Model sharing and knowledge discovery with ModelDB

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modeldb.yale.edu

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What is ModelDB?

- design goals
- what's in it?

Why use ModelDB?

Finding what you want,
and understanding what you found

Sharing your own models

modeldb.yale.edu

A resource for sharing and finding
published models and related knowledge
in the domain of computational neuroscience

Enables model

- discovery and understanding
- replication and reproduction
- attributed reuse and extension

Each entry includes

- citation(s) and concise model description
- source code
- metadata to help find entries of interest

Why use ModelDB?

Help others discover and understand your own models

Discover:

- and understand models published by others
- how modeling is being used to address a given topic
- models for new computational experiments,
  or starting points for new models
- reusable model components (channels, cell classes . . .)
- programming examples, e.g. FInitializeHandler usage
- models for regression testing of simulators

You can help by:

- *citing ModelDB and model authors*
  when you find something useful
- *using ModelDB to share your own published models*

ModelDB as a knowledge discovery tool

Every model is a selective review of the literature

Models reflect what researchers judge to be important.

Example:

131 models of Hippocampus Ca1 pyramidal neurons

I_A	73 models: 2796, 7386, 9769 . . .
$I_{K,Ca}$	23 models: 7907, 20212, 87284 . . .
I_M	31 models: 2937, 7907, 20212 . . .

modeldb.yale.edu

1620 model entries as of 7/21/2020

- 515 network models
- 181 types of neurons, including
  - 9 varieties of artificial spiking cells
  - biological neurons from
    - > 21 animal species
    - > 25 mammalian brain regions

Simulator-agnostic

96 simulators | programming languages

~1500 for NEURON, MATLAB, XPP, Python, or C++

modeldb.yale.edu

search

Advanced search

SenseLab | ModelDB | SimToolDB

- ModelDB Help

User account
- Login
- Register

Find models by
- Model name
- First author
- Each author
- Region(circuits)

Find models for
- Cell type
- Current
- Receptor
- Gene
- Transmitters
- Concept
- Simulators
- Methods

Submit Model

ModelDB provides an accessible location for storing and efficiently retrieving computational neuroscience models. A ModelDB entry contains a model's source code, concise description, and a citation of the article that published it. The source code can be in any language for any environment, can be viewed before downloading, and optionally can be auto-launched on download. For further information, see model sharing in general and ModelDB in particular.

ModelDB is tightly coupled with NeuronDB, a database of neuronal properties that are used to constrain models based on experimental observations.

Browse or search through over 1610 models using the navigation on the left bar or in the menu button on a mobile device. To search papers instead of models, go here; this may be used to identify models whose paper cites or is cited by a given paper.

Tweets by @SenseLabProject

SenseLab
@SenseLabProject

New in #ModelDB: Inhibitory microcircuits for top-down plasticity of sensory representations (Wilmes & Clopath 2019)

Finding models: preconfigured searches

Find models by

- Model name
- First author
- Each author
- Region(circuits)

Find models for

- Cell type
- Current
- Receptor
- Gene
- Transmitters
- Concept
- Simulators
- Methods

Find models of

- Realistic Networks
- Neurons
- Electrical synapses (gap junctions)
- Chemical synapses
- Ion channels
- Neuromuscular junctions
- Axons
- Pathophysiology

Finding models: search box

Top left corner of each page

- full text or attribute search
- word completion,
  live update as you type

Also available: browse and custom search

mag

magnitude
magee
magenta
mag
magnesium

Authors

Magee JC
Magosso E
Magalhães BR
Magalhães B
Magistretti J
4 more...

Concept

Magnetoencephalography
Magnetic stimulation

View all

Basal Ganglia and Levodopa Pharmacodynamics model for parameter estimation in PD (Ursino et al 2020)

A neural mass model for critical assessment of brain connectivity (Ursino et al 2020)

Multisensory integration in the superior colliculus: a neural network model (Ursino et al. 2009)

"Front page" of a model entry

Amyloid beta (IA block) effects on a model CA1 pyramidal cell (Morse et al. 2010)

(1) Download zip file | Auto-launch (2)

Help downloading and running models

Model Information | Model File (3) | Citations (4) | Model Views (5) | Simulation Platform (6) | 3D Print (7)

Accession:87284

The model simulations provide evidence oblique dendrites in CA1 pyramidal neurons are susceptible to hyper-excitability by amyloid beta block of the transient K+ channel, IA. See paper for details. (8)

Reference:

1 . Morse TM, Carnevale NT, Mutalik PG, Migliore M, Shepherd GM (2010) Abnormal Excitability of Oblique Dendrites Implicated in Early Alzheimer's: A Computational Study. *Front Neural Circuits* [PubMed] (9)

Model Information (Click on a link to find other models with that property)

