Chapter 2

Multiple Choice

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

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

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

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

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

6. Ninety percent of the cells in the brain are:
    A) Neurons
    B) Glial cells (*)
    C) Axonic cells
    D) Dendritic cells

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

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

9. ___ have a branched structure and receive stimulation from other neurons.
    A) Dendrites (*)

B) Axons
C) Glial cells
D) Soma

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

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

12. The largest part of a neuron is the:
    A) Soma (*)
    B) Axon
    C) Terminal
    D) Dendritic process

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

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

15. Axons in a human 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 (*)

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

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

18. The connection point between two neurons is called the:
    A) Terminal
    B) Axon

C) Soma
D) Synapse (*)

19. 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

20. 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

21. In motor neurons, the axon and the dendrites branch out from the soma in many directions, giving this type of neuron the designation of a ___ neuron.
    A) multi-fibered motor
    B) unipolar
    C) bipolar
    D) multipolar (*)

22. 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

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

24. 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

25. 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

26. 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 (*)

27. The most common type of neuron in the brain is the ___.
    A) motor neuron

B) unipolar neuron
C) interneuron (*)
D) multipolar neuron

28. 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

29. 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

30. 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

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

32. 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

33. 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

34. 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

35. 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

36. 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

37. 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 (*)

38. ___ are charged atoms that have gained or lost one or more electrons.
    A) Ions (*)
    B) Polarizations
    C) Electrolytes
    D) Positrons

39. Sodium ions are most concentrated in the ___ fluid.
    A) intracellular
    B) extracellular (*)
    C) intracellular and extracellular
    D) polarized

40. Potassium ions are most concentrated in the ___ fluid.
    A) intracellular (*)
    B) extracellular
    C) intracellular and extracellular
    D) non-polarized

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

42. 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

43. 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

44. ___ 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

45. ___ 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

46. 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

47. 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 (*)

48. 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

49. 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

50. The sodium-potassium pump accounts for ___ of the neuron's energy expenditure.
    A) 75%
    B) 40% (*)
    C) 25%
    D) 10%

51. 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

52. The ___ is the neuron's means of transmitting information over long distances.
    A) depolarizing potential
    B) repolarization
    C) action potential (*)
    D) graded potential

53. 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

54. 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

55. 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 (*)

56. 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

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

58. The change in electrical charge from –70 mV to the peak of the action potential is due to ___ and the change in electrical charge from the peak of +30 or +40 mV back to –70 mV 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 (*)

59. What ionic movement is responsible for pulling the membrane potential back to a negative voltage during an action 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. (*)

60. An action potential from beginning to end lasts about:
A) 1 second
B) 1 millisecond (*)
C) 1 microsecond
D) 10 milliseconds

61. 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

62. 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

63. Graded potentials decrease in size as they spread; the term for this is:
    A) Non-decremental
    B) All or none
    C) Decremental (*)
    D) Graded polarization

64. Partial depolarizations fade in intensity the farther they are from the point of maximal voltage change; these depolarizations are known as:
    A) Small scale potentials
    B) Micro potentials
    C) Graded potentials (*)
    D) Nano potentials

65. 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

66. Electricity flowing in power lines drops in voltage over distance, requiring your power company to use transformers to boost the voltage back to the original amplitude. This loss over distance is similar to the behavior of ___ potentials.
    A) hyperpolarizing
    B) non-decremental
    C) action
    D) graded (*)

67. An action potential occurs at a specific amplitude for that neuron, regardless of the stimulus intensity or how much higher than threshold the stimulus is; this is known as the:
    A) Principle of mass action
    B) All-or-none law (*)
    C) Rate law
    D) Law of equipotentiality

68. 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 amplitude of the stimulus that started it. (*)
    D) The frequency at which a neuron fires is independent of the intensity of the stimulus.

69. 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

70. 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

71. 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

72. 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 (*)

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

74. Various toxins from snakes, scorpions, and fish are called ___ because of their sites of action in the nervous system.
A) neural blockers
B) neuroantagonists
C) neurotoxins (*)
D) nociceptors

75. 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 (*)

76. 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

77. 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 (*)

78. 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

79. 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

80. 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

81. The gourmet diner who wants to play Russian roulette with his or her dinner might choose to dine on ___, which if improperly prepared might contain a powerful and fatal neurotoxin called tetrodotoxin.
    A) fugu (*)
    B) sushi
    C) umami
    D) focaccia

82. 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

83. 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

84. 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 (*)

85. 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 (*)

86. 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 (*)

87. 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 (*)

88. 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

89. 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

90. 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

91. 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

92. 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

93. The cells that produce myelin in the central nervous system are called:
    A) Ranvier cells
    B) Astrocytes
    C) Oligodendrocytes (*)
    D) Schwann cells

94. The cells that produce myelin in the peripheral nervous system are called:
    A) Ranvier cells
    B) Node cells
    C) Oligodendrocytes
    D) Schwann cells (*)

95. 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 (*)

96. 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.

