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| **True / False** |

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| 1. Transmission of information between neurons occurs in the same way as transmission along an axon.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 2. Only sensory neurons are found in a reflex arc.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 3. At synapses, the cell that receives the message is called the presynaptic neuron.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 4. Electrical communication between neurons is faster than chemical communication within neurons.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 5. The amount of temporal summation depends on the rate of stimulation.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 6. Spatial summation is the result of synaptic inputs from different locations arriving at the same time.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 7. Inhibitory synapses actively suppress excitatory responses.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 8. Gases can be used as neurotransmitters.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 9. Neurotransmitter levels in the brain can be affected by changes in diet.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 10. Most of the known neurotransmitters are synthesized from amino acids.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 11. Most neurons release more than one kind of neurotransmitter.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 12. Generally speaking, a neuron will release a greater number of neurotransmitters than what it will respond to with its own receptors.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 13. Whether or not a neurotransmitter is excitatory depends on the response of the postsynaptic receptor.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 14. Most of the brain’s excitatory ionotropic synapses use the neurotransmitter glutamate.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 15. Metabotropic synapses use a large variety of transmitters.​   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| **Multiple Choice** |

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| 16. Charles S. Sherrington was the first to infer the properties of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​synapses | |  | b. | ​the refractory period | |  | c. | ​the sodium-potassium pump | |  | d. | ​dendrites and axons |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 17. Sherrington studied \_\_\_\_, which are automatic muscular responses to stimuli.​   |  |  |  | | --- | --- | --- | |  | a. | ​instincts | |  | b. | ​reflexes | |  | c. | ​inhibitions | |  | d. | ​aversions |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 18. Specialized junctions between neurons are called \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​nodes of Ranvier | |  | b. | ​spines | |  | c. | ​dendrites | |  | d. | ​synapses |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 19. On the basis of what evidence were the properties of synapses first inferred?​   |  |  |  | | --- | --- | --- | |  | a. | ​the electron microscope | |  | b. | ​single-neuron recordings | |  | c. | ​behavioral observations | |  | d. | ​PET scans |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 20. The circuit from sensory neuron to muscle response is called \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​a reflex arc | |  | b. | ​a synapse | |  | c. | ​flexion | |  | d. | ​extension |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 21. What is the proper ordering of a reflex arc?​   |  |  |  | | --- | --- | --- | |  | a. | ​motor neuron, sensory neuron, interneuron. | |  | b. | ​sensory neuron, motor neuron, interneuron. | |  | c. | ​motor neuron, interneuron, sensory neuron. | |  | d. | ​sensory neuron, interneuron, motor neuron. |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 22. Why is the speed of conduction through a reflex arc slower than the speed of conduction of an action potential along an axon?​   |  |  |  | | --- | --- | --- | |  | a. | ​Transmission between neurons at synapses is slower than along axons. | |  | b. | ​The longer an axon, the slower its velocity. | |  | c. | ​Interneurons have thicker axons than other neurons. | |  | d. | ​There are greater amounts of myelin involved in the reflex arc. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 23. Sherrington deduced that transmission at a synapse must be slower than conduction along an axon. This was based on what kind of evidence?​   |  |  |  | | --- | --- | --- | |  | a. | ​temporal summation | |  | b. | ​drugs that increase or inhibit activity at synapses | |  | c. | ​the speed of reflexive responses | |  | d. | ​differences in diameter between axons and dendrites |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 24. A certain weak stimulus produces no reflexive response, but a rapid repetition of that stimulus may produce such a response. What is this phenomenon called?​   |  |  |  | | --- | --- | --- | |  | a. | ​spatial summation | |  | b. | ​temporal summation | |  | c. | ​saltatory conduction | |  | d. | ​synaptic combination |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 25. Sherrington found that repeated stimuli within a brief time have a cumulative effect. He referred to this phenomenon as \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​temporal summation | |  | b. | ​spatial summation | |  | c. | ​synaptic summation | |  | d. | ​saltatory summation |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 26. Temporal summation most likely occurs with \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​infrequent, subthreshold excitation | |  | b. | ​rapid succession of stimuli that each exceed threshold | |  | c. | ​infrequent, inhibitory stimuli | |  | d. | ​rapid succession of subthreshold excitation |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 27. Charles Sherrington would most likely agree with which statement about reflexes?