) Potassium ions enter the cell
D) Chloride ions leave the cell
Ans: a

134. During an IPSP:
A) Sodium ions enter the cell
B) Sodium ions leave the cell
C) Potassium ions exit the cell
D) None of the above
Ans: c

135. Most neurons fire spontaneously. EPSPs ___ the rate of firing and IPSPs ___ the rate of firing.
A) decrease, increase
B) increase, decrease
C) increase, have no effect upon
D) have no effect upon, have no effect upon
Ans: b

136. The rate at which a neuron fires depends on the number of:
A) Number of terminals of nearby interneurons
B) Relative strength of excitatory and inhibitory inputs it receives
C) Postsynaptic receptors on this neuron
D) Autoreceptors on this neuron
Ans: b

137. An excitatory synapse will produce hypopolarization potentials of as little as:
A) 10–12 mV
B) 1–2 mV
C) 0.2–0.4 mV
D) 0.5–1.0mV

Ans: c

138. A typical neuron in the brain may receive inputs from how many inputs?
    A) 500,000 to 1,000,000
    B) 1,000 to 100,000
    C) 100,000 to 2,000,000
    D) 1,000 to 5,000
    Ans: b

139. Where do graded potentials become action potentials?
    A) Dendritic spines
    B) Soma
    C) Synaptic cleft
    D) Axon hillock
    Ans: d

140. If different postsynaptic potentials occur at the same time but at different locations, ___ will occur.
    A) temporal summation
    B) simultaneous summation
    C) spatial summation
    D) synaptic summation
    Ans: c

141. At the last home football game, Joel started a taunting chant that slowly spread to more and more fans. Eventually, all those in the stadium picked up the chant and made a roar so deafening, the opposition had to call a timeout. What Joel and fellow fans performed is analogous to the process of ___ at axon hillocks.
    A) temporal summation
    B) spatial summation
    C) spatial integration
    D) temporal integration
    Ans: b

142. If postsynaptic potentials arrive at the same location but a short time apart, ___ will occur.
    A) temporal summation
    B) simultaneous summation
    C) synaptic summation
    D) neural summation
    Ans: a

143. During the industrial revolution, many lines of train tracks were laid down through the hard work of workers, who teamed up to nail in railroad ties. Each person in the group had to hit the nail once, in sequence, for it to be properly seated. This is most similar to:
    A) Temporal summation

B) Spatial summation
C) Neural propagation
D) Inhibitory recovery
Ans: b

144. Since neurons algebraically summate IPSPs and EPSPs to "decide" whether to fire, neurons have been referred to as:
A) Summators
B) Integrators
C) Information processors
D) Data analysis cells
Ans: b

145. Which of the following mechanisms of terminating transmitter action involves the reabsorption of a neurotransmitter by the axon terminals?
A) Deactivation
B) Diffusion
C) Reuptake
D) Active recycling by glial cells
Ans: c

146. Neurotransmitter action can be terminated by:
A) Deactivation of the transmitter by an enzyme
B) Reuptake into the axon terminal
C) Absorption of the neurotransmitter by glial cells
D) All of the above
Ans: d

147. While listening to drug users describe the subjective effects of cocaine, BJ took a few notes to himself to remember that cocaine's effects are due to blocking the:
A) Effects of serotonin
B) Reuptake of norepinephrine and dopamine
C) Reuptake of dopamine
D) Degradation of dopamine
Ans: c

148. The muscle disorder myasthenia gravis can be treated by:
A) Reducing the activity of acetylcholinesterase
B) Reducing ACh function in the brain
C) Removing ACh receptors on muscles
D) Growing additional ACh receptors on muscles
Ans: a

149. Elizabeth was hit hard by the news of her mother's diagnosis with myasthenia gravis. Although a very

serious and progressive disease, the good news is that her mother can be treated with drugs that ___ the action of ___.

