Introduction to Computational Neuroscience
Lab 1: Constructing an H&H-like current in Matlab

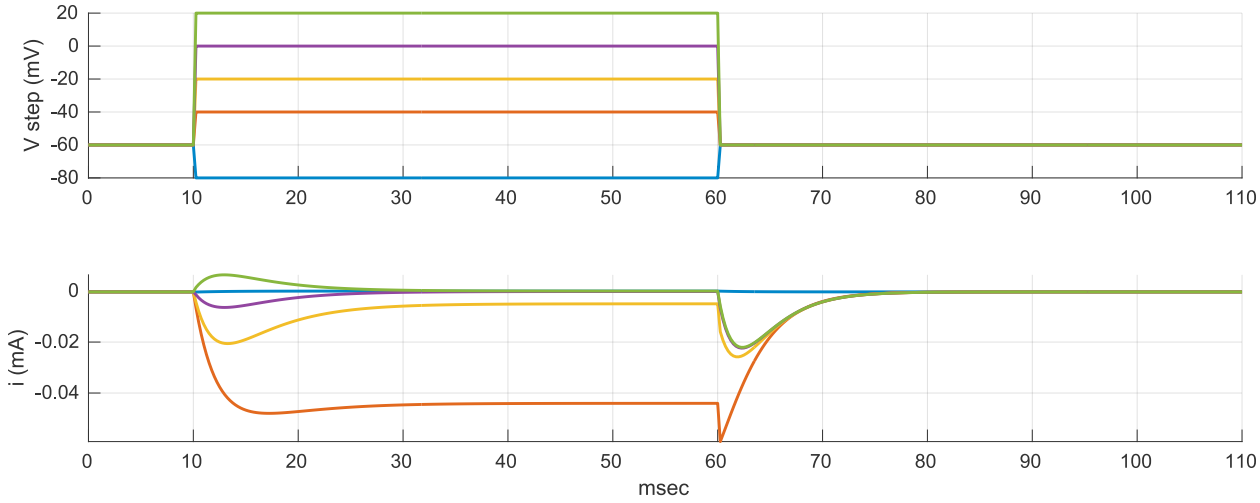
In this lab you will construct a Matlab model of a voltage- and time-dependent current. The goal is to use the H&H formalism to mimic the voltage-clamp response of an unknown current.

Load the voltage-clamp data

Load the data file:

load('CookAssignemnt1UnknownCurrent.mat')

Three variables will be created: 1) Time in ms (t). 2) The time-course of the voltage step in mV (vStep, a matrix of 5 different steps where the rows are time and the columns correspond to each step). 3) The current in mA (iUnknownCurrent, matrix of the current in response to each voltage sweep).



Using the H&H formalism discussed in class, modify the initial Matlab model that takes each voltage-clamp sweep as an input and produces a voltage and time-dependent current as the output.

The initial model parameters are:

Er = reversal potential
gBar = max conductance
taua = time constant for the activation
v0a = midpoint of the steady state activation sigmoid
ba = slope of the steady state activation sigmoid

Run the initial model script (mainInitialModel.m) to generate the attached figure.

Your assignment is to adjust the parameters of the initial model to best mimic the unknown current. You will need to add three additional parameters:

taui = time constant for the inactivation
v0i = midpoint of the steady state inactivation sigmoid
bi = slope of the steady state inactivation sigmoid

If desired, model parameters can adjusted by hand.

What to hand in

All files should be in a single compressed folder named *yourLastName_CookA1* and include:

1) A PDF file of a plot similar to that attached that shows all the components of the model and lists the parameters. The plot should also show the current traces of the data (solid) compared to your model's current (dashed).

2) All the Matlab code used for the model.

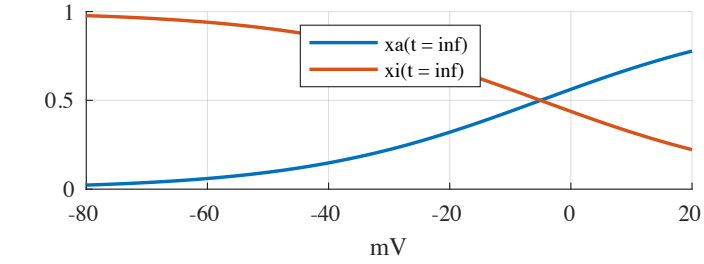
3) A statement of work at the top of your Matlab script listing all sources of help (students, a copy of past assignments, AI, google, etc).

Grading

50% for constructing an appropriate Matlab model that runs.

50% for the ability of the model to mimic the data.

-20% for missing or incomplete statement of work



gBar = 0.005 mS
Er = 0 mV
gBar = 0.005 mS
taua = 2 msec
v0a = -5 mV
ba = 0.05