**Assignment**

Attempt to achieve re-tune the GuntuBanks cells based on the HummosBanks cells. This is an active research model and will be slightly more difficult than the previous model.

Before starting, compile the mod files (in each folder) using `mknrndll` or `nrnivmodl`

Using what you have learned of passive properties, segregation and channel conductance tuning - adjust the cell parameters in the GuntuBanks folder for the CA3 and OLM cells to match the FI curve of the cells found in the HummosBanks folder. Document your process as thoroughly as possible.

Do not be afraid to edit .mod files directly by adding variables for vhalf and slope.

An additional folder “SegBanks” is provided with pre-segregated mod files. If cells in the GuntuBanks folder are not functioning as expected, you may try building a new cell template (Copy the template.hoc from GuntuBanks into the source folders, insert the new channels and adjust the conductance levels within ranges found in the appendix)

Source material **(2017hippocampal\_theta.pdf** and **Hummos\_et\_al-2014-Hippocampus.pdf)** will provide additional context.

**Appendix**

**GuntuBanks Cells**

From the GuntuBanks folder - run the following command to view the tuning interface:

CA3 PYRAMIDAL

bmtool util cell --template CA3PyramidalCell vhseg --othersec dend[0],dend[1] --infvars inf\_im,cinf\_ncaCA3,dinf\_ncaCA3,hinf\_ichan2CA3,minf\_ichan2CA3,nfinf\_ichan2CA3,nsinf\_ichan2CA3,caiinf\_ccanlCA3 --segvars enat,ekf,eks,eca,esk,ek,el\_ichan2CA --eleak el\_ichan2CA3 --gleak gl\_ichan2CA3

OLM

bmtool util cell --template IzhiCell\_OLM vhseg --othersec dend[0],dend[1] --infvars minf\_ichan2OLM,nfinf\_ichan2OLM,nsinf\_ichan2OLM --eleak el\_ichan2OLM --gleak gl\_ichan2OLM

**HummosBanks Cells**

From the HummosBanks folder - run the following commands to view the tuning interfaces:

CA3 PYRAMIDAL

bmtool util cell --template IzhiCell\_CA3 vhseg

OLM

bmtool util cell --template IzhiCell\_OLM vhseg

**SegBanks**

**TABLES AND FIGURES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | min | | | max | | |
|  | soma | axon | dend | soma | axon | dend |
| H | 5.00E-05 |  | 1.00E-05 | 2.30E-04 |  | 0.0093 |
| Nat | 0.001 | 0.04 | 0.008 | 0.135 | 0.36 | 0.045 |
| Nap | 1.00E-05 |  |  | 0.005 |  |  |
| Kdr | 0.0006 |  | 0.0025 | 0.18 |  | 0.02 |
| Kap | 8.00E-07 |  | 8.00E-07 | 0.048 |  | 0.096 |
| Kad |  |  | 0.04 | 0.008 |  | 0.24 |
| KM | 1E-05 |  | 5.00E-06 | 0.017 |  |  |
| Kca | 1.00E-05 | 3.00E-05 |  | 0.002 |  |  |
| sAHP | 1E-05 |  |  | 0.008 |  | 0.008 |
| Ca | 1.00E-05 |  |  | 0.01 |  | 0.017 |
| Leak | 1.50E-05 |  |  | 1.00E-04 |  | 7.14E-05 |

Table1 : conductance of channels when current injected in different parts of neuron

|  |  |  |  |
| --- | --- | --- | --- |
|  | Conductance range (S/cm2) | |  |
|  | Min | Max | LA model |
| H | 1.00E-05 | 0.0093 | 1.50E-05 |
| Nat | 0.001 | 0.36 | 0.027 |
| Nap | 1.00E-05 | 0.005 | 1.42E-04 |
| Kdr | 6.00E-04 | 0.18 | 1.50E-03 |
| Kap | 8.00E-07 | 0.096 | 2.00E-03 |
| Kad | 0.04 | 0.24 |
| KM | 5.00E-06 | 0.017 | 6.00E-04 |
| Kca | 1.00E-05 | 0.002 | - |
| sAHP | 1.00E-05 | 0.008 | 5e-5 to 3e-4 |
| Ca | 1.00E-05 | 0.017 | 5.50E-04 |
| Leak | 1.50E-05 | 1.00E-04 | 5.50E-05 |

Table 2: Conductance range for different channels