Logothetis: Local Anesthesia for the Dental Hygienist

Chapter 02: Neurophysiology

Test Bank

MATCHING

Match each description with the term that correctly identifies the generation and conduction of the nerve impulse stage. Terms may be used more than once.

a. Polarization
b. Slow depolarization
c. Rapid depolarization
d. Repolarization
e. Relative refractory period
f. Absolute refractory period

1. During this stage, the second action potential is inhibited but not impossible should a larger stimulus be applied.
2. The nerve is stimulated by the minimal threshold level.
3. The electrical potential of the neuron is approximately –70 mV.
4. During this stage, the electrical charge on the outside of the membrane is positive, while the electrical charge on the inside of the membrane is negative.
5. Occurs once the peak of the action potential is reached and the membrane potential begins to move back toward the resting potential.
6. The resting potential of the cell changes to become more negative, but not enough to trigger the firing threshold.
7. The interval during which a second action potential cannot be initiated, no matter how large a stimulus is applied.
8. The outside of the cell contains excess sodium ions at a ratio of 14:1; the inside of the cell contains excess potassium ions.
9. The gated Na^+ channels on the resting neuron's membrane release and open suddenly in order to allow the Na^+ in the extracellular fluid to influx into the cell.
10. The impulse moves between the uninsulated nodes of Ranvier that exist between each Schwann cell.

1. ANS: E REF: Page 27, Box 2-5
2. ANS: C REF: Page 26
3. ANS: A REF: Page 25
4. ANS: A REF: Page 25
5. ANS: D REF: Page 27
6. ANS: B REF: Page 26
7. ANS: F REF: Page 27, Box 2-5
8. ANS: A REF: Page 25
9. ANS: C REF: Page 26
10. ANS: C REF: Page 26

MULTIPLE CHOICE

1. What are the nerves that conduct signals from sensory neurons to the spinal cord or brain called?
a. Neurotransmitters
b. Electrical synapses
c. Afferent nerves
d. Efferent nerves

ANS: C
The nerves that conduct signals from sensory neurons to the spinal cord or brain are called *afferent nerves.*

REF: Page 18

2. What are the endogenous chemicals that transmit signals from a neuron to a target cell across a synapse called?
a. Neurotransmitters
b. Electrical synapses
c. Afferent nerves
d. Efferent nerves

ANS: A
The endogenous chemicals that transmit signals from a neuron to a target cell across a synapse are called *neurotransmitters*.

REF: Page 15

3. What are the nerves that conduct signals away from the brain or spinal cord called?
a. Neurotransmitters
b. Electrical synapses
c. Afferent nerves
d. Efferent nerves

ANS: D
The nerves that conduct signals away from the brain or spinal cord are called *efferent nerves*.

REF: Page 18

4. A local anesthetic is said to cause a loss of nociception. What does this mean?
a. A loss of pain
b. A loss of polarization
c. A loss of muscle mobility
d. A loss of cell membrane potential

ANS: A
A local anesthetic is a drug that causes reversible local anesthesia and a *loss of pain or sensation* as a result of the depression of excitation in nerve endings or the inhibition of the conduction process in peripheral nerves.

REF: Page 15 plus a dictionary!

5. Tasks for neurons include receiving, processing, and sending information. They communicate with other neurons through axons and synapses.
a. Both statements are true.
b. Both statements are false.
c. The first statement is true; the second statement is false.
d. The first statement is false; the second statement is true.

ANS: A
Both statements are true. Tasks for neurons include receiving, processing, and sending information. They communicate with other neurons through axons and synapses.

REF: Page 17

6. What is another name for axons?
a. Core bundles
b. Mantle bundles
c. Nerve fibers
d. All of the above

ANS: D
All of the above. Axons are often referred to as nerve fibers. The nerve fibers that are bundled together and located near the outside of the nerve are called mantle bundles. The bundled nerve fibers located near the inside of the nerve are called core bundles.

REF: Page 19

7. What is the most distal arborization of the nerve endings called?
a. Dendritic zone
b. Soma
c. Axon hillock
d. Output zone

ANS: A
The dendritic zone is the most distal section of neuron and is an arborization (if you do not know what arborization means, look it up!) of nerve endings.

REF: Page 19

8. What is the name of the portion of the sensory neuron that is easily excited and has the most negative action potential threshold?
a. Dendritic zone
b. Soma
c. Axon hillock
d. Output zone

ANS: C
The axon hillock is the part of the neuron that has the greatest density of voltage-dependent sodium channels (Na^+); it easily excited and is the portion of the sensory neuron with the most negative action potential threshold.

REF: Page 19

9. The lipoprotein sheath that surrounds many neurons is called _____ and is composed of _____.
a. Lipid; oligodendrocytes
b. Myelin sheath; Schwann cells
c. Nodes of Ranvier; Schwann cells
d. White fibers; oligodendrocytes

ANS: B
The lipoprotein sheath that surrounds many neurons is called *myelin sheath* and is composed of *Schwann cells*.

REF: Page 20

10. What is the propagation of action potentials along myelinated axons from one node of Ranvier to another called?
a. Nonmyelinated
b. Saltatory conduction
c. Polarization
d. Refractory period

ANS: B
Saltatory conduction is the propagation of action potentials along myelinated axons from one node of Ranvier to another.