Model Type:	Neuron or other electrically excitable cell;
Brain Region(s)/Organism:	
Cell Type(s):	Hippocampus CA1 pyramidal GLU cell;
Channel(s):	I Na,t; I L high threshold; I N; I T low threshold; I A; I K; I h; I K,Ca;
Gap Junctions:	
Receptor(s):	
Gene(s):	
Transmitter(s):	
Simulation Environment:	NEURON;
Model Concept(s):	Dendritic Action Potentials; Active Dendrites; Detailed Neuronal Models; Pathophysiology; Aging/Alzheimer`s;
Implementer(s):	Carnevale, Ted [Ted.Carnevale at Yale.edu]; Morse, Tom [Tom.Morse at Yale.edu];

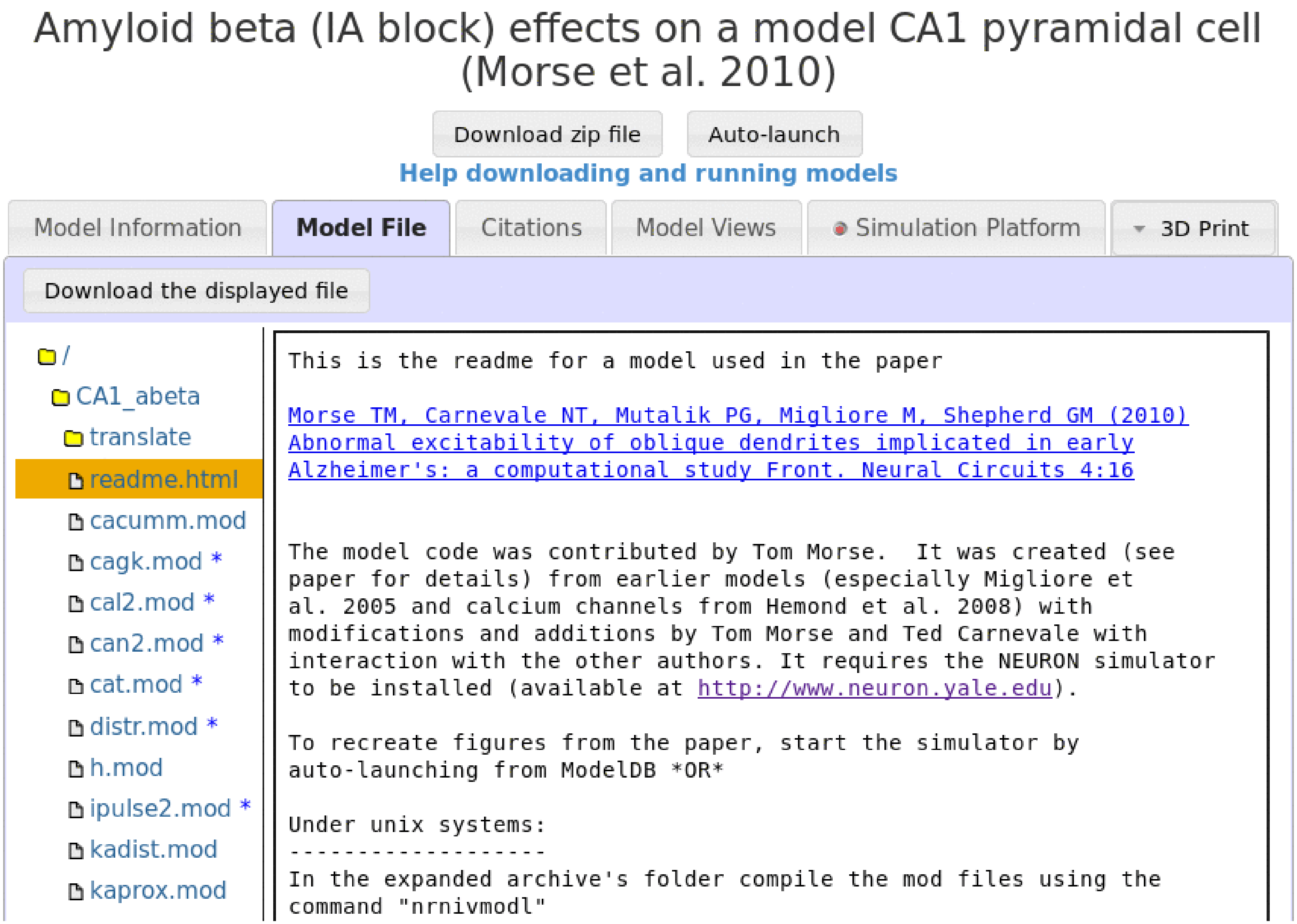
(10)

Search NeuronDB for information about: Hippocampus CA1 pyramidal GLU cell; I Na,t; I L high threshold; I N; I T low threshold; I A; I K; I h; I K,Ca; (11)