97. 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 (*)

98. 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

99. Saltatory conduction occurs only in:
    A) Myelinated dendrites
    B) Myelinated axons (*)
    C) Unmyelinated dendrites
    D) Unmyelinated neurons

100. 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

101. 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

102. As Francine 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

103. 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

104. 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) Superthreshold depolarization

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

106. Myelinated axons consume less energy than unmyelinated axons 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

107. A disease that destroys myelin is:
A) Alzheimer's disease
B) Multiple sclerosis (*)
C) Parkinson's disease
D) Neuropathy

108. 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

109. 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 (*)

110. 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

111. 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

112. Who first observed that individual neurons were in chemical contact with each other?
A) Golgi
B) Loewi (*)
C) Cajal
D) Ranvier

113. The gap between two adjacent neurons was first observed by___. Later, this gap was named the ___.
A) Golgi, synapse
B) Loewi, synaptic cleft
C) Cajal, synaptic cleft (*)
D) Ranvier, synapse

114. Who first observed that neurons communicate at the synapse via chemicals?
    A) Golgi
    B) Loewi (*)
    C) Cajal
    D) Fugu

115. 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

116. Where are vesicles stored?
    A) The soma
    B) The axon terminals (*)
    C) The synapse
    D) The synaptic cleft

117. 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"

118. 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 (*)

119. ___ are released from axon terminals and are detected by protein receptors on an adjacent neuron.
    A) Hormones
    B) Neurotransmitters (*)
    C) Neurotoxins
    D) Pheromones

120. 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 (*)

121. 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

122. The neurotransmitter fits into a very precisely shaped location on the postsynaptic neuron called a:
    A) Ion channel
    B) Receptor (*)
    C) Neurotransmitter cleft

D) Synaptic cleft

123. 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 (*)

124. 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

125. 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

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

127. Excitatory is to inhibitory as ___ is to ___.
A) potassium; chloride
B) hypopolarizing; hyperpolarizing (*)
C) potassium; sodium
D) diffusion; electrical gradient

128. 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

129. 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 stimulate underactive frontal areas of the brain (*)
C) Exert placebo effects
D) Have no such effect

130. If the resting potential changed from -70 mV to -75 mV this would be termed a(n) ___; this would occur as part of an ___.
A) hyperpolarization; IPSP (*)
B) hypopolarization; EPSP
C) action potential; EPSP
D) threshold depolarization; IPSP

131. If the resting potential were to change from -70 mV to -65 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

132. 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

133. 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

134. 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

135. The rate at which a neuron fires depends on the:
A) number of terminals of nearby interneurons
B) relative strength of excitatory and inhibitory inputs it receives (*)
C) number of postsynaptic receptors on this neuron
D) number of autoreceptors on this neuron

136. 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) 0.01–0.02 mV

137. A typical neuron in the brain receives input from how many other neurons?
A) 1,000,000
B) 100,000
C) 10,000
D) 1,000 (*)

138. Where do graded potentials get converted into action potentials on the neuron?
A) Dendritic spines
B) Soma
C) Synaptic cleft
D) Axon hillock (*)

139. If different postsynaptic potentials occur at the same time but from different inputs, ___ will occur.
A) temporal summation
B) simultaneous summation
C) spatial summation (*)
D) synaptic summation

140. 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

141. If postsynaptic potentials arrive from the same input and a short time apart, ___ will occur.
A) temporal summation (*)
B) simultaneous summation
C) synaptic summation
D) neural summation

142. Kerry wanted her son Alex to clean up his room for several days. Frustrated from the lack of response from Alex, she started asking him to clean his room every 3 minutes. Finally, he cleaned up his room because he didn't want to hear his mother's repeated requests anymore. His response is analogous to the process of ___ at axon hillocks.
A) Temporal summation
B) Spatial summation (*)
C) Neural propagation
D) Inhibitory recovery

143. 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

144. 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

145. 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 (*)

146. 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

147. The muscle disorder myasthenia gravis can be treated by:
A) Reducing the activity of acetylcholinesterase (AchE) (*)
B) Reducing acetylcholine function in the brain
C) Removing acetylcholine receptors on muscles
D) Growing additional acetylcholine receptors on muscles

148. 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

149. 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.

150. ___ 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

151. Nicotinic and muscarinic receptors are two types of ___ receptors.
A) tobacco
B) serotonin
C) acetylcholine (*)
D) dopamine

152. Muscles contain ___ receptors.
A) nicotinic
B) muscarinic (*)
C) dopamine
D) serotonin

153. 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

154. ___ is a hormone that is involved in stress, attention, and arousal.
A) Acetylcholine
B) Serotonin
C) Norepinephrine (*)
D) Substance P

155. 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

156. Which transmitter is implicated in schizophrenia and Parkinson's disease?
A) Epinephrine
B) Acetylcholine
C) Dopamine (*)
D) Serotonin

157. 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

158. Which of the following neurotransmitters has been related to the reinforcing action of food, sex, and abused drugs?
    A) Epinephrine
    B) Acetylcholine
    C) Dopamine (*)
    D) Serotonin