​   |  |  |  | | --- | --- | --- | |  | a. | ​The overall speed of conduction through a reflex arc is faster than conduction along an axon. | |  | b. | ​Repeated stimuli occurring within a brief time can have a cumulative effect. | |  | c. | ​Each neuron physically merges with the next one during a reflexive response. | |  | d. | ​Excitatory synapses are more important than inhibitory synapses. |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 28. To measure temporal summation in single cells, researchers \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​attach electrodes to the scalp | |  | b. | ​insert an microelectrode into the scalp | |  | c. | ​collect sodium and potassium ions from nearby glial cells | |  | d. | ​record depolarizations of the postsynaptic neuron |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 29. A graded depolarization is known as an \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​EPIP | |  | b. | ​IPSP | |  | c. | ​ESPN | |  | d. | ​EPSP |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 30. Which statement is TRUE of EPSPs?​   |  |  |  | | --- | --- | --- | |  | a. | ​They work in pairs to produce an action potential. | |  | b. | ​They decay over time and space. | |  | c. | ​They can be either excitatory or inhibitory. | |  | d. | ​They occur because potassium gates open. |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | 51 | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 31. An EPSP is a(n) \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​graded depolarization | |  | b. | ​depolarization with a rebounding hyperpolarization | |  | c. | ​graded hyperpolarization | |  | d. | ​action potential in a reflex arc |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 32. The primary difference between an EPSP and an action potential is that \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​the magnitude of an action potential decreases as it travels along the membrane | |  | b. | ​EPSPs occur without sodium ions entering the cell | |  | c. | ​action potentials are always hyperpolarizations | |  | d. | ​EPSPs are subthreshold events that decay over time and space |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 33. Depolarization is to \_\_\_\_ as hyperpolarization is to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​excitation; inhibition | |  | b. | ​inhibition; excitation | |  | c. | ​increasing the threshold; decreasing the threshold | |  | d. | ​decreasing the threshold; increasing the threshold |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 34. What causes an EPSP?​   |  |  |  | | --- | --- | --- | |  | a. | ​the deactivation of cytoplasmic enzymes | |  | b. | ​the opening of sodium channels | |  | c. | ​the opening of potassium channels | |  | d. | ​the deactivation of stress response pathways |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 35. Which process indicates spatial summation?​   |  |  |  | | --- | --- | --- | |  | a. | ​Present two or more weak stimuli at the same time. | |  | b. | ​Start action potentials at both ends of one axon at the same time. | |  | c. | ​Do not allow a flexor muscle to relax before stimulating it again. | |  | d. | ​Present a rapid sequence of weak stimuli. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 36. Spatial summation refers to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​multiple weak stimulations that occur in rapid succession | |  | b. | ​a decrease in responsiveness after repeated stimulation | |  | c. | ​multiple weak stimulations that occur at the same time | |  | d. | ​an increase in the strength of action potentials after repeated stimulation |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 37. What is the primary difference between temporal summation and spatial summation?​   |  |  |  | | --- | --- | --- | |  | a. | ​Only spatial summation can produce an action potential. | |  | b. | ​Spatial summation depends on contributions from more than one sensory neuron. | |  | c. | ​Temporal summation produces a hyperpolarization instead of a depolarization. | |  | d. | ​Spatial summation alters the response of more than one postsynaptic cell. |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 38. Simultaneous weak stimuli at different locations produce a greater reflexive response than one of the stimuli by itself. What is this phenomenon called?​   |  |  |  | | --- | --- | --- | |  | a. | ​Sherrington's law | |  | b. | ​temporal summation | |  | c. | ​spatial summation | |  | d. | ​the all-or-none law |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 39. What do temporal summation and spatial summation have in common?​   |  |  |  | | --- | --- | --- | |  | a. | ​Both involve the activity of only two neurons. | |  | b. | ​Both require a response from the brain. | |  | c. | ​Both depend on a combination of visual and auditory stimuli. | |  | d. | ​Both enable a reflex to occur in response to weak stimuli. |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 40. Temporal summation is to \_\_\_\_ as spatial summation is to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​time; location | |  | b. | ​EPSP; IPSP | |  | c. | ​location; time | |  | d. | ​depolarization; hyperpolarization |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 41. Which pattern of post-synaptic excitation will most likely result in an action potential?