Morphology Exercises

Exercise 1.

Download and examine the following three CA1 pyramidal cell morphologies (use the "standardized" version) from NeuroMorpho.Org. What are your thoughts on the appropriateness of each for simulation? (i.e. Do they have plausible 3D shapes? Are the diameters reasonable, or do they have "pinch points"? Are they associated with "normal functioning" or with a specific disease or developmental stage? etc)

https://tinyurl.com/neuromorpho-n123
https://tinyurl.com/neuromorpho-c91662
https://tinyurl.com/neuromorpho-calsynteninKO

Exercise 2.

Search https://NeuroMorpho.Org for a Cerebellar Purkinje Cell that has 3D information (Purkinje Cells are very flat, but some are recorded in 2D and some in 3D), has diameter information, has accurate angles, and has a soma.

Using the Import3D GUI, load this cell into NEURON and display it.

Using Python, find the sum of the lengths of all the dendrites. How does this compare to the maximum path distance from the center of the soma to the tips of the dendrites?

Exercise 3.

Load the standardized morphology from:
tinyurl.com/neuromorpho-c91662

Insert Hodgkin-Huxley channels in the soma and axon, insert passive (`h.pas`) channels everywhere, set the passive conductance to `1e-6`, choose a reasonable discretization, and plot the membrane potential across the cell mid-action potential.