

The Nervous System: Neurons and Synapses

Chapter 7

1. Define the following:
 - a. Membrane potential
 - b. Resting membrane potential
 - c. Equilibrium potential
 - d. Synaptic potential
 - e. Graded potential
2. What is the equilibrium potential of sodium?
3. What is the equilibrium potential of potassium?
4. How does the membrane potential change when the following ions are allowed to diffuse down their gradient (Na^+ , K^+ , Ca^{2+} , Cl^-).
5. Is the resting membrane potential primarily due to the permeability of potassium or sodium, why?
6. Describe the following modes of cell signaling:
 - a. Paracrine
 - b. Synaptic
 - c. Endocrine
7. What are the two divisions of the nervous system?
8. What is the function of the following neuronal structures: dendrites, cell body (soma), axon hillock, axon, axon terminal, synapse.
9. Define presynaptic cell, and a postsynaptic cell.
10. What are the two classifications of neurons?
11. Describe the following: unipolar neuron (pseudounipolar), bipolar neuron, multipolar neuron.
12. Describe the following cells/where are they found: Schwann cells, oligodendrocytes
13. How does myelin affect the speed of the action potential (AP)?
14. How are oligodendrocytes and schwann cells similar, how are they different?
15. Describe where in the neuron each occurs, and how they are generated: resting membrane potential, graded potential, action potential, synaptic transmission, synaptic potential.
16. What is the typical resting membrane potential?
17. What is the function of the following gated channels (give examples of each): chemically regulated, voltage regulated, mechanically regulated?
18. Define hyperpolarization and depolarization.
19. Describe the process of a graded response. Include movement of ions and why the message may or may not trigger an action potential.
20. Describe how an action potential (AP) is generated. How does the action potential propagate down the axon? Why doesn't the action potential fizzle out? Why does it only travel in one direction along the axon? Be sure to include movement of sodium and potassium ions, as well as the voltage gated sodium and voltage gated potassium channels.
21. What is the typical action potential threshold?

22. What is the difference between continuous propagation and salutatory propagation?
23. Define refractory period, what contributes to the refractory period?
24. Once the AP arrives at the axon terminal, how is the message transferred to the next neuron? Include the role of Ca^{++} , the movement of neurotransmitters and the effect of neurotransmitters on the postsynaptic cell.
25. Define IPSP and EPSP? How do they participate in signal transduction? How is the strength of the message conveyed to the postsynaptic terminal?

Study Questions on Synaptic Potentials & Cellular Integration:

1. _____ are the incoming signals to the neuron.
 - a. synaptic potentials
 - b. action potentials

2. When the neuron is depolarized to threshold, it generates an _____. The action potential is the outgoing signal of the neuron.
 - a. synaptic potentials
 - b. action potentials

3. Recall that action potentials are all-or-none events. For a given cell, the action potential has the same _____ and _____ as it travels along the axon.
 - a. amplitude and duration
 - b. decay and fizzle out

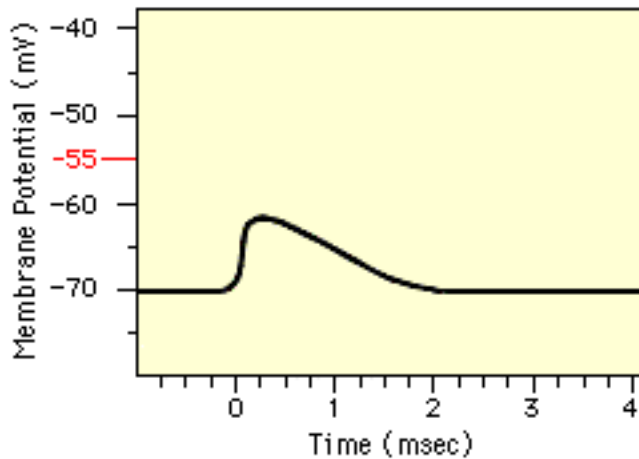
4. _____ are considerably smaller than _____.
 - a. synaptic potentials, action potentials
 - b. action potentials, synaptic potentials

