Models of Neocortical Layer 5b Pyramidal Cells Capturing a Wide Range of Dendritic and Perisomatic Active Properties

By segev
Created 7/31/2011
By segev July 31, 2011


Abstract:

The pyramidal cell of layer 5b in the mammalian neocortex extends its dendritic tree to all six layers of cortex, thus receiving inputs from the entire cortical column and supplying the major output of the column to other brain areas. L5b pyramidal cells have been the subject of extensive experimental and modeling studies, yet realistic models of these cells that faithfully reproduce both their perisomatic Na+ and dendritic Ca2+ firing behaviors are still lacking. Using an automated algorithm and a large body of experimental data, we generated a set of models that faithfully replicate a range of active dendritic and perisomatic properties of L5b pyramidal cells, as well as the experimental variability of the properties. Furthermore, we show a useful way to analyze model parameters with our sets of models, which enabled us to identify some of the mechanisms responsible for the dynamic properties of L5b pyramidal cells as well as mechanisms that are sensitive to morphological changes. This framework can be used to develop a database of faithful models for other neuron types. The models we present can serve as a powerful tool for theoretical investigations of the contribution of single-cell dynamics to network activity and its computational capabilities.

Journal:
(PLoS) Comput Biol

Volume:
7

Pagination:
e1002107
Our Int'l Ph.D. program provides outstanding students with top-notch courses in computational neuroscience.

The Jerusalem Brain Sciences Building will provide a state-of-the-art research and teaching facility for the Edmond and Lily Safra Center for Brain Sciences.

Get into our media channel and investigate ELSC's latest videos: seminars, public lectures, courses and video articles.

Source URL: https://elsc.huji.ac.il/segev/publications/models-neocortical-layer-5b-pyramidal-cells-capturing-wide-range-dendritic-and-pe