1 download link
2 autolaunch simulation
3 view model files
4 cited and citing models and papers
5 ModelView: visualize model structure
6 Simulation platform (external site)
7 printable 3D cells from this model
8 description of model
9 papers that describe or use the model
10 searchable metadata
11 links to NeuronDB (properties of biological cell types)

based on McDougal et al., *J. Comp. Neurosci.* 2017

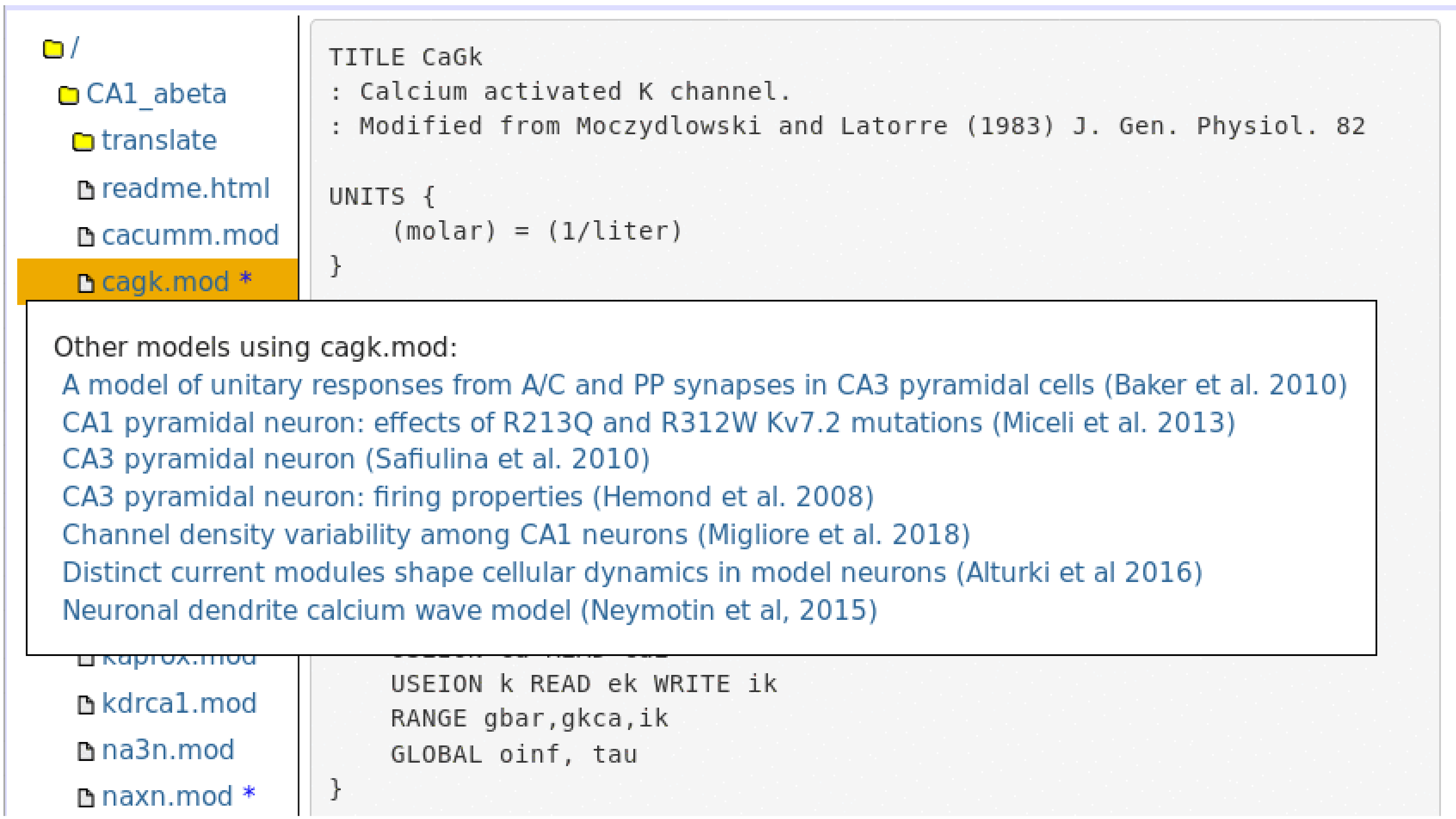
A model entry's "readme" file



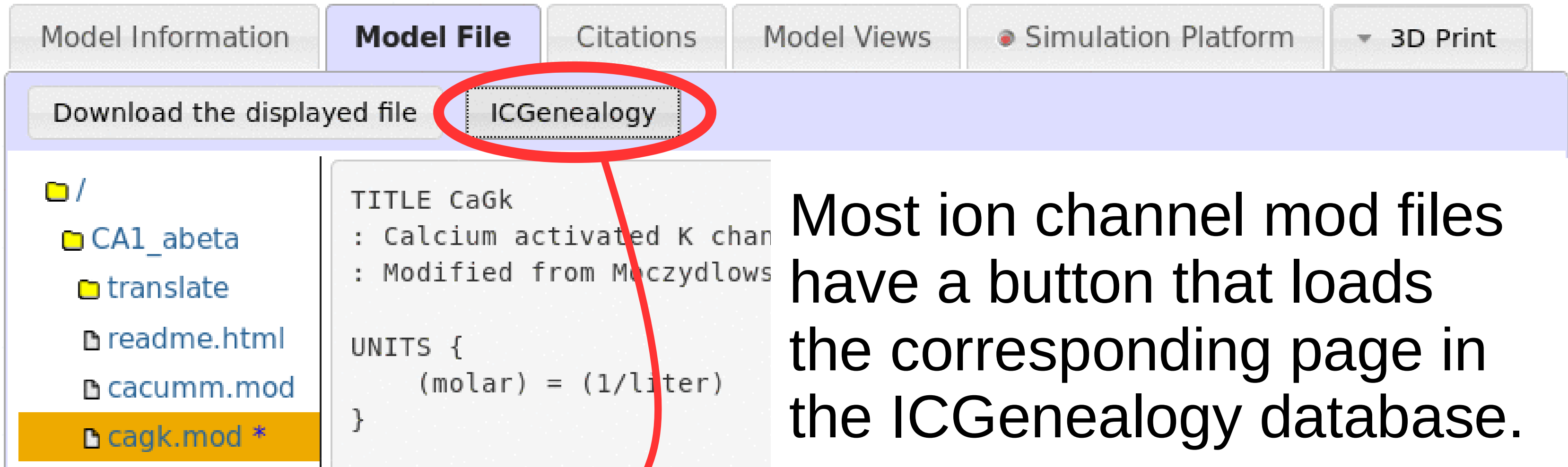
based on McDougal et al., *J. Comp. Neurosci.* 2017

