

ModelDB

<http://modeldb.yale.edu>

ModelDB promotes discoverability and reproducibility of computational neuroscience research by serving as a platform for curated sharing and visualization of published models.

ModelDB Help
User account
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Find models by

Model name

First author

Each author

Region(circuits)

Find models for

Cell type

Current

Receptor

Gene

Transmitters

Topic

Simulators

Methods

Find models of

Realistic Networks

Neurons

Electrical synapses (gap junctions)

Chemical synapses

Ion channels

Neuroinvasive junctions

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

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Model Information

Model File

Citations

Model Views

Simulation Platform

3D Print

Accession:87284

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

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* 4:16 [PubMed]

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 cell;

Channel(s): I_{Na,t}; I_L high threshold; I_N; I_T low threshold; I_A; I_K; I_h;

Gap Junctions:

Receptor(s):

Gene(s):

Transmitter(s):

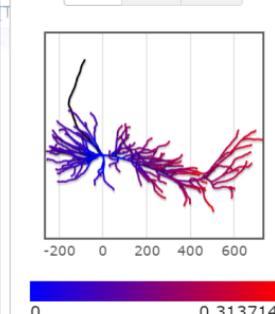
Sim

Morse et al. 2010

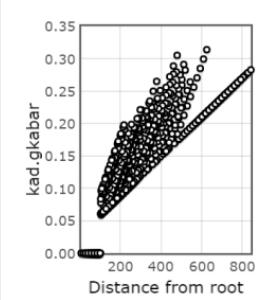
ca_ion
cacum
(cacumm.mod)
cagk (cagk.mod)
cal (cal2.mod)
can (can2.mod)
cat (cat.mod)
ds (distr.mod)
hd (h.mod)
kad (kadist.mod)
gkabar
kap (kaprox.mod)
kdr (kdrca1.mod)
na3 (na3n.mod)

root: soma

X-Y X-Z Y-Z



Morse et al. 2010



Alzheimer's:

I_A block

```
from neuron import h, rxd
import neuron.rxd.node as node
from matplotlib import pyplot
import time
```

`h.load_file('stdrun.hoc')`

```
soma = h.Section()
soma.L = 10
soma.diam = 10
soma.nseg = 11
dend = h.Section()
dend.connect(soma)
dend.L = 50
dend.diam = 2
dend.nseg = 51

def print_nodes():
    print ', '.join(str(v) for v in node._states)

print 'defining rxd'
region = rxd.Region(h.allsec(), nrn_region='i')
ca = rxd.Species(region, name='ca', d=1, charge=2, initial=0.1)
reaction = rxd.Rate(ca, -ca * (1 - ca) * (0.3 - ca))

print 'initializing'
h.initialize()

print 'before:'
print_nodes()
print
```

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* 4:16 [PubMed]

References and models cited by this paper

Acker CD, White JA (2007) Roles of I(A) and morphology in action potential propagation in CA1 pyramidal cell dendrites. *J Comput Neurosci* 23(2):201-16 [Journal] [PubMed]

- Roles of I(A) and morphology in AP prop. in CA1 pyramidal cell dendrites (Acker and White 2007) [Model]

Anderton BH, Callahan L, Coleman P, Davies P, Flood D, Jicha GA, Ohm T, Weaver C (1998) Dendritic changes in Alzheimer's disease and factors that may underlie these changes. *Prog Neurobiol* 55:595-609 [PubMed]

Andrasfalvy BK, Makara JK, Johnston D, Magee JC (2008) Altered synaptic and non-synaptic properties of CA1 pyramidal cell dendrites in Alzheimer's disease. *J Neurosci* 28:12500-12511 [Journal] [PubMed]

References and models that cite this paper

Culmone V, Migliore M (2012) Progressive effect of beta amyloid peptides accumulation on CA1 pyramidal cell neurons: a model study suggesting possible treatments *Front Comput Neurosci* 6:52 [Journal] [PubMed]

- CA1 pyramidal neurons: effects of Alzheimer (Culmone and Migliore 2012) [Model]