159. 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 (*)

160. Which of the following is the principal excitatory neurotransmitter in the brain?
    A) Norepinephrine
    B) GABA
    C) Dopamine
    D) Glutamate (*)

161. Which of the following is an inhibitory neurotransmitter in the spinal cord and lower brain?
    A) Glycine
    B) GABA (*)
    C) Dopamine
    D) Glutamate

162. Dale's principle, a recently discounted theory about synaptic function, stated that a neuron:
    A) Released multiple neurotransmitters
    B) Only released a single neurotransmitter (*)
    C) Never responded to its own autoreceptors
    D) Could be either electrical or chemical at its synapses

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

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

165. The effect of acetylcholine on muscles can be prevented by the antagonist ___.
    A) curare (*)
    B) tetanus
    C) nicotine
    D) muscarine

166. An antagonist for opiates is:

A) Curare
B) Tetanus
C) Nicotine
D) Naloxone (*)

167. Which of the following drugs is an agonist for acetylcholine?
A) Black widow spider venom
B) Botulinum toxin
C) Nicotine (*)
D) Acetylcholinterase

168. In the nervous system, which of the following types of cells is most numerous?
A) Glia (*)
B) Motor neurons
C) Sensory neurons
D) Interneurons

169. 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

170. The *typical* resting potential of a neuron is about:
A) –70 V
B) –35 mV
C) +70 mV
D) –70 mV (*)

171. 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

172. Depolarization means the same thing as:
A) Hypopolarization (*)
B) Hyperpolarization
C) Action potential
D) Electrical gradient

173. The outflow of potassium ions during an action potential results in:
A) Hypopolarization
B) Hyperpolarization (*)
C) Depolarization
D) Another action potential

174. 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) It ensures that the action potential will travel only in one direction.

175. The ___ the axon, the ___ is the conduction rate.
A) thicker; slower
B) thicker; faster (*)

C) longer; slower
D) thinner; faster

176. When an action potential reaches an axon terminal, ___ enters the cell and triggers the release of neurotransmitter from presynaptic vesicles.
A) sodium
B) potassium
C) chloride
D) calcium (*)

177. An IPSP will occur if:
A) Sodium channels open
B) Potassium channels open
C) Calcium channels open
D) Iodine channels open

178. 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

179. 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

180. 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

181. 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 (*)

182. Glial cells contribute to the development and maintenance of neuronal connections; neurons form ___ times as many connections in the presence of glial cells.
A) 2
B) 7 (*)
C) 30
D) 100

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

184. Explain the two forces that produce the resting membrane potential.

185. Describe the electrical and chemical events that underlie an action potential.

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

187. Who was Otto Loewi? Describe the experiment he ran to prove that the synapse was a chemical connection. What were his major findings?

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

189. How do neurons encode the intensity of a stimulus.

190. What are the advantages of saltatory conduction and how myelin contributes to it.

191. Name and describe the functions of different types of glial cells.

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

193. Compare and contrast EPSPs and IPSPs. How do they contribute to triggering an action potential?

194. Describe temporal and spatial summation in neurons.

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

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

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

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

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

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

201. Sensory neurons move the muscles.
Ans: False

202. The most numerous neuron in the central nervous system is the interneuron.
Ans: True

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

204. Axons are the longest part of the neuron.
Ans: True

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

206. The most common type of neuron in the nervous system is the bipolar neuron.
Ans: False

207. Most unipolar and bipolar neurons are sensory in nature.
Ans: True

208. A multipolar neuron is always a sensory neuron.
Ans: False

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

210. Transmitter substance is secreted from the axon terminals.
Ans: True

211. Transmitter substance is secreted from the dendritic spines.
Ans: False

212. The sodium-potassium pumps of a neuron are major consumers of energy.
Ans: True

213.The relative refractory period precedes the absolute refractory period.
Ans: False

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

215.Fugu contains a sodium channel blocker.
Ans: True

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

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

218.The most important supporting cells in the nervous system are the neurons.
Ans: False

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

220.The myelin sheath is formed by either oligodendrocytes or Schwann cells.
Ans: True

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

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

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

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

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

226.Neurons gather information, process it, and control other neurons.

Ans: True

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

228. Neurotransmitters are carried across the synaptic cleft by the sodium potassium pump.
Ans: False

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

230. Dopamine plays a key role in drug abuse.
Ans: True

231. Substance P is an inhibitory neurotransmitter in the lower brain.
Ans: False

232. Autoreceptors are located on the presynaptic membrane.
Ans: True

233. Reuptake and inactivation are two mechanisms that prolong synaptic responses.
Ans: False

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

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

236. Myasthenia gravis can be treated with the enzyme monoamine oxidase.
Ans: False

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

238. Conduction underneath the portions of axons covered by myelin is by graded potentials.
Ans: True

239. Neural networks are a group of neurons that function together to carry out a process.
Ans: True

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