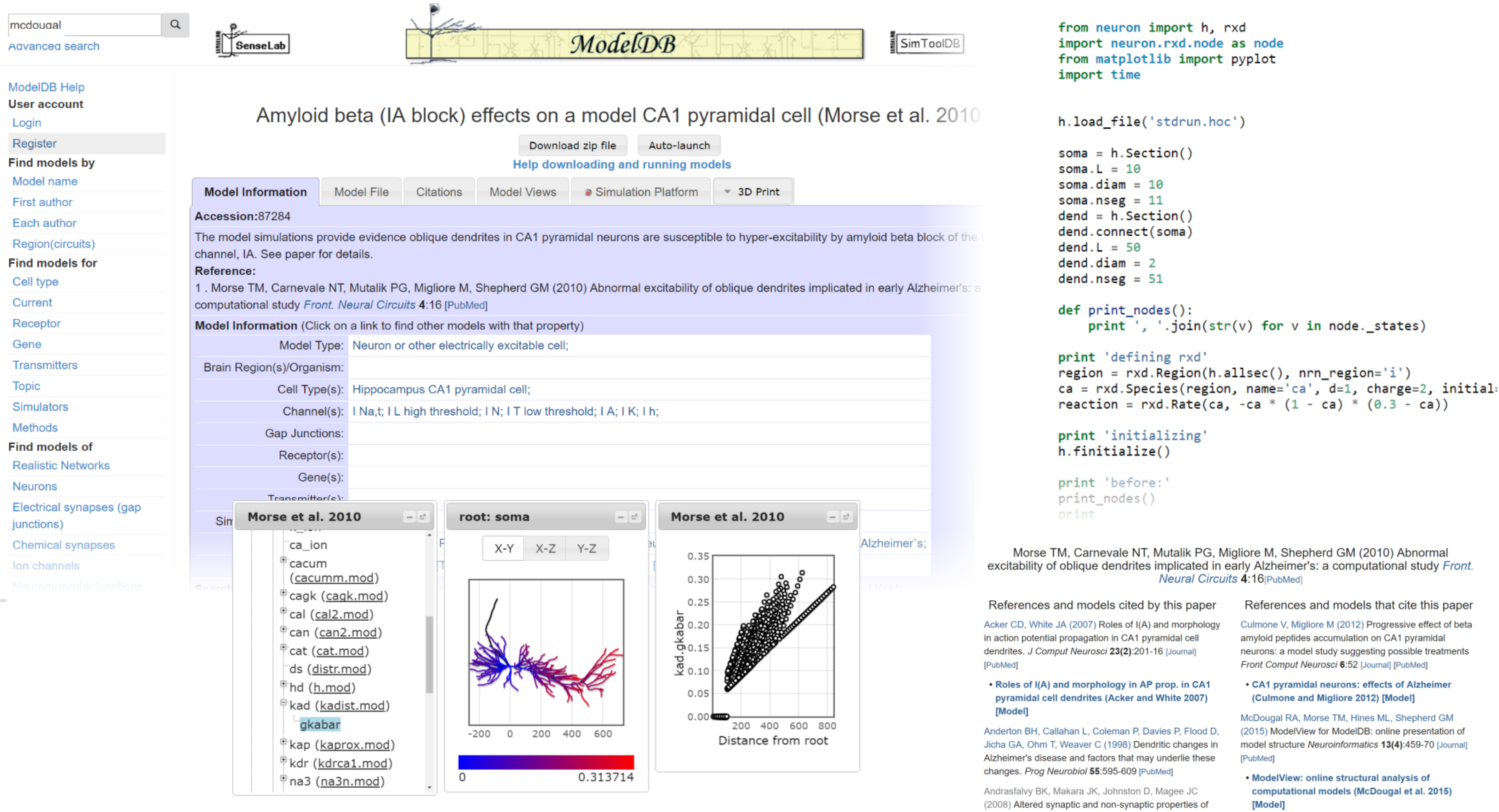
# ModelDB

http://modeldb.yale.edu

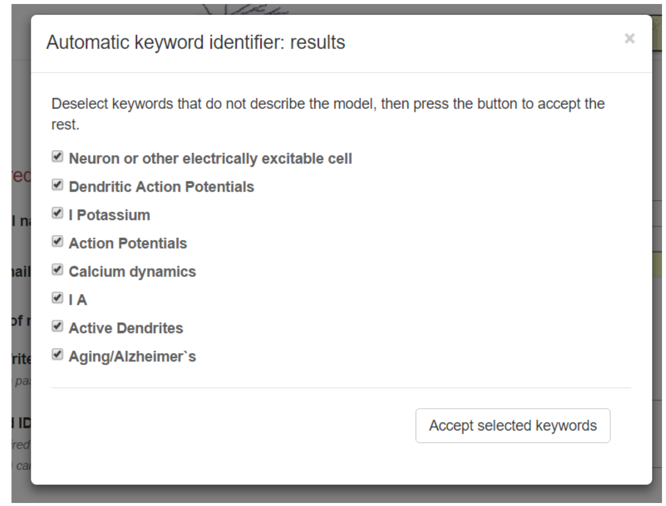
ModelDB promotes discoverability and reproducibility of computational neuroscience research by serving as a platform for curated sharing and visualization of published models.

