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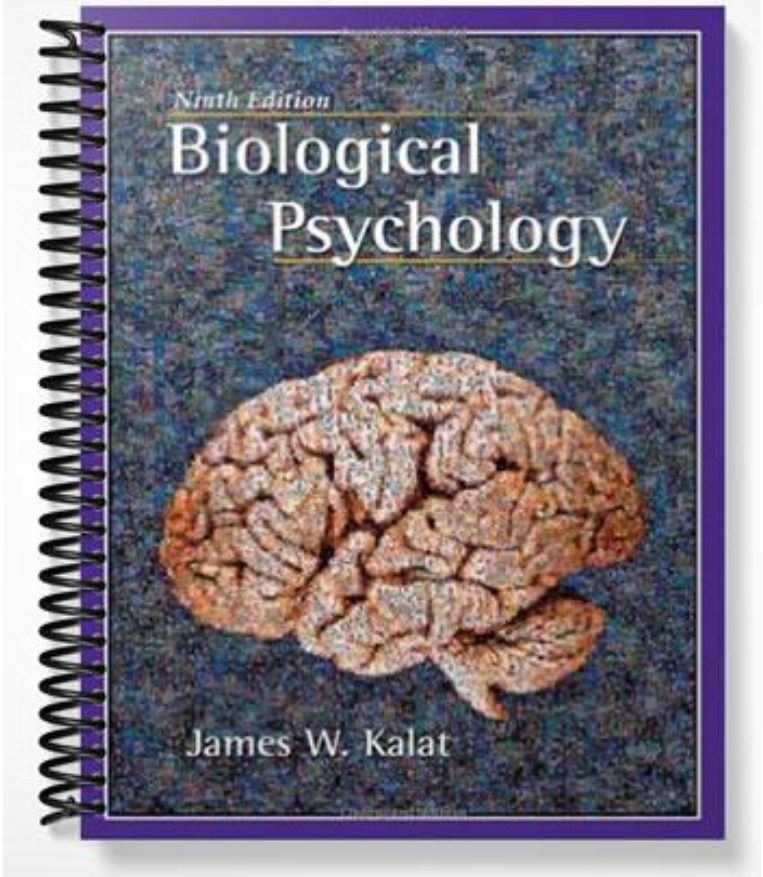

Chapter 2: Nerve Cells and Nerve Impulses

Student: _____

1. A small gap is usually present between neurons.
True False

2. Most chemicals can easily cross the cell membrane of a neuron.
True False

3. Small, uncharged molecules can easily cross the cell membrane.
True False

4. Ribosomes are the sites where cells produce new proteins.
True False

5. Motor neurons receive input from muscle cells.
True False

6. The greater the surface area of a dendrite, the more information it can receive from other neurons.
True False

7. The general rule among neurons is that the wider the branching, the fewer connections with other neurons.
True False

8. Neurons can have any number of dendrites, but no more than one axon.
True False

9. Motor neurons are always efferent from the nervous system.
True False

10. The function of a neuron is closely related to its shape.
True False

11. There are more glial cells than neurons in the human brain.
True False

12. Glial cells transmit information across long distances.
True False

13. Schwann cells build the myelin sheaths in the periphery of the body.
True False

14. The blood-brain barrier is made up of closely packed glial cells.
True False

15. The primary source of energy used by the brain is fat.
True False

16. One disadvantage of the blood-brain barrier is that it keeps out most forms of nutrition.
True False

17. At rest, the inside of a neuron's membrane is more negative than the outside.
True False

18. Increasing the electrical gradient for potassium would reduce the tendency for potassium ions to exit the neuron.
True False

19. The sodium-potassium pump is what normally brings the membrane back to its original state of polarization after the peak of the action potential.
True False

20. If a drug was given that temporarily inactivated the sodium-potassium pumps, action potentials would cease immediately.
True False

21. A prolonged increase in the permeability of the membrane to sodium ions would interfere with a neuron's ability to have an action potential.
True False

22. Additional stimulation beyond the threshold of excitation will result in a greater depolarization of the membrane during an action potential.
True False

23. Dendrites and cell bodies are capable of producing action potentials.
True False

24. In a myelinated axon, sodium channels are absent in the nodes of Ranvier.
True False

25. Santiago Ramon y Cajal demonstrated that:
A. at rest, the neuron has a negative charge inside its membrane.
B. neurons are separate from one another.
C. neurons communicate at specialized junctions called synapses.
D. action potentials follow the all-or-none law.

26. Who was the first researcher to demonstrate that neurons are separate from one another?
A. Curt P. Richter
B. Santiago Ramon y Cajal
C. Charles S. Sherrington
D. Jose Delgado

27. Prior to the work of Santiago Ramon y Cajal, what did many investigators believe?
A. Nerves conducted impulses at the speed of light.
B. Transmission across a synapse was just as fast as transmission along an axon.
C. The tip of an axon physically merged with the next neuron.
D. All neurons were of similar size and shape.

28. What are the two kinds of cells in the nervous system?
A. neurons and glia
B. dendrites and axons
C. ribosomes and lysosomes
D. neurons and axons

29. Which of the following contributed most to Cajal's ability to find that neurons are separate from one another?
A. Charles Sherrington's study of reflexes
B. Camillo Golgi's cell staining method
C. Perves & Hadley's dye injection method
D. Galileo's invention of the telescope

30. Neurons differ most strongly from other body cells in their:
A. temperature.
B. shape.
C. osmotic pressure.
D. mitochondria.

31. What structure is composed of two layers of fat molecules that are free to flow around one another?
A. the endoplasmic reticulum
B. a ribosome
C. a mitochondrion
D. the membrane

32. Which chemicals flow most freely across a cell membrane?
A. proteins, fats, and carbohydrates
B. positively charged ions
C. water, oxygen, and carbon dioxide
D. calcium and magnesium

33. Chemicals than cannot flow freely across a cell membrane enter a neuron through:
A. a Golgi complex.
B. specialized protein channels.
C. the endoplasmic reticulum.
D. gaps in the myelin sheath.

34. The structure that contains the chromosomes is called the:
A. endoplasmic reticulum.
B. nucleus.
C. mitochondrion.
D. ribosome.

35. Which of the following is most likely to cross the cell membrane by simple diffusion?
A. large proteins
B. small, charged ions
C. small, uncharged molecules
D. large, charged ions

36. The cell membrane is comprised of two layers of:
A. protein.
B. fat.
C. carbohydrate.
D. plasma.

37. Small, charged molecules can cross the cell membrane through:
A. diffusion.
B. ribosomes.
C. mitochondria.
D. protein channels.

38. Where do the metabolic activities occur that provide energy for all of the other activities of the cell?
A. mitochondria
B. ribosomes
C. lysosomes
D. Golgi complexes

39. Ribosomes are the part of a cell that:
A. performs metabolic activities.
B. breaks down harmful chemicals.
C. transports proteins.
D. synthesizes new proteins.

40. The sites at which the cell synthesizes new protein molecules are called:
A. mitochondria.
B. endoplasmic reticula.
C. ribosomes.
D. plasma membranes.

41. The endoplasmic reticulum is a:
A. network of thin tubes that transport newly synthesized proteins.
B. site where the cell synthesizes new protein molecules.
C. structure that separates the inside of the cell from the outside.
D. structure that contains the chromosomes.

42. The main feature that distinguishes a neuron from other animal cells is that a neuron has:
A. a larger nucleus.
B. a distinctive shape.
C. the ability to metabolize a variety of fuels.
D. a high internal concentration of sodium ions.

43. One of the most distinctive features of neurons compared to other types of cells is their:
A. shape.
B. number of mitochondria.
C. lack of a cell membrane.
D. size.

44. What receives excitation from other neurons and conducts impulses to muscle or gland cells?
A. sensory neurons
B. motor neurons
C. dendrites
D. dendritic spines

45. The branching fibers that form the information-receiving pole of the nerve cells are called:
A. motor neurons.
B. dendrites.
C. sensory neurons.
D. axons.

46. Sensory neurons:
A. are specialized at one end to be highly sensitive to particular types of stimulation.
B. receive excitation from other neurons and conduct impulses to muscle or gland cells.
C. are covered with an insulating material.
D. have branching fibers of constant diameter.

47. After building a snowman, you notice that your hands are cold. The type of neuron that carries information about the temperature of your hands to your spinal cord is a(n):
A. motor neuron.
B. sensory neuron.
C. interneuron.
D. intrinsic neuron.

48. The surface of a dendrite is lined with specialized junctions through which the dendrite receives information from other neurons. What are these junctions called?
A. synaptic receptors
B. axons
C. synaptic hillocks
D. glia

49. Which of the following is NOT a characteristic of a dendrite?
A. It tapers as it gets further from the cell body.
B. It is in contact with the dendrites of other neurons.
C. Its surface may be lined with synaptic receptors.
D. It receives information from other neurons or the environment.