​   |  |  |  | | --- | --- | --- | |  | a. | ​rapid sequence of EPSPs | |  | b. | ​rapid sequence of IPSPs | |  | c. | ​large number of simultaneous IPSPs | |  | d. | ​large number of simultaneous IPSPs and EPSPs |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 42. When a vertebrate animal contracts the flexor muscles of a leg, it relaxes the extensor muscles of the same leg. Sherrington considered this evidence for the existence of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​spatial summation | |  | b. | ​temporal summation | |  | c. | ​inhibitory messages | |  | d. | ​the delay in transmission at synapses |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 43. What ordinarily prevents extensor muscles from contracting at the same time as flexor muscles?​   |  |  |  | | --- | --- | --- | |  | a. | ​the ligaments and tendons that bind them together | |  | b. | ​learned patterns of coordination in the cerebral cortex | |  | c. | ​inhibitory synapses in the spinal cord | |  | d. | ​control of both muscles by different branches of the same axon |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 44. In a reflex arc, the coordination between contraction of certain muscles and relaxation of others is mediated by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​glial cells | |  | b. | ​motor neurons | |  | c. | ​sensory neurons | |  | d. | ​interneurons |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 45. A normal, healthy animal never contracts the flexor muscles and the extensor muscles of the same leg at the same time. Why not?​   |  |  |  | | --- | --- | --- | |  | a. | ​When the interneuron sends excitatory messages to one, inhibitory messages go to the other. | |  | b. | ​Both muscles are mechanically connected in a way that makes it impossible for both to contract at the same time. | |  | c. | ​Such coordination is learned through prenatal movement. | |  | d. | ​Both muscles are controlled by branches of the same axon. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 46. Inhibitory synapses on a neuron \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​hyperpolarize the postsynaptic cell | |  | b. | ​weaken the cell's polarization | |  | c. | ​increase the probability of an action potential | |  | d. | ​move the potential closer to the cell's threshold |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Properties of Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 47. A temporary hyperpolarization is known as an \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​EPSP | |  | b. | ​IPSP | |  | c. | ​ISPS | |  | d. | ​EPIP |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 48. Which process will most likely result in an IPSP?​   |  |  |  | | --- | --- | --- | |  | a. | ​potassium ions entering the cell | |  | b. | ​sodium ions entering the cell | |  | c. | ​chloride ions entering the cell | |  | d. | ​chloride ions leaving the cell |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Relationship among EPSP, IPSP, and Synapses 95 Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 49. Increased permeability to which type of ion would most likely result in an IPSP?​   |  |  |  | | --- | --- | --- | |  | a. | ​sodium | |  | b. | ​potassium | |  | c. | ​calcium | |  | d. | ​bicarbonate |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 50. An IPSP represents \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​the location where a dendrite branches | |  | b. | ​a gap in a myelin sheath | |  | c. | ​a subthreshold depolarization | |  | d. | ​a temporary hyperpolarization |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 51. Increased permeability to \_\_\_\_ would most likely result in an IPSP.​   |  |  |  | | --- | --- | --- | |  | a. | ​sodium | |  | b. | ​potassium | |  | c. | ​calcium | |  | d. | ​bicarbonate |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 52. An EPSP is to \_\_\_\_ as an IPSP is to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​hyperpolarization; depolarization | |  | b. | ​depolarization; hyperpolarization | |  | c. | ​spatial summation; temporal summation | |  | d. | ​temporal summation; spatial summation |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 53. Even at rest, most neurons have periodic production of action potentials, known as the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​spontaneous firing rate | |  | b. | ​excitatory firing rate | |  | c. | ​all-or-none law | |  | d. | ​law of compensation |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 54. The “decision” for a neuron to fire is determined by the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​number of EPSPs only | |  | b. | ​spontaneous firing rate | |  | c. | ​number of IPSPs only | |  | d. | ​ratio of EPSPs to IPSPs |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 55. The "spontaneous firing rate" of a neuron refers to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​its resting potential | |  | b. | ​its rate of energy consumption | |  | c. | ​its rate of producing action potentials even when it is not stimulated | |  | d. | ​the velocity of its action potentials under normal conditions |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 56. Which statement is TRUE about the spontaneous firing rates of neurons?​   |  |  |  | | --- | --- | --- | |  | a. | ​EPSPs increase the frequency. | |  | b. | ​EPSPs decrease the frequency. | |  | c. | ​IPSPs increase the frequency. | |  | d. | ​One EPSP equals the effect of two IPSPs. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 Synapses | |