A) facilitate, monoamine oxidase
B) facilitate, acetylcholinesterase
C) inhibit, acetylcholinesterase
D) inhibit, monoamine oxidase

Ans: c

150. Which of the following is true of autoreceptors?

A) Autoreceptors are located on postsynaptic membranes.
B) Autoreceptors detect the amount of neurotransmitter in the synaptic cleft.
C) Autoreceptors typically produce EPSPs.
D) Autoreceptors are cell receptors that facilitate enzymes.

Ans: b

151. ___ alters the output of ___.

A) The presynaptic neuron, the postsynaptic neuron
B) An autoreceptor, the presynaptic neuron
C) An autoreceptor, postsynaptic neuron
D) An autoreceptor, the sodium-potassium pump

Ans: b

152. Nicotinic and muscarinic receptors are two types of ___ receptors.

A) tobacco
B) serotonin
C) acetylcholine
D) dopamine

Ans: c

153. Muscles contain ___ receptors.

A) nicotinic
B) muscarinic
C) dopamine
D) serotonin

Ans: b

154. Nicotinic receptors are ___ and are found ___; muscarinic receptors are ___ and are found ___.

A) excitatory, in muscles and the brain, excitatory or inhibitory, more frequently in the digestive system
B) excitatory, in muscles and the brain, excitatory or inhibitory, more frequently in the brain
C) inhibitory, in muscles and the brain, excitatory or inhibitory, more frequently in the muscles
D) excitatory or inhibitory, in muscles and the brain, excitatory, more frequently in the digestive system

Ans: b

155. ___ is a hormone released during stress.
    A) Acetylcholine
    B) Serotonin
    C) Norepinephrine
    D) Substance P
    Ans: c

156. Anyone who carries an emergency bee sting kit might be surprised to learn it dispenses ___, which is a minor brain neurotransmitter as well as a hormone related to bodily stress.
    A) endorphins
    B) norepinephrine
    C) epinephrine
    D) noradrenalin
    Ans: c

157. Which transmitter is involved in schizophrenia and Parkinson's disease?
    A) Epinephrine
    B) Acetylcholine
    C) Dopamine
    D) Serotonin
    Ans: c

158. The primary function of an axoaxonic synapse is to:
    A) Block the opening of sodium ion channels during an EPSP
    B) Modulate the amount of transmitter released from the axon terminals
    C) Block the opening of potassium ion channels during an IPSP
    D) Modify the synthesis of presynaptic neurotransmitters
    Ans: b

159. Which of the following neurotransmitters has been related to the reinforcing action of drugs of abuse?
    A) Epinephrine
    B) Acetylcholine
    C) Dopamine
    D) Serotonin
    Ans: c

160. Two disease conditions associated with dopamine are:
    A) Depression and Parkinson's disease
    B) Parkinson's disease and Huntington's chorea
    C) Alzheimer's disease and schizophrenia
    D) Schizophrenia and Parkinson's disease
    Ans: d

161. Which of the following is the principal excitatory neurotransmitter in the brain?
    A) Norepinephrine
    B) GABA
    C) Dopamine
    D) Glutamate
    Ans: d

162. Which of the following is an inhibitory neurotransmitter in the spinal cord and lower brain?
    A) Glycine
    B) GABA
    C) Dopamine
    D) Glutamate
    Ans: b

163. Dale's principle stated that a neuron:
    A) Always released multiple neurotransmitters
    B) Always released only one neurotransmitter
    C) Never responded to its own autoreceptors
    D) Could be either electrical or chemical at its synapses
    Ans: b

164. A drug that mimics the effects of a neurotransmitter is called a(n):
    A) Agonist
    B) Antagonist
    C) Synergist
    D) Receptor blocker
    Ans: a

165. A drug that blocks the effects of a neurotransmitter is called a(n):
    A) Agonist
    B) Antagonist
    C) Synergist
    D) Receptor blocker
    Ans: b

166. The effect of acetylcholine on muscles can be prevented by ___.
    A) curare
    B) tetanus
    C) nicotine
    D) muscarine
    Ans: a