Asterisks mark reuse

Click asterisk to see by whom and for what



Ion channels linked to ICGenealogy.org



Most ion channel mod files have a button that loads the corresponding page in the ICGenealogy database.

General data

- **ICG id:** 2464
- **ModelDB id:** 87284
- **Reference:** *Morse TM, Carnevale NT, Mutalik PG, Migliore M, Shepherd GM (2010)*: Abnormal Excitability of Oblique Dendrites Implicated in Early Alzheimer's: A Computational Study.

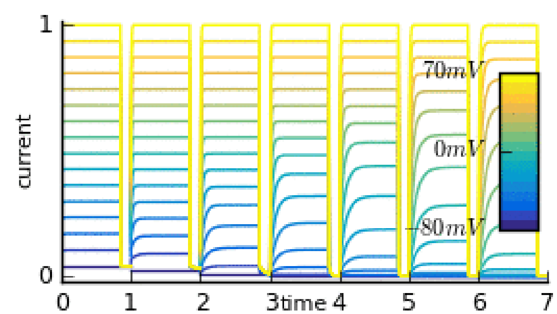
Metadata classes

- **Animal Model:** rat
- **Brain Area:** hippocampus, CA1
- **Neuron Region:** unspecified
- **Neuron Type:** pyramidal cell
- **Runtime Q:** Q4 (slow)
- **Subtype:** not specified

