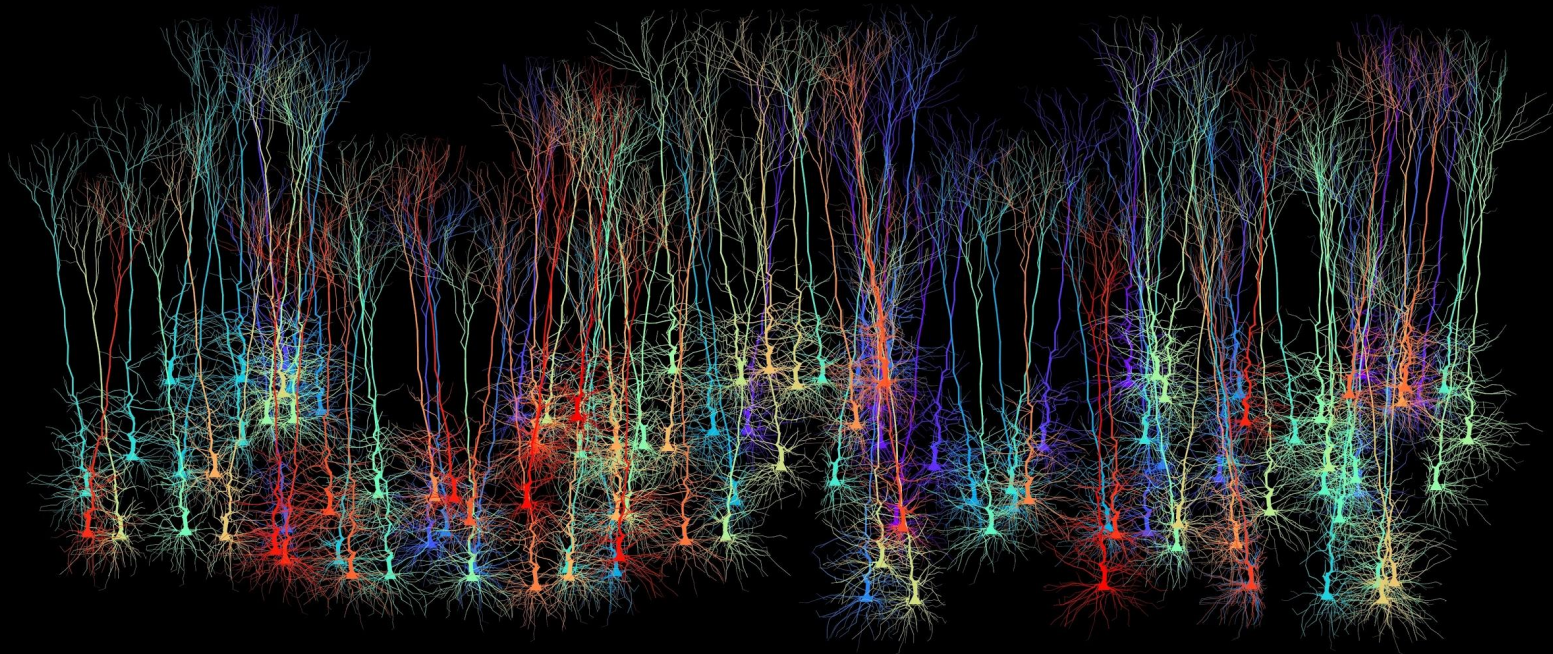


Python and NEURON





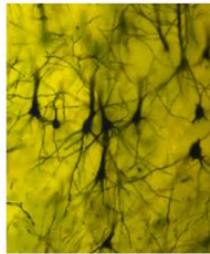
- Python has become the default programming language in computational neuroscience
 - Many important tools can be used through python
- Efficient for humans
 - Very important
- Inefficient for computers
 - Less important
- Lot of useful python packages:
 - Matplotlib, numpy, pandas, scipy
- Tutorial: <http://www.scipy-lectures.org>

