Lab P

With Bonus

NEURON Main Menu

Iconify

File

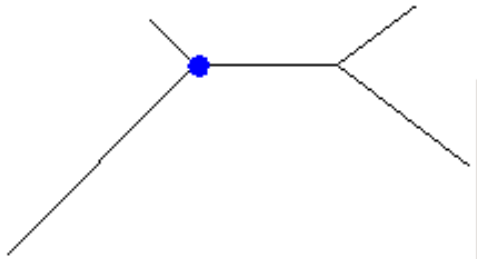
Print & File Window Manager

Close Hide

I/V Clamp Electrode

Close Hide

IClamp
VClamp
VClamp Family
Location
soma(0.5)



Close Hide

Init (mV) -65

Init & Run

Stop

Continue til (ms) 5

Continue for (ms) 1

Single Step

t (ms) 20

Tstop (ms) 20

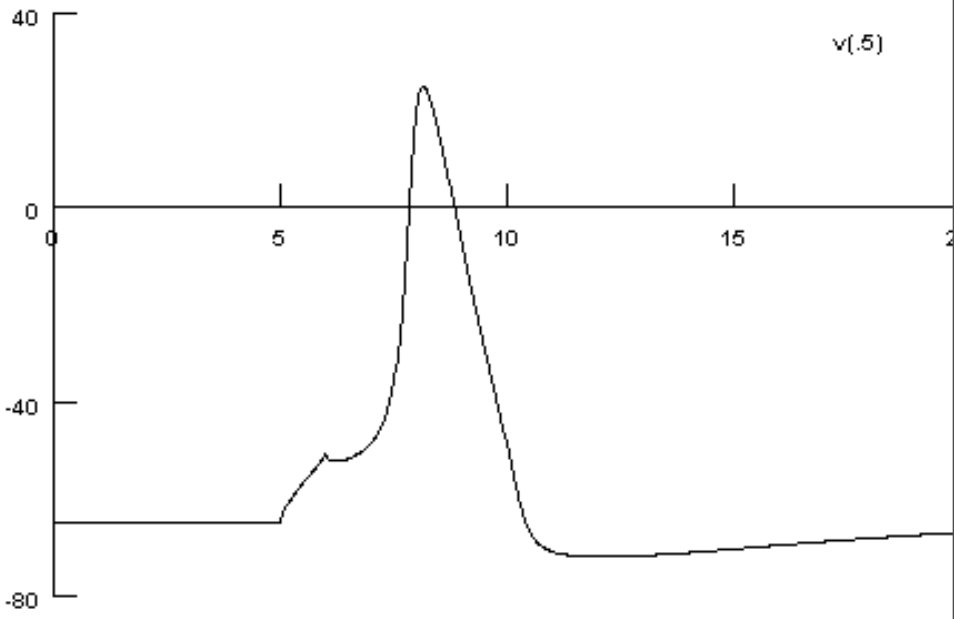
dt (ms) 0.025

Points plotted/ms 40

Scrn update invl (s) 0.05

Real Time (s) 0.08

Close Hide



CellBuild[0]