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| 57. What determines whether a neuron has an action potential?​   |  |  |  | | --- | --- | --- | |  | a. | ​only the number of EPSPs impinging on an axon | |  | b. | ​only the number of IPSPs impinging on the dendrites | |  | c. | ​the combined effects of EPSPs and IPSPs | |  | d. | ​summation effects of IPSPs |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | summation effects of IPSPs | | *REFERENCES:* | Relationship among EPSP, IPSP, and Action Potentials | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 Synapses | |

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| 58. Which one of Sherrington's inferences about the synapse was WRONG?​   |  |  |  | | --- | --- | --- | |  | a. | ​Transmission at a synapse is slower than transmission of impulses along an axon. | |  | b. | ​Transmission at the synapse is primarily an electrical process. | |  | c. | ​Synapses can be either excitatory or inhibitory. | |  | d. | ​Synapses make spatial summation and temporal summation possible. |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Discovery of Chemical Transmission at Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.01 - Describe how Charles Sherrington used behavioral observations to infer the major properties of synapses. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 59. ​Loewi demonstrated that synapses operate by the release of chemicals by \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​applying adrenaline directly to the heart muscle | |  | b. | ​collecting fluid from a stimulated frog's heart, transferring it to another frog's heart, and measuring that heart rate | |  | c. | ​measuring the speed of a dog's reflexes while the dog was under the influence of various drugs | |  | d. | ​applying an extract of marijuana in eye drops and discovering that it dilated the pupils |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Discovery of Chemical Transmission at Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 60. The research that firmly established synaptic communication as chemical was \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​Elliot's adrenaline mimicking sympathetic activation | |  | b. | ​Loewi's transfer of fluid from stimulated frog hearts | |  | c. | ​Sherrington's study of reflexes | |  | d. | ​Eccles's measurement of IPSPs |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Discovery of Chemical Transmission at Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 61. After one frog's heart has been stimulated, an extract of fluid from that heart can make a second frog's heart beat faster. What conclusion did Otto Loewi draw from these results?​   |  |  |  | | --- | --- | --- | |  | a. | ​Transmission at synapses is a chemical event. | |  | b. | ​The sympathetic and parasympathetic nervous systems are antagonistic. | |  | c. | ​Transmission at heart muscle synapses is electrical. | |  | d. | ​Hormones facilitate the actions of the nervous system. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Discovery of Chemical Transmission at Synapses | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 62. Which category of chemicals includes adenosine and several of its derivatives?​   |  |  |  | | --- | --- | --- | |  | a. | ​neuropeptides | |  | b. | ​acetylcholine | |  | c. | ​monoamines | |  | d. | ​purines |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 63. ​On advantage of nitric oxide is that it \_\_\_\_.   |  |  |  | | --- | --- | --- | |  | a. | ​can be made by neurons efficiently | |  | b. | ​is easily synthesized in a laboratory | |  | c. | ​increases the growth of microglia | |  | d. | ​safe for human cells in large quantities |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 64. Which neurotransmitter is released by stimulated neurons to dilate the blood vessels?​   |  |  |  | | --- | --- | --- | |  | a. | ​endorphins | |  | b. | ​glycine | |  | c. | ​nitric oxide | |  | d. | ​acetylcholine |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 65. In addition to influencing other neurons, \_\_\_\_ increases blood flow to a specific area of the brain.​   |  |  |  | | --- | --- | --- | |  | a. | ​endorphins | |  | b. | ​glycine | |  | c. | ​nitric oxide | |  | d. | ​acetylcholine |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 66. What provides the building blocks for synthesizing all neurotransmitters?​   |  |  |  | | --- | --- | --- | |  | a. | ​proteins found in the diet | |  | b. | ​breakdown products of DNA | |  | c. | ​breakdown products formed from other transmitters | |  | d. | ​methane and ethanol |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | Chemical Events at the Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Synapses | |

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| 67. The basic building blocks for the majority of neurotransmitters are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​amino acids | |  | b. | ​nitric oxide | |  | c. | ​sugars | |  | d. | ​carbohydrates |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 68. The catecholamines include \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​epinephrine, norepinephrine, dopamine, and serotonin | |  | b. | ​epinephrine, serotonin, and dopamine | |  | c. | ​dopamine, serotonin, and acetylcholine | |  | d. | ​epinephrine, norepinephrine, and dopamine |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 69. What makes nitric oxide unique among neurotransmitters?​   |  |  |  | | --- | --- | --- | |  | a. | ​It is released before the action potential occurs. | |  | b. | ​It is taken back up into the presynaptic neuron. | |  | c. | ​It is a gas. | |  | d. | ​It is an organelle. |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 70. What do dopamine, norepinephrine, and epinephrine share in common?