ModelDB Exercises

Exercise 1.

Examine the model from https://modeldb.science/249404

Who are the authors? What question were they studying?

Two of the MOD files are shared with a different implementation of the same model, but one is shared with a model that came out in 2006. Which MOD file? Which paper?

More generally, how does the corresponding paper fit into the broader computational neuroscience literature? What modeling papers does it cite? What modeling papers cites it?

Download the model and run it.

Hint: Compile the mod files with `nrnivmodl`

Exercise 2.

Examine the model from https://modeldb.science/2488

Who are the authors? What question were they studying?

Using ModelDB's ModelView:

- How many different simulations are included in this model entry?
- For simulation 1c, the L3 pyramidal cell:
    - How many sections? How many segments?
    - How do you run this simulation?
    - What causes the cell to spike?
    - Is it temperature dependent?

Download the model and run 1c, using the run protocol instructions. See what happens.

Disable that which causes the cell to spike, and drive the cell with a Poisson process spike train (`ns.noise = True`). Using Python, record and plot the soma's membrane potential as a function of time.

Exercise 3.

Download the model from https://modeldb.science/126814

Who are the authors? What question were they studying?

This model was written in a language called HOC, but we can still use it from Python by loading in the model with `h.load_file('mosinit.hoc')`

Create a Python script that loads the model, injects current into the center of the soma from t=2 to t=4 ms sufficient to generate an action potential, and records and plots membrane potential, sodium current, and potassium current as functions of time from t=0 to t=10 ms.

Hint: In this model, `h.soma` is actually a list of sections of length 1; use `h.soma[0]` to get the soma section.

Hint: This model uses the variable time step solver. Be sure to record `t` or switch to a fixed step solver with `h.cvode_active(False)`.

Bonus challenge: Export the recorded data to a CSV file and then open and plot it in Excel, MATLAB, or a similar tool of your choice.

Bonus challenge: How does the plotted data change as `h.celsius` is varied?