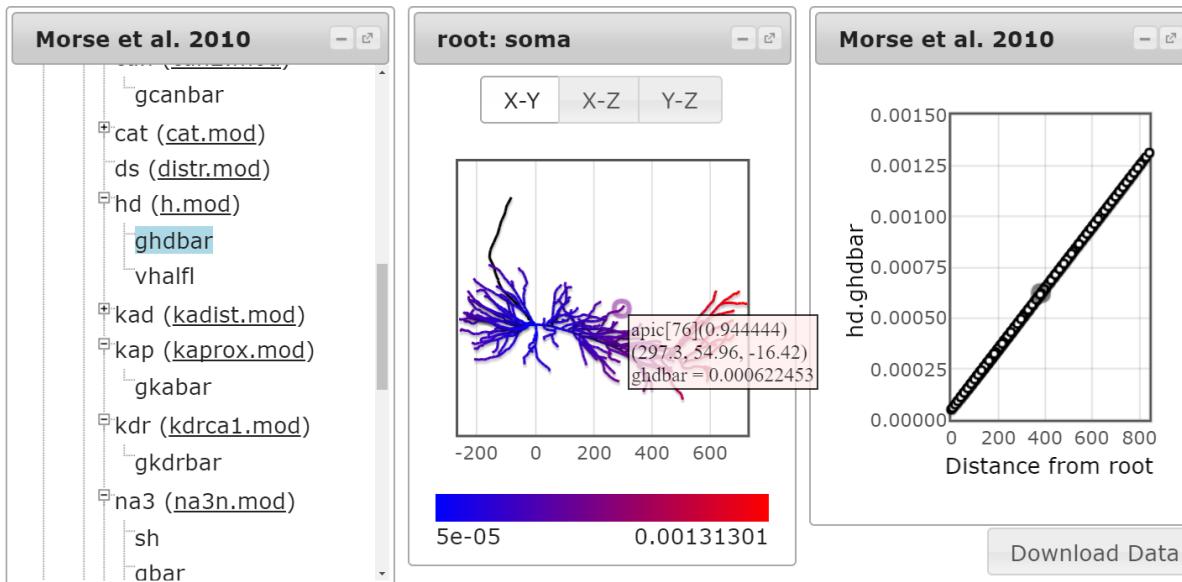
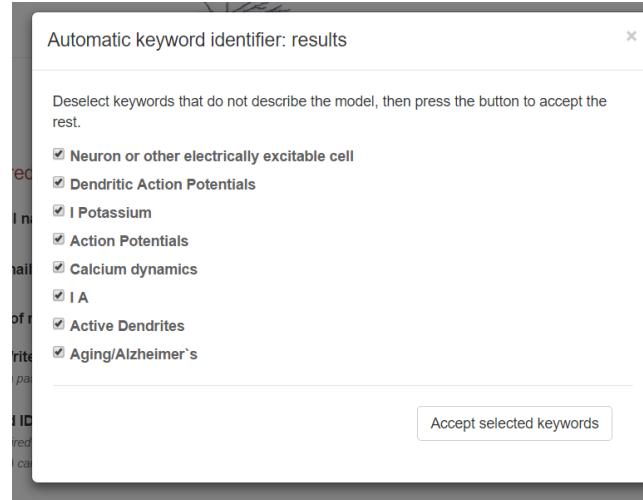
McDougal RA, Morse TM, Hines ML, Shepherd GM (2015) ModelView for ModelDB: online presentation of model structure *Neuroinformatics* 13(4):459-70 [Journal] [PubMed]

- ModelView: online structural analysis of computational models (McDougal et al. 2015) [Model]

Over 1200 models · 76 simulation environments · 178 cell types · 145 topics
(Alzheimer's, STDP, etc) · 16+ species · 54 ion channels, pumps, etc ·
24+ mammalian brain regions

Ongoing ModelDB projects

Improving quantity and quality of model entries by actively identifying new modelling literature and providing NLP tools to assist entry of descriptive metadata.



Model visualization tools make models more accessible by allowing insight into the model structure without reading code.

Model Information Model File Citations Model Views ▾ 3D Print

Download the displayed file **ICCGenealogy**

- /
- CA1_abeta
- translate
- readme.html
- cacumm.mod
- cagk.mod *
- cal2.mod *
- can2.mod *
- cat.mod *

```

TITLE CaGK
: Calcium activated K channel.
: Modified from Moczydlowski and Latorre (1983)

UNITS {
    (molar) = (1/liter)
}

UNITS {
    (mV) = (millivolt)
    (mA) = (milliamp)
    (mM) = (millimolar)
}

```

General data

- ICG id: 2464
- ModelDB id: 87284
- Reference: Morse TM, Carnevale NT, Mutualik 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

- **Age:** 7-14 weeks old.
- **Authors:** M Migliore.
- **Comments:** Calcium activated k channel, modified from moczydlowski and latorre (1983). From hemond et al. (2008), model no. 101629, with no changes (identical mod file). Animal model taken from chen (2005) which is used to constrain model. Channel kinetics from previous study on hippocampal pyramidal neuron (hemond et al. 2008).

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

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Download the displayed file

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- translate
- readme.html
- cacumm.mod
- cagk.mod *
- cal2.mod *
- can2.mod *
- cat.mod *
- distr.mod *
- h.mod
- ipulse2.mod *
- kadist.mod
- kaprox.mod
- kdrc1.mod
- na3n.mod
- naxn.mod *
- zcaquant.mod
- aBeta.hoc

This is the readme.html file for the model cagk.mod. It contains information about the model's purpose, authors, and references. The model code was contributed by Tom Morse. It was created (see paper for details) from earlier models (especially Migliore et al. 2008) and contains modifications and interaction with other models. To recreate figures, auto-launching is recommended. Under unix systems, run the command "openmod -run cagk.mod". In the expanded command line, "openmod -run cagk.mod" will run the simulation. Under Windows systems, compile the model (aBeta.hoc) and run the command "mosinit.hoc". Under MAC OS X, double click on the "aBeta.hoc" file to open it in the simulator. Other models using cagk.mod:
A model of unitary responses from A/C and PP synapses in CA3 pyramidal cells (Baker et al. 2010)
CA1 pyramidal neuron: effects of R213Q and R312W Kv7.2 mutations (Miceli et al. 2013)
CA3 pyramidal neuron (Saifullina et al. 2010)
CA3 pyramidal neuron: firing properties (Hemond et al. 2008)
Neuronal dendrite calcium wave model (Neymotin et al. 2015)