5. Excitatory postsynaptic potentials _____ neurons.
 - a. depolarize
 - b. hyperpolarize

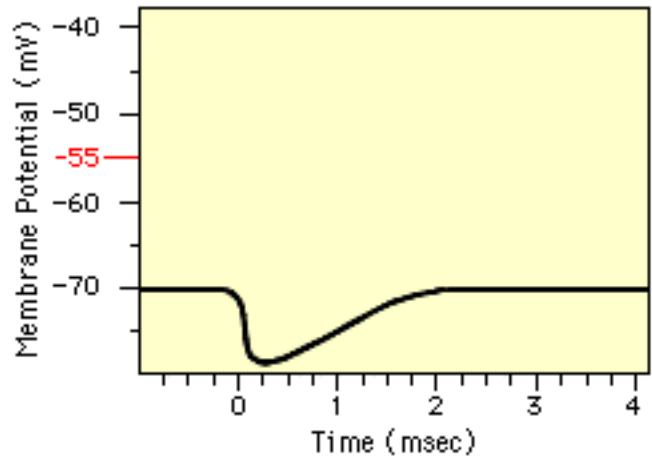
6. Inhibitory postsynaptic potentials _____ neurons.
 - a. depolarize
 - b. hyperpolarize

7. Which of these is a depolarization and which is a hyperpolarization?

a.



b.



8. The amplitude of a synaptic potential varies and is related to the number of synaptic vesicles releasing _____.

- a. calcium b. neurotransmitter c. sodium

9. The number of vesicles releasing neurotransmitter in turn is related to the amount of _____ that enters the presynaptic terminal.

- a. calcium b. neurotransmitter c. sodium

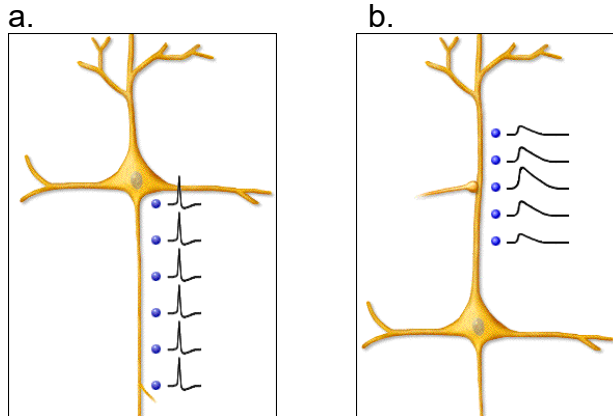
13. Synaptic potentials are largest at the synapse where they originate. Synaptic potentials _____ as they travel away from the synapse.

- a. potentiate b. decay c. remain as is

14. Unlike the action potential, the synaptic potential can only travel for _____ because it decays as it moves along the neuronal membrane. This effect is true for both excitatory postsynaptic potentials and inhibitory postsynaptic potentials.

- a. short distances b. long distances

15. Which of these shows a graded potential and which shows an action potential?



16. A single action potential in a presynaptic cell leads to an _____, which is too small to depolarize a neuron to threshold.
 a. EPSP b. IPSP c. postsynaptic potentials d. presynaptic inhibition

20. Many _____ are required to depolarize a neuron to threshold.
 a. depolarization b. hyperpolarization c. EPSP d. IPSP

22. The overall effect of inhibitory activity is to keep the membrane potential below threshold, thus preventing the postsynaptic cell from generating an _____.
 a. synaptic potentials b. action potentials

23. Inhibitory postsynaptic potentials and excitatory postsynaptic potentials also _____ with each other.
 a. depolarization b. hyperpolarization c. summate d. reduce

25. Excitatory activity must travel from the synapse across the cell body to depolarize a neuron to _____.
 a. threshold b. depolarize c. hyperpolarize