Action Potential

1. Which part of a neuron is the site from which an action potential is usually fired?
2. Which part of a neuron is usually the site where graded potentials begin?
3. 5 "phases" of an action potential.
4. IPSP compared to EPSP.
5. Graded potential versus action potential: location, amplitude, variability, end result.
6. How is the resting membrane potential maintained?
7. Using the ATPase pump, how many Na+ ions exit and how many K+ ions are brought in?
8. If the pump only moves positive ions, why is the inside of the cell "negative"?
9. During depolarization, which ion moves, and which way?
10. Amplitude of action potential is:
11. Amplitude of threshold is:
12. What happens at threshold that causes depolarization?
13. During repolarization, which ion moves, and which way?
14. Why does Na+ enter and K+ exit when their channels are opened?
15. Why does the cell not go higher than +30mV?
16. Why does the cell hyperpolarize?
17. How long is a typical action potential?
18. How is intensity of touch, or desire to move, communicated in neurons?
19. How is an action potential able to propagate, or jump, along an axon?
20. Would a hyperpolarized cell be more or less likely to fire an action potential?

Answers:

Action Potential

1. Which part of a neuron is the site from which an action potential is usually fired?
   axon hillock
2. Which parts of a neuron are where graded potentials may occur?
   dendrites, cell body, and axon hillock (but at hillock an action potential can be fired if the graded potential is strong enough to reach threshold)
3. 5 "phases" of an action potential.
   Resting
   Graded Potential
   Threshold
   Depolarization
   Repolarization
   Hyperpolarization
4. IPSP compared to EPSP.
   Inhibitory post synaptic membrane potential
   Excitatory post synaptic membrane potential
   IPSP is a graded potential that decreases the chance of reaching threshold at the axon hillock; EPSP increases the chance of reaching threshold at the axon hillock.
5. Graded potential versus action potential: location, amplitude, variability, end result.
   A graded potential is any change in the membrane potential in the dendrites or soma. An action potential is a 100mV change in the membrane potential generated at the axon hillock.
6. How is the resting membrane potential maintained?
   3Na+/2K+ ATPase pump is a type of membrane protein that can pump 3 Na+ ions OUT and 2 K+ ions IN. It is powered by ATP. It ensures that Na+ is always highly concentrated outside the cell; and K+ is always concentrated inside the cell.
   If a poison or toxin blocks the work of this pump, the membrane will settle toward equilibrium. If that happens, no more action potentials can be generated.
7. Using the ATPase pump, how many Na+ ions exit and how many K+enter?
   3 Na+ pumped out for every 2 K+ pumped in.
8. If the pump only moves positive ions, why is the inside of the cell "negative"?
   There are relatively more positive ions outside of the cell, so the inside is negative compared to the outside.
9. During depolarization, which ion moves, and which way?
   Na+ rushes IN because it moves down its concentration gradient when Na+ channels open.
10. Amplitude of action potential is:
    +30mV
11. Amplitude of threshold is:
    -55mV
12. What happens at threshold that causes depolarization?
    All the Na+ channels are triggered to open
13. During repolarization, which ion moves, and which way?
    K+ channels open and K+ leaves the cell to move down its concentration gradient.
14. Why does Na+ enter and K+ exit when their channels are opened?
    The ions always move from their area of high concentration to their area of low concentration (this is another way of saying they move down their concentration gradient).
15. Why does the cell not go higher than +30mV?
    All of the Na+ channels close again, so no more Na+ can come in.
16. Why does the cell hyperpolarize?
    The K+ channels close somewhat slowly, and more K+ is allowed to leave the cell than necessary to return the cell to resting membrane potential.
17. How long is a typical action potential?
    Less than 2/10 of a second (a little more than 150msec)
18. How is intensity of touch, or desire to move, communicated in neurons?
    Greater frequency of action potentials
19. How is an action potential able to propagate, or jump, along an axon?
    Na+ rushes in and K+ leaves, at each Node of Ranvier. Na+ and K+ channels are only found at these sites, so the action potential does not have to propagated at each patch of membrane.
20. Would a hyperpolarized cell be more or less likely to fire an action potential?
    LESS