

Membrane Potential Encyclopedia Article

Membrane Potential

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Membrane Potential

Certain cells within the nervous system are called "excitable cells." Surrounding each of these cells is a highly complex, semipermeable membrane, an insulating barrier which separates fluids inside the cell from fluids outside. In the quiet state, when the cell is resting or unstimulated, the inside of a neuron's membrane is negatively charged--about -70 millivolts (mV)--and the outside is positively charged. This difference in voltage or charge is stored in the membrane and called the membrane potential because it provides a source of potential energy which can be used to generate and propagate electrical signals from one cell to the next through ion currents. The membrane is selectively permeable to ions, particularly potassium (K^+), which is more highly concentrated inside the cell, and sodium (Na^+), more highly concentrated outside the cell. When an event excites the cell, these ions change places through voltage-gated channels--or special pores--in the membrane. The inner and outer membrane charges reverse, triggering an action potential, an all-or-none response which travels down the cell's axon to the synaptic terminals where it causes the release of neurotransmitters into the synapse. These neurotransmitters, in turn, stimulate the adjoining cell. Neurons have a threshold stimulus, which means there is a minimum level of stimulation needed to trigger the exchange of K^+ and Na^+ ions across the membrane. They also need a refractory period, time during which the K^+ and Na^+ to return to their normal intra and extracellular levels, once again giving the membrane its potential to fire off another signal.