50. What tends to open the sodium gates across a neuron's membrane?
A. hyperpolarization of the membrane
B. depolarization of the membrane
C. increase in the sodium concentration outside the neuron
D. passing the peak of the action potential and entering the refractory period

51. What happens to the ion gates when the membrane of a neuron starts to be depolarized?
A. Potassium gates close.
B. Chloride gates open.
C. Sodium gates close.
D. Sodium gates open.

52. Stimulus A depolarizes a neuron just barely above the threshold. Stimulus B depolarizes a neuron to 10 mV beyond threshold. What can we expect to happen?
A. Stimulus B will produce an action potential that is conducted at a faster speed than A.
B. Stimulus B will produce an action potential of greater magnitude than stimulus A.
C. Stimulus B will produce an action potential but stimulus A will not.
D. Stimulus A and stimulus B will produce the same response in the neurons.

53. If depolarization is less than the cell's threshold:
A. sodium is prevented from crossing the membrane.
B. potassium is prevented from crossing the membrane.
C. sodium crosses the membrane only slightly more than usual.
D. the cell will still produce an action potential.

54. Which of the following actions would depolarize a neuron?
A. increasing membrane permeability to sodium
B. increasing membrane permeability to potassium
C. decreasing membrane permeability to sodium
D. decreasing membrane permeability to calcium

55. The action potential of a neuron depends mostly on what movement of ions?
A. sodium ions entering the cell
B. sodium ions leaving the cell
C. potassium ions entering the cell
D. potassium ions leaving the cell

56. In the normal course of an action potential:
A. sodium channel remain open for long periods of time.
B. the concentration of sodium equalizes across the membrane.
C. sodium remains much more concentrated outside than inside the neuron.
D. subthreshold stimulation intensifies the action potential.

57. At the peak of the action potential, the electrical gradient of potassium:
A. is the same as during the resting potential.
B. pulls sodium into the cell.
C. pushes potassium out of the cell.
D. pulls potassium into the cell.

58. When the potential across a membrane reaches threshold, the sodium channels:
A. open to let sodium enter the cell rapidly.
B. close to prevent sodium from entering the cell.
C. open to let sodium exit the cell rapidly.
D. close to prevent sodium from exiting the cell.

59. Voltage-activated channels are channels for which a change in the voltage across the membrane alters their:
A. permeability.
B. length.
C. number.
D. threshold.

60. Suppose we applied a drug to a neuron that caused its sodium gates to suddenly open wide. What would happen?
A. hyperpolarization of the membrane
B. an increase in the threshold
C. an action potential
D. nothing, because potassium gates would compensate

61. During the entire course of events from the start of an action potential until the membrane returns to its resting potential, what is the net movement of ions?
A. sodium in, potassium in
B. sodium out, potassium out
C. sodium in, potassium out
D. sodium out, potassium in

62. A drug that blocks the sodium gates of a neuron's membrane would:
A. decrease the threshold.
B. block the action potential.
C. cause repeated action potentials.
D. eliminate the refractory period.

63. After the peak of an action potential, what prevents sodium ions from continuing to enter the cell?
A. There is no longer a concentration gradient for sodium.
B. The sodium-potassium pump greatly increases its rate of activity.
C. All the available sodium ions have already entered the cell.
D. The sodium gates in the membrane close.

64. At what point do the sodium gates begin to close, shutting out further entry of sodium into the cell?
A. at the peak of the action potential
B. when the threshold is reached
C. at the end of the relative refractory period
D. when the concentration gradient for sodium is eliminated

65. Just after the peak of the action potential, what movement of ions restores the membrane to approximately the resting potential?
A. Sodium ions enter the cell.
B. Potassium ions enter the cell.
C. Potassium ions leave the cell.
D. Sodium ions travel down the axon.

66. What causes potassium ions to leave the axon just after the peak of the action potential?
A. a continuing concentration gradient and the opening of the potassium gates
B. an increase in the concentration gradient across the membrane
C. increased tendency of the sodium-potassium pump to pump potassium out
D. binding of potassium ions to proteins that leave at this time

67. A drug that decreases the flow of potassium through the potassium gates of the membrane would:
A. block action potentials.
B. increase the threshold of the membrane.
C. slow the return of the membrane to its resting potential.
D. cause the membrane to be hyperpolarized.

68. Local anesthetic drugs, such as Novocain, work by:
A. opening the potassium gates.
B. blocking the sodium gates.
C. inactivating the sodium-potassium pump.
D. decreasing blood flow to certain areas of the brain.

69. A drug would prevent an action potential if it:
A. lowers the threshold of the membrane.
B. blocks the movement of potassium across the membrane.
C. blocks the movement of sodium across the membrane.
D. increases the movement of sodium across the membrane.

70. Scorpion venom attacks the nervous system by:
A. opening sodium and potassium channels.
B. closing sodium and potassium channels.
C. inactivating the sodium-potassium pump.
D. opening sodium channels and closing potassium channels.

71. Which of the following represents the all-or-none law?
A. Every depolarization produces an action potential.
B. Every hyperpolarization produces an action potential.
C. The size of the action potential is independent of the strength of the stimulus that initiated it.
D. Every depolarization reaches the threshold, even if it fails to produce an action potential.

72. The all-or-none law states that:
A. a neuron produces an action potential of maximal strength, or none at all.
B. all neurons fire or none at all.
C. all neurons in a pathway fire at the same time, or none do.
D. all ions move in the same direction, or none do.

73. The all-or-none law applies to:
A. cell bodies of neurons.
B. dendrites.
C. axons.
D. all parts of a neuron.

74. The presence of an all-or-none law suggests that neurons can only convey different messages by changing their:
A. rate or pattern of action potentials.
B. size of action potentials.
C. speed of action potentials.
D. sodium-potassium pump activity.

75. According to the all-or-none law:
A. all neurons produce an action potential at the same time or none at all.
B. all of the extracellular sodium enters the axon, or none at all.
C. once an axon reaches threshold, the amplitude and velocity of an action potential are nearly equal each time.
D. neurons are either active all the time or not at all.

76. The primary feature of a neuron that prevents the action potential from traveling back from where it just passed is the:
A. concentration gradient.
B. refractory period.
C. sodium potassium pump.
D. phospholipid bilayer.

77. Under what conditions is it impossible for a stimulus to produce an action potential?
A. if the membrane is in its absolute refractory period
B. if it occurs at the same time as a hyperpolarizing stimulus
C. if sodium ions are more concentrated outside the cell than inside
D. if the potassium gates have been blocked

78. Which feature of a neuron limits the number of action potentials it can produce per second?
A. the threshold
B. the refractory period
C. saltatory conduction
D. the length of the axon

79. A neuron's sodium gates are firmly closed and the membrane cannot produce an action potential during:
A. the absolute refractory period.
B. the relative refractory period.
C. depolarization.
D. saltatory conduction.

80. Which function is NOT performed by glia?
A. removing waste materials
B. building myelin sheaths
C. transmitting information
D. guiding the growth of axons and dendrites

81. One type of glia helps synchronize the activity of axons. They are called:
A. oligodendrocytes.
B. astrocytes.
C. radial glia.
D. Schwann cells.

82. Which type of glia builds myelin sheaths around axons in the periphery of the body?
A. astrocytes.
B. Schwann cells.
C. oligodendrocytes.
D. radial glia.

83. Which of the following is NOT true of astrocytes?
A. They wrap around the presynaptic terminals of several axons.
B. They help synchronize the activity of the axons.
C. They remove waste material.
D. They make up the myelin sheaths in the periphery of the body.

84. Which type of glia remove waste material in the nervous system?
A. astrocytes
B. Schwann cells
C. oligodendrocytes
D. radial glia

85. Glial cells whose function most closely resembles that of the immune system are called:
A. oligodendrocytes.
B. Schwann cells.
C. microglia.
D. radio glia.

86. Radial glia:
A. guide the migration of neurons during embryonic development.
B. synchronize the activity of axons.
C. wrap around the presynaptic terminals of several axons.
D. build the myelin sheaths that surround and insulate certain axons.

87. Of the following, the most important consideration in developing a drug that will act in the brain is:
A. if the drug can be inexpensively manufactured.
B. if the drug will cross the blood-brain barrier.
C. how long the drug will act.
D. the number of people who will use the drug.

88. The risk of having part of the brain unprotected by the blood-brain barrier is:
A. it is invisible to brain imaging techniques.
B. it takes longer for drugs to work.
C. viruses or toxic chemicals are more likely to damage it.
D. the blood is poorly oxygenated.

