Simulation of Postsynaptic Inhibition Caused by GABA Neurotransmitter

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Abstract

The neuron is an elementary processing unit in the nervous system. There are many highly specialized types of neurons that differ in appearance. Generally, a neuron consists of three distinct parts:

1. The dendrite, a short, branching arbor of cellular extensions.
2. The soma, or cell body is a large central part of the cell between the dendrites and the axon.
3. The axon, a projection, which may extend tens, hundreds, or, the diameter of the soma in length. Neurons have only one axon, but this axon may undergo extensive branching, enabling communication with many target cells.

Dendrites bring information to the cell body and axons take information away from it. Neurons communicate with each other through an electrochemical process. Neurons contain some specialized structures (synapses) and chemicals (neurotransmitters). Synapses provide a communication mechanism between neurons.

The most common transmitters in brain are gamma-aminobutyric acid (GABA), N-methyl-D-aspartate (NMDA) and alpha-amin-3-hydroxi-5-methylisoxasole-propiononate (AMPA). The neurotransmitters not only allow neurons to communicate accurately and quickly but also to control the proper level of arousal of the nervous system for efficient and correct processing of the information. Many mental disorders are due to disturbances in postsynaptic inhibition.

The goal of this research is to understand how inhibitory postsynaptic potentials (IPSP) “clams” the membrane voltage and to examine how membrane excitability following an IPSP is affected. In order to achieve this goal we perform a wide range of experiments on NEURON simulator with different sets of parameters close to those found by medical researchers.