​   |  |  |  | | --- | --- | --- | |  | a. | ​They all affect the same receptors. | |  | b. | ​They are all synthesized from the same amino acids. | |  | c. | ​They are all released by the same neurons. | |  | d. | ​They all are gases. |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 71. Avoiding foods with lecithin, such as eggs and peanuts, would affect the levels of which neurotransmitter the most?​   |  |  |  | | --- | --- | --- | |  | a. | ​acetylcholine | |  | b. | ​serotonin | |  | c. | ​GABA | |  | d. | ​endorphin |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 72. The amino acid tryptophan is the precursor to which neurotransmitter?​   |  |  |  | | --- | --- | --- | |  | a. | ​dopamine | |  | b. | ​endorphin | |  | c. | ​serotonin | |  | d. | ​nitric oxide |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 73. You are eating a food containing tryptophan. What can you consume with it to increase its entry to the brain?​   |  |  |  | | --- | --- | --- | |  | a. | ​phenylalanine | |  | b. | ​carbohydrates | |  | c. | ​fats | |  | d. | ​thiamine |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 74. Dopamine and norepinephrine are classified as \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​second messengers | |  | b. | ​purines | |  | c. | ​proteins | |  | d. | ​catecholamines |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 75. Insulin increases the entry of tryptophan into the brain by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​weakening the blood-brain barrier | |  | b. | ​converting tryptophan into a compound that more easily enters the brain | |  | c. | ​increasing metabolic activity only in those areas of the brain that use tryptophan | |  | d. | ​causing certain competing amino acids to enter other cells, outside the brain |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 76. The presynaptic terminal stores high concentrations of neurotransmitter molecules in \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​axons | |  | b. | ​vesicles | |  | c. | ​peptides | |  | d. | ​dendrites |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 77. Neuropeptides are synthesized in the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​postsynaptic terminal | |  | b. | ​presynaptic terminal | |  | c. | ​cell body | |  | d. | ​dendrites |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 78. Although slower than an action potential, synaptic transmission is still relatively fast because \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​the synaptic cleft is very narrow | |  | b. | ​sodium ions are transported quickly | |  | c. | ​neurotransmitters diffuse faster than electricity | |  | d. | ​EPSPs travel faster than IPSPs |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 79. Vesicles are located \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​in postsynaptic terminals | |  | b. | ​in dendrites | |  | c. | ​in presynaptic terminals | |  | d. | ​outside of the neuron in the extracellular fluid |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 80. When an action potential reaches the end of an axon, it evokes the release of neurotransmitters by opening \_\_\_\_ channels in the axon terminal.​   |  |  |  | | --- | --- | --- | |  | a. | ​chloride | |  | b. | ​bicarbonate | |  | c. | ​calcium | |  | d. | ​oxygen |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 81. When an action potential reaches the end of an axon, the depolarization causes what ionic movement in the presynaptic cell?​   |  |  |  | | --- | --- | --- | |  | a. | ​sodium out of the cell | |  | b. | ​lithium out of the cell | |  | c. | ​iron into the cell | |  | d. | ​calcium into the cell |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 82. An action potential causes the release of neurotransmitters by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​blocking potassium pores in the membrane | |  | b. | ​opening chloride pores in the membrane | |  | c. | ​blocking iron pores in the membrane | |  | d. | ​opening calcium pores in the membrane |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 83. A neuron excretes neurotransmitters through its membrane by a process called \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​reuptake | |  | b. | ​exocytosis | |  | c. | ​endocytosis | |  | d. | ​synaptic diffusion |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 84. Exocytosis is the process by which neurotransmitters are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​released from the presynaptic neuron | |  | b. | ​synthesized | |  | c. | ​destroyed | |  | d. | ​secreted into synaptic vesicles |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 85. What is the synaptic cleft?​   |  |  |  | | --- | --- | --- | |  | a. | ​the gap between the presynaptic neuron and the postsynaptic neuron | |  | b. | ​a packet that stores neurotransmitter molecules for release | |  | c. | ​a subthreshold depolarization mechanism | |  | d. | ​the long-term storage location for calcium ions |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 86. What happens when a neurotransmitter is released by a presynaptic cell?​   |  |  |  | | --- | --- | --- | |  | a. | ​It causes calcium to rush into the presynaptic neuron. | |  | b. | ​It causes calcium to rush into the postsynaptic neuron. | |  | c. | ​The neurotransmitter passively spreads across the synaptic cleft. | |  | d. | ​The neurotransmitter is actively transported across the synaptic cleft. |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 87. In general, a single neuron releases \_\_\_\_ neurotransmitter(s) and can respond to \_\_\_\_ neurotransmitter(s).