|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. Dendrites contain the nuclei, ribosomes, mitochondria, and other structures found in most cells.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2. Neurons receive information and transmit it to other cells.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3. Santiago Ramón y Cajal used special staining techniques to reveal that the brain is composed of individual cells.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4. An efferent axon carries information away from a structure.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5. The greater the surface area of a dendrite, the more information it can receive from other neurons.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6. Neurons are distinguished from other cells by their shape.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| 7. The role of glial cells is to act like “glue” or scaffolding to support the neurons.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 8. Glial cells transmit information across long distances.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| 9. There are two types of glial cells that produce myelin sheath. In the central nervous system, Schwann cells fulfill this role and, in the periphery, oligodendrocytes produce it.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 10. The blood-brain barrier is made up of closely packed glial cells.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11. The difference in voltage in a resting neuron is called the resting potential.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| 12. Increasing the electrical gradient for potassium will reduce the tendency for potassium ions to exit the neuron.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13. At the resting potential, the potassium channels are completely closed and the sodium channels are almost closed.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 14. Dr. Skinner is working in the lab measuring the voltage of neurons, and during one condition, she tried to depolarize the neurons from -70 mV to -80 mV.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| 15. Action potentials can be produced in the dendrites of some neurons.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | |

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| 16. The two basic kinds of cells in the nervous system are \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | neurons and glia | |  | b. | dendrites and axons | |  | c. | ribosomes and lysosomes | |  | d. | neurons and axons |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 17. 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 18. Both \_\_\_\_ and \_\_\_\_ shared the Nobel Prize for Physiology or Medicine in 1906.   |  |  |  | | --- | --- | --- | |  | a. | Golgi and Cajal | |  | b. | Cajal and Sherrington | |  | c. | Sherrington and Golgi | |  | d. | Cajal and Kalat |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 19. Dr. Kimi studies the plasma membrane of neurons. He specifically researches the specialized \_\_\_\_\_ that allow in important things like water, oxygen, sodium, and so on.   |  |  |  | | --- | --- | --- | |  | a. | lipid channels | |  | b. | protein channels | |  | c. | lipid receptors | |  | d. | protein receptors |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 20. Neurons differ most strongly from other body cells in their \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | temperature | |  | b. | shape | |  | c. | osmotic pressure | |  | d. | mitochondria |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 21. What do neurons have that other cells do not?   |  |  |  | | --- | --- | --- | |  | a. | A plasma membrane | |  | b. | Large, branching extensions | |  | c. | Protein channels | |  | d. | An endoplasmic reticulum |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 22. Dr. McLaughlin’s lab studies how newly formed proteins are folded inside neurons. They would be most interested in studying the \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | endoplasmic reticulum | |  | b. | mitochondria | |  | c. | ribosomes | |  | d. | nucleus |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 23. Water, oxygen, and \_\_\_\_ freely flow across a cell membrane.   |  |  |  | | --- | --- | --- | |  | a. | calcium | |  | b. | positively charged ions | |  | c. | magnesium | |  | d. | carbon dioxide |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 24. The structure that contains a cell’s chromosomes is called the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | endoplasmic reticulum | |  | b. | nucleus | |  | c. | mitochondrion | |  | d. | ribosome |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 25. Small, charged molecules can cross the cell membrane through \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | diffusion | |  | b. | ribosomes | |  | c. | mitochondria | |  | d. | protein channels |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 26. Professor Lopez studies the specialized \_\_\_\_\_\_\_\_\_ in the eye that detect light.   |  |  |  | | --- | --- | --- | |  | a. | motor neurons | |  | b. | sensory neurons | |  | c. | glial cells | |  | d. | interneurons |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 27. Ribosomes are the part of a cell that \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | performs metabolic activities | |  | b. | breaks down harmful chemicals | |  | c. | transports proteins | |  | d. | synthesizes new proteins |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 28. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 29. Dendrites \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | contain the nucleus, ribosomes, and other structures found in most cells | |  | b. | are branching fibers that get narrower near their ends | |  | c. | are thin fibers of constant diameter | |  | d. | are an insulating material that cover an axon |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 30. 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 31. Professor Xi studies the \_\_\_\_\_ located on the \_\_\_\_\_ of neurons in order to better understand how messages are received by the neuron.   |  |  |  | | --- | --- | --- | |  | a. | synaptic receptors; dendrites | |  | b. | axons; somas | |  | c. | synaptic hillocks; dendrites | |  | d. | synaptic receptors; somas |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 32. The tree-like branches of a neuron that receive information from other neurons are called \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | axons | |  | b. | dendrites | |  | c. | soma | |  | d. | myelin |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 33. Many dendrites contain short outgrowths called spines that \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | increase the surface area available for synapses | |  | b. | increase the speed of transmission | |  | c. | eliminate cell waste products | |  | d. | increase the symmetry of the soma |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 34. As compared to dendrites, axons usually \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | form the information-receiving pole of the neuron | |  | b. | are shorter in length | |  | c. | are covered with myelin | |  | d. | taper in diameter toward their periphery |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 35. The insulating material that covers many vertebrate axons is called the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | dendrite | |  | b. | myelin sheath | |  | c. | cell body or soma | |  | d. | presynaptic terminal |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 36. Jasmine is in her physiology lab practicing labeling a neuron. When she gets to the nodes of Ranvier, she will be labeling \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | the spiny outgrowths on dendrites | |  | b. | the myelin sheath | |  | c. | the swelling at the end of the axon | |  | d. | the gaps in the myelin sheath along the axon |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 37. Gaps in the insulating material that surrounds axons are known as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | interpeduncular nuclei | |  | b. | nodes of Ranvier | |  | c. | myelin synapses | |  | d. | presynaptic terminals |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 38. A presynaptic terminal is also known as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | an end bulb | |  | b. | a node of Ranvier | |  | c. | myelin | |  | d. | a spine |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 39. An axon has many branches, each of which swells at its tip. These are known as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | presynaptic terminals | |  | b. | efferent axons | |  | c. | afferent axons | |  | d. | intrinsic neurons |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 40. Professor Case studies how drugs of abuse change the amount of chemical that neurons release from the presynaptic terminal into the \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | dendritic terminal | |  | b. | junction between neurons | |  | c. | afferent space | |  | d. | nucleus |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 41. Neurons typically have one \_\_\_\_, but many \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | dendrite; axons | |  | b. | axon; dendrites | |  | c. | cell body; axons | |  | d. | dendrite; cell bodies |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 42. As a general rule, axons convey information \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | toward dendrites of their own cell | |  | b. | toward their own cell body | |  | c. | away from their own cell body | |  | d. | to surrounding glia |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 43. If you were to accidentally touch a hot stove with your hand, you would quickly pull your hand away. The information carried to the muscles in your arm to make them contract was carried by \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | efferent neurons | |  | b. | afferent neurons | |  | c. | intrinsic neurons | |  | d. | sensory neurons |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 44. If all of a neuron’s dendrites or axons were contained within the spinal cord, it would be considered a(n) \_\_\_\_ neuron.   |  |  |  | | --- | --- | --- | |  | a. | efferent | |  | b. | afferent | |  | c. | intrinsic | |  | d. | Purkinje |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 45. What type of neuron in the pons receives information only from other cells in the pons and sends information only to other cells in the pons?   |  |  |  | | --- | --- | --- | |  | a. | Afferent | |  | b. | Efferent | |  | c. | Intrinsic | |  | d. | Inter-synaptic |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 46. Professor Peach is lecturing in her class about glial cells. She will tell her class that glial cells \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | are less common than neurons in the human nervous system. | |  | b. | are responsible for transmitting information within the peripheral nervous system. | |  | c. | are the “glue” that holds all of the neurons together in the brain. | |  | d. | are not as well studied as neurons but have been shown to perform many important functions in the nervous system. |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 47. What type of glia helps to synchronize the activity of axons?   |  |  |  | | --- | --- | --- | |  | a. | Oligodendrocytes | |  | b. | Astrocytes | |  | c. | Radial glia | |  | d. | Schwann cells |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 48. Which type of glia remove waste material in the nervous system?   |  |  |  | | --- | --- | --- | |  | a. | Astrocytes | |  | b. | Schwann cells | |  | c. | Oligodendrocytes | |  | d. | Radial glia |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 49. What type of glial cells myelinate axons in the brain and spinal cord?   |  |  |  | | --- | --- | --- | |  | a. | oligodendrocytes | |  | b. | Schwann cells | |  | c. | radial glia | |  | d. | astrocytes |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 50. Which type of glia release chemicals that modify the activity of neighboring neurons?   |  |  |  | | --- | --- | --- | |  | a. | Astrocytes | |  | b. | Schwann cells | |  | c. | Oligodendrocytes | |  | d. | Radial glia |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 51. 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 52. \_\_\_\_ in the brain and spinal cord and \_\_\_\_ in the periphery are specialized types of glia that build the myelin sheaths that surround neurons.   |  |  |  | | --- | --- | --- | |  | a. | Oligodendrocytes; Schwann cells | |  | b. | Schwann cells; oligodendrocytes | |  | c. | Microglia; oligodendrocytes | |  | d. | Radial glia; Schwann cells |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 53. Dr. Pautz studies the immune system and has recently become interested in the glial cells that function similar to other cells in the immune system. What cells has Dr. Pautz started exploring?   |  |  |  | | --- | --- | --- | |  | a. | Schwann cells | |  | b. | Microglia | |  | c. | Astrocytes | |  | d. | Radial glia |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 54. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 55. What mechanism 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 56. Andrew was exposed to the chicken pox virus as a child. What happened to that virus after it crossed the blood-brain barrier and entered Andrew’s brain?   |  |  |  | | --- | --- | --- | |  | a. | Andrew’s natural killer cells were able to quickly destroy it. | |  | b. | The glia in his brain engulfed the virus and then natural killer cells destroyed them both. | |  | c. | Nothing happened since the chicken pox virus cannot cross the blood-brain barrier. | |  | d. | Nothing happened at first, but the virus remained there and caused negative effects for Andrew as he got older. |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 57. 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 that can dissolve in the fats of the capillary walls |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 58. The major disadvantage of a blood-brain barrier is that \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | many chemicals can easily diffuse into the brain | |  | b. | so much glucose is required to maintain it | |  | c. | certain required chemicals must be actively transported | |  | d. | viruses cannot escape |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 59. Marquitta is studying for a quiz and records in her notes that glucose is the main source of fuel for the nervous system and enters the brain via \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | active transport | |  | b. | passive transport | |  | c. | gaps in the ventricles | |  | d. | gaps in the blood-brain barrier |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 60. What is the main source of nutrition for vertebrate neurons?   |  |  |  | | --- | --- | --- | |  | a. | Fats | |  | b. | Glucose | |  | c. | Sodium | |  | d. | Complex carbohydrates |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 61. Professor Nuno explained to her class that glucose is so important to the brain because \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | neurons and glial cells can only metabolize glucose. | |  | b. | glial cells can only breakdown glucose into energy that the neurons can use. | |  | c. | glucose is unique and can cross the blood-brain barrier to be used by neurons. | |  | d. | all other forms of energy are used up by the body and don’t make it to the brain. |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 62. 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 63. Dalton has been diagnosed with Korsakoff’s syndrome. What likely caused his disorder?   |  |  |  | | --- | --- | --- | |  | a. | He is an alcoholic and has damaged his nervous system such that glucose cannot cross the blood-brain barrier. | |  | b. | He has been exposed to a virus that has now started killing neurons. | |  | c. | He doesn’t have enough thiamine probably as a result of chronic alcoholism. | |  | d. | His glial cells are overactive and are damaging healthy neurons. |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 64. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 65. The membrane of a neuron is composed of \_\_\_\_ with \_\_\_\_ embedded in them.   |  |  |  | | --- | --- | --- | |  | a. | carbohydrates; purines | |  | b. | phospholipids; proteins | |  | c. | proteins; neurotransmitters | |  | d. | benzene molecules; carbohydrates |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 66. What term describes the difference in voltage that typically exists between the inside and the outside of a neuron?   |  |  |  | | --- | --- | --- | |  | a. | Concentration gradient | |  | b. | Generator potential | |  | c. | Resting potential | |  | d. | Shock gradient |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 67. In order to change the amount of polarization of a neuron, Professor Alley would need to change the difference in voltage between \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | the dendrites and the axon hillock | |  | b. | the axon and the soma | |  | c. | inside the nucleus and outside the nucleus | |  | d. | inside the cell and outside the cell |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 68. The resting potential is mainly the result of \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | negatively charged proteins inside the cell | |  | b. | positively charged proteins inside the cell | |  | c. | negatively charged proteins outside the cell | |  | d. | positively charged proteins outside the cell |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 69. Professor Durrant explained to his students that the resting potential of a neuron is the \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | total amount of positive charge inside the neuron relative to the outside | |  | b. | total amount of negative charge inside the neuron relative to the outside | |  | c. | total amount of sodium ions compared to potassium ions | |  | d. | the amount of positive charge in the dendrites compared to the axon |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 70. Pok is in the lab and is measuring the resting potential of neurons. Approximately what should she measure as the resting potential?   |  |  |  | | --- | --- | --- | |  | a. | -65 millivolts | |  | b. | 0 millivolts | |  | c. | 70 millivolts | |  | d. | -70 millivolts |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 71. 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 72. Jena is reviewing her notes on action potentials for a quiz. She makes an extra notation that before the action potential when the neuron is at rest, sodium channels \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | are open and allow sodium ions to flow through easily | |  | b. | are closed and don’t allow sodium to pass through. | |  | c. | are partially open, so sodium leaks through slowly | |  | d. | are partially open but at equilibrium, so the sodium doesn’t move |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 73. Professor Rhodus is lecturing about selective permeability of neurons. What would he tell the class?   |  |  |  | | --- | --- | --- | |  | a. | All ions can only travel in one direction across the membrane. | |  | b. | All molecules must cross the membrane via a designated channel. | |  | c. | Only certain molecules can cross the membrane freely. | |  | d. | Only sodium and potassium ions can cross the membrane. |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 74. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 75. 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 76. Electrical gradients lead to the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | general movement of ions into the neuron | |  | b. | general movement of ions out of the neuron | |  | c. | movement of ions to areas having the same electrical charges | |  | d. | movement of ions to areas having opposite electrical charges |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 77. Under which conditions would the sodium-potassium pump likely 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 78. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 79. Dr. Delillo studies the resting potential of neurons. He has found that \_\_\_\_\_\_\_ is the main reason the neuron is able to maintain the resting potential.   |  |  |  | | --- | --- | --- | |  | a. | the size difference between the axon and dendrites | |  | b. | the sodium-potassium pump | |  | c. | the concentration gradient | |  | d. | the refractory period of the membrane |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 80. The concentration gradient refers to the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | fact that the concentration of ions is greater on the inside of a neuron | |  | b. | fact that the concentration of ions is greater on the outside of a neuron | |  | c. | difference in distribution for various ions between the inside and outside of the membrane | |  | d. | negatively charged proteins inside the cell |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 81. Which event will increase the concentration gradient of sodium?   |  |  |  | | --- | --- | --- | |  | a. | Decreasing permeability to potassium ions | |  | b. | Increasing activity of the sodium potassium pump | |  | c. | Increasing membrane permeability to sodium ions | |  | d. | Increasing membrane permeability to chloride ions |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 82. 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 83. Professor Michaels is explaining to his students that, when the neuron is at rest, \_\_\_\_\_\_ is mostly responsible for the movement of potassium ions out of the cell.   |  |  |  | | --- | --- | --- | |  | a. | potassium’s electrical gradient | |  | b. | potassium’s concentration gradient | |  | c. | the sodium-potassium pump | |  | d. | sodium's electrical gradient |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 84. When a neuron is at rest, what is primarily 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 85. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 86. 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 87. Professor Windell is lecturing about the resting potential of neurons. He will tell his class that the resting potential is advantageous because \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | it minimizes the toxic effects of sodium | |  | b. | the cell is ready to produce an action potential quickly following a stimulus | |  | c. | it prevents the cell from having to use any energy to keep itself prepared to fire an action potential. | |  | d. | this maintains equal levels of the ions both inside and outside of the neuron |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 88. Ordinarily, stimulation of a neuron takes place \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | through hyperpolarization | |  | b. | at the synapse | |  | c. | in the mitochondria | |  | d. | in the endoplasmic reticulum |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 89. What occurs when 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 90. Dr. O’Reilly is trying to produce hyperpolarization in the neurons in her laboratory. What should she do?   |  |  |  | | --- | --- | --- | |  | a. | Use a microelectrode to apply a positive charge | |  | b. | Use a microelectrode to apply a negative charge | |  | c. | Add a drug that will increase the membrane’s permeability to sodium | |  | d. | Add a drug that will decrease the membrane’s permeability to potassium |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 91. In order to produce an action potential, the collective amount of depolarization must exceed the \_\_\_\_\_   |  |  |  | | --- | --- | --- | |  | a. | threshold of excitation | |  | b. | energy required to open the potassium channels | |  | c. | absolute refractory period | |  | d. | resting membrane potential |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 92. 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 93. Nettie is in the laboratory working with cultured neurons. She wants to record the voltage following the opening of the sodium channels. What does she need to do to get the sodium channels to open?   |  |  |  | | --- | --- | --- | |  | a. | Add a solution that will result in depolarizing the membrane. | |  | b. | Add a solution that will result in hyperpolarizing the membrane. | |  | c. | Increase the amount of sodium outside of the neuron. | |  | d. | Produce an action potential and get to the refractory periods. |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 94. What occurs when 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. |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 95. Which action would depolarize a neuron?   |  |  |  | | --- | --- | --- | |  | a. | Decreasing membrane permeability to calcium | |  | b. | Increasing membrane permeability to potassium | |  | c. | Decreasing membrane permeability to sodium | |  | d. | Increasing membrane permeability to sodium |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 96. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 97. Zandra is studying about the ions involved in the action potential. She records in her notes that \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | the concentration of sodium remains more concentrated outside the neuron than inside even during an action potential | |  | b. | the concentration of potassium remains more concentrated outside the neuron than inside even during an action potential | |  | c. | the concentration of sodium and potassium equalize across the membrane during an action potential | |  | d. | during an action potential, the sodium channels stay open for a long period of time |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 98. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 99. 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 100. 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 |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 101. A drug that blocks the sodium gates of a neuron's membrane will \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | decrease the threshold | |  | b. | block the action potential | |  | c. | cause repeated action potentials | |  | d. | eliminate the refractory period |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 102. 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. |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 103. Mae is studying for an exam on the action potential. She writes in her notes that the sodium channel closes \_\_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | when the electrical gradient for sodium is eliminated | |  | b. | after the neuron reaches threshold | |  | c. | at the peak of the action potential | |  | d. | as a result of the refractory periods |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 104. 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. | An increased tendency of the sodium-potassium pump to push potassium out | |  | d. | Binding of potassium ions to proteins that leave at this time |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 105. A drug will 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 |  |  |  | | --- | --- | | *ANSWER:* | c | |

