

Using NEURON to Model Cells and Networks

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Supported by NIH and European Human Brain Project

NEURON: a tool for empirically-based modeling of neurons and neural circuits

Active development

Open source project directed by Michael Hines

<https://github.com/neuronsimulator/nrn>

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User support

Downloads, documentation, tutorials, and Forum

<https://www.neuron.yale.edu/>

Individual support via Forum, email

Courses: meetings (SFN, OCNS, other),
summer course, workshops, webinars

The NEURON user community

Used by experimentalists, theoreticians, and educators
for neuroscience research and teaching

As of November 2020

- more than 2300 publications
- more than 2000 subscribers to Forum and mailing list
- source code for >740 published models at ModelDB
<https://modeldb.yale.edu/>

Building and Using Models with NEURON

Specifying biological properties via
programming: hoc and/or Python

GUI tools:

Import3d for morphometric data

NeuroLucida, SWC, Eutectic

Channel Builder, CellBuilder,

Network Builder, Linear Circuit Builder

Analyzing models

Model View tool

import/export NeuroML

Impedance class and GUI tool

Pythonic introspection

including NMODL-specified mechanisms

Building and Using Models *continued*

Instrumentation

- stimulators, current or voltage clamps,
other signal sources
- recording and plotting variables

Simulation control

- default and custom initializations
- integration methods
 - fixed time step
 - adaptive integration
- event system useful for implementing
"experimental protocols"

User interface

Building and Using Models *continued*

NMODL for adding new functionality

- ion channels, synaptic mechanisms

- chemical signaling: accumulation, transport,
reactions and reaction-diffusion

- algebraic equations

- signal sources (e.g. waveform generators)

- events, state machines, artificial spiking cells

RxD for reactions, accumulation, diffusion, transport

Parallel simulation

- multithreaded execution

- embarrassingly parallel problems

- distributed models

Optimization tools

Where to learn more

The NEURON Book

<https://neuron.yale.edu>

Documentation

hints and tutorials

FAQ list

key papers about NEURON

Programmer's Reference

Forum: <https://neuron.yale.edu/phpBB>

Getting started

Hot tips

Announcements (new releases, courses)