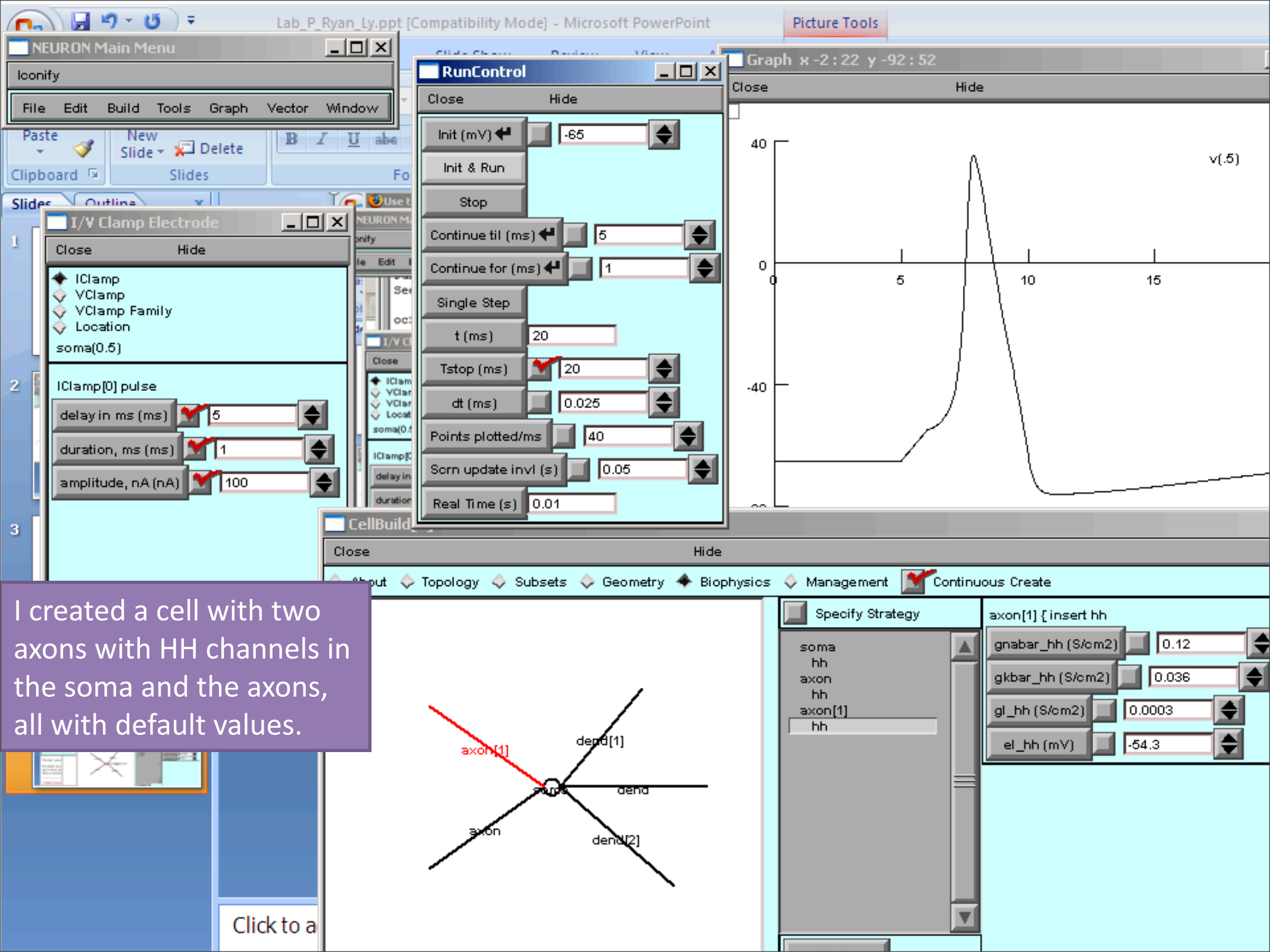
Close Hide

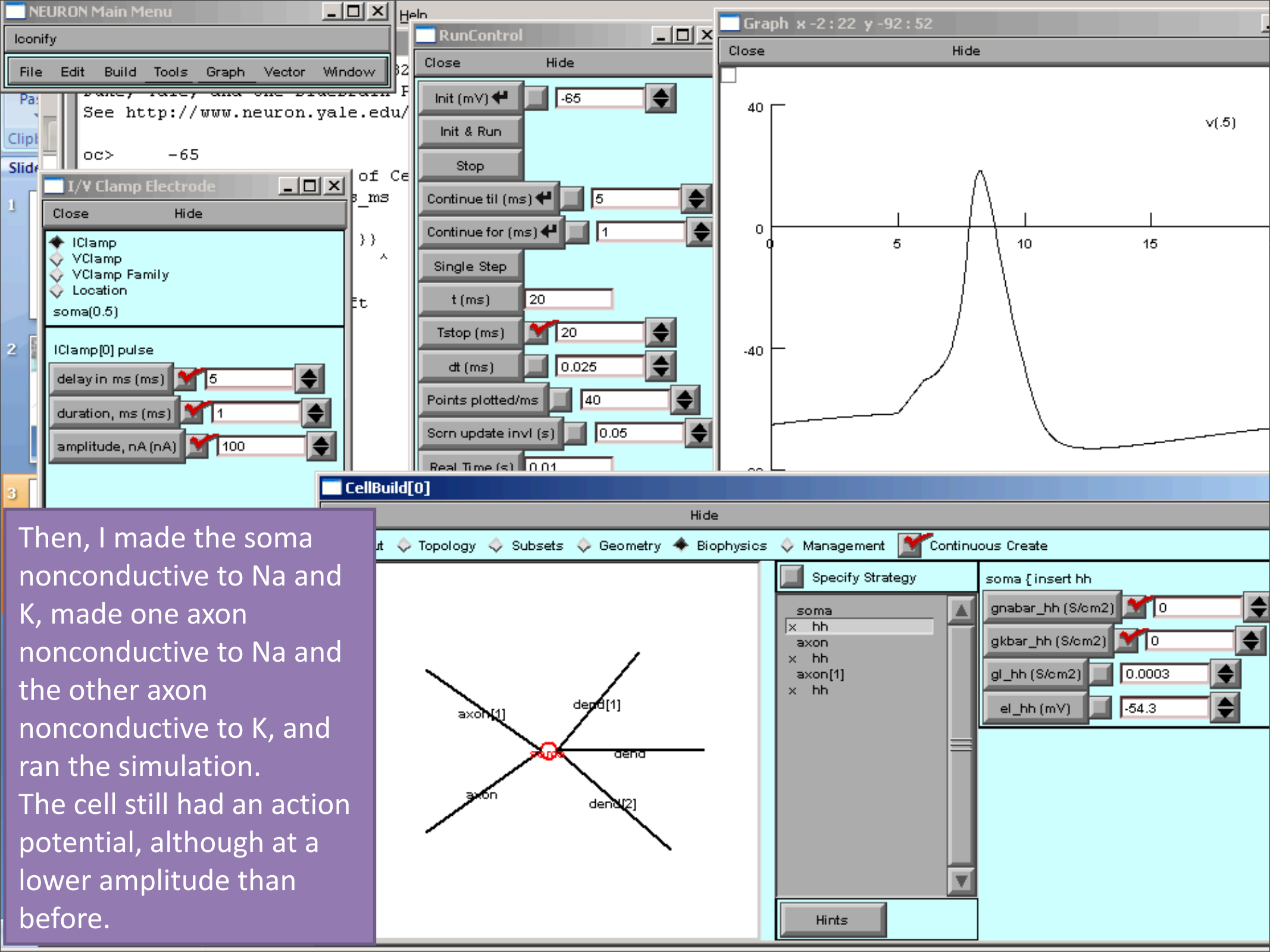
About Topology Subsets Geometry Biophysics Management Continuous Create

Topology refers to section names, connections, and 2d orientation
without regard to section length or diameter.
Short sections are represented in that tool as circles, longer ones as lines.
Subsets allows one to define named section subsets as functional
groups for the purpose of specifying membrane properties.
Geometry refers to specification of L and diam (microns), and nseg
for each section (or subset) in the topology of the cell.
Biophysics is used to insert membrane density mechanisms and specify their parameters.
Management specifies how to actually bring the cell into existence for simulation.
The default is to first build the entire cell and export it to the top level
Or else specify it as a cell type for use in networks,
It also allows you to import the existing top level cell into this builder
for modification.
If "Continuous Create" is checked, the spec is continuously instantiated
at the top level as it is changed.

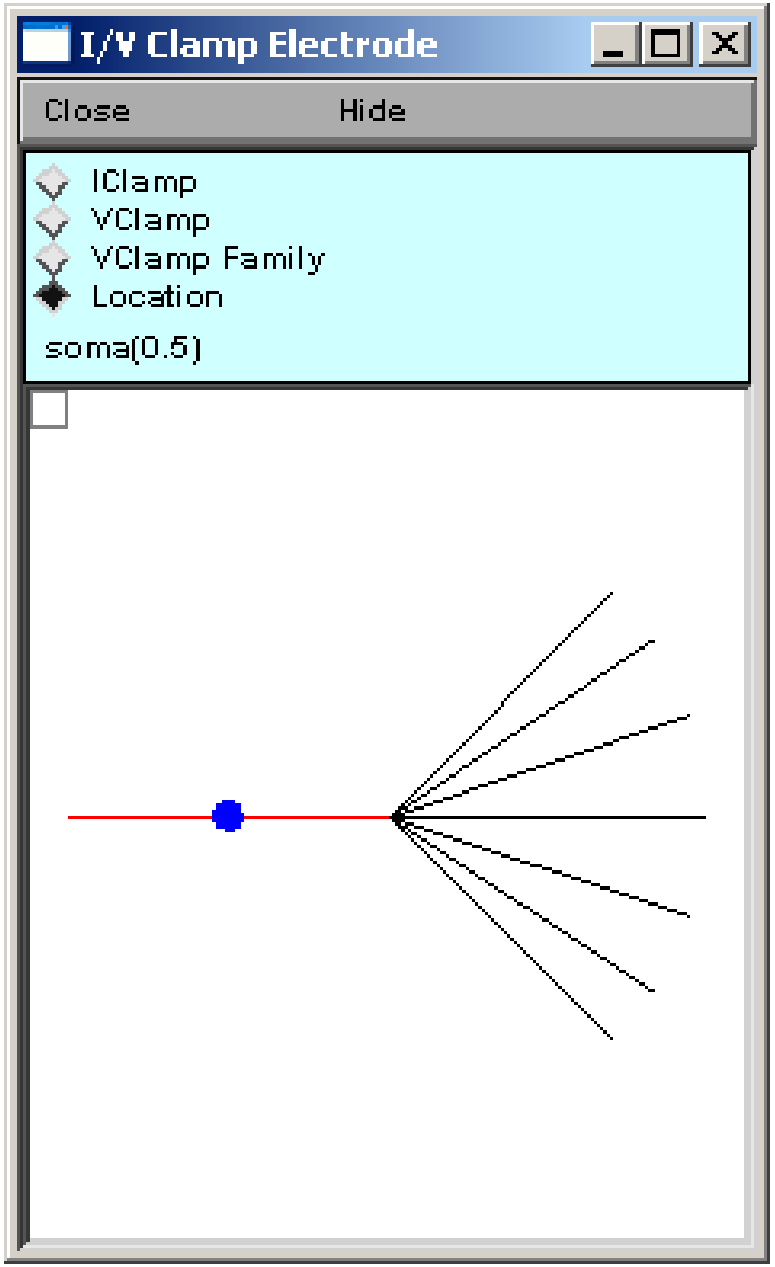
Slide 2 of 2 "Office Theme

Type: NEURON m


Lab_P_Ryan_Ly.ppt [Compatibility Mode] - Microsoft PowerPoint
Picture Tools
NEURON Main Menu
Iconify
File Edit Build Tools Graph Vector Window
RunControl
Close Hide
Init (mV) -65
Init & Run
Stop
Continue til (ms) 5
Continue for (ms) 1
Single Step
t (ms) 20
Tstop (ms) 20
dt (ms) 0.025
Points plotted/ms 40
Scrn update invl (s) 0.05
Real Time (s) 0.01
Graph x -2 : 22 y -92 : 52
Close Hide
40
0
-40
0
5
10
15
v(.5)
I/V Clamp Electrode
Close Hide
IClamp
VClamp
VClamp Family
Location
soma(0.5)
IClamp[0] pulse
delay in ms (ms) 5
duration, ms (ms) 1
amplitude, nA (nA) 100
CellBuild
Close Hide
Topology Subsets Geometry Biophysics Management Continuous Create
Specify Strategy
soma
hh
axon
hh
axon[1]
hh
axon[1] { insert hh
gnabar_hh (S/cm2) 0.12
gkbar_hh (S/cm2) 0.036
gl_hh (S/cm2) 0.0003
el_hh (mV) -54.3
axon[1]
dend[1]
dend
axon
dend[2]
I created a cell with two axons with HH channels in the soma and the axons, all with default values.