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| 106. Terrance went to the dentist and was given some Novocain. This prevented him from feeling pain because the drug \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | attached to sodium channels letting in sodium and stopping the action potential from sending a pain message | |  | b. | attached to potassium channels letting in potassium and stopping the action potential from sending a pain message | |  | c. | attached to potassium channels blocking potassium from entering and stopping the action potential from sending a pain message | |  | d. | attached to sodium channels blocking sodium from entering and stopping the action potential from sending a pain message |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 107. Dr. Blanchard is giving a lecture about the propagation of the action potential. What would she tell the class?   |  |  |  | | --- | --- | --- | |  | a. | That the process of an action potential repeats itself over and over down the length of the axon thanks to the diffusion of sodium ions. | |  | b. | That the process of an action potential repeats itself over and over down the length of the axon thanks to the diffusion of potassium ions. | |  | c. | The action potential moves down the length of the axon because all the sodium channels open all at once after the neuron reaches threshold. | |  | d. | The action potential moves down the length of the axon because all the potassium channels open all at once after the neuron reaches threshold. |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 108. Dr. Ruggs is giving a lecture about the all-or-none-law. What would she tell the class?   |  |  |  | | --- | --- | --- | |  | a. | That all neurons produce an action potential at the same time or none produce one. | |  | b. | That all neurons are active at the same time or none at all. | |  | c. | That all ion channels open at the same time or none at all. | |  | d. | That after reaching threshold, the amplitude and velocity of the action potential is the same each time. |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 109. 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 |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 110. During the relative refractory period, the \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | sodium gates are firmly closed | |  | b. | sodium gates are reverting to their usual state | |  | c. | sodium gates are wide open | |  | d. | potassium gates are firmly closed |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 111. What will *most* 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 112. The speed of an action potential down an unmyelinated axon is best described as \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 113. Professor Cook is lecturing on the importance of the myelin sheath. He told that class that \_\_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | myelin is the only structure that can prevent action potentials from traveling the wrong direction. | |  | b. | the fatty nature of the myelin speeds up the action potential down the length of the axon | |  | c. | the fatty nature of myelin provide storage for key nutrients for the neuron | |  | d. | myelin increases the strength of the action potential |  |  |  | | --- | --- | | *ANSWER:* | b | |