The model code was contributed by Tom Morse. It was created (see paper for details) from earlier models (especially Migliore et al. 2008) and contains modifications and interaction with other models. To recreate figures, auto-launching is recommended. Under unix systems, run the command "openmod -run cagk.mod". In the expanded command line, "openmod -run cagk.mod" will run the simulation. Under Windows systems, compile the model (aBeta.hoc) and run the command "mosinit.hoc". Under MAC OS X, double click on the "aBeta.hoc" file to open it in the simulator. Other models using naxn.mod:
CA1 pyramidal neuron: effects of R213Q and R312W Kv7.2 mutations (Miceli et al. 2013)
CA1 pyramidal neuron: functional significance of axonal Kv7 channels (Shah et al. 2008)
CA1 pyramidal neuron: rebound spiking (Ascoli et al. 2010)
CA1 pyramidal neuron: schizophrenic behavior (Migliore et al. 2011)
CA1 pyramidal neuron: signal propagation in oblique dendrites (Migliore et al. 2005)
CA1 pyramidal neurons: binding properties and the magical number 7 (Migliore et al. 2008)
CA1 pyramidal neurons: effect of external electric field from power lines (Cavarratta et al. 2014)
CA1 pyramidal neurons: effects of Alzheimer (Culmone and Migliore 2012)
CA1 pyramidal neurons: effects of Kv7 (M-) channels on synaptic integration (Shah et al. 2011)
CA1 pyramidal neurons: effects of a Kv7.2 mutation (Miceli et al. 2009)
Ca1 pyramidal neuron: reduction model (Marasco et al. 2012)
Effect of the initial synaptic state on the probability to induce LTP and LTD (Migliore et al. 2015)
Effects of electric fields on cognitive functions (Migliore et al. 2016)
Neuronal morphology goes digital ... (Parekh & Ascoli 2013)
Spine head calcium in a CA1 pyramidal cell model (Graham et al. 2014)

Better model context through partnerships with external neuroinformatics resources like the Ion Channel Genealogy (above) and through identifying repeated patterns within ModelDB itself (right).

Open Source Brain

<http://www.opensourcebrain.org>

The Open Source Brain initiative (OSB) makes computational models of neurons and networks available in open source, standardized formats such as NeuroML and PyNN, encouraging collaborative development. Models and model components can be viewed, analysed and their functional behaviour explored through online simulations in standard web browsers.



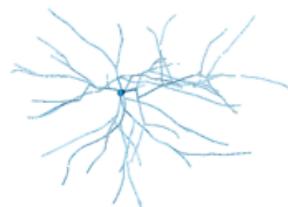
Modelling the brain, together

Open Source Brain is a resource for sharing and collaboratively developing computational models of neural systems.

Try exploring one of these models:



Primary Auditory Cortex
Network



L23 Cell

...

•

•



Hodgkin-Huxley Neuron



CA1 Pyramidal Cell

Explore OSB to see all the rest, create an account to add your own models and **run simulations!**

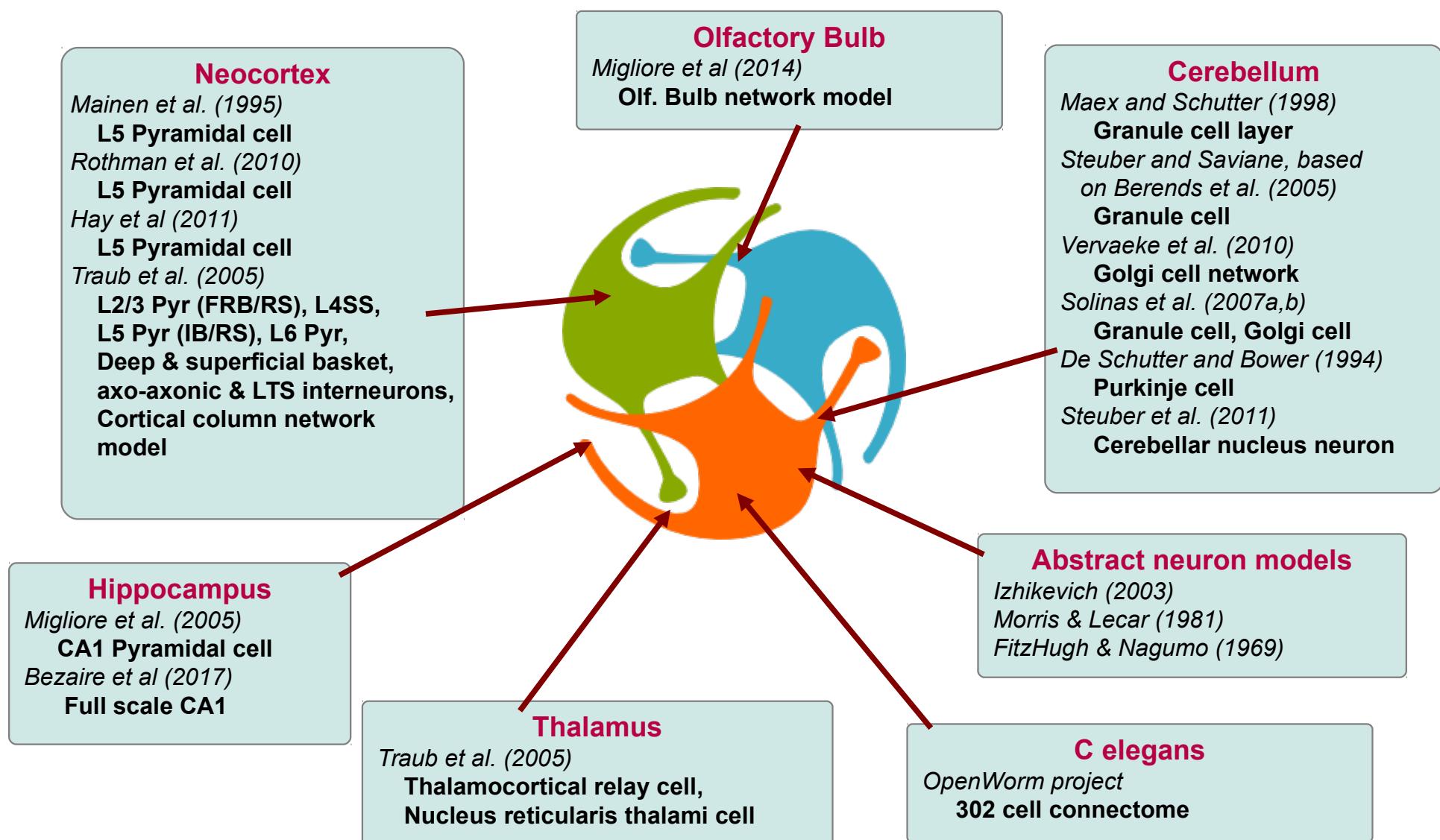
[Explore OSB](#)

