

Converting Neuromorpho Neurons into Hoc Neurons

Preparatory Comments: Neuromorpho.org has a large array of modeling neurons that are in a .dat file format. The neurons themselves though are not compatible with Hoc directly. This is because the .dat file has to be read and constructed carefully through a premade script that was designed in this lab. The neurons once read through the script can then be directly used in Hoc and modeled correctly in Sim4Life.

Work Environment: Numerous people can work together at first to get the hang of implementation. Once comfortable every person should be performing the operation on their own in order to allow for more neurons to be created for further testing.

Equipment: NEURON, Neuromorpho neuron of interest, java file with the script (script.java on the computer system), Sim4Life (for easy visualization).

Caution:

- This process can cause frustration with neurons that are not complete or do not work properly. You have been warned :)

These directions assume the reader is using the in-lab computers and as a result has access to all software mentioned which are pinned to the taskbar.

1. **Open** neuromorpho.org, **click** *search by keyword*
2. **Click** “show summary”
 - a. It is preferable if the neuron has a complete or incomplete axon, this is because the magnetic field we are investigating is associated with the action potential which is transmitted down the axon
 - b. Additionally, our interested in the basal ganglia, therefore it is preferred to pick neurons that are labeled as
 - i. Palladia
 - ii. Thalamic
 - iii. Striatum
 - iv. Subthalamic
 - v. Or substantia nigra
3. **Click** on neuron then **click** “morphology file (standardized)” this will download the file
 - a. The geometry file gives the specification of the soma (cell body), the dendrites and the axon
4. **Copy** the content of the morphology file and **paste** them in a text editor (like notepad or sublime)
5. **Delete** the comments and keep the coordinates (comments are denoted by hashtags)
6. **Save** the text file as a .swc file
7. **Ensure** that “select all files” is clicked
8. **Open** NEURON (using version 4.2)
9. **Select** “Tools” and scroll down to “miscellaneous” then select “import 3D”

10. **Select** “choose file” and attach the directory (or go to the directory) where the .swc file from step 6 is saved
11. After the neuron has been found, **uncheck** “show points” then **click** on “export” and **scroll down** to “cell builder”
12. Another window will pop up. **Check** “continuous create” and then click on “biophysics”
13. In the biophysics section, **check** the first five options (cm, Ra, pas, extracellular, and hh)
 - a. Ra is cytoplasmic resistance, pas is the passive channel, extracellular is the extracellular properties and hh is the Hodgkin Huxley channel
14. **Click** on “management” and then on “export” -> “export to file” -> **save** the file in the directory of choice
 - a. nameOfFile.hoc
15. **Open** Sim4Life and move to the “simulation” tab
16. **Click** “new” then choose “Neuron”
17. Under the Explorer Tab, **click** on “Neurons” under Nr-Neuron go to “New Settings” and click “Hoc”
18. **Click** “Hoc Neuron Settings” under Neurons
19. Under the Properties tab, **click** on the box to the right of “Path to hoc file” and find your hoc/neuron file to open
20. **Click** on the “load model” in the ribbon. The neuron should show up in the simulation :)