​   |  |  |  | | --- | --- | --- | |  | a. | ​one; many | |  | b. | ​dozens of; only one | |  | c. | ​several; only one | |  | d. | ​several; many |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 88. The main advantage of a neuron releasing more than one neurotransmitter is that:​   |  |  |  | | --- | --- | --- | |  | a. | ​if it runs out of one, it has others | |  | b. | ​it can release different transmitters on different occasions | |  | c. | ​it can send more complex messages | |  | d. | ​it can release one from the axon's terminal and one from another location along the axon |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 89. The effect of a neurotransmitter on a postsynaptic neuron is determined by the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​speed the action potential traveled down the axon | |  | b. | ​number of branches of the presynaptic axon | |  | c. | ​receptors on the postsynaptic membrane | |  | d. | ​distance between the synapse and the cell body |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 90. A receptor can directly open a channel and thereby exert a(n) \_\_\_\_ effect, or it can produce slower but longer \_\_\_\_ effects.​   |  |  |  | | --- | --- | --- | |  | a. | ​gated; metabotropic | |  | b. | ​ionotropic; gated | |  | c. | ​metabotropic; ionotropic | |  | d. | ​ionotropic; metabotropic |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 91. Which event is most likely to be dependent on ionotropic effects?​   |  |  |  | | --- | --- | --- | |  | a. | ​drowsiness | |  | b. | ​hormone release | |  | c. | ​hunger | |  | d. | ​rapid muscle contraction |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 92. Glutamate opens sodium gates, enabling sodium ions to enter the postsynaptic cell. What type of effect is this?​   |  |  |  | | --- | --- | --- | |  | a. | ​metabotropic | |  | b. | ​ionotropic | |  | c. | ​modulatory | |  | d. | ​orthodromic |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 93. Ionotropic effects \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​depolarize the postsynaptic membrane | |  | b. | ​hyperpolarize the postsynaptic membrane | |  | c. | ​may depolarize or hyperpolarize the postsynaptic membrane | |  | d. | ​enhance the reabsorption of neurotransmitters |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 94. Ionotropic effects are characterized by \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​rapid and short-lived effects | |  | b. | ​rapid and long lasting effects | |  | c. | ​excitatory effects only | |  | d. | ​inhibitory effects only |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 95. Which terms refers to a chemical that binds to another chemical?​   |  |  |  | | --- | --- | --- | |  | a. | ​ligand | |  | b. | ​electrolyte | |  | c. | ​vesicle | |  | d. | ​autoreceptor |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 96. Compared to ionotropic effects, metabotropic effects are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​quicker and briefer | |  | b. | ​slower and briefer | |  | c. | ​quicker and longer lasting | |  | d. | ​slower and longer lasting |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 97. Which process is more typical of a metabotropic effect than an ionotropic effect?​   |  |  |  | | --- | --- | --- | |  | a. | ​producing inhibitory effects on the postsynaptic cell | |  | b. | ​influencing the speed of conduction by the postsynaptic cell | |  | c. | ​producing long-lasting effects on the post-synaptic cell | |  | d. | ​controlling sensory processes |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 98. Receptor molecules for neurotransmitters that exert metabotropic effects are proteins that bind to \_\_\_\_ outside the membrane, and attach to \_\_\_\_ inside the membrane.​   |  |  |  | | --- | --- | --- | |  | a. | ​calcium; potassium | |  | b. | ​neurotransmitters; nicotine | |  | c. | ​neurotransmitters; G-proteins | |  | d. | ​adenosine; nitric oxide |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 99. "Second messengers" carry their messages to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​the presynaptic membrane | |  | b. | ​areas within the postsynaptic cell | |  | c. | ​areas within the presynaptic cell | |  | d. | ​the surrounding glia |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 100. A metabotropic synapse, by way of its second messenger, \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​has effects localized to one point on the membrane | |  | b. | ​can influence activity in much of the presynaptic cell | |  | c. | ​can influence activity in much or all of the postsynaptic cell | |  | d. | ​has minimal effect on the postsynaptic cell |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 101. Many neurons release neuropeptides mostly from the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​vesicles | |  | b. | ​nodes | |  | c. | ​axons | |  | d. | ​dendrites |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 102. A hormone is a chemical that is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​secreted by a gland to the outside world | |  | b. | ​conveyed by the blood to other organs, whose activity it influences | |  | c. | ​capable of activating or inhibiting muscle fibers | |  | d. | ​a feedback message from the postsynaptic neuron to the presynaptic neuron |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Hormones | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 103. Hormones exert their effects \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​similarly