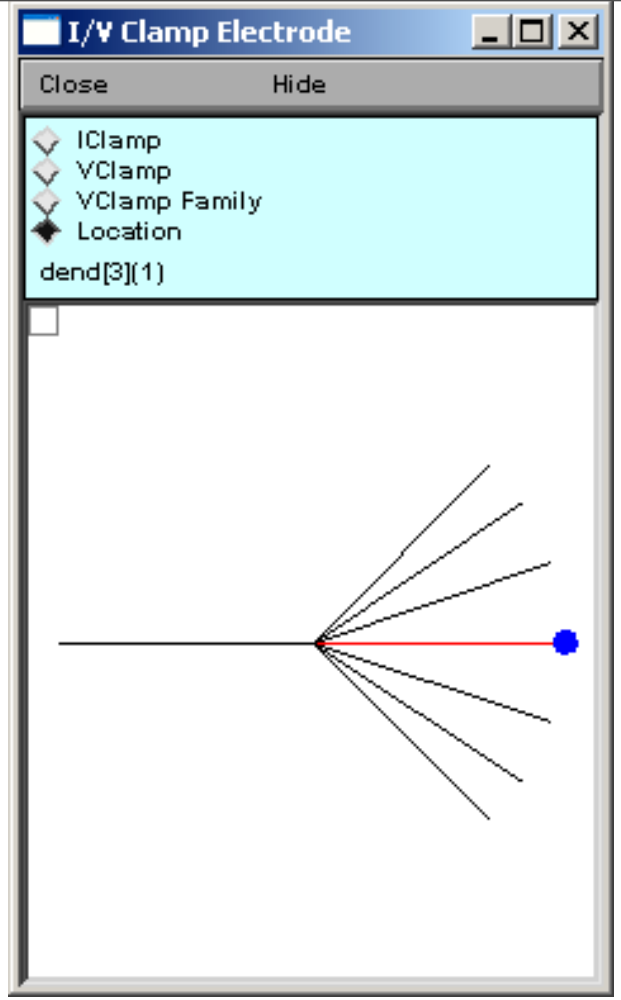


Then, I made the soma nonconductive to Na and K, made one axon nonconductive to Na and the other axon nonconductive to K, and ran the simulation.
The cell still had an action potential, although at a lower amplitude than before.

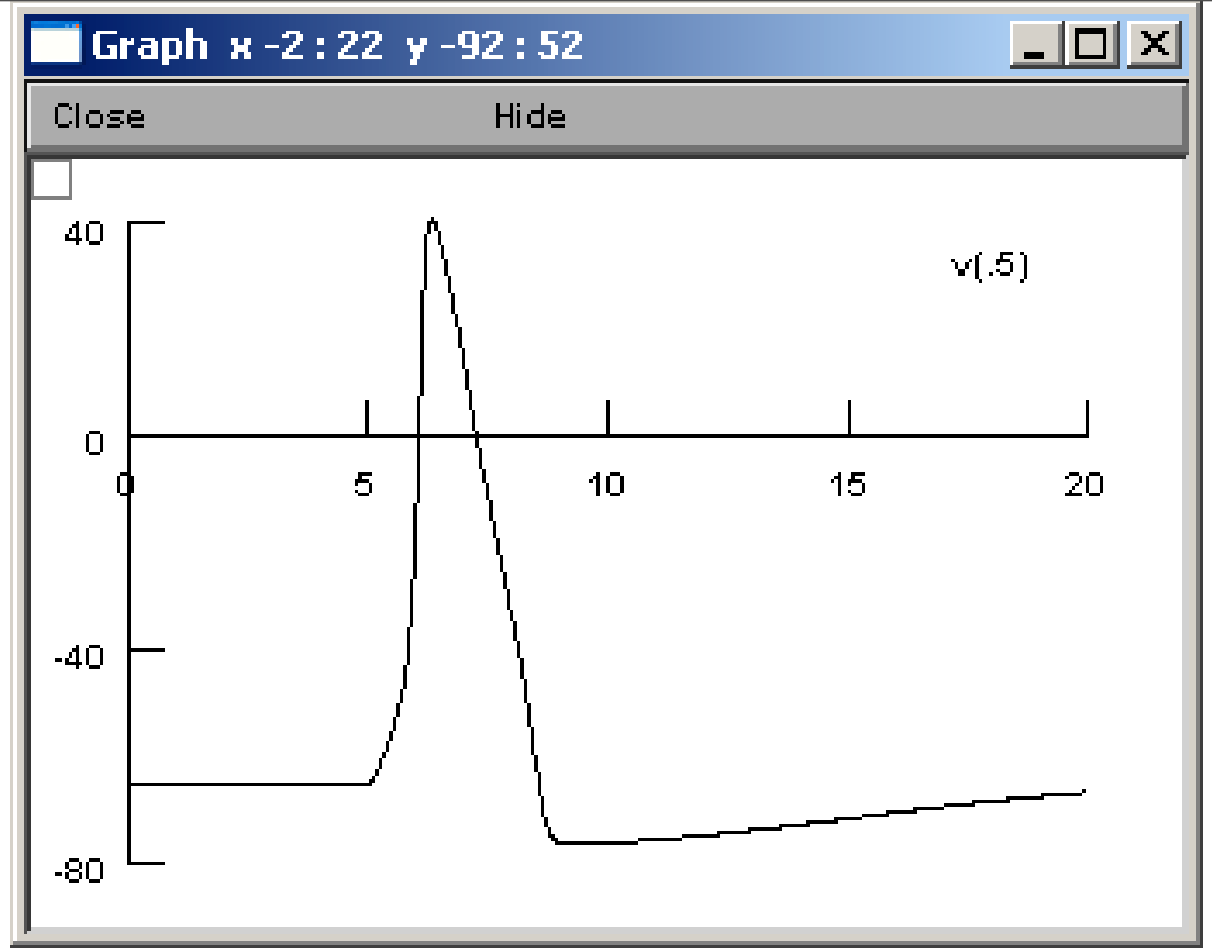


P.2

- I tried to create something similar to a hair cell.
- My model only consists of 1 soma and 7 dendrites, where all of them follow the HH model.
- L, and diameter of the dendrites were all constant
- All the biophysical variables used the default



- Signal given at the tip of the middle dendrite.
- Signal delay: 5ms
- Duration: 1ms
- Amplitude 0.6nA