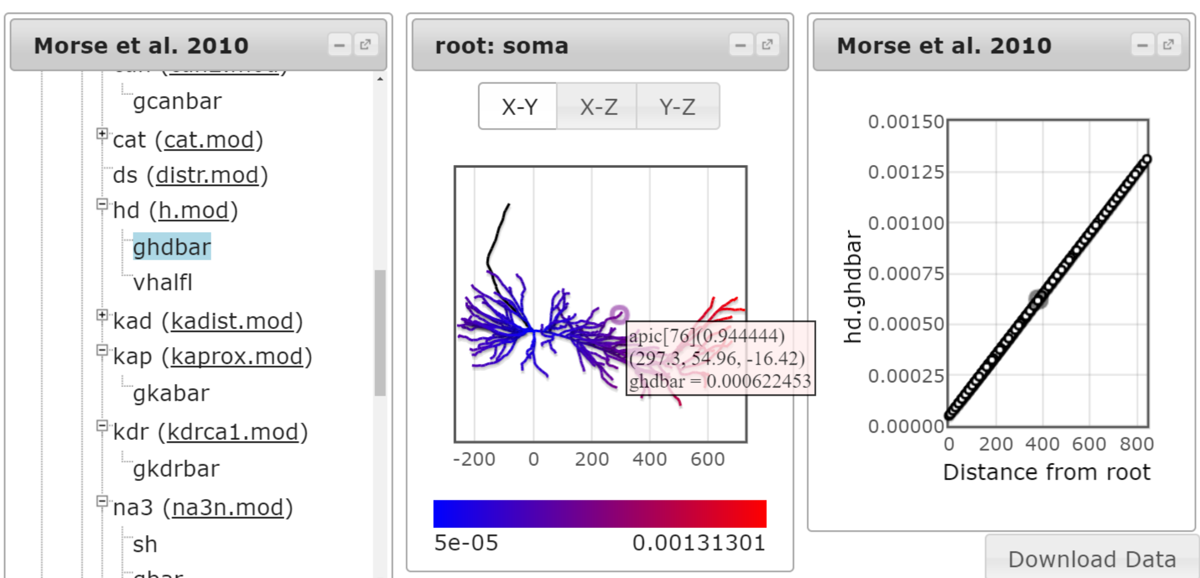



*Over 1200 models · 76 simulation environments · 178 cell types · 145 topics (Alzheimer's, STDP, etc) · 16+ species · 54 ion channels, pumps, etc · 24+ mammalian brain regions*