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| 114. 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 |  |  |  | | --- | --- | | *ANSWER:* | d | |

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| 115. 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. |  |  |  | | --- | --- | | *ANSWER:* | a | |

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| 116. Describe the structure of the blood-brain barrier and explain why it is important.   |  |  | | --- | --- | | *ANSWER:* | 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. | |

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| 117. Provide a summary of the all-or-none law of action potentials.   |  |  | | --- | --- | | *ANSWER:* | 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. | |

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| 118. Describe how the brain transports essential chemicals.   |  |  | | --- | --- | | *ANSWER:* | The brain has several transport mechanisms. Small, uncharged molecules, including oxygen and carbon dioxide, cross freely. Water crosses through special protein channels in the wall of the endothelial cells. Also, molecules that dissolve in the fats of the membrane cross easily. Examples include vitamins A and D and all the drugs that affect the brain—from antidepressants and other psychiatric drugs to illegal drugs such as heroin. How fast a drug takes effect depends partly on how readily it dissolves in fats and therefore crosses the blood– brain barrier.For a few other chemicals, the brain uses active transport, a protein-mediated process that expends energy to pump chemicals from the blood into the brain. Chemicals that are actively transported into the brain include glucose (the brain’s main fuel), amino acids (the building blocks of proteins), purines, choline, a few vitamins, iron, and certain hormones. | |

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| 119. Describe the key aspects of the resting potential.   |  |  | | --- | --- | | *ANSWER:* | All parts of a neuron are covered by a membrane about 8 nanometers (nm) thick (just less than 0.00001 mm), composed of two layers (free to float relative to each other) of phospholipid molecules (containing chains of fatty acids and a phosphate group). Embedded among the phospholipids are cylindrical protein molecules through which various chemicals can pass. The structure of the membrane and its proteins controls the flow of chemicals between the inside and outside of the cell. When at rest, the membrane maintains an electrical gradient, also known as polarization—a difference in electrical charge between the inside and outside of the cell. The neuron inside the membrane has a slightly negative electrical potential with respect to the outside, mainly because of negatively charged proteins inside the cell. This difference in voltage is called the resting potential. | |