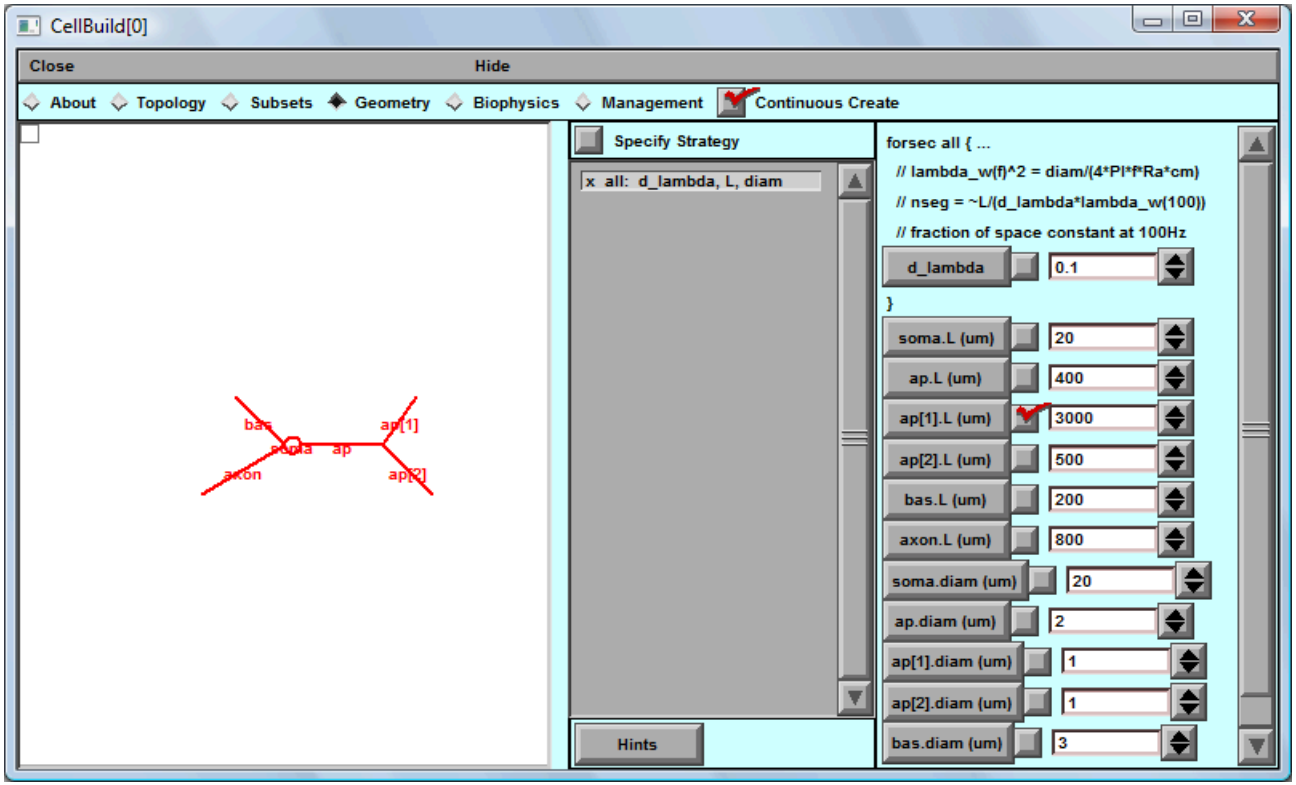


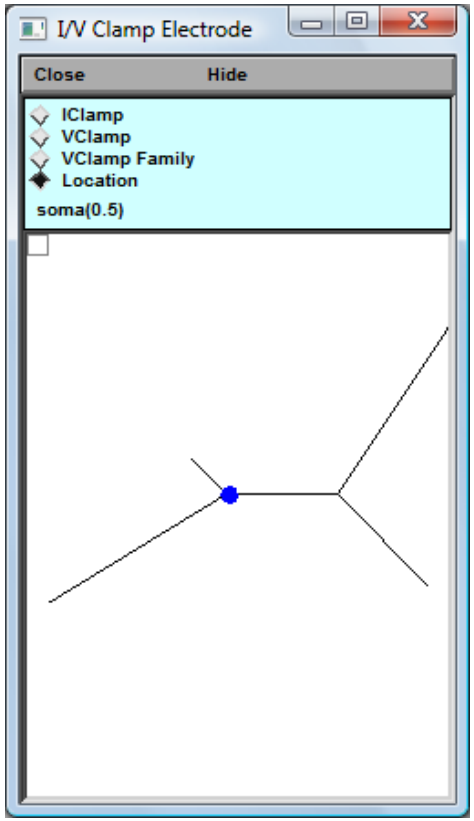
- The resulting graph
- Just like a hair cell, though the biophysical parameters must be way off the actual cell, it doesn't show a typical action potential graph like the one from the tutorial. It's only a constant, shift depolarization.

Q2

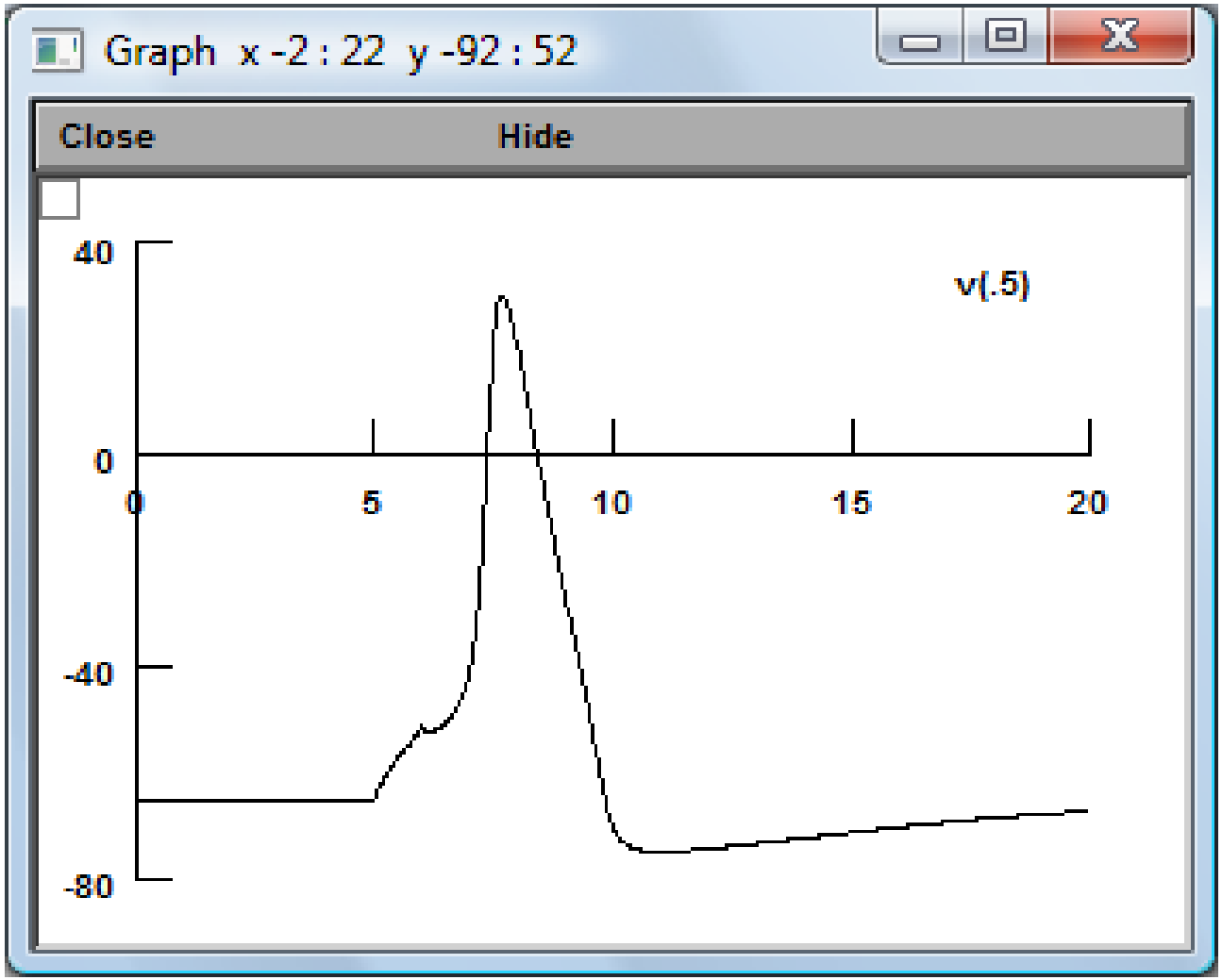
Initially, I tried creating a loop, but neuron seems to recognize it and treat as errors. As a result, I couldn't get a result.

So, I decided to make one of the branches very very long and see if it has any effects on AP.