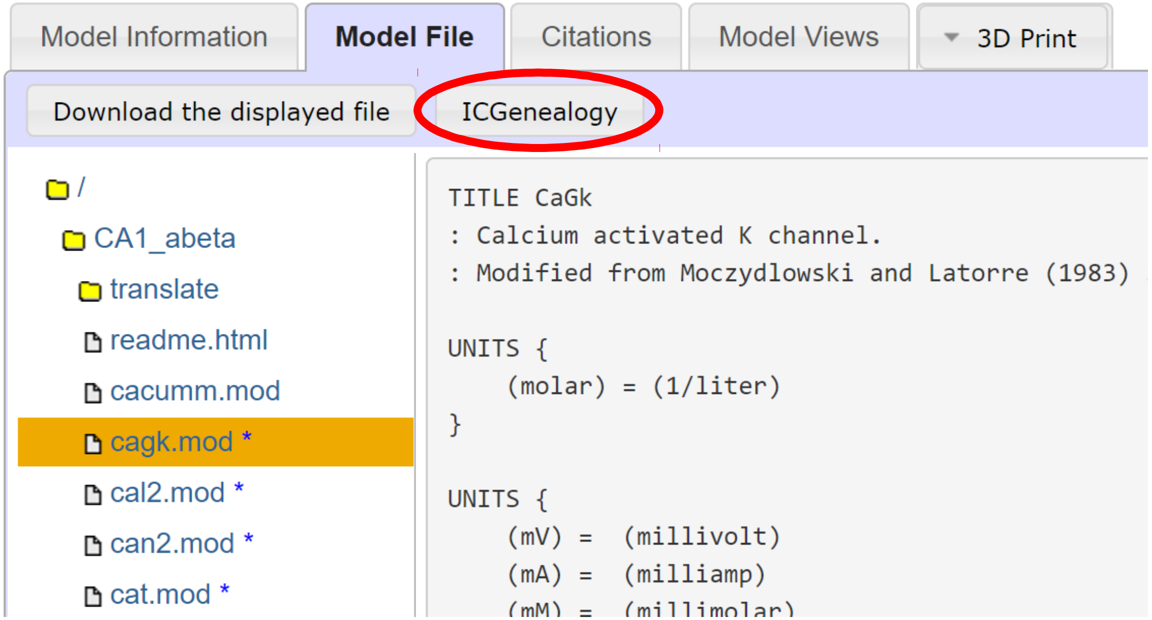
# Ongoing ModelDB projects

***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.*




## General data

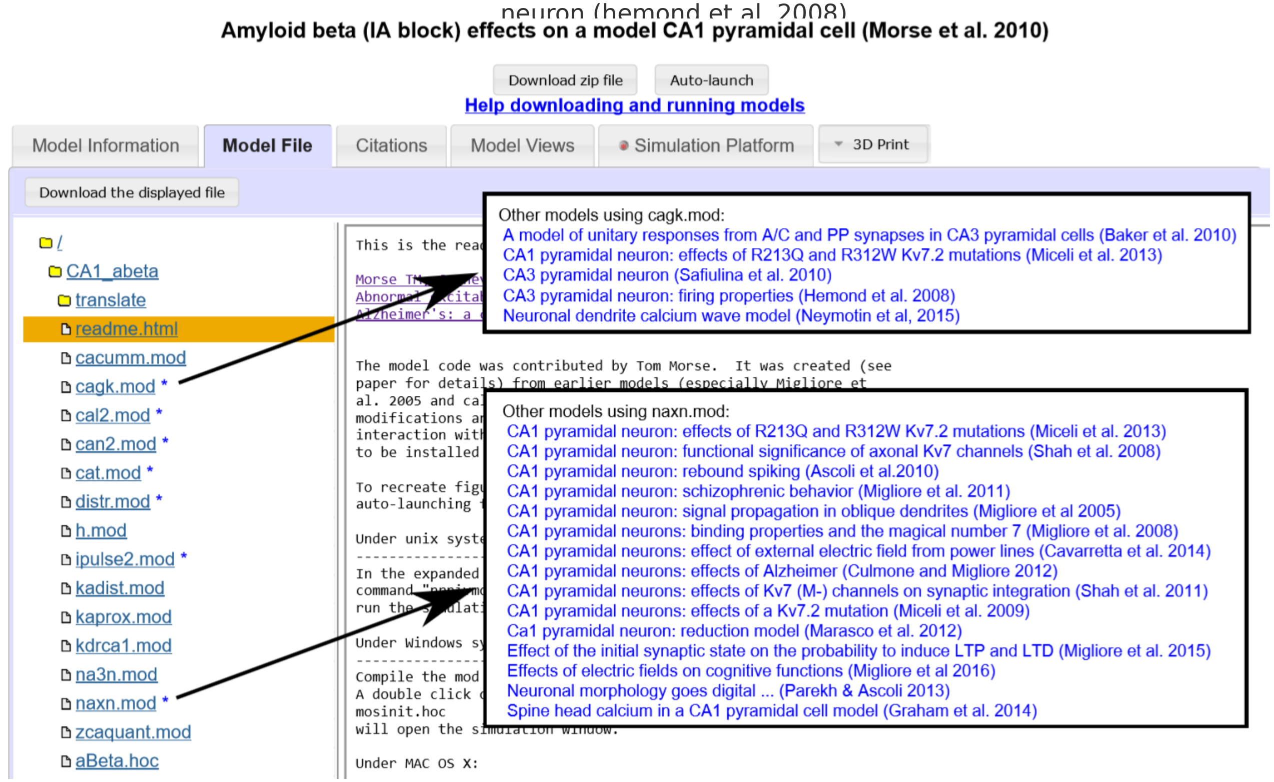
- **ICG id:** 2464
- **ModelDB id:** 87284
- **Reference:** *Morse TM, Carnevale NT, Mutalik PG, Migliore M, Shepherd GM (2010)*: Abnormal Excitability of Oblique Dendrites Implicated in Early Alzheimer's: A Computational Study.

## 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

- **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)

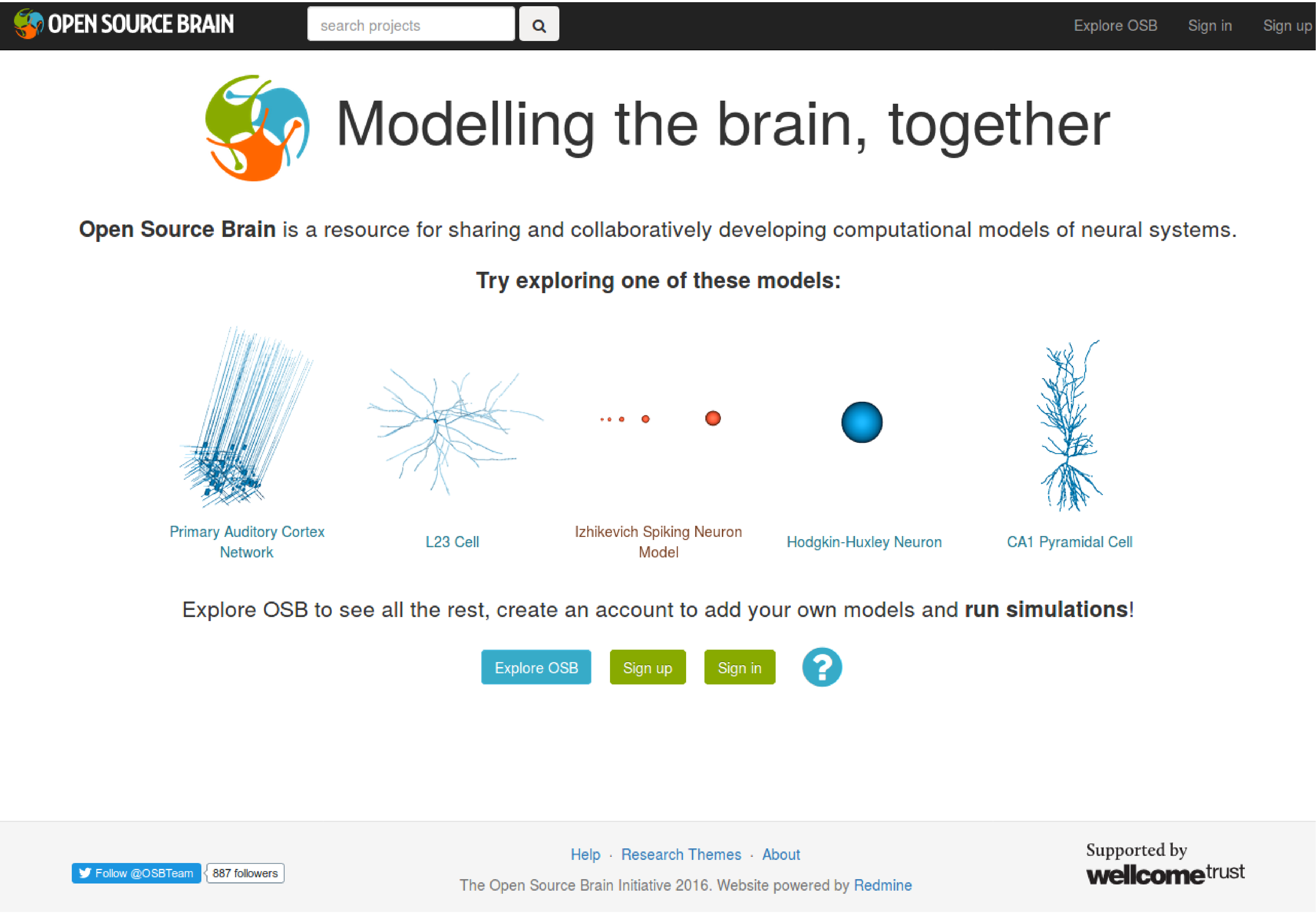



***Better model context*** *through partnerships with external neuroinformatics resources like the Ion Channel Genealogy (above) and through identifying repeated patterns within ModelDB itself (right).*