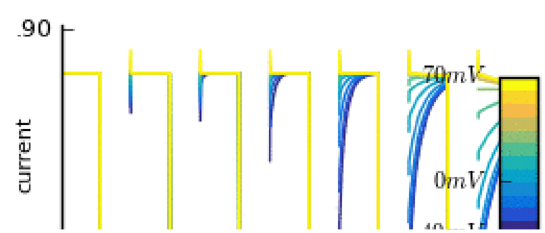
Metadata generic

Current Response Traces

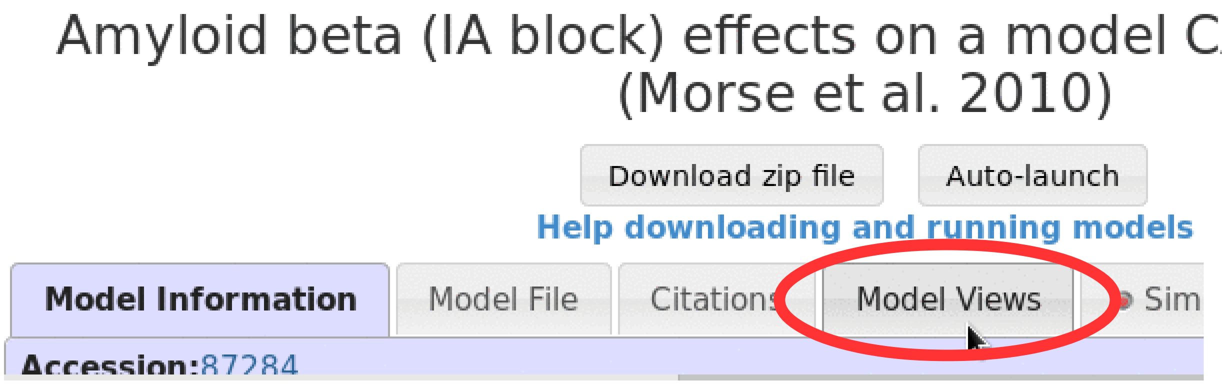
Activation



Inactivation



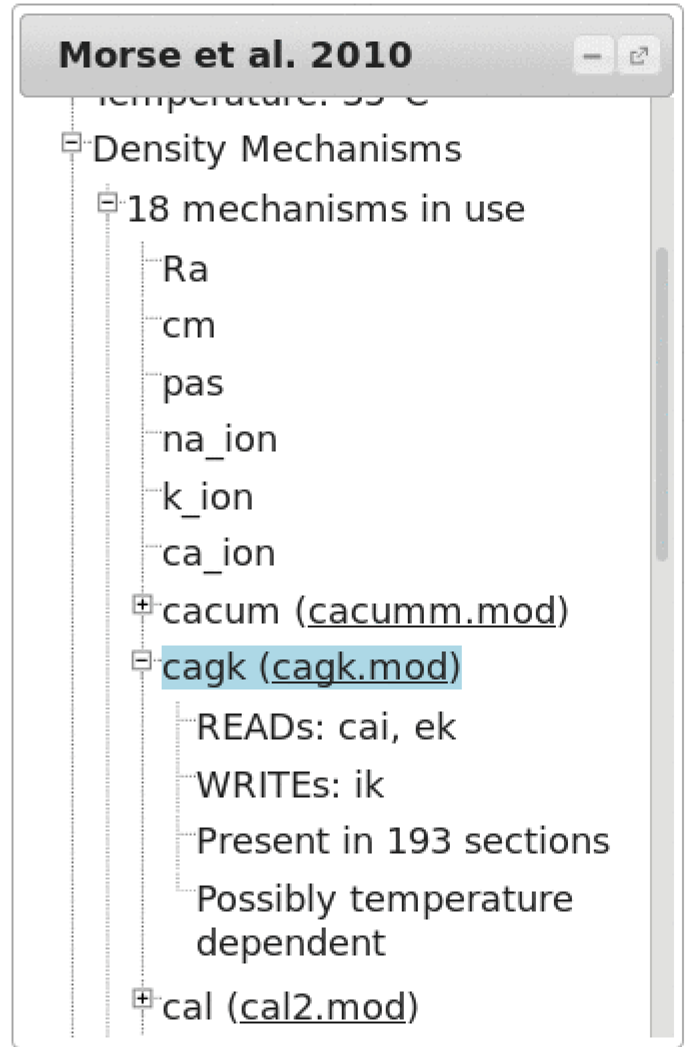
Model Views: interactive model analysis



Click the Model Views tab to reveal . . .

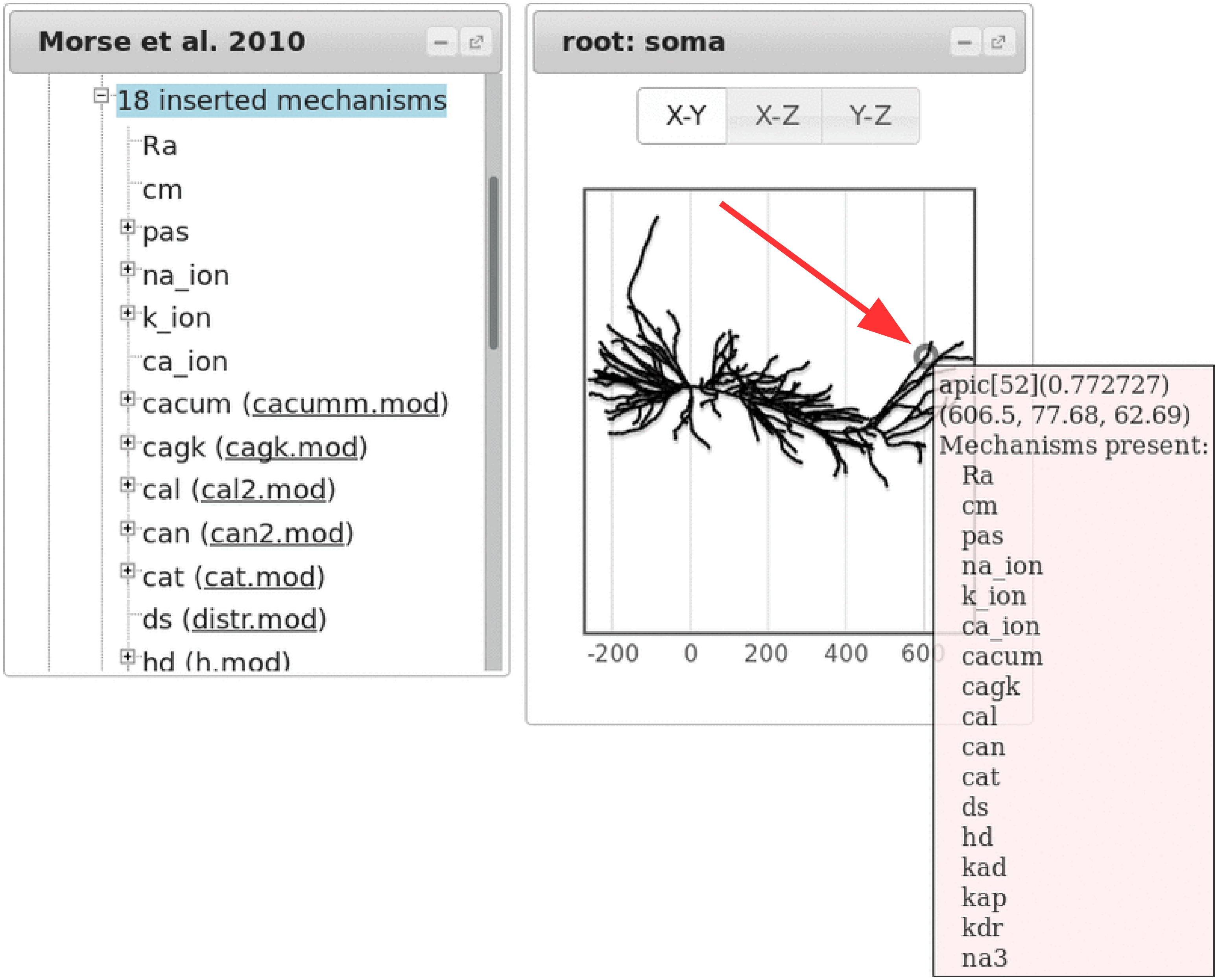
. . . an expandable outline . . .