The NEURON simulator

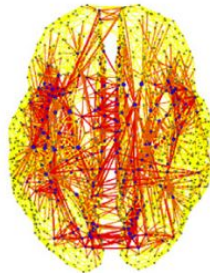
- The brain is studied at different levels
- NEURON is for simulating single cells and “small” neural networks



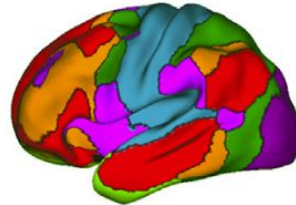
genes



neurons



networks



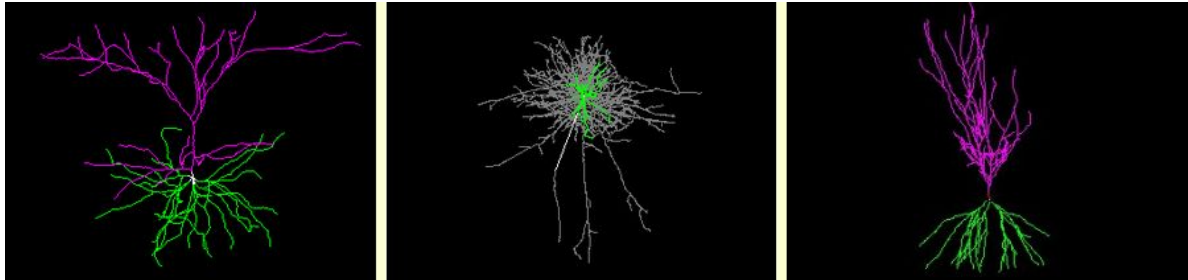
brain systems



behavior

The NEURON simulator

- Most commonly used simulator for biologically detailed cell models
- From point neurons to very detailed cell models
- From single cells to large networks
- For larger networks: NEST etc.



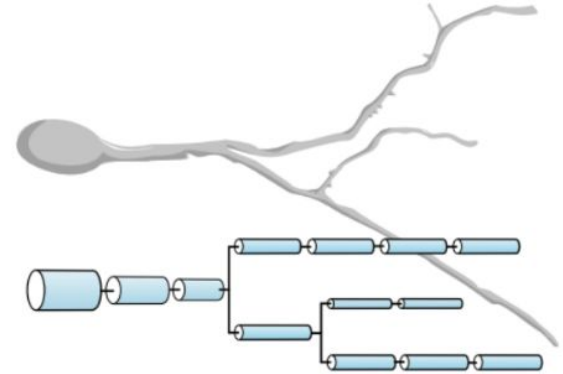
The NEURON simulator

- HOC was the original programming language supported by NEURON
 - I recommend that you stick with python when you can
- Ionic mechanisms (mod-files)
 - In a terminal at the location of the “*.mod” files, write “nrnivmodl”

```
import os
retval = os.getcwd()
print("Current working directory %s" % retval)
os.chdir("hay_model/mod/")
!nrnivmodl
os.chdir(retval)
```

