Recent advances in ModelDB

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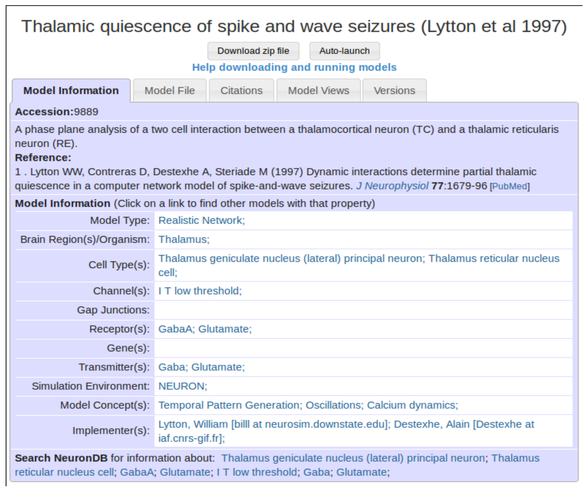
Thomas M. Morse[1], Robert A. McDougal[1,2], N. Ted Carnevale[1], Luis Marenco[1,2,3], Rixin Wang[2,4], Michele Migliore[1,5], Perry L. Miller[2,3,4], Gordon M. Shepherd[1], Michael L. Hines[1]
[1]Department of Neuroscience, Yale University, New Haven CT, [2]Center for Medical Informatics, Yale University, New Haven CT, [3]VA Connecticut Healthcare System, West Haven CT, [4]Department of Anesthesiology, Yale University, New Haven CT, [5]Institute of Biophysics, National Research Council, Palermo, Italy

Introduction

Experiment-based models of neurons and neuronal circuits have grown increasingly complex since the early computational neuroscience work of Hodgkin and Huxley and Rall. Complexity potentially improves realism, but at the cost of reproducibility. ModelDB, founded in 1996, addresses this difficulty and enhances the scientific utility of computational neuroscience models by providing a convenient venue to share and discover model computer code associated with peer-reviewed publications. ModelDB now contains approximately 1100 published models covering more than 130 research topics built using a wide variety of simulation software. It is actively curated and developed to help users locate and understand models of interest. For example, every model entry is tagged with searchable metadata about the biological system and phenomena that it addresses.

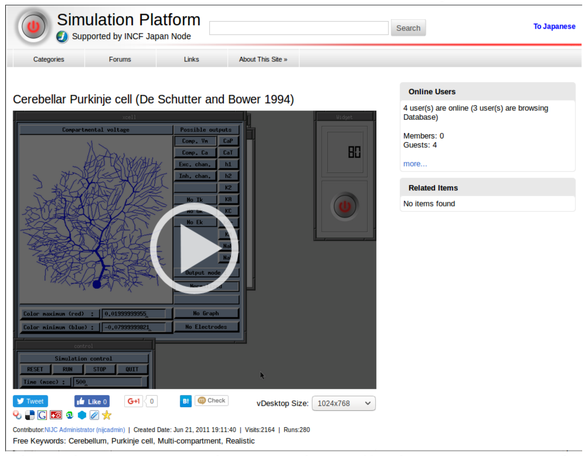
ModelDB example model entry



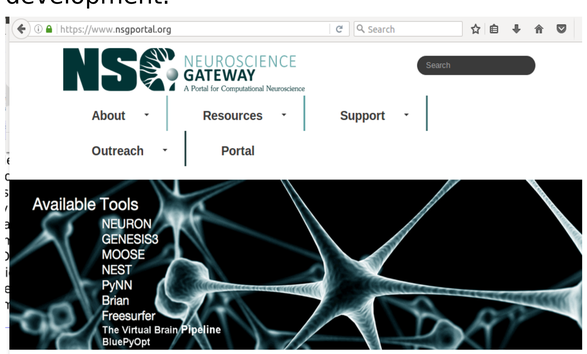
New "tabbed" showmodel page is illustrated in above example ModelDB entry #9889. Note displayed metadata keywords such as "Realtistic Network" and "Thalamus". These curated keywords are entered by the modeler or database administrator and are time consuming to assign at the time of model submission. To ease the process ModelDB now provides an abstract keyword detection tool (see adjacent poster "755.13 Automated metadata identification for better model discovery").