# 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.


OPEN SOURCE BRAIN
search projects
Explore OSB
Sign in
Sign up
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
Izhikevich Spiking Neuron Model
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
Sign in
Follow @OSBTeam
887 followers
Help · Research Themes · About
The Open Source Brain Initiative 2016. Website powered by Redmine
Supported by
wellcometrust

# Models available on OSB

## Neocortex

- *Mainen et al. (1995)*
- **L5 Pyramidal cell**
- *Rothman et al. (2010)*
- **L5 Pyramidal cell**
- *Hay et al (2011)*
- **L5 Pyramidal cell**
- *Traub et al. (2005)*
- **L2/3 Pyr (FRB/RS), L4SS,**
- **L5 Pyr (IB/RS), L6 Pyr,**
- **Deep & superficial basket,**
- **axo-axonic & LTS**
- **interneurons,**
- **Cortical column network**
- **model**

## Olfactory Bulb

- *Migliore et al (2014)*
- **Olf. Bulb network model**

## Cerebellum

- *Maex and Schutter (1998)*
- **Granule cell layer**
- *Steuber and Saviane, based*
- *on Berends et al. (2005)*
- **Granule cell**
- *Vervaeke et al. (2010)*
- **Golgi cell network**
- *Solinas et al. (2007a,b)*
- **Granule cell, Golgi cell**
- *De Schutter and Bower (1994)*
- **Purkinje cell**
- *Steuber et al. (2011)*
- **Cerebellar nucleus**
- **neuron**

## Hippocampus

- *Migliore et al. (2005)*
- **CA1 Pyramidal cell**
- *Bezaire et al (2017)*
  - **Full scale CA1**

## Abstract neuron models

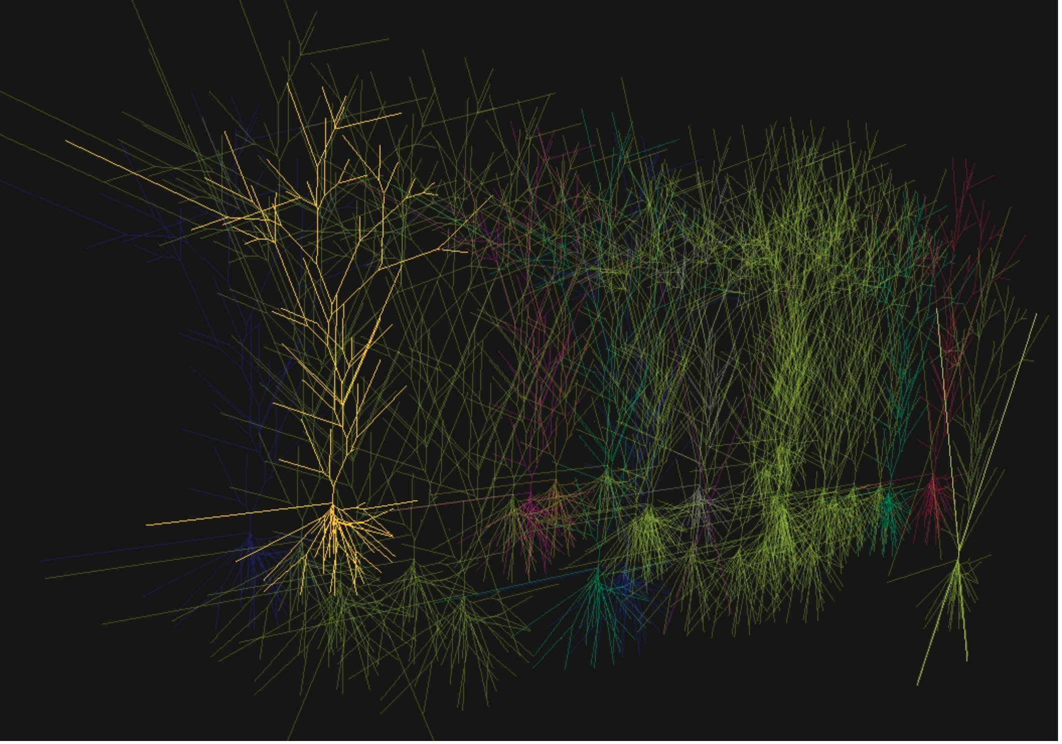
- *Izhikevich (2003)*
- *Morris & Lecar (1981)*
- *FitzHugh & Nagumo (1969)*