to metabotropic neurotransmitters | |  | b. | ​similarly to ionotropic neurotransmitters | |  | c. | ​by attaching to special receptors on muscle fibers | |  | d. | ​by being metabolized and converted via presynaptic cells |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Hormones | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 104. The anterior pituitary is composed of \_\_\_\_ and the posterior pituitary is composed of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​glandular tissue; neural tissue | |  | b. | ​neural tissue; glandular tissue | |  | c. | ​neural tissue; neural tissue | |  | d. | ​glandular tissue; glandular tissue |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Hormones | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 105. Releasing hormones are synthesized in the \_\_\_\_ and released in the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​anterior pituitary; bloodstream | |  | b. | ​hypothalamus; anterior pituitary | |  | c. | ​hypothalamus; posterior pituitary | |  | d. | ​posterior pituitary; hypothalamus |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Hormones | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 106. Adrenocorticotropic hormone (ACTH) controls secretions of the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​gonads | |  | b. | ​mammary glands | |  | c. | ​thyroid gland | |  | d. | ​adrenal cortex |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | Hormones | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 107. What is the function of the enzyme acetylcholinesterase?​   |  |  |  | | --- | --- | --- | |  | a. | ​It synthesizes acetylcholine from the diet. | |  | b. | ​It increases the sensitivity of the postsynaptic cell to acetylcholine. | |  | c. | ​It blocks further release of the transmitter acetylcholine. | |  | d. | ​It breaks acetylcholine down into components for recycling. |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 108. What happens to acetylcholine after it attaches to a receptor on the postsynaptic cell?​   |  |  |  | | --- | --- | --- | |  | a. | ​It is broken down into two components. | |  | b. | ​It is reabsorbed intact by the presynaptic cell. | |  | c. | ​It is metabolized by the postsynaptic cell as a source of energy. | |  | d. | ​It continues to stimulate the postsynaptic neuron until replaced by another neurotransmitter. |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 3.2 Chemical Events at the Synapse | |

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| 109. A drug that inhibits the action of the enzyme acetylcholinesterase will have the effect of \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​prolonging the action of acetylcholine at its synapses | |  | b. | ​decreasing the duration of action of acetylcholine at its synapses | |  | c. | ​decreasing the synthesis of acetylcholine by the presynaptic cell | |  | d. | ​increasing the synthesis of acetylcholine by the presynaptic cell |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.04 - Discuss how certain drugs affect behavior by altering events at synapses. | | *TOPICS:* | 3.2 Chemical Events at the Synapse | |

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| 110. Reuptake is an alternative to which other process?​   |  |  |  | | --- | --- | --- | |  | a. | ​recycling of neurotransmitters | |  | b. | ​breaking down neurotransmitters via an enzymatic process | |  | c. | ​absorbing neurotransmitters by postsynaptic neurons | |  | d. | ​re-releasing neurotransmitters from postsynaptic neurons |  |  |  | | --- | --- | | *ANSWER:* | b | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 111. "Transporter" proteins transport neurotransmitters \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​back into the presynaptic neuron | |  | b. | ​across the synapse to the postsynaptic neuron | |  | c. | ​across the synapse back to the presynaptic neuron | |  | d. | ​to the appropriate receptor sites |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 112. COMT and MAO are \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​enzymes that convert catecholamines into inactive chemicals | |  | b. | ​enzymes that make catecholamines | |  | c. | ​neurotransmitters in the same group as serotonin | |  | d. | ​the inactive fragments of catecholamines |  |  |  | | --- | --- | | *ANSWER:* | a | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 113. The primary method for disposal of peptide neurotransmitters is \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​inactivation | |  | b. | ​reuptake by the presynaptic neuron | |  | c. | ​diffusion | |  | d. | ​reuptake by the postsynaptic neuron |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 114. Activation of autoreceptors tends to \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​increase further neurotransmitter release | |  | b. | ​stimulate GABA release | |  | c. | ​increase sodium-potassium pump activity | |  | d. | ​decrease further neurotransmitter release |  |  |  | | --- | --- | | *ANSWER:* | d | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 115. Autoreceptors monitor the \_\_\_\_.​   |  |  |  | | --- | --- | --- | |  | a. | ​number of action potentials | |  | b. | ​extracellular sodium concentration | |  | c. | ​amount of neurotransmitter released | |  | d. | ​amount of reuptake |  |  |  | | --- | --- | | *ANSWER:* | c | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 116. Describe the sequence of events that occurs in synaptic transmission.