89. What is the mechanism that prevents or slows some chemicals from entering the brain, while allowing others to enter?
A. a threshold
B. a blood-brain barrier
C. an endoplasmic wall
D. a differential-drug inhibitor

90. Drugs can cross the blood-brain barrier if they are soluble in:
A. proteins.
B. water.
C. fats.
D. alcohol.

91. Which would be MOST likely to cross the blood-brain barrier?
A. small, uncharged molecules
B. large, charged molecules
C. molecules that are not fat soluble
D. viruses

92. Which of the following molecules would be able to passively cross the blood-brain barrier?
A. small, uncharged molecules
B. large, charged molecules
C. glucose
D. amino acids

93. In the brain, an arrangement of endothelial cells:
A. has gaps large enough to allow the passage of molecules.
B. synthesizes neurotransmitters.
C. does not allow most molecules to pass because the cells are so tightly packed.
D. has gaps that are filled with enzymes that attack most blood chemicals.

94. The blood-brain barrier is most like a(n):
A. stone wall around a castle that is impermeable.
B. bullet-proof vest.
C. balloon that allows air molecules to escape through its wall.
D. unopened can of soda pop.

95. What happens to a virus that manages to cross the blood-brain barrier and enter the brain?
A. It is destroyed by natural killer cells.
B. It gets trapped in a neuron, then both are destroyed by natural killer cells.
C. It gets trapped in a glial cell, then both are destroyed by natural killer cells.
D. It stays in the nervous system throughout the person's life.

96. Molecules that can cross the blood-brain barrier are usually:
A. large, uncharged molecules, such as lactose.
B. large, charged molecules.
C. neurotransmitters, such as dopamine.
D. molecules which can dissolve in the fats of the capillary walls.

97. The major disadvantage of a blood-brain barrier is that:
A. many chemicals can easily diffuse into the brain.
B. it requires so much glucose to maintain it.
C. certain required chemicals must be actively transported.
D. viruses can’t escape.

98. How does glucose enter the brain?
A. It passes freely through the blood-brain barrier because it is fat-soluble.
B. It is pumped in by an active transport system.
C. It attaches to charged molecules in order to cross the blood-brain barrier.
D. It passes freely through the blood-brain barrier because it is water-soluble.

99. Compared to passive transport, the major disadvantage of active transport is that it:
A. can't transport chemicals out of the brain.
B. requires expenditure of energy.
C. transports glucose into the brain.
D. transports viruses into the brain.

100. What is the main source of nutrition for vertebrate neurons?
A. fats
B. glucose
C. sodium
D. complex carbohydrates

101. Why do neurons rely so heavily on glucose as their source of nutrition?
A. Neurons lack the enzymes necessary to metabolize other fuels.
B. Glucose is the only fuel that can be used even in the absence of vitamins.
C. Glucose is not used extensively by other parts of the body.
D. Other fuels do not readily cross the blood-brain barrier.

102. What are two requirements for the brain to metabolize glucose?
A. thiamine and oxygen
B. vitamin C and nitrogen
C. niacin and bicarbonate
D. riboflavin and iron

103. Why does the brain need thiamine?
A. to enable glucose to cross the blood-brain barrier
B. as a source of fuel in case there is not enough glucose
C. as a building block for making proteins
D. to enable it to metabolize glucose

104. If the brain does not have enough thiamine, what is it unable to do?
A. maintain its blood-brain barrier
B. pump glucose across the blood-brain barrier
C. produce certain neurotransmitters
D. metabolize glucose

105. Who is most likely to suffer from a thiamine deficiency?
A. alcoholics
B. heroin addicts
C. diabetics
D. infants

106. What leads to Korsakoff's syndrome?
A. thiamine deficiency resulting from alcoholism
B. glucose deficiency resulting from alcoholism
C. viruses that manage to cross the blood-brain barrier
D. glial cells that over-reproduce and increase pressure in the brain

107. Korsakoff's syndrome:
A. is marked by severe memory impairments.
B. results from too much thiamine.
C. results from lack of oxygen to the brain.
D. is due to a breakdown of the blood-brain barrier.

108. The membrane of a neuron is specialized to:
A. keep all types of intercellular chemicals from moving out of the neuron.
B. keep all types of extracellular chemicals from moving into the neuron.
C. control the exchange of chemicals between the inside and outside of the cell.
D. produce chains of fatty acids and proteins.

109. The membrane of a neuron is composed of ____ with ____ embedded in them.
A. carbohydrates; purines
B. fat molecules; proteins
C. proteins; neurotransmitters
D. benzene molecules; carbohydrates

110. What is the difference in voltage called that typically exists between the inside and the outside of a neuron?
A. concentration gradient
B. generator potential
C. resting potential
D. shock value

111. When you state that the neuron's membrane is polarized, you are referring to a difference in electrical potential between:
A. the axons and the dendrites.
B. the axon hillock and the cell body.
C. sodium ions and potassium ions.
D. the inside and the outside of the membrane.

112. The resting potential of a neuron refers to:
A. the net positive charge on the inside of the neuron.
B. ions which rest in one place in the cell.
C. the movement of ions to the outside of the neuron.
D. the net negative charge on the inside of the neuron.

113. What is the approximate resting potential of the inside of a neuron's membrane, relative to the outside?
A. -70 millivolts
B. +10 millivolts
C. 0 millivolts
D. +90 millivolts

114. Allowing only certain people to cross the street, and only at certain times. is comparable to a neuron’s ____ with respect to ions.
A. threshold of excitation
B. all-or-none law
C. resting potential
D. selective permeability

115. Once sodium ions are transported out of the neuron, they:
A. stay out.
B. immediately leak back in.
C. attract potassium ions.
D. are actively transported into axons.

116. When a neuron's membrane is at rest, which of the following molecules crosses through it MOST slowly?
A. potassium
B. sodium
C. water
D. carbon dioxide

117. When the neuronal membrane is at rest, the potassium channels:
A. permit potassium ions to pass quickly and easily.
B. permit potassium ions to pass slowly.
C. prohibit any movement of potassium ions.
D. help to open up the sodium channels.

118. When the neuronal membrane is at rest, the sodium channels:
A. permit sodium ions to pass quickly and easily.
B. permit potassium ions to cross instead of sodium.
C. are closed.
D. fluctuate rapidly between open and closed.

119. Which of the following describes selective permeability?
A. Ions can only travel in certain directions across the membrane.
B. Only certain molecules are allowed to cross the membrane freely.
C. Only certain types of stimulation will result in an action potential.
D. All molecules must pass through designated channels.

120. When a neuron's membrane is at rest, the concentration gradient tends to move sodium ____ the cell and the electrical gradient tends to move it ____ the cell.
A. into, into
B. into, out of
C. out of, into
D. out of, out of

121. When a neuron's membrane is at rest, the concentration gradient tends to move potassium ____ the cell and the electrical gradient tends to move it ____ the cell.
A. into, into
B. into, out of
C. out of, into
D. out of, out of

122. Which feature of a neuron does the sodium-potassium pump make possible?
A. the refractory period
B. the resting potential
C. selective permeability
D. saltatory conduction

123. Electrical gradients lead to what kind of movements?
A. the general movement of ions into the neuron
B. the general movement of ions out of the neuron
C. the movement of ions to areas having the same electrical charges
D. the movement of ions to areas having the opposite electrical charges

124. Under which conditions would the sodium-potassium pump be far less effective in creating a concentration gradient?
A. if dendrites were generally longer than axons
B. if the glia-to-neuron ratio were higher
C. if selective permeability of the membrane did not exist
D. if it were an active transport system that required energy

125. The net effect of each cycle of the sodium-potassium pump is to:
A. decrease the number of positively charged ions within the cell.
B. increase the number of positively charged ions within the cell.
C. decrease the number of positively charged ions outside the cell.
D. increase the number of negatively charged ions within the cell.

126. What is one major cause for the resting potential of a neuron's membrane?
A. a difference in size between axons and dendrites
B. a high permeability of the membrane to water molecules
C. the refractory period of the membrane
D. the sodium-potassium pump

127. The sodium-potassium pump pumps sodium ions ____ and potassium ions ____.
A. into the cell; into the cell
B. into the cell; out of the cell
C. out of the cell; out of the cell
D. out of the cell; into the cell

128. Under normal conditions the sodium-potassium pump moves:
A. two Na+ ions into a neuron for every three K+ ions it moves out.
B. three Na+ ions into a neuron for every three K+ ions it moves out.
C. three Na+ ions out of a neuron for every two K+ ions it moves in.
D. two Na+ ions out of a neuron for every three K+ ions it moves in.

129. The concentration gradient refers to:
A. the fact that the concentration of ions is greater on the inside of a neuron.
B. the fact that the concentration of ions is greater on the outside of a neuron.
C. the difference in distribution for various ions between the inside and outside of the membrane.
D. the negatively charged proteins inside the cell.