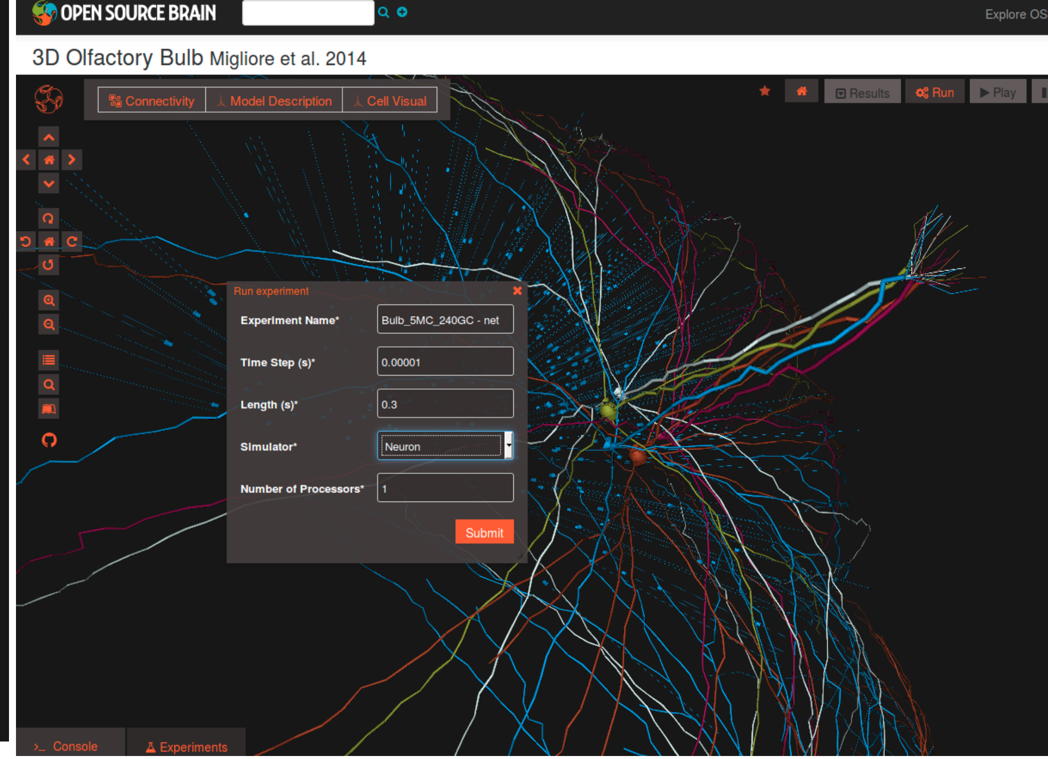
## Thalamus

- *Traub et al. (2005)*
- **Thalamocortical relay cell,**
- **Nucleus reticularis thalami cell**