​   |  |  | | --- | --- | | *ANSWER:* | ​The sequence of events involves synthesis, storage, release, diffusion, activation of receptor, and inactivation/reuptake. | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 117. Briefly compare the differences between ionotropic and metabotropic receptors. Include their mechanisms of action and how they explains the difference in the effects on the postsynaptic cell.​   |  |  | | --- | --- | | *ANSWER:* | Ionotropic receptors are ion channels that open as soon as the neurotransmitter attaches and close when the neurotransmitter is removed, making the effects rapid and short-lived.  Metabotropic receptors use a second messenger system to affect many different activities in the cell, which are slower but longer lasting.​ | | *DIFFICULTY:* | Bloom’s: Analyze | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 118. Briefly describe spatial summation.​   |  |  | | --- | --- | | *ANSWER:* | Sherrington found that synapses have the property of spatial summation—that is, summation over space. Synaptic inputs from separate locations combine their effects on a neuron. Sherrington again began with a pinch too weak to elicit a reflex. This time, instead of pinching one point twice, he pinched two points at once. Although neither pinch alone produced a reflex, together they did. Sherrington concluded that pinching two points activated separate sensory neurons, whose axons converged onto one neuron in the spinal cord. Excitation from either sensory axon excited that spinal neuron, but not enough to reach the threshold. A combination of excitations exceeded the threshold and produced an action potential. Again, Eccles confirmed Sherrington’s inference, demonstrating that EPSPs from several axons summate their effects on a postsynaptic cell.  Spatial summation is critical to brain functioning. Sensory input to the brain arrives at synapses that individually produce weak effects. However, each neuron receives many incoming axons that might produce synchronized responses. Spatial summation assures that those synchronized inputs excite a neuron enough to activate it.​ | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Properties of the Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.02 - Relate the activities at a synapse to the probability that a neuron will produce an action potential. | | *TOPICS:* | 2.1 The Concept of the Synapse | |

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| 119. Describe the main chemical events at a synapse.​   |  |  | | --- | --- | | *ANSWER:* | Understanding the chemical events at a synapse is fundamental to understanding the nervous system. Every year, researchers discover more and more details about synapses, their structure, and how those structures relate to function. Here are the major events: 1. The neuron synthesizes chemicals that serve as neurotransmitters. It synthesizes the smaller neurotransmitters in the axon terminals and synthesizes neuropeptides in the cell body. 2. Action potentials travel down the axon. At the presynaptic terminal, an action potential enables calcium to enter the cell. Calcium releases neurotransmitters from the terminals and into the synaptic cleft, the space between the presynaptic and postsynaptic neurons. 3. The released molecules diffuse across the cleft, attach to receptors, and alter the activity of the postsynaptic neuron. 4. The neurotransmitter molecules separate from their receptors.  5. The neurotransmitter molecules may be taken back into the presynaptic neuron for recycling or they may diffuse away.  6. Some postsynaptic cells send reverse messages to control the further release of neurotransmitter by presynaptic cells.​ | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.03 - List and explain the sequence of events at a synapse, from synthesis of neurotransmitters, through stimulation of receptors, to the later disposition of the transmitter molecules. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |

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| 120. Describe the main properties of neuropeptides (neuromodulators).​   |  |  | | --- | --- | | *ANSWER:* | Researchers often refer to the neuropeptides as neuromodulators, because they have several Synapses 111 properties that set them apart from other transmitters. Whereas the neuron synthesizes most other neurotransmitters in the presynaptic terminal, it synthesizes neuropeptides in the cell body and then slowly transports them to other parts of the cell. Whereas other neurotransmitters are released at the axon terminal, the neuropeptides are released mainly by dendrites, and also by the cell body and the sides of the axon. A single action potential can release other neurotransmitters, but neuropeptide release requires repeated stimulation. However, after a few dendrites release a neuropeptide, the released chemical primes other nearby dendrites to release the same neuropeptide also, including dendrites of other cells. Thus, neurons containing neuropeptides do not release them often, but when they do, they release substantial amounts. Furthermore, unlike other transmitters that are released immediately adjacent to their receptors, neuropeptides diffuse widely, slowly affecting many neurons in their region of the brain. In that way they resemble hormones. Because many of them exert their effects by altering gene activity, their effects are long-lasting, in the range of 20 minutes or more. Neuropeptides are important for hunger, thirst, and other long-term changes in behavior and experience.​ | | *DIFFICULTY:* | Bloom’s: Understand | | *REFERENCES:* | The Sequence of Chemical Events at a Synapse | | *LEARNING OBJECTIVES:* | KALA.BIOP.16.02.05 - Contrast neurotransmitters, neuropeptides, and hormones. | | *TOPICS:* | 2.2 Chemical Events at the Synapse | |