. . . with interactive graphics



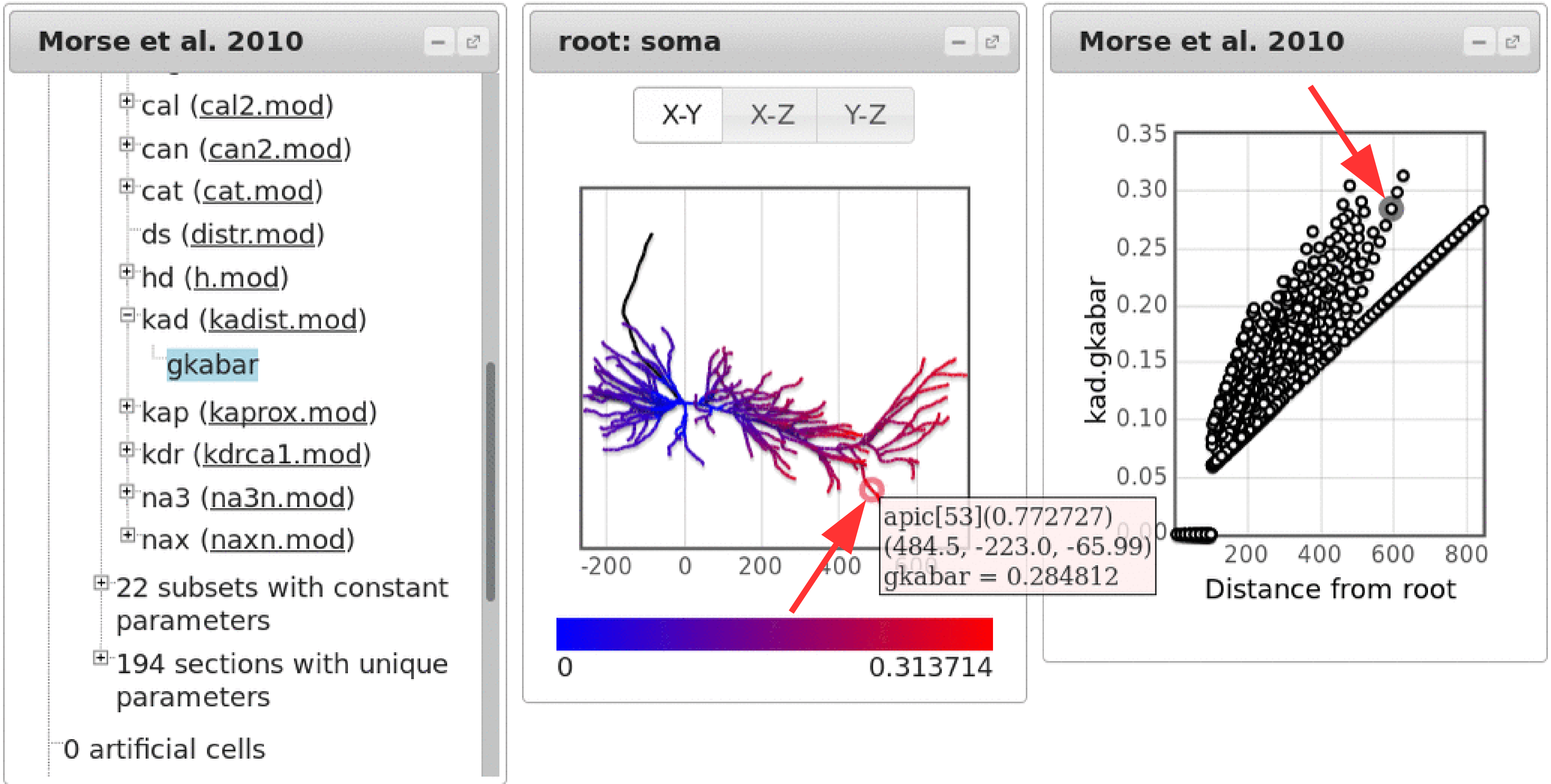
based on McDougal et al., *Neuroinformatics* 2015