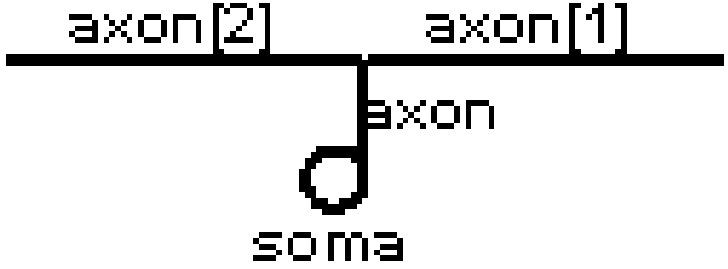


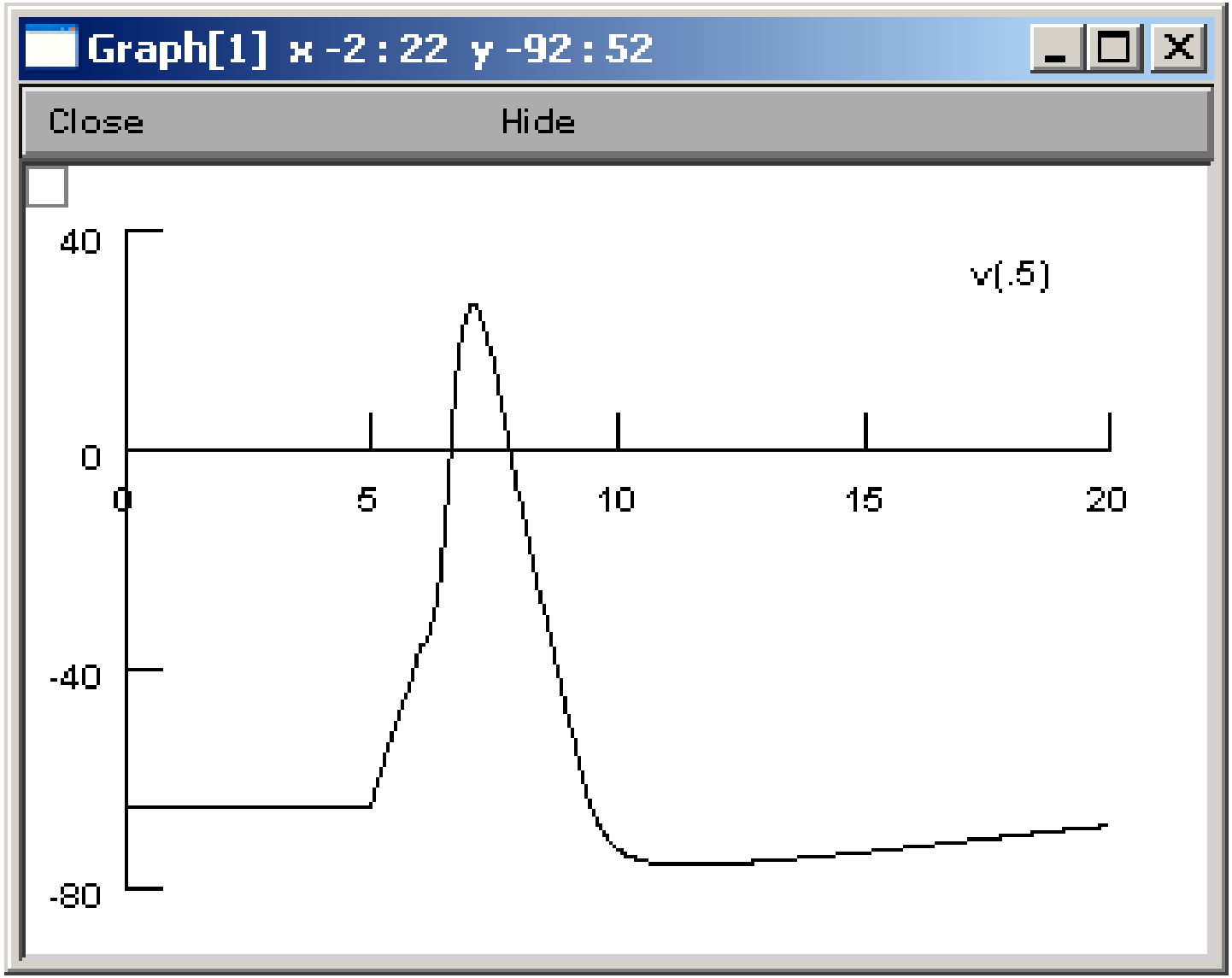
Q2



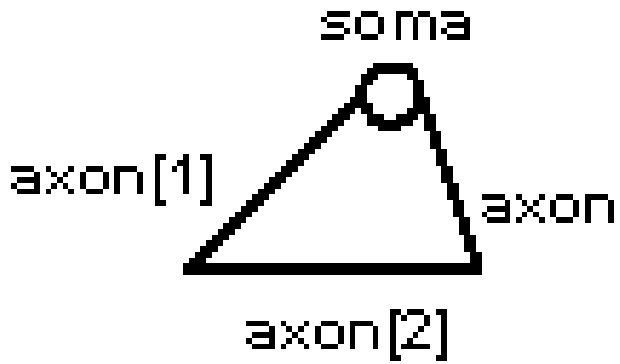
There was a very slight shifting of AP to the left side (earlier AP) but not much noticeable change, even though I increased AP1's length by 10 times.

