

CIS6930/4930 Intro to Computational Neuroscience Spring 2006

Home Work Assignment 2: Due Monday 01/13/06 before class

1. (50 pts) 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 $1 \mu\text{m}$ to $10 \mu\text{m}$. 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 potassium 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. (50 pts) 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 at 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.