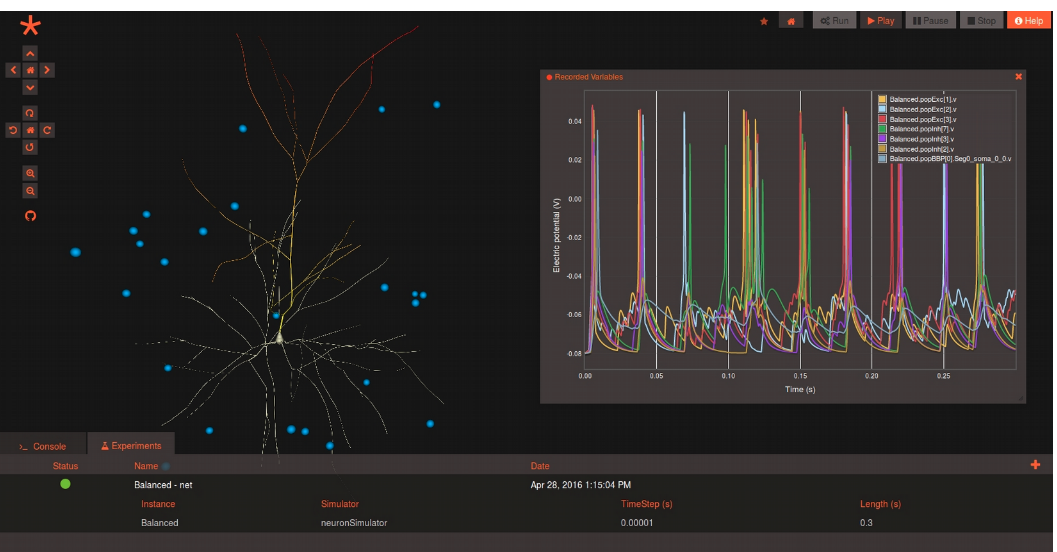
## C elegans

- *OpenWorm project*
- **302 cell connectome**

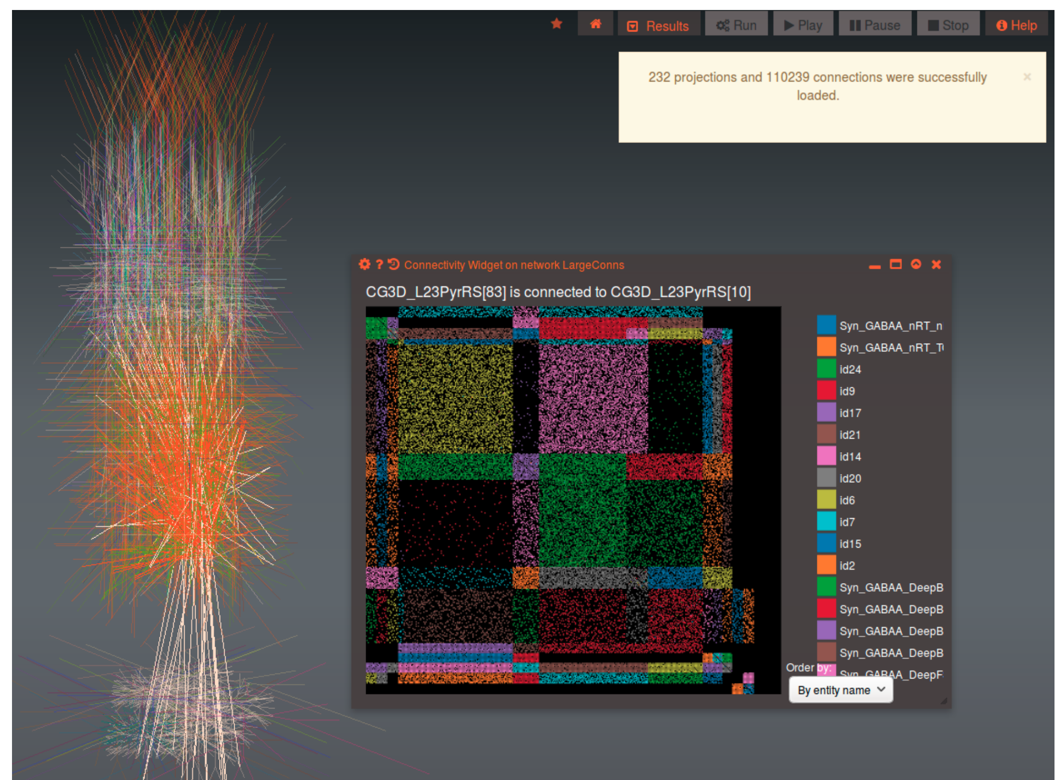




OPEN SOURCE BRAIN
Explore OSB
3D Olfactory Bulb Migliore et al. 2014
Results
Run
Play
Connectivity
Model Description
Cell Visual
Run experiment
Experiment Name*
Bulb_5MC_240GC - net
Time Step (s)*
0.00001
Length (s)*
0.3
Simulator*
Neuron
Number of Processors*
1
Submit
Console
Experiments

Run
Play
Pause
Stop
Help
Recorded Variables
Balanced.popExc[1].v
Balanced.popExc[2].v
Balanced.popExc[3].v
Balanced.popInh[7].v
Balanced.popInh[3].v
Balanced.popInh[2].v
Electric potential (V)
Time (s)
Console
Experiments
Status
Name
Date
Balanced - net
Apr 28, 2016 1:15:04 PM
Instance
Simulator
TimeStep (s)
Length (s)
Balanced
neuronSimulator
0.00001
0.3

Results
Run
Play
Pause
Stop
Help
232 projections and 110239 connections were successfully loaded.
Connectivity Widget on network LargeConns
CG3D_L23PyrRS[83] is connected to CG3D_L23PyrRS[10]
id24
id9
id17
id21
id14
id20
id6
id7
id15
id2
Order by:
By entity name

# 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

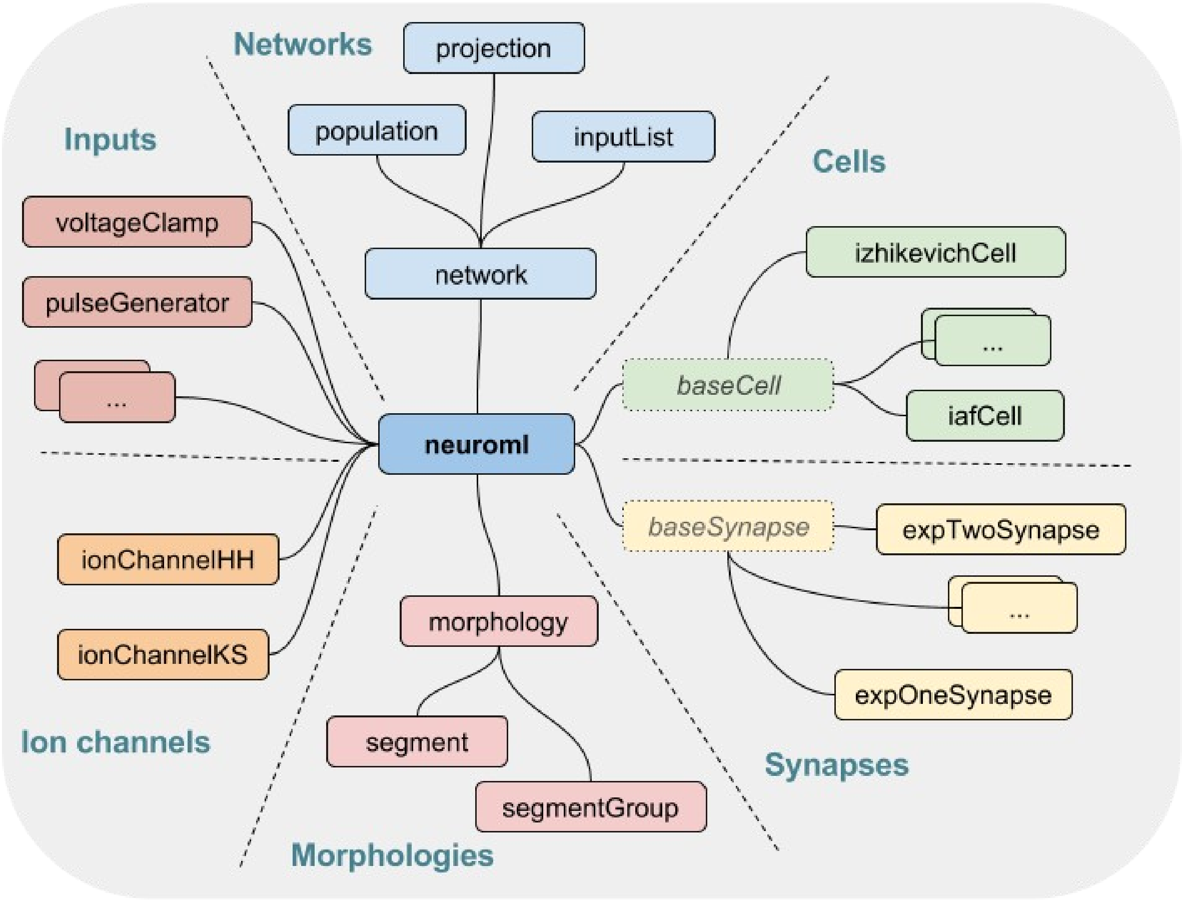
**Simulators**
NEURON
GENESIS
MOOSE
Brian

