CIS6930/4930 Intro to Computational Neuroscience Fall 2008

Home Work Assignment 2: Due Teusday 09/30/08 before class

1. Use the Hodgkin-Huxley equations to model a simple neuron that is an isopotential sphere. Does anything happen if the radius of the sphere is changed from 1 μm to 10 μm. If so (if not) why? You are required to do a literature search to find out what the typical values for the capacitance, leak conductance, and voltage-dependent sodium and pottasium conductances per unit area are. Now inject a variety of current waveforms, starting from rectangular (of variable length) to alpha functions ($f(t) = \alpha t e^{-t/\tau}$) and report the sub-threshold and supra-threshold voltage response of your neuron.

2. Use the passive membrane equations and build a compartmental model of a neuron comprising of a soma and a dendrite that branches in two. Inject currents a various locations on the two branches and show cases where the resultant voltage response at the soma is close to linear and cases where it is not so linear.