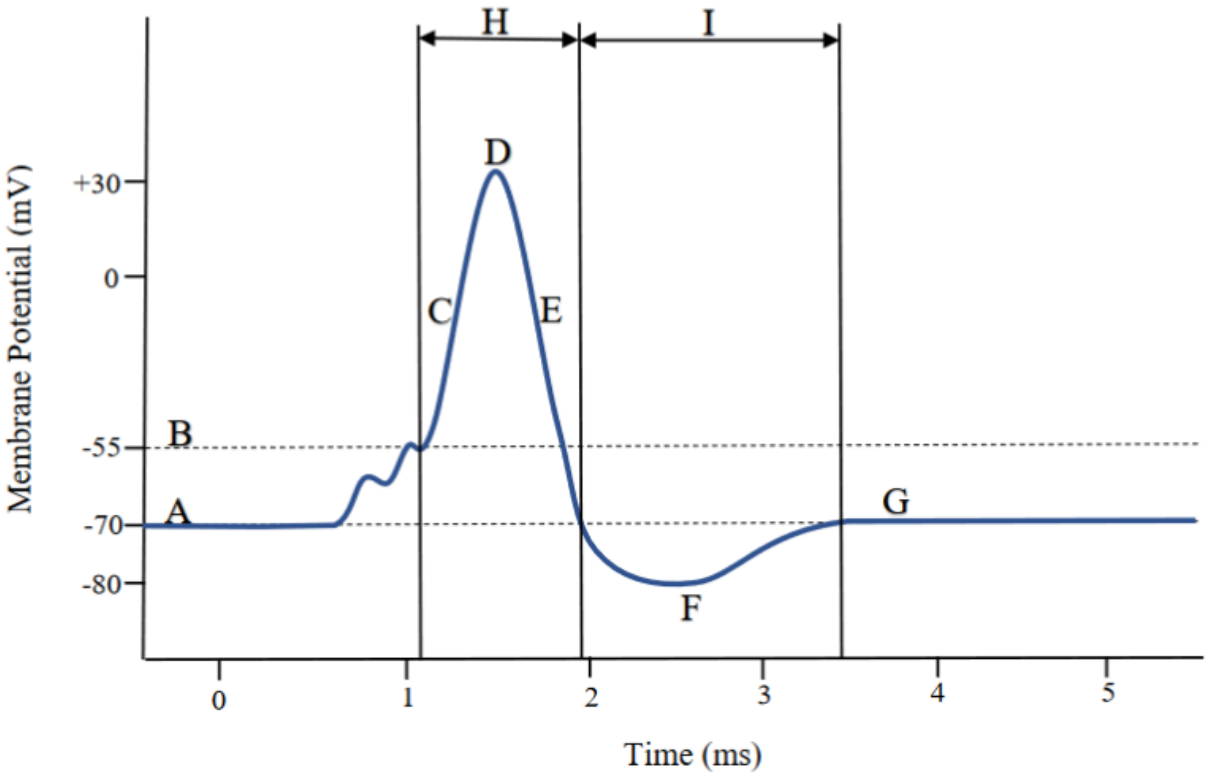
The Action Potential

Label the significant membrane potentials and phases of the action potential in a neuron. Indicate which gates are open/closed as well as the direction of the net movement of sodium and potassium ions across the cell membrane for A-G.



1. What type of summation is shown for the graded potentials in the above graph?

2. What happens when the threshold potential is reached?

3. At approximately +30 mV on the graph, what happens in between the depolarization and repolarization phases?

4. What mechanism is responsible for the occurrence of the hyperpolarization phase?

5. How is the resting membrane potential of the neuron restored?

6. Is it possible to generate a second action potential during either refractory period? If so, which one and how?

Place the following events in chronological order from 1-8:

_____ Na^+ enters the cell, and depolarization occurs to approximately +30 mV.

_____ The voltage across the cell membrane is -70 mV, the resting membrane potential.

_____ Upon reaching the peak of the action potential, the VG Na^+ channels are inactivated by the closing of their inactivation gate and the activation gate of each VG K^+ channel opens.

_____ VG K^+ channels close by the closing of their activation gate, and the resting membrane potential is gradually restored.

_____ An excitatory post-synaptic potential depolarizes the membrane to threshold and the activation gate of VG Na^+ channels open.

_____ Upon returning to the resting membrane potential, VG Na^+ channels are reset by opening of the inactivation gate and the closing of the activation gate.

_____ VG K^+ channels are slow to close, resulting in an excess of K^+ efflux and hyperpolarization.

_____ Depolarization occurs as K^+ flows out of the cell.

Determine whether each statement is true or false. If a statement is false, explain why.

_____ 1. Voltage gated sodium channels are quick to open and slow to close, while voltage gated potassium channels are quick to open and slow to close.

_____ 2. Before a second action potential can be generated, the concentration of sodium and potassium on either side of the cell membrane must be fully restored.

_____ 3. The strength of an action potential is represented by the amplitude of the wave. A stronger stimulus will generate an action potential with a higher peak than a weaker stimulus.

_____ 4. Action potentials travel in a non-decremental manner down the axon, with the voltage constantly being regenerated along the way, unlike graded potentials which quickly diminish over short distances.

_____ 5. Contiguous conduction is faster than saltatory conduction.

_____ 6. Action potentials originate in the axon hillock and travel down the axon to the terminal boutons (pre-synaptic axon terminals).