167. An antagonist for opiates is:
    A) Curare

B) Tetanus
C) Nicotine
D) Naloxone
Ans: d

168. Which of the following drugs is an agonist for acetylcholine?
A) Black widow spider venom
B) Botulinum toxin
C) Nicotine
D) Acetylcholinterase
Ans: c

169. In the nervous system, which of the following types of cells is most numerous?
A) Glia
B) Motor neurons
C) Sensory neurons
D) Interneurons
E) Ans: a

170. A neuron that transmits information between the central nervous system and a muscle is called a(n):
A) Motor neuron
B) Sensory neuron
C) Interneuron
D) Projection neuron
Ans: a

171. The *typical* resting potential of a neuron is about:
A) –70 V
B) –35 mV
C) 70 mV
D) –70 mV
Ans: d

172. Which of the following statements regarding the sodium-potassium pump is *false*?
A) It requires a lot of energy.
B) It works against the concentration gradient.
C) It pumps sodium into the cell.
D) It helps maintain the resting potential.
Ans: c

173. Depolarization means the same thing as:
A) Hypopolarization
B) Hyperpolarization
C) Action potential

D) Electrical gradient
Ans: a

174. The outflow of potassium ions during an action potential results in:
A) Hypopolarization
B) Hyperpolarization
C) Depolarization
D) Another action potential
Ans: b

175. Which of the following statements regarding the absolute refractory period is *false*?
A) The potassium channels are closed and cannot be opened.
B) The sodium channels are closed and cannot be opened.
C) An action potential cannot be generated.
D) The absolute refractory period ensures that the action potential will travel only in one direction.
Ans: a

176. The ___ the axon, the ___ is the conduction rate.
A) thicker, slower
B) thicker, faster
C) longer, slower
D) thinner, faster
Ans: b

177. When an action potential reaches an axon terminal, ___ enters the cell and triggers the release of neurotransmitter.
A) sodium
B) potassium
C) chloride
D) calcium
Ans: d

178. An IPSP will occur if:
A) Sodium channels open
B) Potassium channels open
C) Chloride channels open
D) B or C
Ans: d

179. Acetylcholine ceases to stimulate the post-synaptic cell by:
A) Reuptake by the presynaptic neuron
B) Absorption by the postsynaptic neuron
C) Enzymatic deactivation

D) Absorption by glial cells
Ans: c

180. Which of the following statements regarding nicotinic receptors is *false*?
A) They are inhibitory.
B) They are stimulated by acetylcholine.
C) They are found in the brain.
D) They are found in muscles.
Ans: a

181. The depolarization of the cell membrane produced when the threshold is reached results in which of the following?
A) Sodium ions entering the axon 500 times faster than normal
B) Potassium ions exiting the axon 500 times faster than normal
C) Sodium ions entering the axon 1,000 times faster than normal
D) Sodium ions entering the axon 700 times faster than normal
Ans: a

182. As myelin is lost from axons:
A) The capacitance increases
B) The distance that graded potentials can spread before dying out is reduced
C) Action potentials become less likely
D) All of the above
Ans: d

183. Glial cells contribute to the development and maintenance of neuronal connections; neurons form ___ times as many connections in the presence of glial cells.
A) two
B) fifty
C) thirty
D) seven
Ans: d

184. Identify the principal structures of a neuron and describe the functions of each.

185. Explain the forces that produce the resting membrane potential.

186. Describe the electrical and chemical events that initiate an action potential.

187. What is a graded potential? Contrast its role in myelinated and unmyelinated neurons.

188. Who was Otto Loewi, and what were his major findings? Describe the experiment he ran to prove that the synapse was a chemical connection.