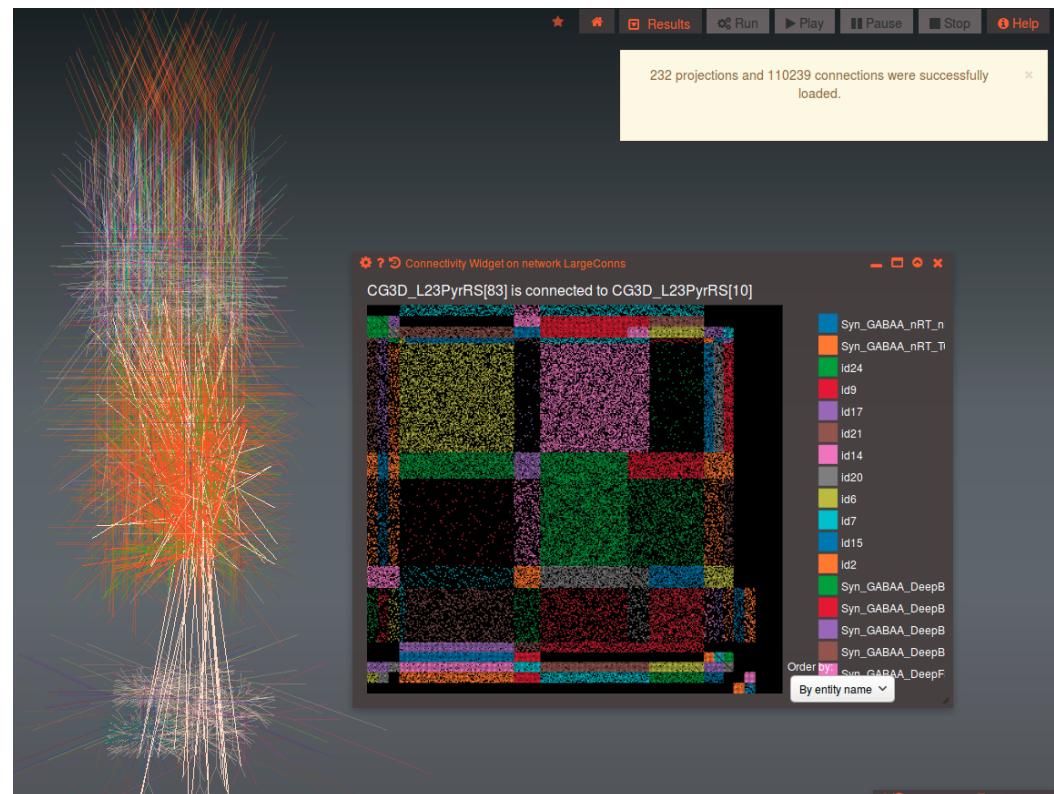
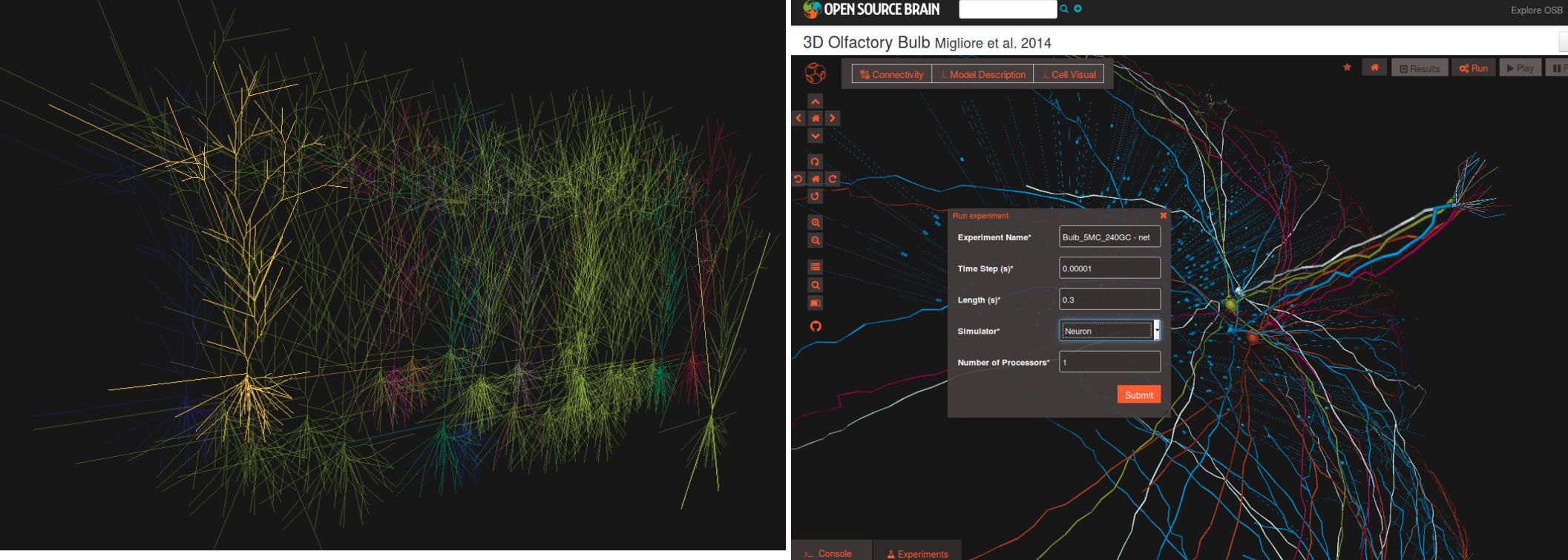
[Sign up](#)