ModelView: discover what's where



based on McDougal et al., *Neuroinformatics* 2015

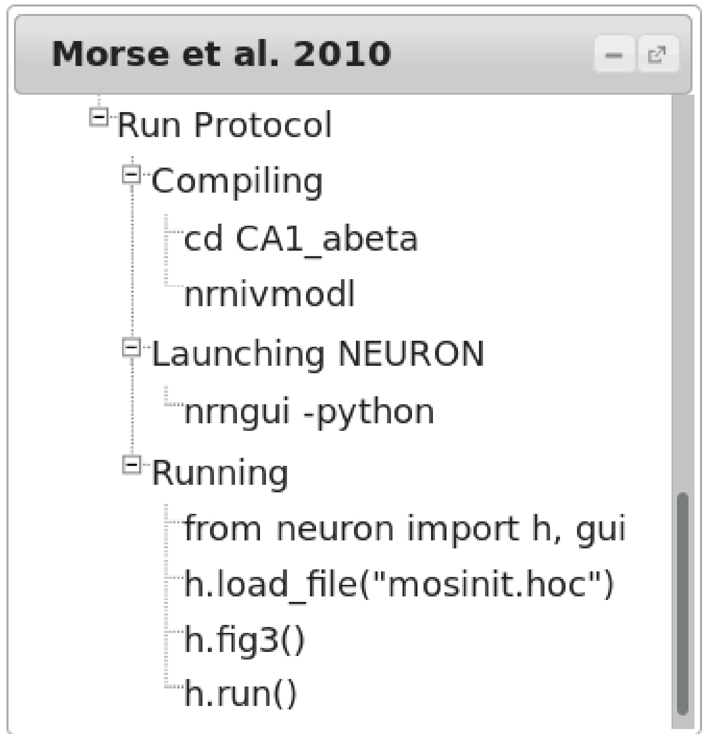
ModelView: inhomogeneous params



based on McDougal et al., *Neuroinformatics* 2015

Model View: run protocol

Answering one of life's vexing, if smaller, questions . . .



based on McDougal et al., *Neuroinformatics* 2015

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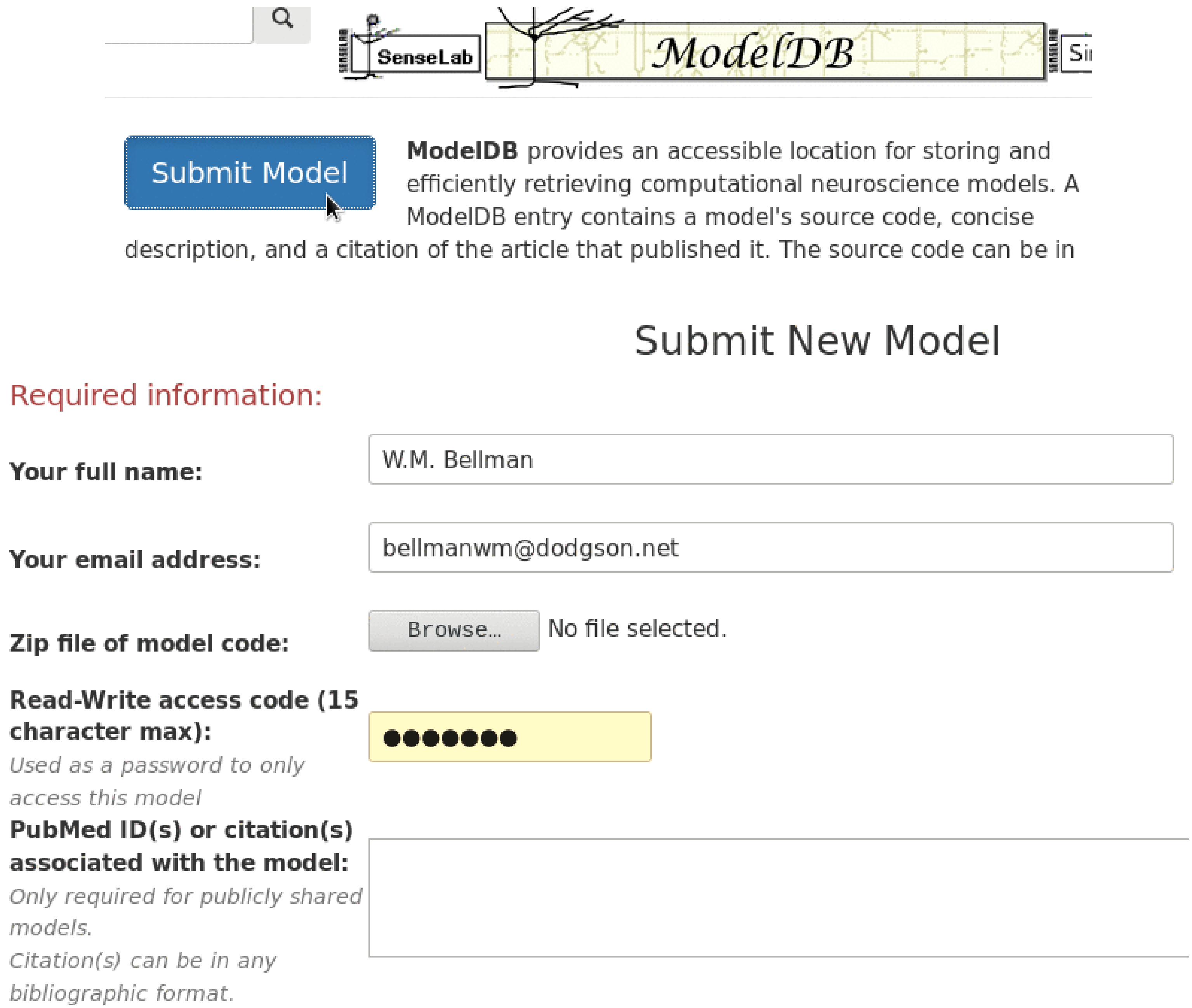
Sharing your models



Sharing your models *continued*

Let us find ModelDB keywords for you!