REF: Page 20

11. Nerve fiber type _____ , the smallest and the most numerous nerve fiber, is responsible for what type of pain?
a. A alpha; pain related to temperature
b. A delta; sharp pain
c. B; touch and pressure pain
d. C; dull, aching pain

ANS: D
Nerve fiber type *C*, the smallest and the most numerous nerve fiber, is responsible for *dull, aching pain*.

REF: Page 23

12. Nerve fiber type _____ , the largest nerve fiber with the fastest conduction velocity, is responsible for what type of pain?
a. A alpha; pain related to temperature
b. A delta; sharp pain
c. B; touch and pressure pain
d. C; dull, aching pain

ANS: B
Nerve fiber type *A delta*, the largest nerve fiber with the fastest conduction velocity, is responsible for *sharp pain.*

REF: Page 23

13. As the action potential moves down the line, its strength decreases as it moves from one neuron to the next. The action potential in myelinated axons does not propagate as waves as in unmyelinated axons.
a. Both statements are true.
b. Both statements are false.
c. The first statement is true; the second statement is false.
d. The first statement is false; the second statement is true.

ANS: D
Once a nerve is excited, the intensity of stimulation does not produce a stronger signal or become diminished as it propagates down the line. The action potential in myelinated axons does not propagate as waves as in unmyelinated axons.

REF: Pages 23, 24 and 25

14. Which description best describes the mechanism by which local anesthetic drugs work?
a. Anesthetic drugs bind to the sodium channels, the influx of sodium is interrupted, the action potential cannot rise, and the signal conduction is inhibited.
b. Anesthetic drugs bind to the potassium channels, the influx of sodium is interrupted, the action potential cannot rise, and the signal conduction is inhibited.
c. Anesthetic drugs bind to the sodium channels, the influx of potassium is interrupted, the action potential cannot rise, and the signal conduction is inhibited.
d. Anesthetic drugs bind to the sodium channels, the influx of sodium and potassium is interrupted, the action potential cannot rise, and the signal conduction is inhibited.

ANS: A
Anesthetic drugs bind to the sodium channels, the influx of sodium is interrupted, the action potential cannot rise, and the signal conduction is inhibited.

REF: Page 28

15. What is the layer of connective tissue that surrounds each axon within a nerve called?
a. Epineurium
b. Endoneurium
c. Perineurium
d. Fascicle

ANS: B
Within a nerve, each axon is surrounded by a layer of connective tissue called the *endoneurium.*

REF: Page 17

16. What is the layer of connective tissue that surrounds the entire nerve called?
a. Epineurium
b. Endoneurium
c. Perineurium
d. Fascicle

ANS: A
The entire nerve is wrapped in a layer of connective tissue called the *epineurium.*

REF: Page 17

17. The main difference between motor neurons and sensory neurons is the location of which body part?
a. Axon
b. Dendritic zone
c. Cell body
d. Terminal arborization

ANS: C
The main difference between motor neurons and sensory neurons is the location of the *cell body.*

REF: Page 19, Figure 2-6

18. The cell body of which neuron participates in impulse conduction and therefore is located at the terminal arborization?
a. Sensory neurons
b. Motor neurons
c. Somatic neurons
d. All of the above

ANS: B
The cell body of the *motor neuron* participates in impulse conduction and therefore is located at the terminal arborization.

REF: Page 19

19. The difference between the electrical charge on the outside of the cell and that on the inside of the cell is called what?
a. Firing threshold
b. Membrane potential
c. Polarization
d. Action potential

ANS: B
The difference between the electrical charge on the outside of the cell and that on the inside of the cell is called the membrane potential.

REF: Page 25

20. At the synaptic knobs of neuron cells, what type of action is required to have the electrical impulse cross the synapse of one cell to another cell?
a. The action of electrical synapses
b. The action of chemical synapses
c. The action of either electrical or chemical synapses
d. Repolarization

ANS: C
To have the electrical impulse cross the synapse of one cell to another cell requires *the action of either electrical synapses or chemical synapses.*

REF: Page 25

21. The nerve cell stage in which potassium returns to the inside of the cell and sodium returns to the outside of the cell is called what?
a. All-or-none principle
b. Polarization
c. Depolarization
d. Refractory period

ANS: D
The refractory period puts everything back to normal: Potassium returns inside, and sodium returns outside the cell membrane.

REF: Page 27

22. What do local anesthetic drugs inhibit in order to prevent nerve cell stimulation?
a. Sodium influx
b. Potassium influx
c. Chloride excretion
d. All of the above

ANS: A
Local anesthetic drugs act mainly by inhibiting *sodium influx* through sodium-specific ion channels in the neuronal cell membrane.

REF: Page 28

23. Why do the IA and PSA require more anesthetic than an infiltration of local anesthetic?
a. The locations for injecting the IA and PSA are more posterior than anterior.
b. The diameter of the nerve fiber is larger for the IA and PSA.
c. The nerve fibers are unmyelinated.
d. All of the above

ANS: B
The *diameter of the nerve fiber is larger* for the IA and PSA, thus requiring a greater amount of local anesthetic.

REF: Page 28