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Models available on OSB





NeuroML

<http://www.neuroml.org>

NeuroML is a language for expressing models in computational neuroscience in a simulator independent, standardised format. It can express models from integrate and fire cells to complex networks of multicompartmental neurons.

Standardised XML language for computational neuroscience

Version 1.x allowed specification of:

- Detailed neuronal morphologies
- Ion channels
- Synapses
- 3D network structure

30+ simulators/applications/ databases/libraries support NeuroML

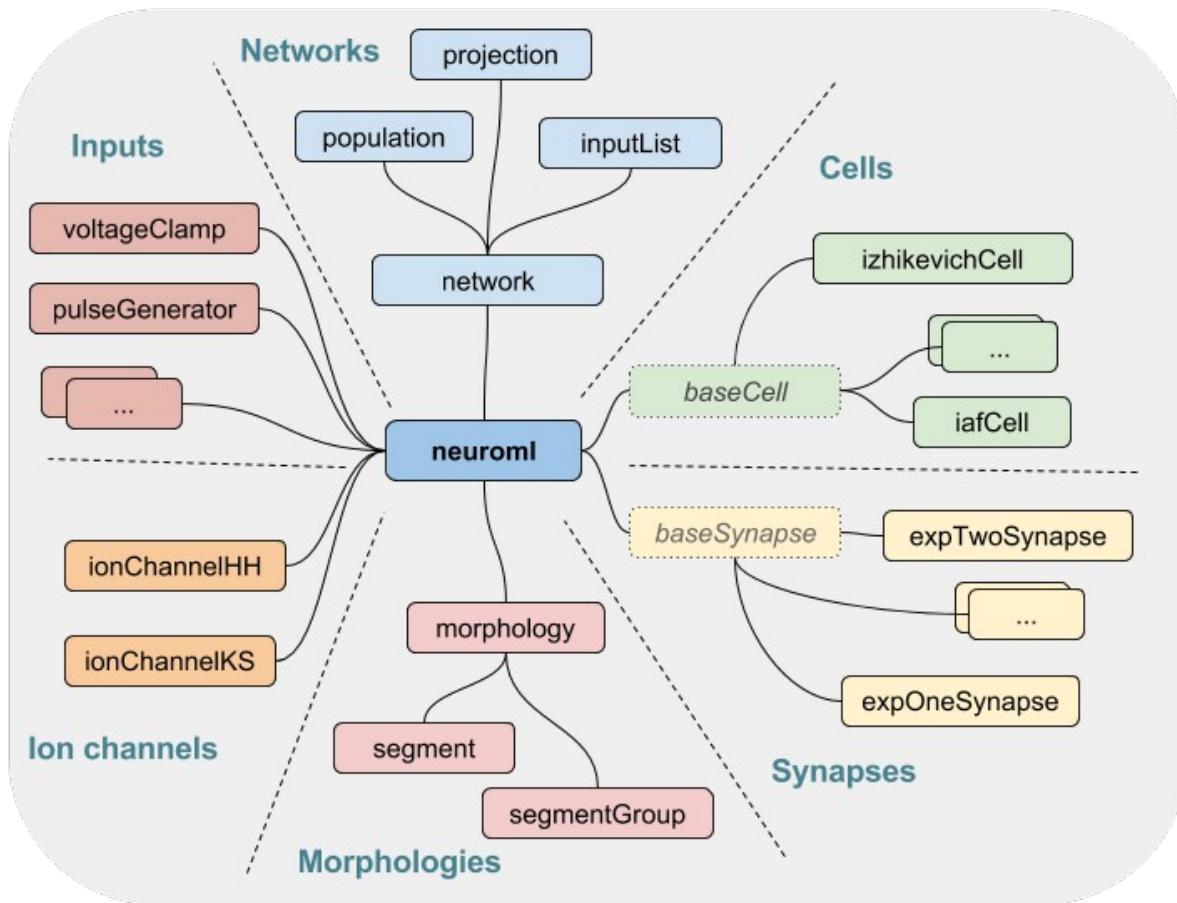
Simulators
NEURON
GENESIS
MOOSE
Brian

Interoperability
PyNN
neuroConstruct

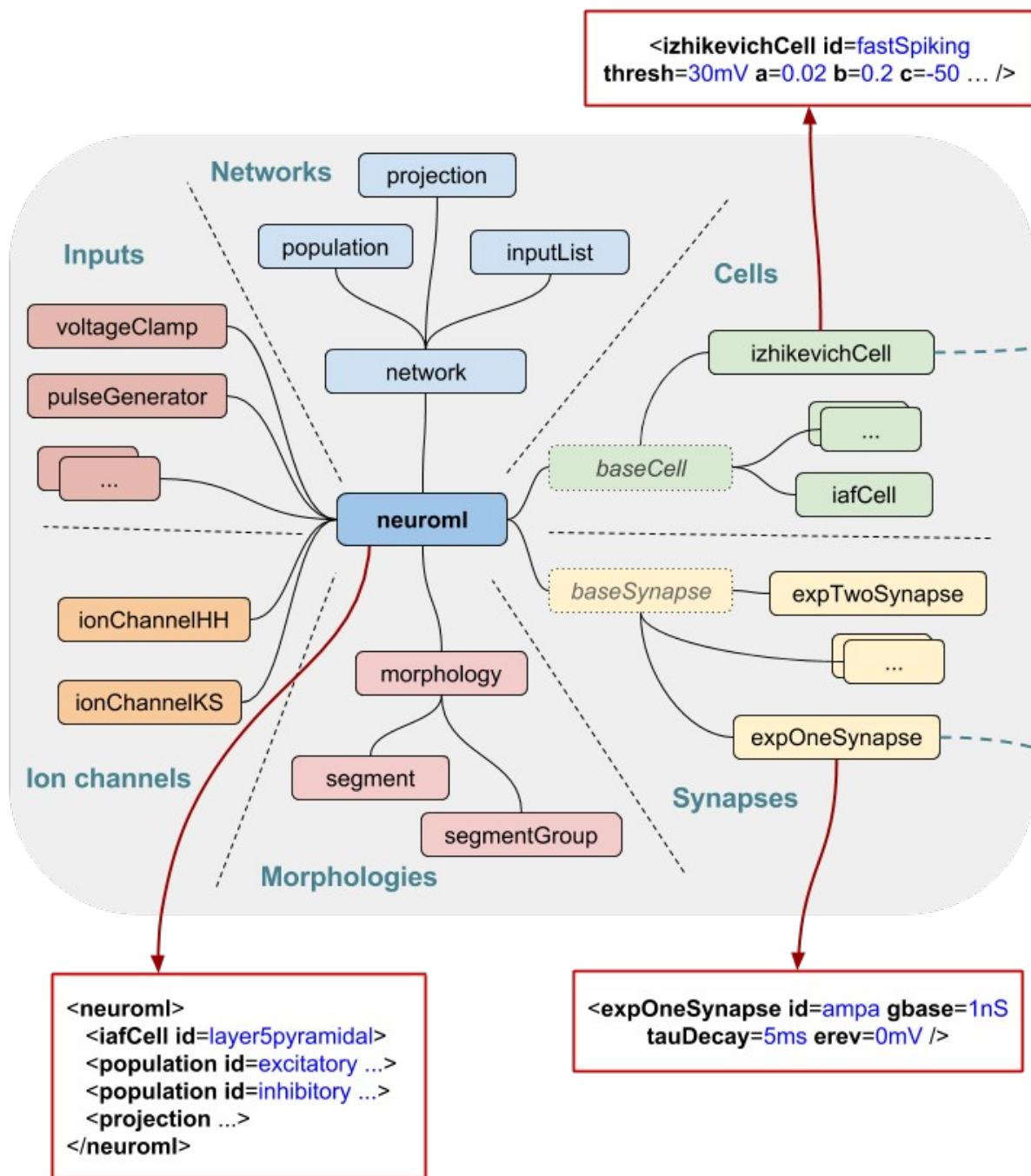
Initiatives
OpenWorm
Open Source Brain

Databases
Channelpedia
BBP NMC
NeuroMorpho
Allen Institute
Cell Types DB

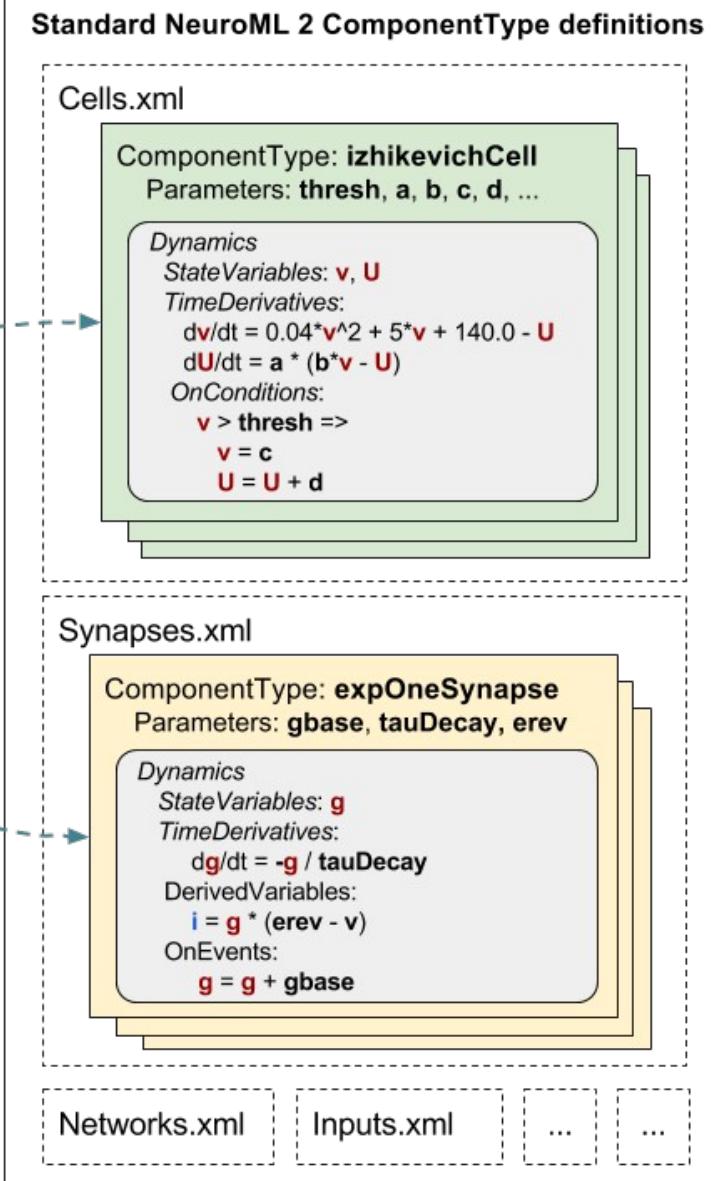
Morphological analysis/generation
Cx3D
TREES Toolbox
NeuGen



