9.01 Introduction to Neuroscience
Fall 2007

The simulation program HHsim

In 1952, Hodgkin and Huxley introduced a mathematical model of action potential generation based on their neurophysiological measurements of squid giant axons. To construct the model, they performed experiments to determine how the conductances g_{Na} and g_K depended on activation and inactivation variables, and in turn how these variables depended on voltage. These experiments were summarized in a set of differential equations which made up the model. Because the equations are fairly complex, they will not be described here. You can learn about them if you take the class 9.29 Introduction to Computational Neuroscience.

In 9.01, we will use the computer program `HHsim` to simulate a variant of the Hodgkin-Huxley model. This is a helpful exercise because we can use `HHsim` to perform simulated experiments on neurons. This is helpful for developing intuition about the behaviors of real neurons, but is a lot easier than doing real experiments.

The simulation program `HHsim`, which was developed at CMU by David Touretzky and his collaborators, is available at `http://www.cs.cmu.edu/~dst/HHsim/`. Here is how to obtain and install it.

Microsoft Windows or Linux

If you use Microsoft Windows, you can download a standalone version of `HHsim`. This should create an application that you can double click to run.

Macintosh or MIT Server

If you use Mac OS X, or do not own a personal computer, you should run `HHsim` within the MATLAB environment. (Although there is a standalone version for Mac available for download, it is an outdated release.) MATLAB is also an option for Windows and Linux users.

If you do not already have MATLAB installed, you should download it from `http://web.mit.edu/matlab/www/` Hopefully you will be able to install and run with no problems. If all else fails, or you do not own a computer, you can run MATLAB on an MIT Server.

Assuming that you have MATLAB working, download the MATLAB source code for `HHsim` from `http://www.cs.cmu.edu/~dst/HHsim/`. When you unzip the file, there will be a directory called `hhsim` on your disk.

At the MATLAB command prompt, type the command `cd hhsim` to change to that directory. Then type `hhsim` to start the simulation program. A graphical user interface (GUI) window should come up on your screen, and you will be able to interact with it using buttons, text boxes, sliders, and so on.