What is an Action Potential?

Worksheet

An action potential is a brief reversal of a neuron's membrane voltage - from about 70 mV resting potential to +40 mV and back - triggered when depolarization crosses a threshold, typically around 55 mV.

Questions

1. What is the approximate threshold for firing an action potential?

A) 70 mV
B) 55 mV
C) 0 mV
D) +40 mV

2. Which ion enters the neuron during depolarization?

A) Potassium (K+)
B) Chloride (Cl)
C) Sodium (Na+)
D) Calcium (Ca2+) only

3. What does 'all-or-nothing' mean for action potentials?

A) They vary in size with stimulus strength
B) They either fire fully or not at all
C) They only occur in myelinated axons
D) They repeat continuously

4. What causes repolarization back toward resting potential?

A) Sodium influx
B) Potassium efflux
C) Calcium influx
D) Chloride influx

5. A neuron's membrane sits at 70 mV. A stimulus depolarizes it to 50 mV. Does an action potential fire?

6. During depolarization, which ion rushes into the neuron and why?

7. After the peak, the membrane potential drops below 70 mV briefly. What causes this hyperpolarization?

8. Define: What is the resting membrane potential of a typical neuron?

9. Define: What triggers an action potential?

10. Define: What is the 'all-or-nothing' principle?

Answer Key

1. B) 55 mV - Threshold is typically around 55 mV.

2. C) Sodium (Na+) - Voltage-gated Na+ channels open, letting sodium rush in.

3. B) They either fire fully or not at all - Below threshold nothing happens; above it, a full-amplitude action potential fires.

4. B) Potassium efflux - K+ channels open and potassium flows out, restoring negative charge inside.

5. Threshold is about 55 mV 50 mV is above (less negative than) threshold Yes - an action potential fires because the threshold was crossed

6. Voltage-gated sodium (Na+) channels open at threshold Na+ concentration is much higher outside the cell Na+ flows in down its concentration gradient, rapidly making the inside more positive (up to +40 mV)

7. Voltage-gated potassium (K+) channels open and stay open slightly too long K+ flows out of the cell down its gradient This overshoots resting potential, causing a brief hyperpolarization before returning to 70 mV

8. About 70 mV - the inside of the cell is negative relative to outside.

9. Depolarization crossing a threshold, usually around 55 mV.

10. Once threshold is reached, a full action potential fires; below threshold, nothing happens.