NeuroML 2



LEMS



Gepetto

<http://www.gepetto.org>

Gepetto is a web-based visualisation and simulation platform engineered to explore complex biological systems. In use by a number of neuroinformatics resources including Open Source Brain and Virtual Fly Brain, Gepetto facilitates integration of diverse data and models, and can support different standard formats for both experimental and computational data.

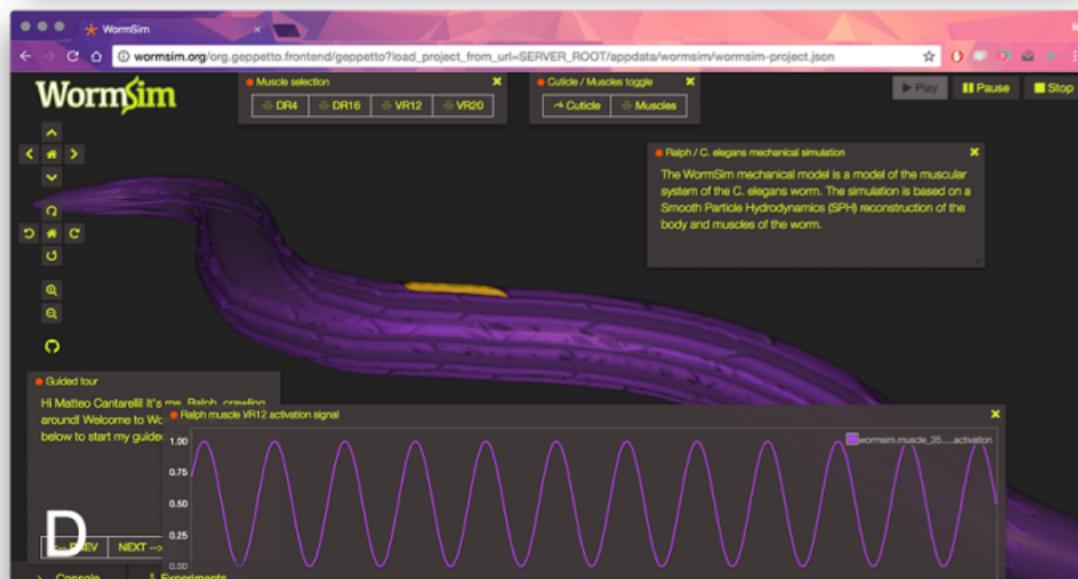
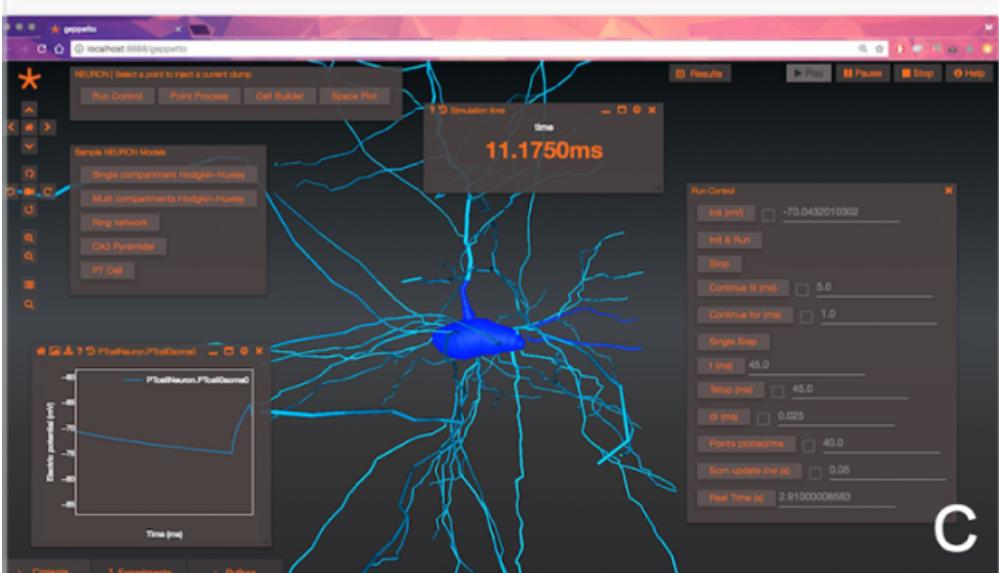
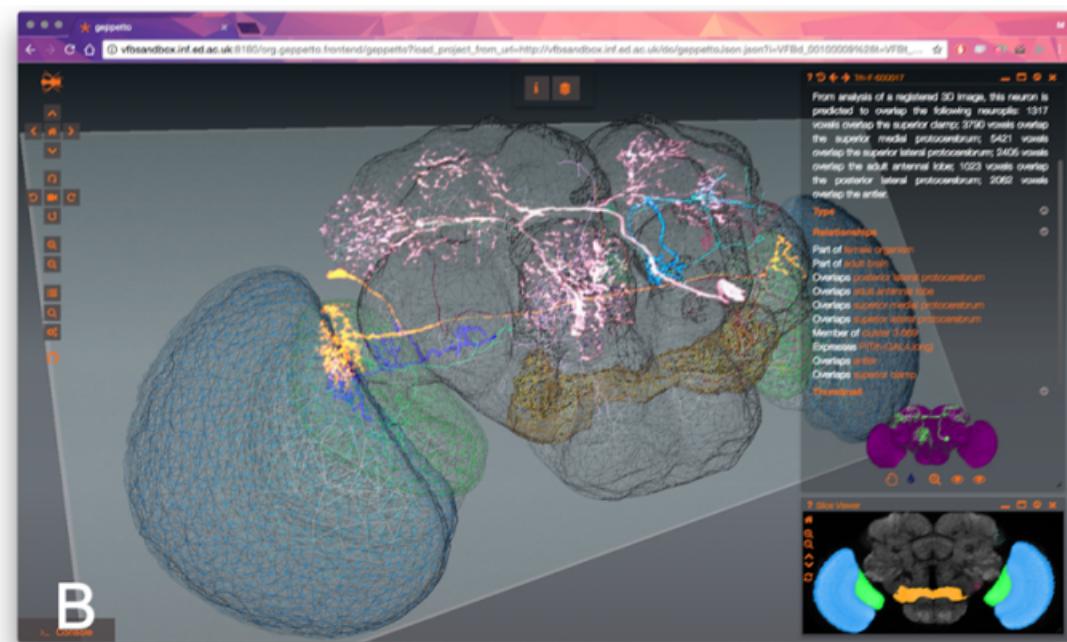
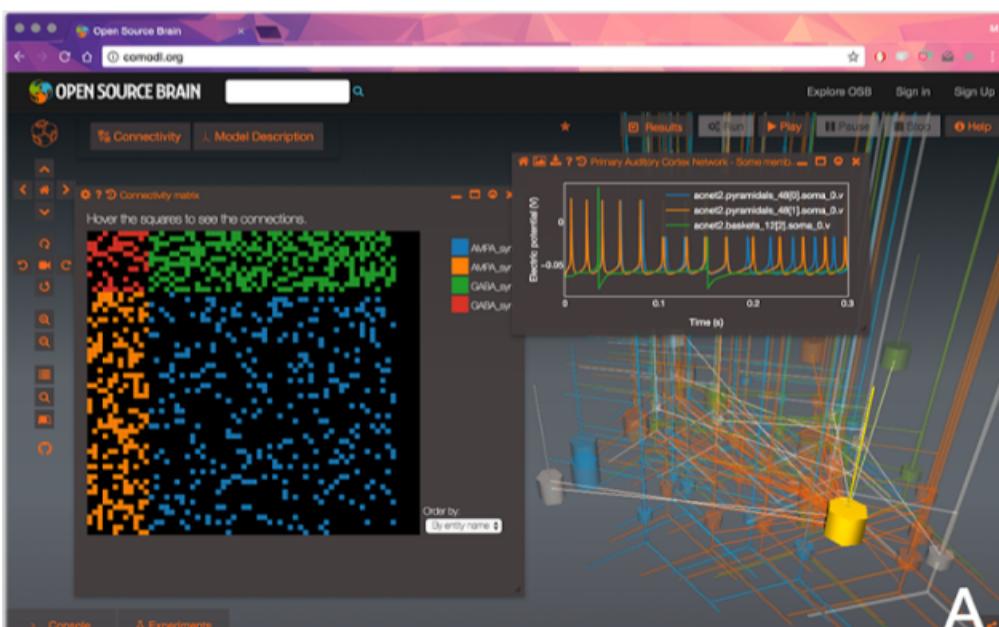