130. What is meant by the term "concentration gradient" with respect to neurons?
A. Sodium is more concentrated in the dendrites and potassium in the axon.
B. Negative charges are more concentrated outside the cell.
C. Sodium and potassium ions are more concentrated on opposite sides of the membrane.
D. Potassium is more concentrated in the dendrites and sodium in the axon.

131. Concentration gradients lead to what kind of movements?
A. the general movement of ions into the neuron
B. the general movement of ions out of the neuron
C. the movement of ions to areas of their highest concentrations
D. the movement of ions to areas of their lowest concentrations

132. Which of the following events would increase the concentration gradient of sodium?
A. decreased permeability to potassium ions
B. increased activity of the sodium potassium pump
C. increased membrane permeability to sodium ions
D. increased membrane permeability to chloride ions

133. The concentration gradient for potassium tends to:
A. draw potassium into the cell.
B. push chloride out of the cell.
C. push sodium out of the cell.
D. push potassium out of the cell.

134. Which of the following is NOT true for sodium ions when the cell is at resting potential?
A. Sodium ions remain outside the cell because the sodium- potassium pump drives them out.
B. Sodium gates are tightly closed.
C. Sodium tends to be driven into the neuron by the concentration gradient.
D. Sodium tends to be driven out of the neuron by the electrical gradient.

135. When the neuron is at rest, what is responsible for moving potassium ions OUT of the cell?
A. a concentration gradient
B. an electrical gradient
C. both a concentration gradient and an electrical gradient
D. the sodium-potassium pump

136. When the neuron is at rest, what is responsible for moving potassium ions into the cell?
A. concentration gradient
B. an electrical gradient
C. the sodium-potassium pump
D. both the sodium-potassium pump and electrical gradient

137. When a membrane is at rest, what attracts potassium ions to the inside of the cell?
A. an electrical gradient
B. a concentration gradient
C. both an electrical gradient and a concentration gradient
D. neither an electrical gradient nor a concentration gradient

138. When a membrane is at rest, what attracts sodium ions to the inside of the cell?
A. an electrical gradient
B. a concentration gradient
C. both an electrical gradient and a concentration gradient
D. neither an electrical gradient nor a concentration gradient

139. When the neuron is at rest, what is responsible for moving sodium ions out of the cell?
A. a concentration gradient
B. an electrical gradient
C. both a concentration gradient and an electrical gradient
D. the sodium-potassium pump

140. Which of the following is an advantage of having a resting potential?
A. The toxic effects of sodium are minimized inside the cell.
B. No energy is required to maintain it.
C. The cell is prepared to respond quickly to a stimulus.
D. All of the ions are maintained in equal concentrations throughout the cytoplasm.

141. Ordinarily, stimulation of a neuron takes place:
A. through hyperpolarization.
B. at the synapse.
C. in the mitochondria.
D. in the endoplasmic reticulum.

142. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a more negative potential?
A. hyperpolarization
B. depolarization
C. an action potential
D. a threshold

143. Hyperpolarization is:
A. increased polarization.
B. decreased polarization.
C. the threshold of the cell.
D. the resting potential of the cell.

144. Which of the following would produce a hyperpolarization of a neuron?
A. applying a negative charge inside the neuron with a microelectrode
B. applying a positive charge inside the neuron with a microelectrode
C. increasing the membrane's permeability to sodium
D. decreasing the membrane's permeability to potassium

145. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a potential slightly closer to zero?
A. hyperpolarization
B. depolarization
C. selective permeability
D. a refractory period

146. The neuron will produce an action potential only if the depolarization exceeds what level?
A. the threshold of excitation
B. the resting potential
C. hyperpolarization
D. the refractory period

147. A membrane produces an action potential whenever the potential across it reaches what level?
A. the resting potential
B. -90 mV
C. the threshold of excitation
D. the refractory period

148. If there is a depolarizing effect on a neuron, the result will be that the neuron will fire:
A. no matter how slight the effect.
B. forever.
C. only if it reaches threshold.
D. only if the cell is in its relative refractory period.

149. At what point do the sodium gates start to allow sodium into the neuron?
A. only when the threshold is surpassed
B. in response to any depolarization
C. in response to any hyperpolarization
D. sodium is always allowed in, the gates prevent it from going out

150. During the relative refractory period:
A. the sodium gates are firmly closed.
B. the sodium gates are reverting to their usual state.
C. the sodium gates are wide open.
D. the potassium gates are firmly closed.

151. Where do most action potentials begin?
A. in the dendrites
B. in the cell body
C. at the axon hillock
D. at the tip of the axon

152. What happens once an action potential starts?
A. It is conducted the rest of the way as an electrical current.
B. It needs additional stimulation to keep it going along the axon.
C. It increases in speed as it goes.
D. It is regenerated at other points along the axon.

153. What will affect the speed of an action potential?
A. the strength of the stimulus
B. the time since the last action potential
C. the length of the axon
D. the resistance of the membrane

154. What will NOT affect the speed of an action potential?
A. the presence of myelin
B. the diameter of the axon
C. the length of the axon
D. the number of sodium gates

155. How is the speed of an action potential down an unmyelinated axon BEST described?
A. the speed of electricity, regardless of the size of the axon
B. less than 1 meter per second, regardless of the size of the axon
C. faster in thin axons than in thick ones
D. faster in thick axons than in thin ones

156. Which two factors will affect the speed of an action potential?
A. the strength and frequency of the stimulus
B. the location of the cell body and the length of the axon
C. the length and diameter of the axon
D. the presence of myelin and the diameter of the axon

157. On which type of axon would action potentials travel the slowest?
A. a thin, myelinated axon
B. a thin, unmyelinated axon
C. a thick, myelinated axon
D. a thick, unmyelinated axon

158. What is to prevent an action potential from exciting the area behind it and starting a "rebound" action potential traveling the opposite direction?
A. the refractory period
B. the absence of sodium ions in the area behind it
C. the membrane can conduct action potentials in only one direction
D. nothing; such rebound action potentials occur routinely

159. The function of a myelin sheath is to:
A. prevent action potentials from traveling in the wrong direction.
B. increase the velocity of transmission along an axon.
C. increase the magnitude of an action potential.
D. provide a store of nutrients for the neuron.

160. If you were to stub your toe and feel the pressure a second or two before you feel the pain, then which of the following statements is most likely true?
A. Pain sensitive neurons are large and myelinated.
B. Pain sensitive neurons are longer.
C. Pressure sensitive neurons are small and lightly myelinated.
D. Pressure sensitive neurons are large and myelinated.

161. What are the nodes of Ranvier?
A. gates in the membrane that admit all ions freely
B. gaps in the myelin sheath
C. branching points in an axon
D. places where dendrites join the cell body

162. In a myelinated axon, where are sodium gates abundant?
A. in the areas covered by myelin
B. at the nodes of Ranvier
C. throughout the axon
D. only in the axon hillock

163. To what does saltatory conduction refer?
A. the production of an action potential by the movement of sodium ions
B. the transmission of an impulse along a myelinated axon
C. the transmission of impulses along dendrites
D. the transmission of an impulse between one neuron and another

164. Saltatory conduction ____ the velocity of action potentials, and ____ the amount of energy used by the neuron.
A. decreases; decreases
B. decreases; increases
C. increases; decreases
D. increases; increases

165. How does saltatory conduction affect energy use in a neuron?
A. It eliminates the need for action potentials.
B. It increases the duration of the refractory period.
C. It reduces the frequency of action potentials.
D. It reduces the work load for the sodium-potassium pump.

166. What disease is related to the destruction of myelin sheaths?
A. multiple sclerosis
B. cystic fibrosis
C. myasthenia gravis
D. Parkinson's disease

167. In what way is a myelinated axon that has lost its myelin (through disease) different from an axon that was never myelinated?
A. It has a smaller diameter.
B. It lacks sodium gates along parts of its surface.
C. It has a longer refractory period.
D. It has a much higher threshold.

168. Which of the following is missing in a small local neuron?
A. dendrites
B. cell body
C. action potentials
D. an electrical gradient across its membrane

169. Which of the following is NOT governed by the all-or-none law?
A. unmyelinated axons
B. myelinated axons
C. motor neurons
D. local neurons

170. In what direction does a local neuron transmit information?
A. through its dendrites to cell body to axon
B. through its axon to cell body to dendrites
C. only toward the cell body
D. equally well in any direction

171. Which of the following describes the transmission of information in a local neuron?
A. The signal decreases in strength as it travels.
B. The signal increases in strength as it travels.
C. The signal strength remains constant as it travels.
D. Local neurons do not transmit any information.