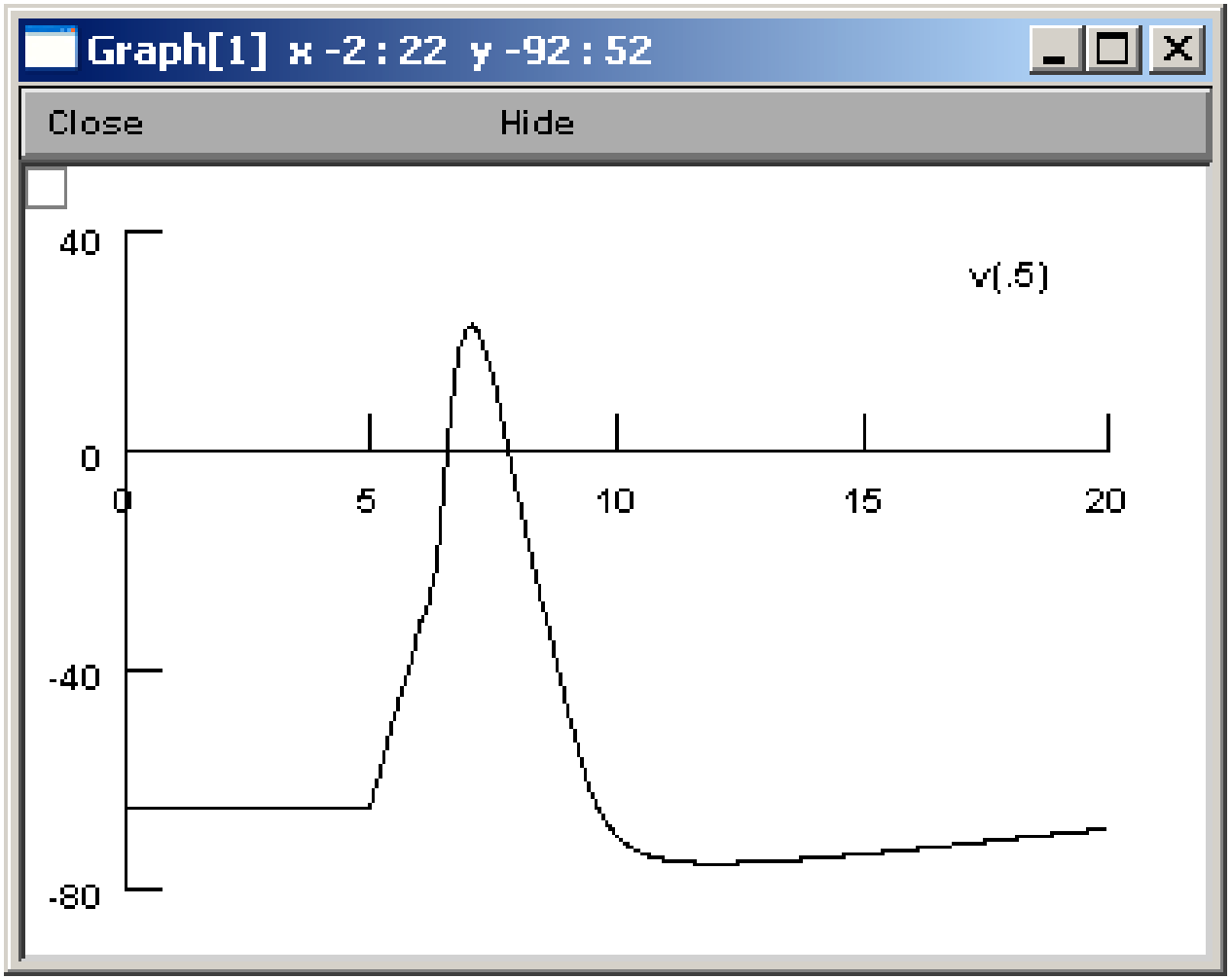
P.2 Unipolar Neuron



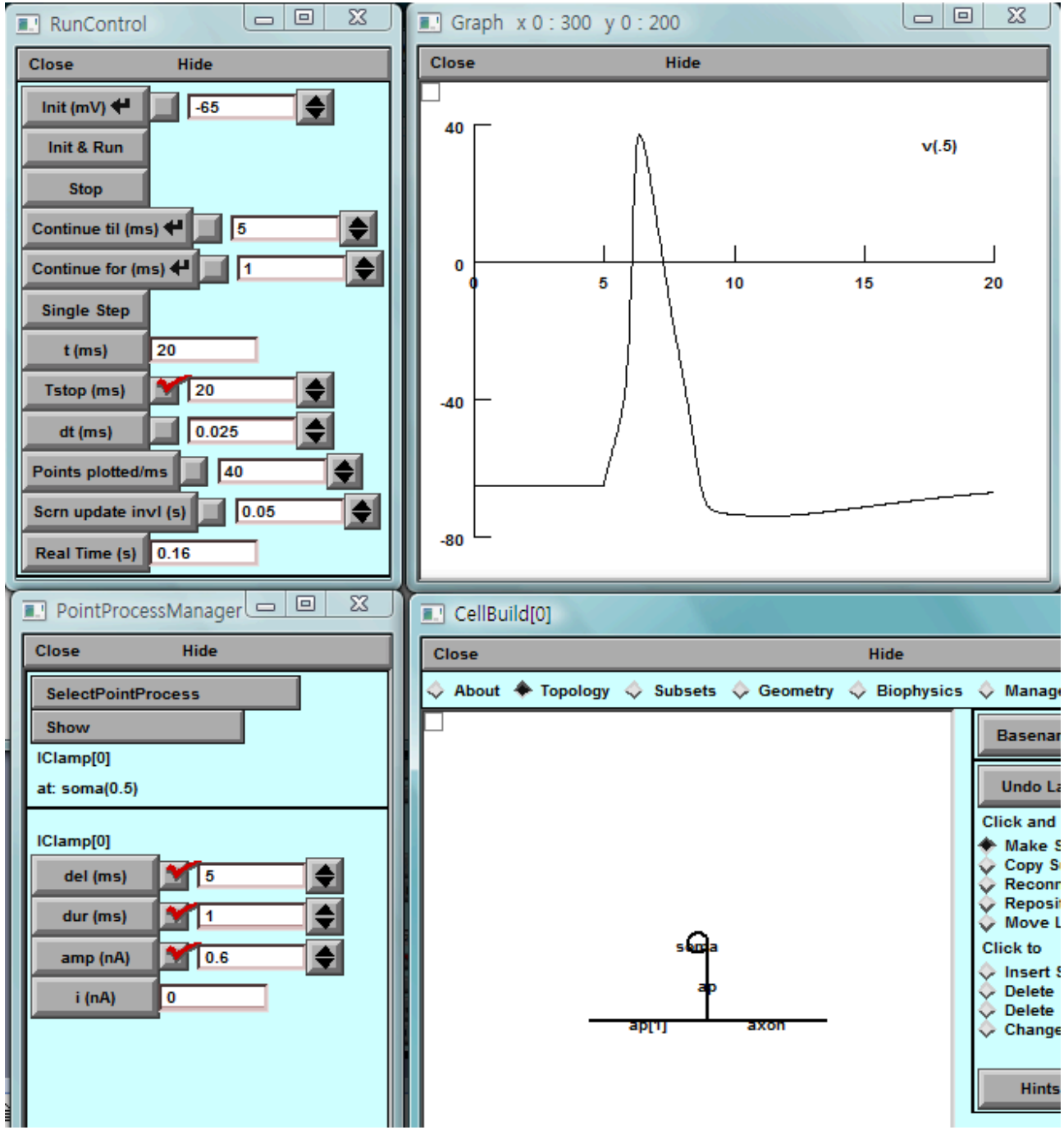


P.2 Circular Neuron

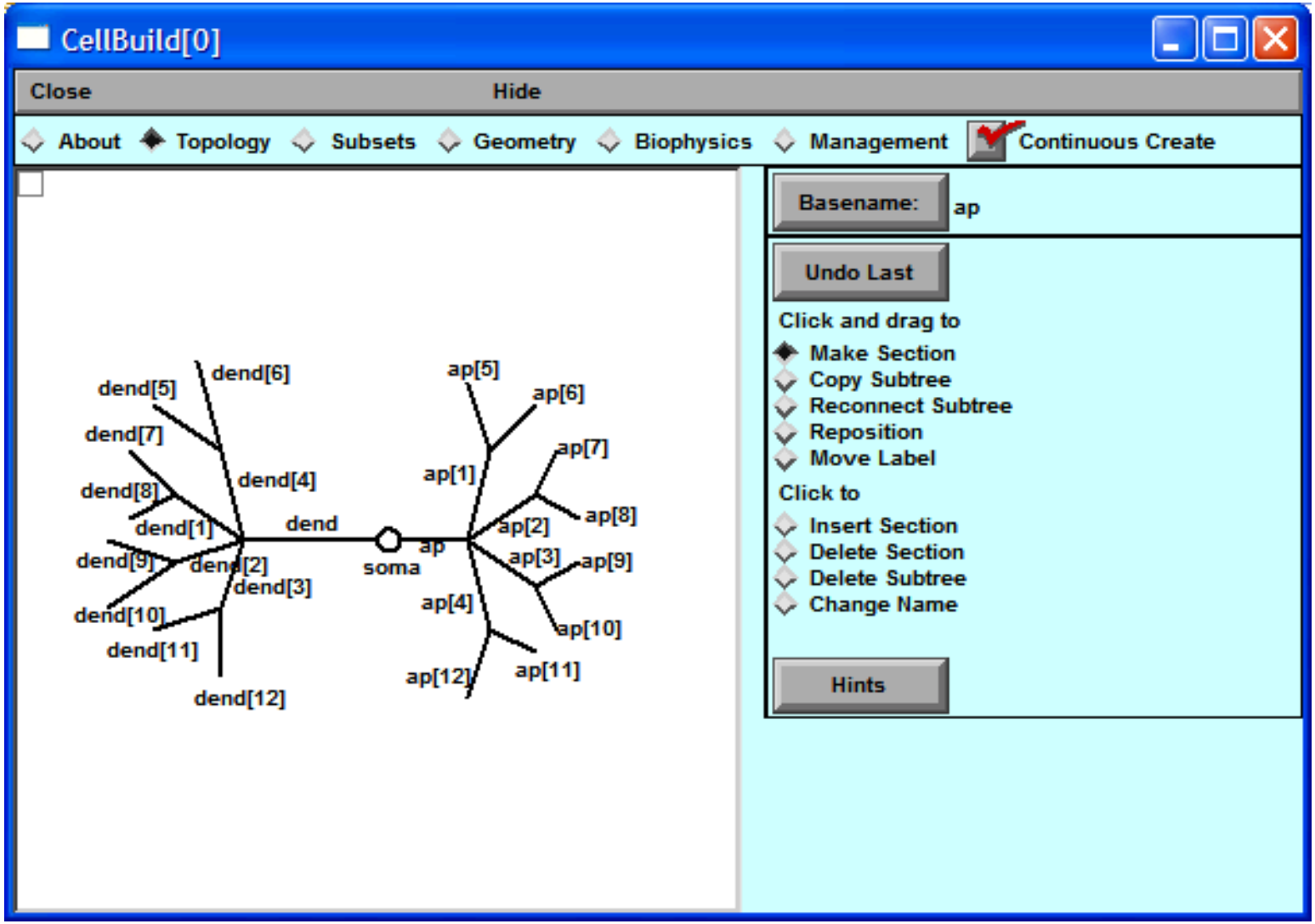


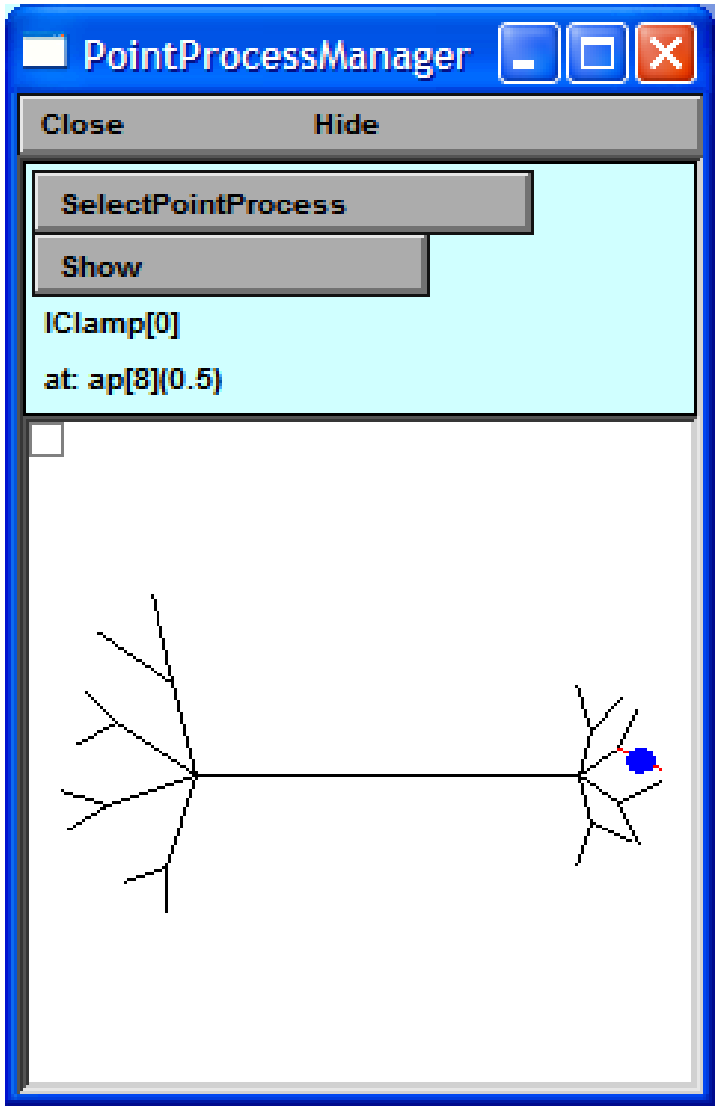


Homework: P.2


RunControl
Close
Hide
Init (mV)
-65
Init & Run
Stop
Continue til (ms)
5
Continue for (ms)
1
Single Step
t (ms)
20
Tstop (ms)
20
dt (ms)
0.025
Points plotted/ms
40
Scrn update invl (s)
0.05
Real Time (s)
0.16
Graph x 0 : 300 y 0 : 200
Close
Hide
v(.5)
40
0
-40
-80
0
5
10
15
20