Running models

ModelDB also provides mechanisms to assist running models both locally and remotely.
If NEURON is installed and an internet browser is configured to use it as an application, then many of the NEURON models can be automatically started on the client computer by clicking the auto-launch button (see example ModelDB entry previous panel). A recent extension to this method provides the ability to auto-launch python versions of NEURON scripts.
ModelDB's long time collaboration with SimPF (the INCF Japan Node) maintains a remote platform where hundreds of ModelDB models can be launched immediately.



The SimPF group has preinstalled NEURON and GENESIS so the only software required for the modeler is an internet browser.
An additional method to launch models on the Neuroscience Gateway (NSG), a freely available supercomputer portal for computational neuroscience is under development.

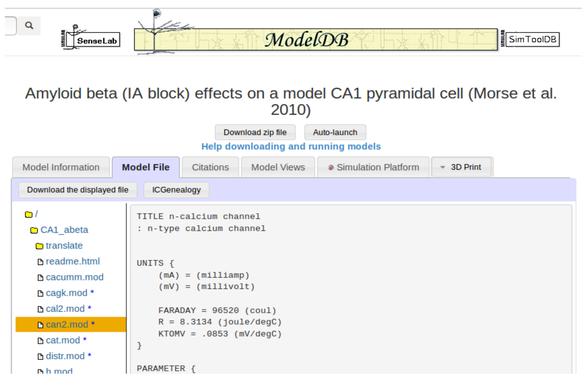


Institutional Model Import Methods

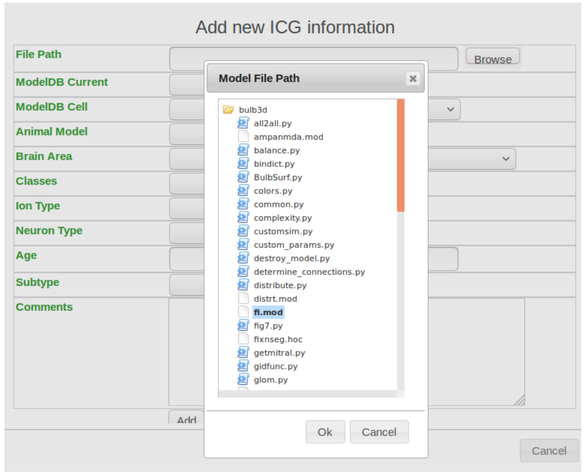
Large research groups (Allen Brain Institute, Human Brain Project, etc.) are emerging that collect data across multiple scales and integrate that data into complex and numerous models. To support this new modeling paradigm, we have developed scripts to facilitate importing a large number of models. In the case of the Allen Institute models, our scripts produced a pure-NEURON version that is shared in addition to the original version which uses the Allen Institute's Software Development Kit. By using a semi-automated import process, not only are we able to reduce curation time, but we improve consistency and quality: the quality improves because advanced features like interactive results graphs for the readme can be developed once and used for all, making a low per-model investment infeature support. We are developing strategies to ensure that models from these large groups are individually discoverable while simultaneously ensuring that they do not impair the discovery of the contributions of other researchers.

Ion Channel Genealogy

We are collaborating with the Ion Channel Genealogy group to interoperate with their portal (https://icg.neurotheory.ox.ac.uk).
For ion channel model files for which they provide data we provide a link to them:



We have added new data entry forms that enable modeler's to contribute ion channel genealogy information as they contribute models:



The first three of these fields, File Path, ModeDB Current, and ModelDB are populated by ModelDB data, while the remainder allow selecting from data maintained at the ICGenealogy portal. After the model is made public the ion channel data is sent to ICGenealogy for further curation. The ICGenealogy team provides additional results; generated inactivation, activation, deactivation, action potential, and current ramp traces from simulations. One additional planned use of the ICGenealogy data is to provide the ability to find identified currents model files in new ModelDB search methods.

Conclusions

Each of ModelDB's capabilities, from the model entry submitting and editing forms that the modeling community uses, to the search engines used to find models, the display of model information (showmodel page), the metadata itself such as new ion channel genealogy structures, as well as the topic keywords used to further describe the models, is undergoing additions, continued refinement and improvement.

Keep up-to-date

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Acknowledgements

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