172. Why are local neurons more difficult to study?
A. There are so few of them, they are difficult to find.
B. They are so small.
C. They exist only in humans, so there are ethical considerations.
D. They die if separated from other neurons.

173. Which of the following is true of local neurons?
A. They exchange information with distant neurons.
B. They abide by the all-or-none principle.
C. The change in membrane potential increases as it travels.
D. They have short dendrites and axons.

174. A local neuron:
A. has an axon approximately a meter long.
B. conveys information to other neurons across great distances.
C. is a small neuron with no axon or a very short one.
D. has an axon with many branches far from the cell body.

175. Briefly describe the structure of the blood-brain barrier and why it is important.

176. What would happen to the resting potential if a neuron's membrane was always completely permeable to charged ions?

177. Briefly describe the all-or-none law of action potentials.

Chapter 2: Nerve Cells and Nerve Impulses Key

1. A small gap is usually present between neurons.
TRUE

2. Most chemicals can easily cross the cell membrane of a neuron.
FALSE

3. Small, uncharged molecules can easily cross the cell membrane.
TRUE

4. Ribosomes are the sites where cells produce new proteins.
TRUE

5. Motor neurons receive input from muscle cells.
FALSE

6. The greater the surface area of a dendrite, the more information it can receive from other neurons.
TRUE

7. The general rule among neurons is that the wider the branching, the fewer connections with other neurons.
FALSE

8. Neurons can have any number of dendrites, but no more than one axon.
TRUE

9. Motor neurons are always efferent from the nervous system.
TRUE

10. The function of a neuron is closely related to its shape.
TRUE

11. There are more glial cells than neurons in the human brain.
TRUE

12. Glial cells transmit information across long distances.
FALSE

13. Schwann cells build the myelin sheaths in the periphery of the body.
TRUE

14. The blood-brain barrier is made up of closely packed glial cells.
FALSE

15. The primary source of energy used by the brain is fat.
FALSE

16. One disadvantage of the blood-brain barrier is that it keeps out most forms of nutrition.
TRUE

17. At rest, the inside of a neuron's membrane is more negative than the outside.
TRUE

18. Increasing the electrical gradient for potassium would reduce the tendency for potassium ions to exit the neuron.
TRUE

19. The sodium-potassium pump is what normally brings the membrane back to its original state of polarization after the peak of the action potential.
FALSE

20. If a drug was given that temporarily inactivated the sodium-potassium pumps, action potentials would cease immediately.
FALSE

21. A prolonged increase in the permeability of the membrane to sodium ions would interfere with a neuron's ability to have an action potential.
TRUE

22. Additional stimulation beyond the threshold of excitation will result in a greater depolarization of the membrane during an action potential.
FALSE

23. Dendrites and cell bodies are capable of producing action potentials.
FALSE

24. In a myelinated axon, sodium channels are absent in the nodes of Ranvier.
FALSE

25. Santiago Ramon y Cajal demonstrated that:
A. at rest, the neuron has a negative charge inside its membrane.
B. neurons are separate from one another.
C. neurons communicate at specialized junctions called synapses.
D. action potentials follow the all-or-none law.

26. Who was the first researcher to demonstrate that neurons are separate from one another?
A. Curt P. Richter
B. Santiago Ramon y Cajal
C. Charles S. Sherrington
D. Jose Delgado

27. Prior to the work of Santiago Ramon y Cajal, what did many investigators believe?
A. Nerves conducted impulses at the speed of light.
B. Transmission across a synapse was just as fast as transmission along an axon.
C. The tip of an axon physically merged with the next neuron.
D. All neurons were of similar size and shape.

28. What are the two kinds of cells in the nervous system?
A. neurons and glia
B. dendrites and axons
C. ribosomes and lysosomes
D. neurons and axons

29. Which of the following contributed most to Cajal's ability to find that neurons are separate from one another?
A. Charles Sherrington's study of reflexes
B. Camillo Golgi's cell staining method
C. Perves & Hadley's dye injection method
D. Galileo's invention of the telescope

30. Neurons differ most strongly from other body cells in their:
A. temperature.
B. shape.
C. osmotic pressure.
D. mitochondria.

31. What structure is composed of two layers of fat molecules that are free to flow around one another?
A. the endoplasmic reticulum
B. a ribosome
C. a mitochondrion
D. the membrane

32. Which chemicals flow most freely across a cell membrane?
A. proteins, fats, and carbohydrates
B. positively charged ions
C. water, oxygen, and carbon dioxide
D. calcium and magnesium

33. Chemicals than cannot flow freely across a cell membrane enter a neuron through:
A. a Golgi complex.
B. specialized protein channels.
C. the endoplasmic reticulum.
D. gaps in the myelin sheath.

34. The structure that contains the chromosomes is called the:
A. endoplasmic reticulum.
B. nucleus.
C. mitochondrion.
D. ribosome.

35. Which of the following is most likely to cross the cell membrane by simple diffusion?
A. large proteins
B. small, charged ions
C. small, uncharged molecules
D. large, charged ions

36. The cell membrane is comprised of two layers of:
A. protein.
B. fat.
C. carbohydrate.
D. plasma.

37. Small, charged molecules can cross the cell membrane through:
A. diffusion.
B. ribosomes.
C. mitochondria.
D. protein channels.

38. Where do the metabolic activities occur that provide energy for all of the other activities of the cell?
A. mitochondria
B. ribosomes
C. lysosomes
D. Golgi complexes

39. Ribosomes are the part of a cell that:
A. performs metabolic activities.
B. breaks down harmful chemicals.
C. transports proteins.
D. synthesizes new proteins.

40. The sites at which the cell synthesizes new protein molecules are called:
A. mitochondria.
B. endoplasmic reticula.
C. ribosomes.
D. plasma membranes.

41. The endoplasmic reticulum is a:
A. network of thin tubes that transport newly synthesized proteins.
B. site where the cell synthesizes new protein molecules.
C. structure that separates the inside of the cell from the outside.
D. structure that contains the chromosomes.

42. The main feature that distinguishes a neuron from other animal cells is that a neuron has:
A. a larger nucleus.
B. a distinctive shape.
C. the ability to metabolize a variety of fuels.
D. a high internal concentration of sodium ions.

43. One of the most distinctive features of neurons compared to other types of cells is their:
A. shape.
B. number of mitochondria.
C. lack of a cell membrane.
D. size.

44. What receives excitation from other neurons and conducts impulses to muscle or gland cells?
A. sensory neurons
B. motor neurons
C. dendrites
D. dendritic spines

45. The branching fibers that form the information-receiving pole of the nerve cells are called:
A. motor neurons.
B. dendrites.
C. sensory neurons.
D. axons.

46. Sensory neurons:
A. are specialized at one end to be highly sensitive to particular types of stimulation.
B. receive excitation from other neurons and conduct impulses to muscle or gland cells.
C. are covered with an insulating material.
D. have branching fibers of constant diameter.

47. After building a snowman, you notice that your hands are cold. The type of neuron that carries information about the temperature of your hands to your spinal cord is a(n):
A. motor neuron.
B. sensory neuron.
C. interneuron.
D. intrinsic neuron.

48. The surface of a dendrite is lined with specialized junctions through which the dendrite receives information from other neurons. What are these junctions called?
A. synaptic receptors
B. axons
C. synaptic hillocks
D. glia

49. Which of the following is NOT a characteristic of a dendrite?
A. It tapers as it gets further from the cell body.
B. It is in contact with the dendrites of other neurons.
C. Its surface may be lined with synaptic receptors.
D. It receives information from other neurons or the environment.

50. What tends to open the sodium gates across a neuron's membrane?
A. hyperpolarization of the membrane
B. depolarization of the membrane
C. increase in the sodium concentration outside the neuron
D. passing the peak of the action potential and entering the refractory period

51. What happens to the ion gates when the membrane of a neuron starts to be depolarized?
A. Potassium gates close.
B. Chloride gates open.
C. Sodium gates close.
D. Sodium gates open.

52. Stimulus A depolarizes a neuron just barely above the threshold. Stimulus B depolarizes a neuron to 10 mV beyond threshold. What can we expect to happen?
A. Stimulus B will produce an action potential that is conducted at a faster speed than A.
B. Stimulus B will produce an action potential of greater magnitude than stimulus A.
C. Stimulus B will produce an action potential but stimulus A will not.
D. Stimulus A and stimulus B will produce the same response in the neurons.

53. If depolarization is less than the cell's threshold:
A. sodium is prevented from crossing the membrane.
B. potassium is prevented from crossing the membrane.
C. sodium crosses the membrane only slightly more than usual.
D. the cell will still produce an action potential.