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| 120. Explain the function and process of a neuron’s refractory period.   |  |  | | --- | --- | | *ANSWER:* | Although the electrical potential across the membrane is returning from its peak toward the resting point, it is still above the threshold. Why doesn’t the cell produce another action potential during this period? (If it did, of course, it would endlessly repeat one action potential after another.) Immediately after an action potential, the cell is in a refractory period during which it resists the production of further action potentials. In the first part of this period, the absolute refractory period, the membrane cannot produce an action potential, regardless of the stimulation. During the second part, the relative refractory period, a stronger-than-usual stimulus is necessary to initiate an action potential. The refractory period depends on two facts: The sodium channels are closed, and potassium is flowing out of the cell at a faster-than-usual rate. In most of the neurons that researchers have tested, the absolute refractory period is about 1 millisecond (ms), and the relative refractory period is another 2-4 ms. | |

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| 121. What is the role of the myelin sheath? Describe the two types of cells that make the myelin sheath.   |  |  | | --- | --- | | *ANSWER:* | Myelin sheath is a fatty substance produced by glial cells that wraps around the axons of neurons and speeds up neurotransmission. It can also provide the axon with nutrients needed for proper functioning. There are two types of glial cells that make myelin. In the central nervous system (brain and spinal cord), myelin is made by Oligodendrocytes. In the periphery, myelin is made by Schwann cells. | |

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| 122. Using motor and sensory neurons as examples, explain the difference between afferent and efferent.   |  |  | | --- | --- | | *ANSWER:* | An afferent axon brings information into a structure whereas an efferent axon carries information away from a structure. Sensory neurons detect sensory information (e.g., light, pressure) and convert that energy into neural impulses. That information is sent to the brain via afferent pathways. Motor neurons carry information from the brain and spinal cord to muscles and glands via efferent pathways. | |

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| 123. Mr. Doyal has been diagnosed with Parkinson’s disease (which is the result of damaged dopamine signaling). Instead of giving him dopamine, his doctors have given him a derivative of dopamine called L-DOPA to take. Given what you know about substances entering the nervous system, why do you think Mr. Doyal was given L-DOPA instead of dopamine?   |  |  | | --- | --- | | *ANSWER:* | Mr. Doyal was likely given L-DOPA instead of dopamine because of the blood-brain barrier. Dopamine cannot cross the blood-brain barrier so giving it to Mr. Doyal would not relieve his symptoms. His doctors gave him L-DOPA since it would cross the blood-brain barrier and could then be converted into dopamine in the brain. | |

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| 124. Jena has been assigned a project for school where she is asked to demonstrate the activity of the sodium-potassium pump using yellow marbles to represent sodium and green marbles to represent potassium. How many marbles will Jena need and explain how she could demonstrate the movement of the ions through the pump?   |  |  | | --- | --- | | *ANSWER:* | Jena needs to explain to the class that the sodium-potassium pump pushes three sodium ions out of the cell and brings in two potassium ions. So she will need three yellow marbles to represent the sodium and two green marbles to represent the potassium. She should show that the pump moves the three yellow marbles out of the cell and brings in the two green marbles. | |

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| 125. Bryson is having a cavity filled at the dentist and was given Novocain to prevent feeling any pain. Later, he explains to his roommate how the Novocain worked to stop the pain. What did he tell his roommate?   |  |  | | --- | --- | | *ANSWER:* | Bryson told his roommate that Novocain works by binding to the sodium channels on the axons of neurons and prevents sodium from entering. Because sodium cannot enter the axon, the neuron cannot produce an action potential. Therefore, the pain message was never sent to Bryson’s brain from his mouth. | |