PointProcessManager
Close
Hide
SelectPointProcess
Show
IClamp[0]
at: soma(0.5)
IClamp[0]
del (ms)
5
dur (ms)
1
amp (nA)
0.6
i (nA)
0
CellBuild[0]
Close
Hide
About
Topology
Subsets
Geometry
Biophysics
soma
ap
ap[1]
axon
Click and
Click to
Hints

2. My own bipolar neuron (things like this probably occur in the motor system to relay signals over long distances).

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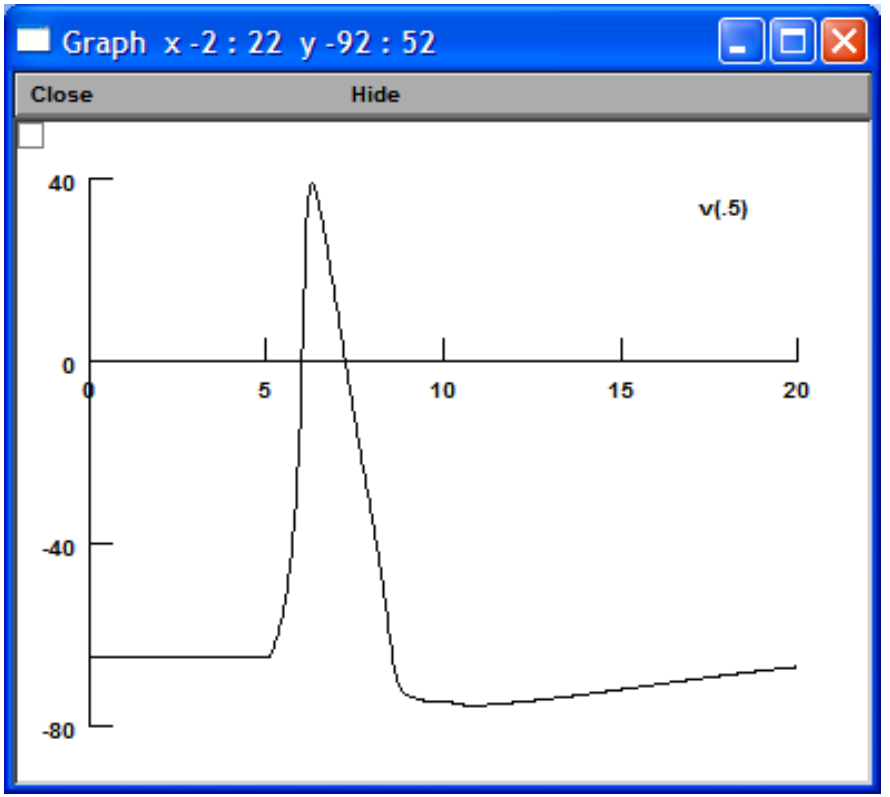
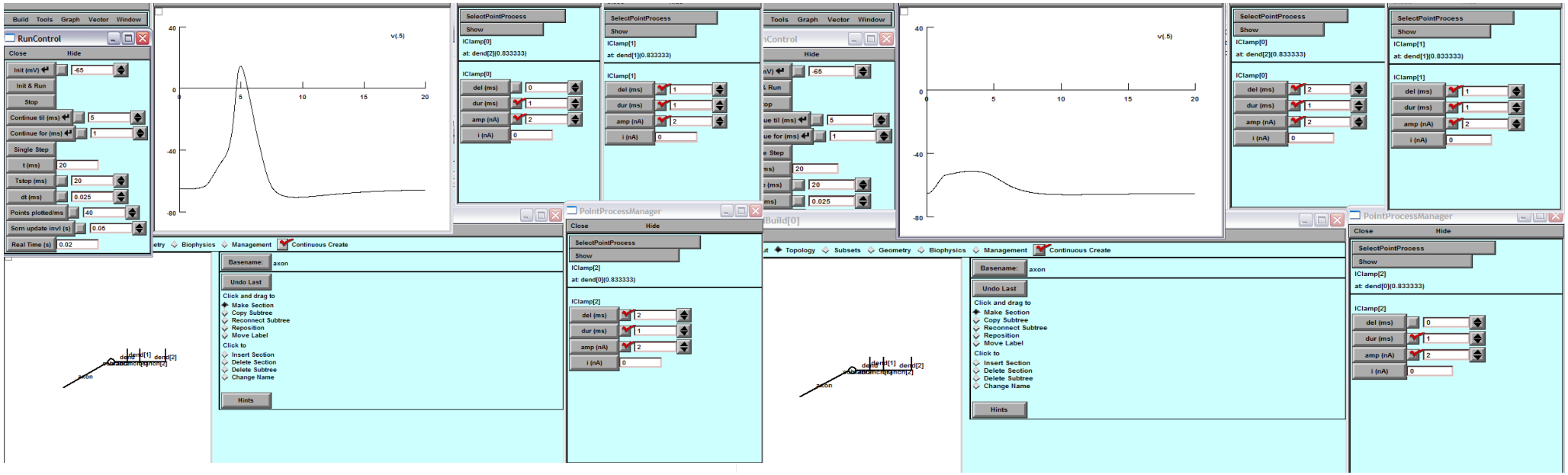
IClamp[0]
at: ap[8](0.5)