189. Explain the all-or-none law in the generation of an action potential.

190. Explain how neurons encode the intensity of a stimulus.

191. Explain the advantages of saltatory conduction and how myelin contributes to it.

192. Explain the various functions of glial cells.

193. Explain the events that occur at a synapse, both in the presynaptic neuron and the postsynaptic neuron.

194. Compare and contrast EPSPs and IPSPs. How do EPSPs become an action potential?

195. Describe temporal and spatial summation in neurons.

196. Explain how neural excitation and or inhibition translate into effects on behavior.

197. Describe how the effects of a neurotransmitter are terminated.

198. Explain the different types of synapses and presynaptic excitation and inhibition.

199. Explain the terms *agonist* and *antagonist* using acetylcholine as an example.

200. Describe some diseases that are a result of either a problem with myelination or a problem with synaptic function.

201. An individual neuron can also be referred to as a nerve.
Ans: False

202. Sensory neurons move the muscles.
Ans: True

203. The most numerous neuron in the central nervous system is the interneuron.
Ans: False

204. The cell membrane is made of a single layer of lipid molecules.
Ans: False

205. Dendritic spines are places on axons where synapses occur.
Ans: True

206. Axons are the longest part of the neuron.
Ans: False

207. Synapses can occur only between axon terminals of one neuron.
Ans: False

208. The most common type of neuron in the nervous system is the bipolar neuron.
Ans: True

209. Most unipolar and bipolar neurons are sensory in nature.
Ans: False

210. A multipolar neuron is always a sensory neuron.
Ans: True

211. Neurons gather information, process it, and control muscle movements.
Ans: True

212. Transmitter substance is secreted from the axon terminals.
Ans: False

213. Transmitter substance is secreted from the dendritic spines.
Ans: True

214. The sodium-potassium pumps of a neuron are major consumers of energy.
Ans: False

215. When an action potential is transmitted, there is a measurable flow of ions down the transmitting axon.
Ans: False

216. The relative refractory period precedes the absolute refractory period.
Ans: True

217. Local potentials decay as they spread.
Ans: True

218. Fugu contains a sodium channel blocker.
Ans: False

219. Local anesthetics produce their effects via blockade of potassium ion channels.
Ans: False

220. Cone snail toxins are looking like promising new treatments for schizophrenia.
Ans: False

221. The most important supporting cells in the nervous system are the neurons.
Ans: True

222. One function of glial cells is to clean up the debris in the nervous system.
Ans: True

223. The myelin sheath is formed by either oligodendrocytes or Schwann cells.

Ans: False

224. Myelinated axons require more energy to transmit action potentials at faster rates of conduction.
Ans: False

225. An excitatory message received by a neuron decreases the likelihood that it will send a message down its axon.
Ans: True

226. The activity of excitatory synapses can be canceled by activity in inhibitory synapses.
Ans: True

227. Temporal summation and spatial summation always occur together.
Ans: False

228. Spatial summation, by definition, can only occur on a multipolar neuron.
Ans: True

229. Neurons gather information, process it, and control other neurons.
Ans: False

230. Axon terminals have never been observed to form synapses on the membranes of dendrites or soma.
Ans: False

231. Neurotransmitters are carried across the synaptic cleft by the sodium potassium pump.
Ans: True

232. Glycine is an inhibitory transmitter in the brain stem and spinal cord.
Ans: True

233. Dopamine plays a key role in drug abuse.
Ans: False

234. Substance P is an inhibitory neurotransmitter in the lower brain.

Ans: False

235. Electrical synapses appear to function to synchronize adjacent neurons.
Ans: True

236. Autoreceptors are located on the presynaptic membrane.
Ans: False

237. Reuptake and deactivation are two mechanisms that prolong cellular depolarization.
Ans: False

238. The IPSP produced by acetylcholine is terminated by reuptake.
Ans: False

239. Myasthenia gravis is the result of the loss of myelin.
Ans: False

240. Myasthenia gravis can be treated with monoamine oxidase.
Ans: True

241. The effects of curare and myasthenia gravis are the same in symptoms as well as involving acetylcholine synapses.
Ans: True

242. Conduction underneath the portions of axons covered by myelin is by graded potentials.
Ans: False

243. Neural networks are a group of neurons that are linked in series.
Ans: True

244. Detecting cancer cells in a biopsy is one use for artificial neural networks.
Ans: False