**Interoperability**
PyNN
neuroConstruct

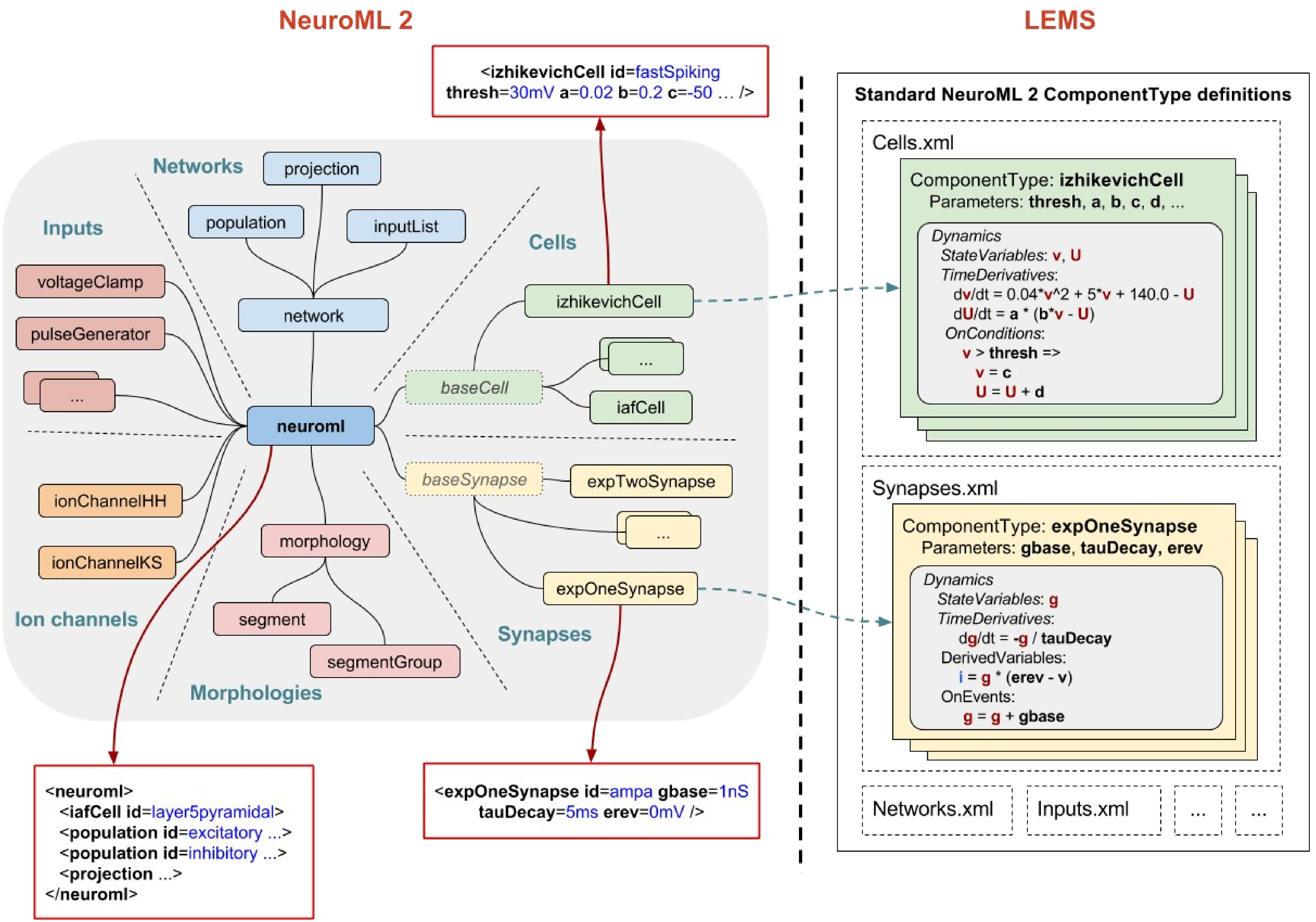
**Initiatives**
OpenWorm
Open Source Brain

**Databases**
Channelpedia
BBP NMC
NeuroMorpho
Allen Institute Cell Types DB

**Morphological analysis/ generation**
Cx3D
TREES Toolbox
NeuGen



Networks
projection
population
inputList
network
Inputs
voltageClamp
pulseGenerator
...
Cells
izhikevichCell
...
baseCell
iafCell
neuroml
baseSynapse
expTwoSynapse
...
expOneSynapse
ionChannelHH
ionChannelKS
morphology
segment
segmentGroup
Ion channels
Morphologies
Synapses



NeuroML 2
LEMS
<izhikevichCell id=fastSpiking thresh=30mV a=0.02 b=0.2 c=-50 … />
Networks
projection
population
inputList
network
Inputs
voltageClamp
pulseGenerator
...
Cells
izhikevichCell
baseCell
...
iafCell
neuroml
baseSynapse
expTwoSynapse
...
expOneSynapse
ionChannelHH
ionChannelKS
morphology
segment
segmentGroup
Ion channels
Synapses
Morphologies
<neuroml>
<iafCell id=layer5pyramidal>
<population id=excitatory ...>
<population id=inhibitory ...>
<projection ...>
</neuroml>
<expOneSynapse id=ampa gbase=1nS tauDecay=5ms erev=0mV />
Standard NeuroML 2 ComponentType definitions
Cells.xml
ComponentType: izhikevichCell
Parameters: thresh, a, b, c, d, ...
Dynamics
StateVariables: v, U
TimeDerivatives:
dv/dt = 0.04*v^2 + 5*v + 140.0 - U
dU/dt = a * (b*v - U)
OnConditions:
v > thresh =>
v = c
U = U + d
Synapses.xml
ComponentType: expOneSynapse
Parameters: gbase, tauDecay, erev
Dynamics
StateVariables: g
TimeDerivatives:
dg/dt = -g / tauDecay
DerivedVariables:
i = g * (erev - v)
OnEvents:
g = g + gbase
Networks.xml
Inputs.xml
...
...