54. Which of the following actions would depolarize a neuron?
A. increasing membrane permeability to sodium
B. increasing membrane permeability to potassium
C. decreasing membrane permeability to sodium
D. decreasing membrane permeability to calcium

55. The action potential of a neuron depends mostly on what movement of ions?
A. sodium ions entering the cell
B. sodium ions leaving the cell
C. potassium ions entering the cell
D. potassium ions leaving the cell

56. In the normal course of an action potential:
A. sodium channel remain open for long periods of time.
B. the concentration of sodium equalizes across the membrane.
C. sodium remains much more concentrated outside than inside the neuron.
D. subthreshold stimulation intensifies the action potential.

57. At the peak of the action potential, the electrical gradient of potassium:
A. is the same as during the resting potential.
B. pulls sodium into the cell.
C. pushes potassium out of the cell.
D. pulls potassium into the cell.

58. When the potential across a membrane reaches threshold, the sodium channels:
A. open to let sodium enter the cell rapidly.
B. close to prevent sodium from entering the cell.
C. open to let sodium exit the cell rapidly.
D. close to prevent sodium from exiting the cell.

59. Voltage-activated channels are channels for which a change in the voltage across the membrane alters their:
A. permeability.
B. length.
C. number.
D. threshold.

60. Suppose we applied a drug to a neuron that caused its sodium gates to suddenly open wide. What would happen?
A. hyperpolarization of the membrane
B. an increase in the threshold
C. an action potential
D. nothing, because potassium gates would compensate

61. During the entire course of events from the start of an action potential until the membrane returns to its resting potential, what is the net movement of ions?
A. sodium in, potassium in
B. sodium out, potassium out
C. sodium in, potassium out
D. sodium out, potassium in

62. A drug that blocks the sodium gates of a neuron's membrane would:
A. decrease the threshold.
B. block the action potential.
C. cause repeated action potentials.
D. eliminate the refractory period.

63. After the peak of an action potential, what prevents sodium ions from continuing to enter the cell?
A. There is no longer a concentration gradient for sodium.
B. The sodium-potassium pump greatly increases its rate of activity.
C. All the available sodium ions have already entered the cell.
D. The sodium gates in the membrane close.

64. At what point do the sodium gates begin to close, shutting out further entry of sodium into the cell?
A. at the peak of the action potential
B. when the threshold is reached
C. at the end of the relative refractory period
D. when the concentration gradient for sodium is eliminated

65. Just after the peak of the action potential, what movement of ions restores the membrane to approximately the resting potential?
A. Sodium ions enter the cell.
B. Potassium ions enter the cell.
C. Potassium ions leave the cell.
D. Sodium ions travel down the axon.

66. What causes potassium ions to leave the axon just after the peak of the action potential?
A. a continuing concentration gradient and the opening of the potassium gates
B. an increase in the concentration gradient across the membrane
C. increased tendency of the sodium-potassium pump to pump potassium out
D. binding of potassium ions to proteins that leave at this time

67. A drug that decreases the flow of potassium through the potassium gates of the membrane would:
A. block action potentials.
B. increase the threshold of the membrane.
C. slow the return of the membrane to its resting potential.
D. cause the membrane to be hyperpolarized.

68. Local anesthetic drugs, such as Novocain, work by:
A. opening the potassium gates.
B. blocking the sodium gates.
C. inactivating the sodium-potassium pump.
D. decreasing blood flow to certain areas of the brain.

69. A drug would prevent an action potential if it:
A. lowers the threshold of the membrane.
B. blocks the movement of potassium across the membrane.
C. blocks the movement of sodium across the membrane.
D. increases the movement of sodium across the membrane.

70. Scorpion venom attacks the nervous system by:
A. opening sodium and potassium channels.
B. closing sodium and potassium channels.
C. inactivating the sodium-potassium pump.
D. opening sodium channels and closing potassium channels.

71. Which of the following represents the all-or-none law?
A. Every depolarization produces an action potential.
B. Every hyperpolarization produces an action potential.
C. The size of the action potential is independent of the strength of the stimulus that initiated it.
D. Every depolarization reaches the threshold, even if it fails to produce an action potential.

72. The all-or-none law states that:
A. a neuron produces an action potential of maximal strength, or none at all.
B. all neurons fire or none at all.
C. all neurons in a pathway fire at the same time, or none do.
D. all ions move in the same direction, or none do.

73. The all-or-none law applies to:
A. cell bodies of neurons.
B. dendrites.
C. axons.
D. all parts of a neuron.

74. The presence of an all-or-none law suggests that neurons can only convey different messages by changing their:
A. rate or pattern of action potentials.
B. size of action potentials.
C. speed of action potentials.
D. sodium-potassium pump activity.

75. According to the all-or-none law:
A. all neurons produce an action potential at the same time or none at all.
B. all of the extracellular sodium enters the axon, or none at all.
C. once an axon reaches threshold, the amplitude and velocity of an action potential are nearly equal each time.
D. neurons are either active all the time or not at all.

76. The primary feature of a neuron that prevents the action potential from traveling back from where it just passed is the:
A. concentration gradient.
B. refractory period.
C. sodium potassium pump.
D. phospholipid bilayer.

77. Under what conditions is it impossible for a stimulus to produce an action potential?
A. if the membrane is in its absolute refractory period
B. if it occurs at the same time as a hyperpolarizing stimulus
C. if sodium ions are more concentrated outside the cell than inside
D. if the potassium gates have been blocked

78. Which feature of a neuron limits the number of action potentials it can produce per second?
A. the threshold
B. the refractory period
C. saltatory conduction
D. the length of the axon

79. A neuron's sodium gates are firmly closed and the membrane cannot produce an action potential during:
A. the absolute refractory period.
B. the relative refractory period.
C. depolarization.
D. saltatory conduction.

80. Which function is NOT performed by glia?
A. removing waste materials
B. building myelin sheaths
C. transmitting information
D. guiding the growth of axons and dendrites

81. One type of glia helps synchronize the activity of axons. They are called:
A. oligodendrocytes.
B. astrocytes.
C. radial glia.
D. Schwann cells.

82. Which type of glia builds myelin sheaths around axons in the periphery of the body?
A. astrocytes.
B. Schwann cells.
C. oligodendrocytes.
D. radial glia.

83. Which of the following is NOT true of astrocytes?
A. They wrap around the presynaptic terminals of several axons.
B. They help synchronize the activity of the axons.
C. They remove waste material.
D. They make up the myelin sheaths in the periphery of the body.

84. Which type of glia remove waste material in the nervous system?
A. astrocytes
B. Schwann cells
C. oligodendrocytes
D. radial glia

85. Glial cells whose function most closely resembles that of the immune system are called:
A. oligodendrocytes.
B. Schwann cells.
C. microglia.
D. radio glia.

86. Radial glia:
A. guide the migration of neurons during embryonic development.
B. synchronize the activity of axons.
C. wrap around the presynaptic terminals of several axons.
D. build the myelin sheaths that surround and insulate certain axons.

87. Of the following, the most important consideration in developing a drug that will act in the brain is:
A. if the drug can be inexpensively manufactured.
B. if the drug will cross the blood-brain barrier.
C. how long the drug will act.
D. the number of people who will use the drug.

88. The risk of having part of the brain unprotected by the blood-brain barrier is:
A. it is invisible to brain imaging techniques.
B. it takes longer for drugs to work.
C. viruses or toxic chemicals are more likely to damage it.
D. the blood is poorly oxygenated.

89. What is the mechanism that prevents or slows some chemicals from entering the brain, while allowing others to enter?
A. a threshold
B. a blood-brain barrier
C. an endoplasmic wall
D. a differential-drug inhibitor

90. Drugs can cross the blood-brain barrier if they are soluble in:
A. proteins.
B. water.
C. fats.
D. alcohol.

91. Which would be MOST likely to cross the blood-brain barrier?
A. small, uncharged molecules
B. large, charged molecules
C. molecules that are not fat soluble
D. viruses

92. Which of the following molecules would be able to passively cross the blood-brain barrier?
A. small, uncharged molecules
B. large, charged molecules
C. glucose
D. amino acids

93. In the brain, an arrangement of endothelial cells:
A. has gaps large enough to allow the passage of molecules.
B. synthesizes neurotransmitters.
C. does not allow most molecules to pass because the cells are so tightly packed.
D. has gaps that are filled with enzymes that attack most blood chemicals.

94. The blood-brain barrier is most like a(n):
A. stone wall around a castle that is impermeable.
B. bullet-proof vest.
C. balloon that allows air molecules to escape through its wall.
D. unopened can of soda pop.

95. What happens to a virus that manages to cross the blood-brain barrier and enter the brain?
A. It is destroyed by natural killer cells.
B. It gets trapped in a neuron, then both are destroyed by natural killer cells.
C. It gets trapped in a glial cell, then both are destroyed by natural killer cells.
D. It stays in the nervous system throughout the person's life.