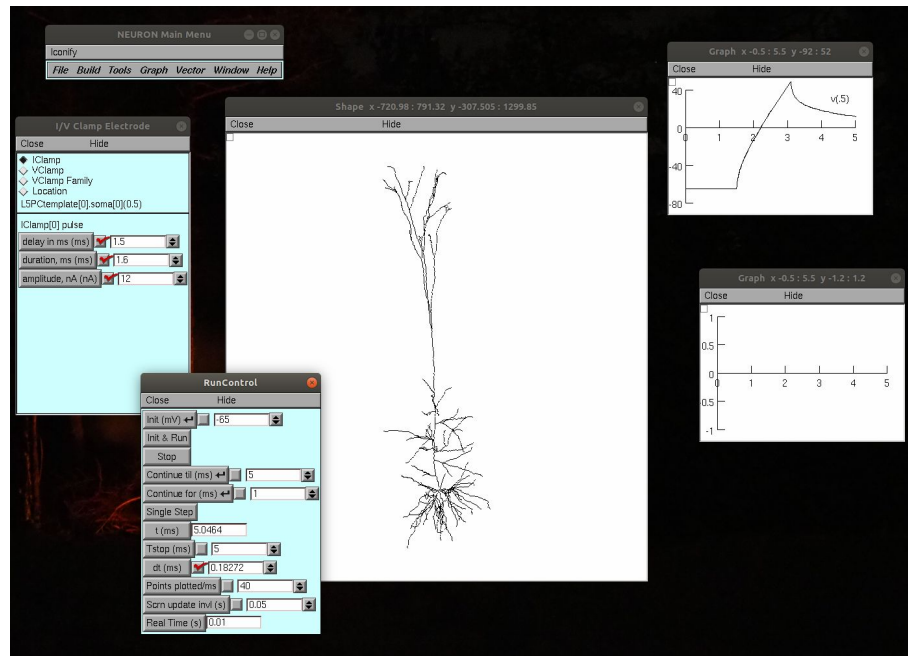
The NEURON simulator

- Cells are represented as electrically connected cylinders
- Cells are divided into different non-branching **sections** (soma, dendrite, axon)
- Sections are subdivided into **segments**
- To access a part of the section, specify a value between 0 and 1, where 0 is typically the end closest to the soma and 1 is the distal end



The NEURON simulator

- The NEURON simulator has been developed over more than 30 years
 - Developed by scientists, not programmers
 - Open source (, but not that open source)
 - Helpful developers



```
[c]#if VT125
case VT:
vtplo(mode, x, y);
break;
#endif[/c]
```

Now, I didn't know what VT125 was when I first saw this, but a quick search on the web reminded me that I'm still a young software developer. I present to you, the VT100:



[caption id="attachment_1367" align="center" width="640"]
I couldn't find a good picture of the VT125. I apologize if it looks way more modern than its older cousin. [/caption]

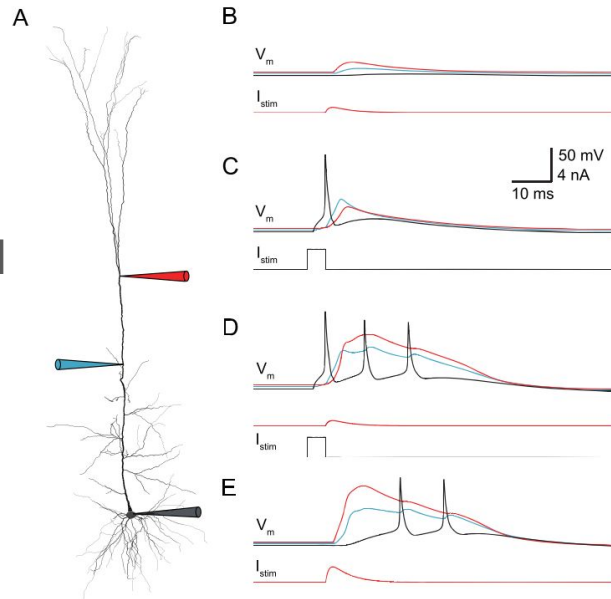
I couldn't find a good picture of the VT125. I apologize if it looks way more modern than its older cousin.

Svenn-Arne Dragly

<https://dragly.org/2015/10/26/straight-from-the-source-neurons-incredible-backwards-compatibility/>

Online databases

- ModelDB
 - senselab.med.yale.edu/ModelDB
 - Large database of detailed cell models
 - Fully-developed cell models
- NeuroMorpho.org
 - ~100'000 reconstructed cell models
 - Only morphologies
- The Neocortical Microcircuit Collaboration Portal
 - <https://bbp.epfl.ch/nmc-portal/microcircuit>
 - A lot of detail about rat somatosensory barrel cortex





NEURON and Python

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www.neuron.yale.edu/