Gepetto is an open source web platform to **explore** and **simulate** **neuroscience** models and data in a **web** browser

What can Gepetto do?

- Visualize **neuroscience data** in the browser
 - Computational Neuroscience Models (NeuroML, NEURON)
 - Morphology reconstructions (SWC, OBJ, Collada)
 - Electrophysiology recordings (NWB, HDF5)
 - Medical data (MRI, Electromicroscopy via DICOM, NIFTI, DZI)
- **Record variables, set parameters, an run simulations** from the browser
 - Simulation can run in the same server where Gepetto is running or in a remote one (e.g. San Diego Supercomputer center)
- Connect to Jupyter Notebook
- Seamless **exploration** of data and models in the browser
- Facilitates **reproducibility** of workflows
 - The entire user interface works on top of an API layer. Every user action corresponds to an API command easy to inspect and reproduce.

* gepetto



ReScience

<http://rescience.github.io>

Reproducible Science is good, Replicated Science is Better.

ReScience is a scientific journal dedicated to the publication of replication in computational sciences.

Journal Philosophy

ReScience is a peer-reviewed journal that targets computational research and encourages the explicit [replication](#) of already published research, promoting new and open-source implementations in order to ensure that the original research is [reproducible](#).

To achieve this goal, the whole publishing chain is radically different from other traditional scientific journals. ReScience lives on [GitHub](#) where each new implementation of a computational study is made available together with comments, explanations and tests. Each submission takes the form of a pull request that is publicly reviewed and tested in order to guarantee that any researcher can re-use it.

If you ever replicated computational results from the literature in your research, ReScience is the perfect place to publish your new implementation.

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Criteria for Publication

To be considered for publication in ReScience, any given submission must satisfy the following criteria:

- Replicability
- Rigorous methodology
- Original source code
- Substantial evidence for replication of the original results

Furthermore, you cannot submit the replication of your own research, nor the research of your close collaborators. We believe such restrictions will favor the cross-fertilization of research and the spread of knowledge.

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Reproducible science is good. Replicated science is better.