Click the button to automatically find, approve, and populate model entry keywords based on your paper abstract.

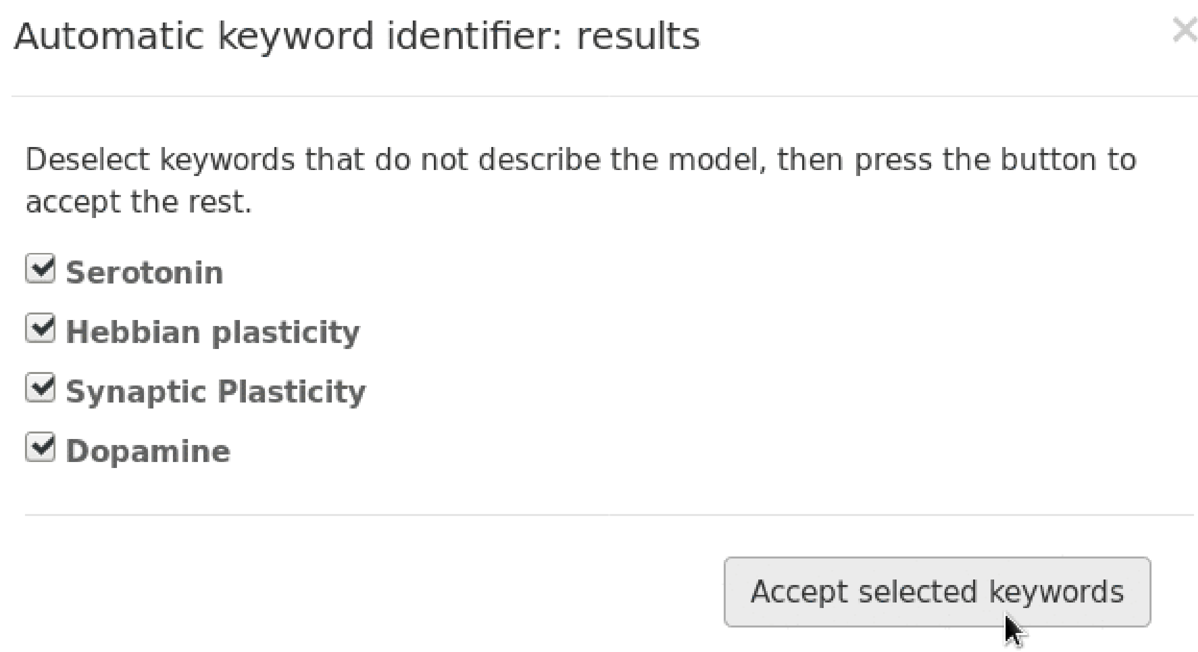
Automatic keyword identifier ×

Please paste your paper abstract here.

We used a large scale mechanistic model of snark wulst to explore the role of asynchronous dopaminergic and serotonergic signaling in triggering the boojum state. Our model relates this phenomenon to spillover of these neurotransmitters into adjacent neural circuits, activating D1, D2, and 5HT receptors throughout the brain. Simulations reveal acceleration of axonal conduction, sometimes to supraluminal levels. This is accompanied by local violations of causality, granger and otherwise, including temporary conversion of Hebbian to anti-Hebbian plasticity and vice-versa. In-vivo experiments are now under way to determine how this is related to the tendency of nearby organisms to revert to uncoupled pairs of gametes through the process known as

Cancel Submit

Sharing your models *continued*



References

SenseLab (including ModelDB) Twitter feed: @SenseLabProject

*** McDougal RA, Morse TM, Carnevale T, Marenco L, Wang R, Migliore M, Miller PL, Shepherd GM, Hines M. Twenty years of ModelDB and beyond: building essential modeling tools for the future of neuroscience. J. Comput. Neurosci. 42:1-10, 2017.**

McDougal RA, Morse TM, Hines ML, Shepherd GM. ModelView for ModelDB: online presentation of model architecture. Neuroinformatics 13:459-470, 2015.

[ICGenealogy] Podlaski WF, Seeholzer A, Groschner LN, Miesenböck G, Ranjan R, Vogels T. Mapping the function of neuronal ion channels in model and experiment. eLife 6:e22152, doi: 10.7554/eLife.22152, 2017

***--How to cite ModelDB.** For more specific information,
see "How to cite ModelDB" link at modeldb.yale.edu