# Geppetto

http://www.geppetto.org

Geppetto 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, Geppetto facilitates integration of diverse data and models, and can support different standard formats for both experimental and computational data.

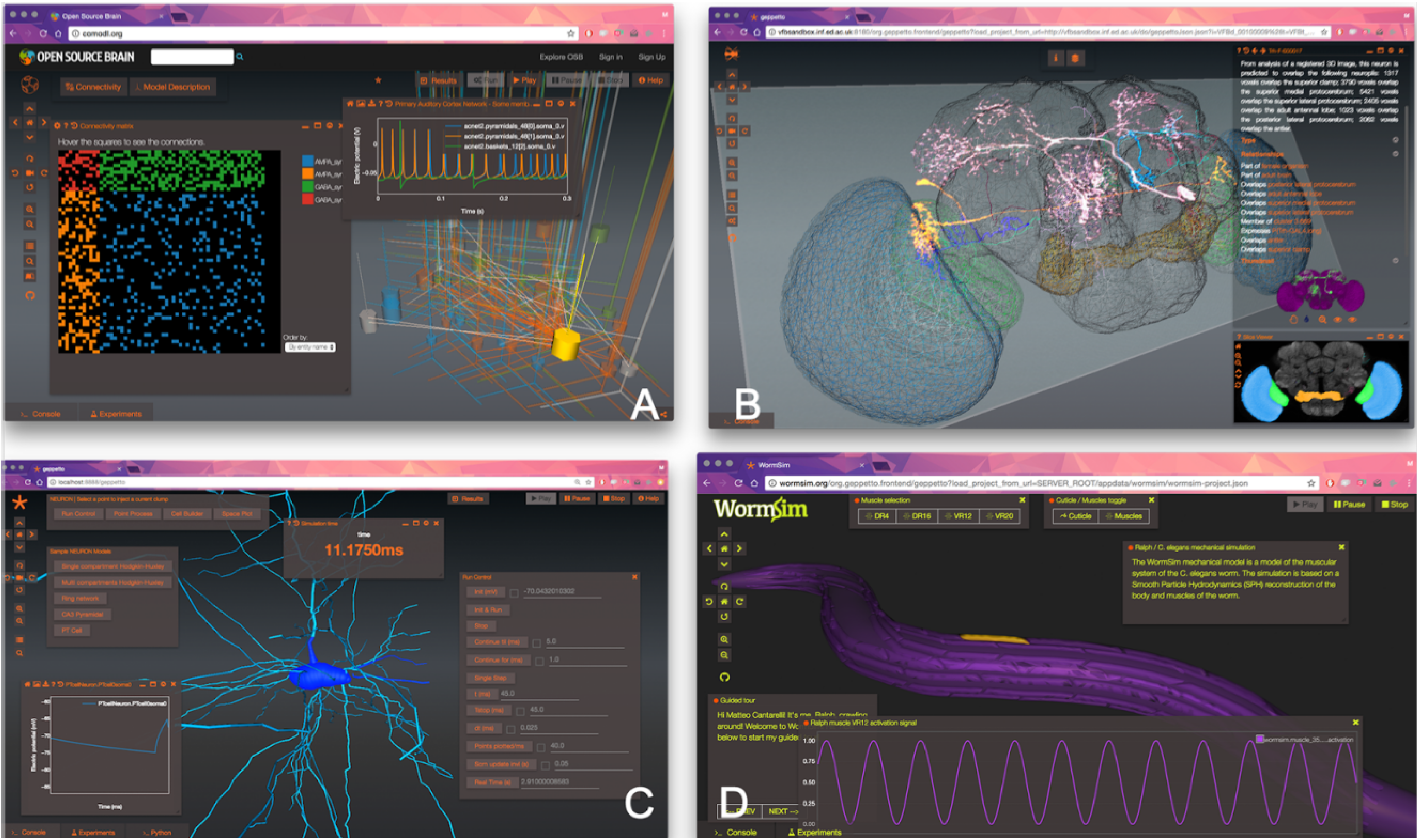
geppetto

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

## What can Geppetto do?

- Visualize **neuroscience data** in the browser
  - Computational Neuroscience Models (NeuroML, NEURON)
  - Morphology reconstructions (SWC, OBJ, Collada)
  - Electrophisiology 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 Geppetto 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.

geppetto



Open Source Brain
comodl.org
OPEN SOURCE BRAIN
Explore OSB
Sign in
Sign Up
Connectivity
Model Description
Results
Play
Help
Connectivity matrix
Hover the squares to see the connections.
Time (s)
A
geppetto
B
11.1750ms
Run Control
C
WormSim
wormsim.org/org.geppetto.frontend/geppetto?load_project_from_url=SERVER_ROOT/appdata/wormsim/wormsim-project.json
Muscle selection
DR4
DR16
VR12
VR20
Cuticle / Muscles toggle
Cuticle
Muscles
Play
Pause
Stop
Ralph / C. elegans mechanical simulation
The WormSim mechanical model is a model of the muscular system of the C. elegans worm. The simulation is based on a Smooth Particle Hydrodynamics (SPH) reconstruction of the body and muscles of the worm.
Guided tour
Ralph muscle VR12 activation signal
Console
Experiments
D

# 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.

## Publishing fees

None. Zero. Nada. 0$. 0€.

## 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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We redo Science !

ReScience

Reproducible science is good. Replicated science is better.