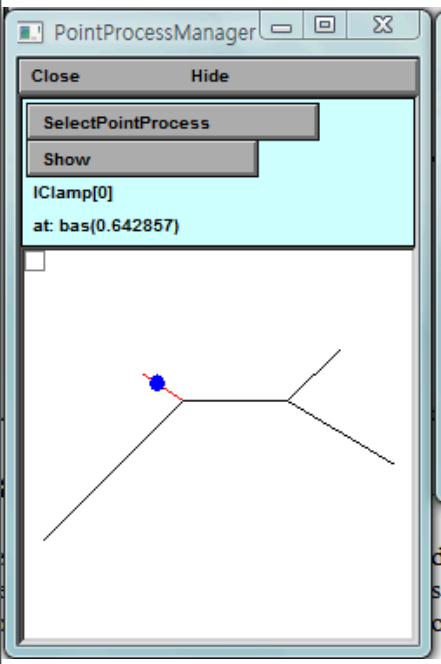

Graph x -2 : 22 y -92 : 52
Close
Hide
v(.5)
40
0
-40
-80
0
5
10
15
20

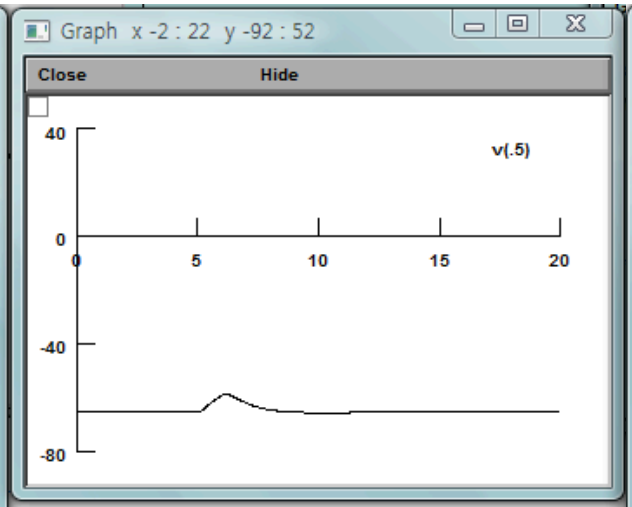
A Neuron with an asymmetric, linear receptive field

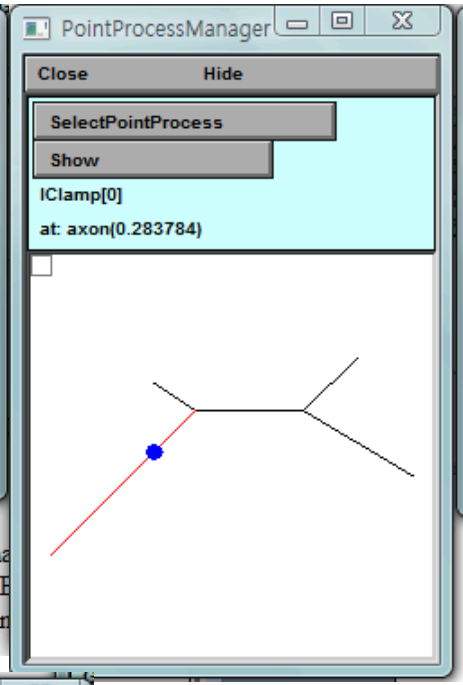
This very simple cell has the soma located to the left end (with an axon coming off of it). To the right is a dendrite with three branches. Shown is the voltage of the soma with a varying order of stimulation for these dendrites. The left graph shows the result of inputting a stimulus of 2nA starting at the right most dendritic branch (0 ms) and stimulating the middle and leftmost branches at 1 and 2 ms respectively. On the left only the order is changed, this time stimulating from the left to the right. As can be seen, the order of the dendrites activated directly impacts whether an action potential is fired or not. (a sort of directional dependence of the receptive field)

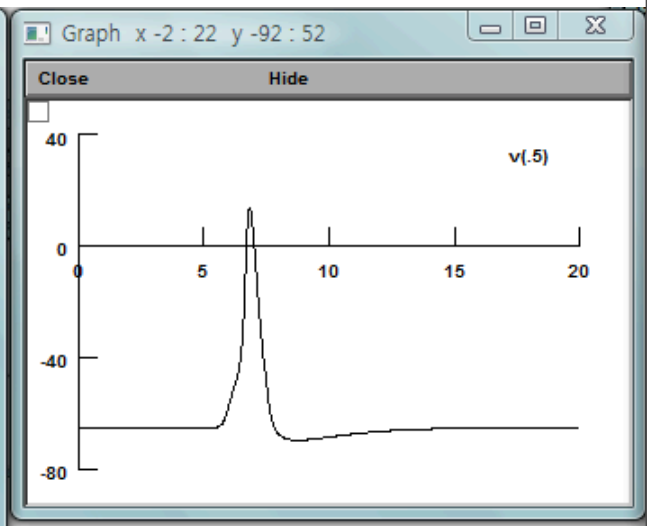


Homework: P.*

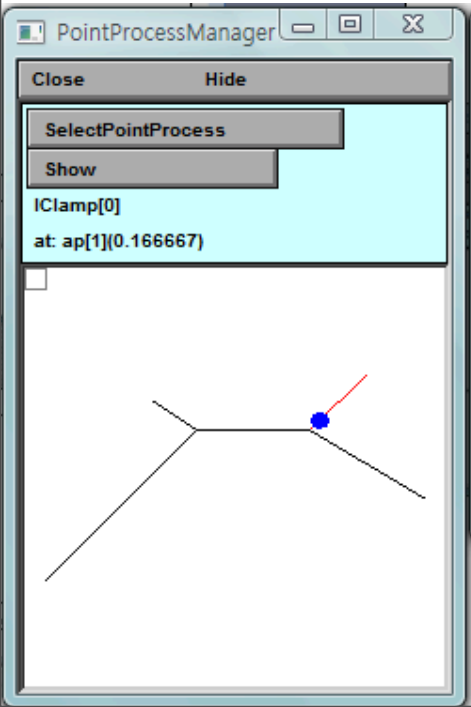


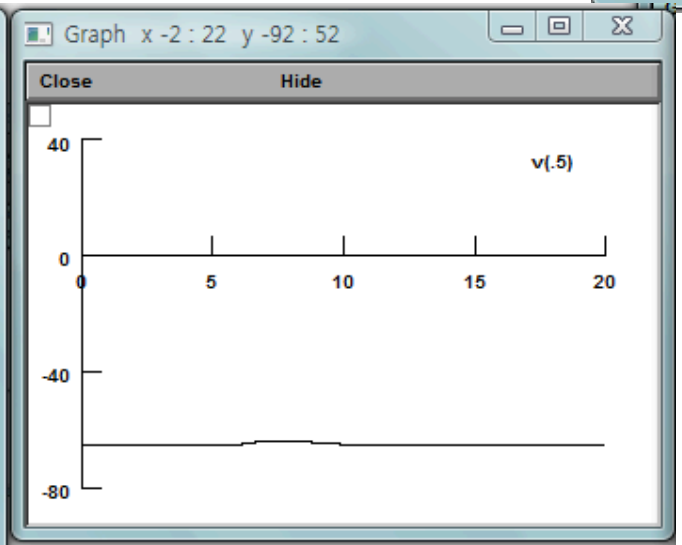






dels need to be revised. This is especially true of models tha
se the CellBuilder than to decipher idiosyncratic old code. F
oc file with the Management page's Export or Cell Type fun





The same I clamp results in different voltage graphs when put into different parts of the neuron.