96. Molecules that can cross the blood-brain barrier are usually:
A. large, uncharged molecules, such as lactose.
B. large, charged molecules.
C. neurotransmitters, such as dopamine.
D. molecules which can dissolve in the fats of the capillary walls.

97. The major disadvantage of a blood-brain barrier is that:
A. many chemicals can easily diffuse into the brain.
B. it requires so much glucose to maintain it.
C. certain required chemicals must be actively transported.
D. viruses can’t escape.

98. How does glucose enter the brain?
A. It passes freely through the blood-brain barrier because it is fat-soluble.
B. It is pumped in by an active transport system.
C. It attaches to charged molecules in order to cross the blood-brain barrier.
D. It passes freely through the blood-brain barrier because it is water-soluble.

99. Compared to passive transport, the major disadvantage of active transport is that it:
A. can't transport chemicals out of the brain.
B. requires expenditure of energy.
C. transports glucose into the brain.
D. transports viruses into the brain.

100. What is the main source of nutrition for vertebrate neurons?
A. fats
B. glucose
C. sodium
D. complex carbohydrates

101. Why do neurons rely so heavily on glucose as their source of nutrition?
A. Neurons lack the enzymes necessary to metabolize other fuels.
B. Glucose is the only fuel that can be used even in the absence of vitamins.
C. Glucose is not used extensively by other parts of the body.
D. Other fuels do not readily cross the blood-brain barrier.

102. What are two requirements for the brain to metabolize glucose?
A. thiamine and oxygen
B. vitamin C and nitrogen
C. niacin and bicarbonate
D. riboflavin and iron

103. Why does the brain need thiamine?
A. to enable glucose to cross the blood-brain barrier
B. as a source of fuel in case there is not enough glucose
C. as a building block for making proteins
D. to enable it to metabolize glucose

104. If the brain does not have enough thiamine, what is it unable to do?
A. maintain its blood-brain barrier
B. pump glucose across the blood-brain barrier
C. produce certain neurotransmitters
D. metabolize glucose

105. Who is most likely to suffer from a thiamine deficiency?
A. alcoholics
B. heroin addicts
C. diabetics
D. infants

106. What leads to Korsakoff's syndrome?
A. thiamine deficiency resulting from alcoholism
B. glucose deficiency resulting from alcoholism
C. viruses that manage to cross the blood-brain barrier
D. glial cells that over-reproduce and increase pressure in the brain

107. Korsakoff's syndrome:
A. is marked by severe memory impairments.
B. results from too much thiamine.
C. results from lack of oxygen to the brain.
D. is due to a breakdown of the blood-brain barrier.

108. The membrane of a neuron is specialized to:
A. keep all types of intercellular chemicals from moving out of the neuron.
B. keep all types of extracellular chemicals from moving into the neuron.
C. control the exchange of chemicals between the inside and outside of the cell.
D. produce chains of fatty acids and proteins.

109. The membrane of a neuron is composed of ____ with ____ embedded in them.
A. carbohydrates; purines
B. fat molecules; proteins
C. proteins; neurotransmitters
D. benzene molecules; carbohydrates

110. What is the difference in voltage called that typically exists between the inside and the outside of a neuron?
A. concentration gradient
B. generator potential
C. resting potential
D. shock value

111. When you state that the neuron's membrane is polarized, you are referring to a difference in electrical potential between:
A. the axons and the dendrites.
B. the axon hillock and the cell body.
C. sodium ions and potassium ions.
D. the inside and the outside of the membrane.

112. The resting potential of a neuron refers to:
A. the net positive charge on the inside of the neuron.
B. ions which rest in one place in the cell.
C. the movement of ions to the outside of the neuron.
D. the net negative charge on the inside of the neuron.

113. What is the approximate resting potential of the inside of a neuron's membrane, relative to the outside?
A. -70 millivolts
B. +10 millivolts
C. 0 millivolts
D. +90 millivolts

114. Allowing only certain people to cross the street, and only at certain times. is comparable to a neuron's ____ with respect to ions.
A. threshold of excitation
B. all-or-none law
C. resting potential
D. selective permeability

115. Once sodium ions are transported out of the neuron, they:
A. stay out.
B. immediately leak back in.
C. attract potassium ions.
D. are actively transported into axons.

116. When a neuron's membrane is at rest, which of the following molecules crosses through it MOST slowly?
A. potassium
B. sodium
C. water
D. carbon dioxide

117. When the neuronal membrane is at rest, the potassium channels:
A. permit potassium ions to pass quickly and easily.
B. permit potassium ions to pass slowly.
C. prohibit any movement of potassium ions.
D. help to open up the sodium channels.

118. When the neuronal membrane is at rest, the sodium channels:
A. permit sodium ions to pass quickly and easily.
B. permit potassium ions to cross instead of sodium.
C. are closed.
D. fluctuate rapidly between open and closed.

119. Which of the following describes selective permeability?
A. Ions can only travel in certain directions across the membrane.
B. Only certain molecules are allowed to cross the membrane freely.
C. Only certain types of stimulation will result in an action potential.
D. All molecules must pass through designated channels.

120. When a neuron's membrane is at rest, the concentration gradient tends to move sodium ____ the cell and the electrical gradient tends to move it ____ the cell.
A. into, into
B. into, out of
C. out of, into
D. out of, out of

121. When a neuron's membrane is at rest, the concentration gradient tends to move potassium ____ the cell and the electrical gradient tends to move it ____ the cell.
A. into, into
B. into, out of
C. out of, into
D. out of, out of

122. Which feature of a neuron does the sodium-potassium pump make possible?
A. the refractory period
B. the resting potential
C. selective permeability
D. saltatory conduction

123. Electrical gradients lead to what kind of movements?
A. the general movement of ions into the neuron
B. the general movement of ions out of the neuron
C. the movement of ions to areas having the same electrical charges
D. the movement of ions to areas having the opposite electrical charges

124. Under which conditions would the sodium-potassium pump be far less effective in creating a concentration gradient?
A. if dendrites were generally longer than axons
B. if the glia-to-neuron ratio were higher
C. if selective permeability of the membrane did not exist
D. if it were an active transport system that required energy

125. The net effect of each cycle of the sodium-potassium pump is to:
A. decrease the number of positively charged ions within the cell.
B. increase the number of positively charged ions within the cell.
C. decrease the number of positively charged ions outside the cell.
D. increase the number of negatively charged ions within the cell.

126. What is one major cause for the resting potential of a neuron's membrane?
A. a difference in size between axons and dendrites
B. a high permeability of the membrane to water molecules
C. the refractory period of the membrane
D. the sodium-potassium pump

127. The sodium-potassium pump pumps sodium ions ____ and potassium ions ____.
A. into the cell; into the cell
B. into the cell; out of the cell
C. out of the cell; out of the cell
D. out of the cell; into the cell

128. Under normal conditions the sodium-potassium pump moves:
A. two Na+ ions into a neuron for every three K+ ions it moves out.
B. three Na+ ions into a neuron for every three K+ ions it moves out.
C. three Na+ ions out of a neuron for every two K+ ions it moves in.
D. two Na+ ions out of a neuron for every three K+ ions it moves in.

129. The concentration gradient refers to:
A. the fact that the concentration of ions is greater on the inside of a neuron.
B. the fact that the concentration of ions is greater on the outside of a neuron.
C. the difference in distribution for various ions between the inside and outside of the membrane.
D. the negatively charged proteins inside the cell.

130. What is meant by the term "concentration gradient" with respect to neurons?
A. Sodium is more concentrated in the dendrites and potassium in the axon.
B. Negative charges are more concentrated outside the cell.
C. Sodium and potassium ions are more concentrated on opposite sides of the membrane.
D. Potassium is more concentrated in the dendrites and sodium in the axon.

131. Concentration gradients lead to what kind of movements?
A. the general movement of ions into the neuron
B. the general movement of ions out of the neuron
C. the movement of ions to areas of their highest concentrations
D. the movement of ions to areas of their lowest concentrations

132. Which of the following events would increase the concentration gradient of sodium?
A. decreased permeability to potassium ions
B. increased activity of the sodium potassium pump
C. increased membrane permeability to sodium ions
D. increased membrane permeability to chloride ions

133. The concentration gradient for potassium tends to:
A. draw potassium into the cell.
B. push chloride out of the cell.
C. push sodium out of the cell.
D. push potassium out of the cell.

134. Which of the following is NOT true for sodium ions when the cell is at resting potential?
A. Sodium ions remain outside the cell because the sodium- potassium pump drives them out.
B. Sodium gates are tightly closed.
C. Sodium tends to be driven into the neuron by the concentration gradient.
D. Sodium tends to be driven out of the neuron by the electrical gradient.

135. When the neuron is at rest, what is responsible for moving potassium ions OUT of the cell?
A. a concentration gradient
B. an electrical gradient
C. both a concentration gradient and an electrical gradient
D. the sodium-potassium pump

136. When the neuron is at rest, what is responsible for moving potassium ions into the cell?
A. concentration gradient
B. an electrical gradient
C. the sodium-potassium pump
D. both the sodium-potassium pump and electrical gradient

137. When a membrane is at rest, what attracts potassium ions to the inside of the cell?
A. an electrical gradient
B. a concentration gradient
C. both an electrical gradient and a concentration gradient
D. neither an electrical gradient nor a concentration gradient

138. When a membrane is at rest, what attracts sodium ions to the inside of the cell?
A. an electrical gradient
B. a concentration gradient
C. both an electrical gradient and a concentration gradient
D. neither an electrical gradient nor a concentration gradient

139. When the neuron is at rest, what is responsible for moving sodium ions out of the cell?
A. a concentration gradient
B. an electrical gradient
C. both a concentration gradient and an electrical gradient
D. the sodium-potassium pump

140. Which of the following is an advantage of having a resting potential?
A. The toxic effects of sodium are minimized inside the cell.
B. No energy is required to maintain it.
C. The cell is prepared to respond quickly to a stimulus.
D. All of the ions are maintained in equal concentrations throughout the cytoplasm.

141. Ordinarily, stimulation of a neuron takes place:
A. through hyperpolarization.
B. at the synapse.
C. in the mitochondria.
D. in the endoplasmic reticulum.

142. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a more negative potential?
A. hyperpolarization
B. depolarization
C. an action potential
D. a threshold

143. Hyperpolarization is:
A. increased polarization.
B. decreased polarization.
C. the threshold of the cell.
D. the resting potential of the cell.

144. Which of the following would produce a hyperpolarization of a neuron?
A. applying a negative charge inside the neuron with a microelectrode
B. applying a positive charge inside the neuron with a microelectrode
C. increasing the membrane's permeability to sodium
D. decreasing the membrane's permeability to potassium

145. What is the result if a stimulus shifts the potential inside a neuron from the resting potential to a potential slightly closer to zero?
A. hyperpolarization
B. depolarization
C. selective permeability
D. a refractory period

146. The neuron will produce an action potential only if the depolarization exceeds what level?
A. the threshold of excitation
B. the resting potential
C. hyperpolarization
D. the refractory period

147. A membrane produces an action potential whenever the potential across it reaches what level?
A. the resting potential
B. -90 mV
C. the threshold of excitation
D. the refractory period

148. If there is a depolarizing effect on a neuron, the result will be that the neuron will fire:
A. no matter how slight the effect.
B. forever.
C. only if it reaches threshold.
D. only if the cell is in its relative refractory period.

149. At what point do the sodium gates start to allow sodium into the neuron?
A. only when the threshold is surpassed
B. in response to any depolarization
C. in response to any hyperpolarization
D. sodium is always allowed in, the gates prevent it from going out

150. During the relative refractory period:
A. the sodium gates are firmly closed.
B. the sodium gates are reverting to their usual state.
C. the sodium gates are wide open.
D. the potassium gates are firmly closed.

151. Where do most action potentials begin?
A. in the dendrites
B. in the cell body
C. at the axon hillock
D. at the tip of the axon

152. What happens once an action potential starts?
A. It is conducted the rest of the way as an electrical current.
B. It needs additional stimulation to keep it going along the axon.
C. It increases in speed as it goes.
D. It is regenerated at other points along the axon.

153. What will affect the speed of an action potential?
A. the strength of the stimulus
B. the time since the last action potential
C. the length of the axon
D. the resistance of the membrane

154. What will NOT affect the speed of an action potential?
A. the presence of myelin
B. the diameter of the axon
C. the length of the axon
D. the number of sodium gates

155. How is the speed of an action potential down an unmyelinated axon BEST described?
A. the speed of electricity, regardless of the size of the axon
B. less than 1 meter per second, regardless of the size of the axon
C. faster in thin axons than in thick ones
D. faster in thick axons than in thin ones

156. Which two factors will affect the speed of an action potential?
A. the strength and frequency of the stimulus
B. the location of the cell body and the length of the axon
C. the length and diameter of the axon
D. the presence of myelin and the diameter of the axon

157. On which type of axon would action potentials travel the slowest?
A. a thin, myelinated axon
B. a thin, unmyelinated axon
C. a thick, myelinated axon
D. a thick, unmyelinated axon

158. What is to prevent an action potential from exciting the area behind it and starting a "rebound" action potential traveling the opposite direction?
A. the refractory period
B. the absence of sodium ions in the area behind it
C. the membrane can conduct action potentials in only one direction
D. nothing; such rebound action potentials occur routinely

159. The function of a myelin sheath is to:
A. prevent action potentials from traveling in the wrong direction.
B. increase the velocity of transmission along an axon.
C. increase the magnitude of an action potential.
D. provide a store of nutrients for the neuron.

160. If you were to stub your toe and feel the pressure a second or two before you feel the pain, then which of the following statements is most likely true?
A. Pain sensitive neurons are large and myelinated.
B. Pain sensitive neurons are longer.
C. Pressure sensitive neurons are small and lightly myelinated.
D. Pressure sensitive neurons are large and myelinated.

161. What are the nodes of Ranvier?
A. gates in the membrane that admit all ions freely
B. gaps in the myelin sheath
C. branching points in an axon
D. places where dendrites join the cell body

162. In a myelinated axon, where are sodium gates abundant?
A. in the areas covered by myelin
B. at the nodes of Ranvier
C. throughout the axon
D. only in the axon hillock

163. To what does saltatory conduction refer?
A. the production of an action potential by the movement of sodium ions
B. the transmission of an impulse along a myelinated axon
C. the transmission of impulses along dendrites
D. the transmission of an impulse between one neuron and another

164. Saltatory conduction ____ the velocity of action potentials, and ____ the amount of energy used by the neuron.
A. decreases; decreases
B. decreases; increases
C. increases; decreases
D. increases; increases

165. How does saltatory conduction affect energy use in a neuron?
A. It eliminates the need for action potentials.
B. It increases the duration of the refractory period.
C. It reduces the frequency of action potentials.
D. It reduces the work load for the sodium-potassium pump.

166. What disease is related to the destruction of myelin sheaths?
A. multiple sclerosis
B. cystic fibrosis
C. myasthenia gravis
D. Parkinson's disease

167. In what way is a myelinated axon that has lost its myelin (through disease) different from an axon that was never myelinated?
A. It has a smaller diameter.
B. It lacks sodium gates along parts of its surface.
C. It has a longer refractory period.
D. It has a much higher threshold.

168. Which of the following is missing in a small local neuron?
A. dendrites
B. cell body
C. action potentials
D. an electrical gradient across its membrane

169. Which of the following is NOT governed by the all-or-none law?
A. unmyelinated axons
B. myelinated axons
C. motor neurons
D. local neurons

170. In what direction does a local neuron transmit information?
A. through its dendrites to cell body to axon
B. through its axon to cell body to dendrites
C. only toward the cell body
D. equally well in any direction

171. Which of the following describes the transmission of information in a local neuron?
A. The signal decreases in strength as it travels.
B. The signal increases in strength as it travels.
C. The signal strength remains constant as it travels.
D. Local neurons do not transmit any information.

172. Why are local neurons more difficult to study?
A. There are so few of them, they are difficult to find.
B. They are so small.
C. They exist only in humans, so there are ethical considerations.
D. They die if separated from other neurons.

173. Which of the following is true of local neurons?
A. They exchange information with distant neurons.
B. They abide by the all-or-none principle.
C. The change in membrane potential increases as it travels.
D. They have short dendrites and axons.

174. A local neuron:
A. has an axon approximately a meter long.
B. conveys information to other neurons across great distances.
C. is a small neuron with no axon or a very short one.
D. has an axon with many branches far from the cell body.

175. Briefly describe the structure of the blood-brain barrier and why it is important.

Tightly joined endothelial cells form the capillary walls in the brain, making the blood-brain barrier. This protects the brain from harmful viruses, bacteria, and chemicals that might otherwise be able to enter the brain and cause damage.

176. What would happen to the resting potential if a neuron's membrane was always completely permeable to charged ions?

The freedom of movement would allow the ions to equalize on either side of the membrane, causing the resting potential to disappear.

177. Briefly describe the all-or-none law of action potentials.

Once a neuron reaches the threshold of activation, the action potential is conducted all of the way down the axon without loss of intensity. Furthermore, the magnitude of the action potential is roughly the same every time and is independent of the intensity of the stimulus that initiated it.