

Blue Brain
Open Platform

Virtual labs to explore, build and simulate the brain

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Blue Brain Open Platform

Over the course of the past two decades, the Blue Brain Project has pioneered simulation neuroscience as a complement to experimental and theoretical approaches.

Now, we are releasing a platform for the neuroscience community to leverage simulation neuroscience and accelerate their research.

The Blue Brain Open Platform offers the capability of exploring, building and simulating brain models.

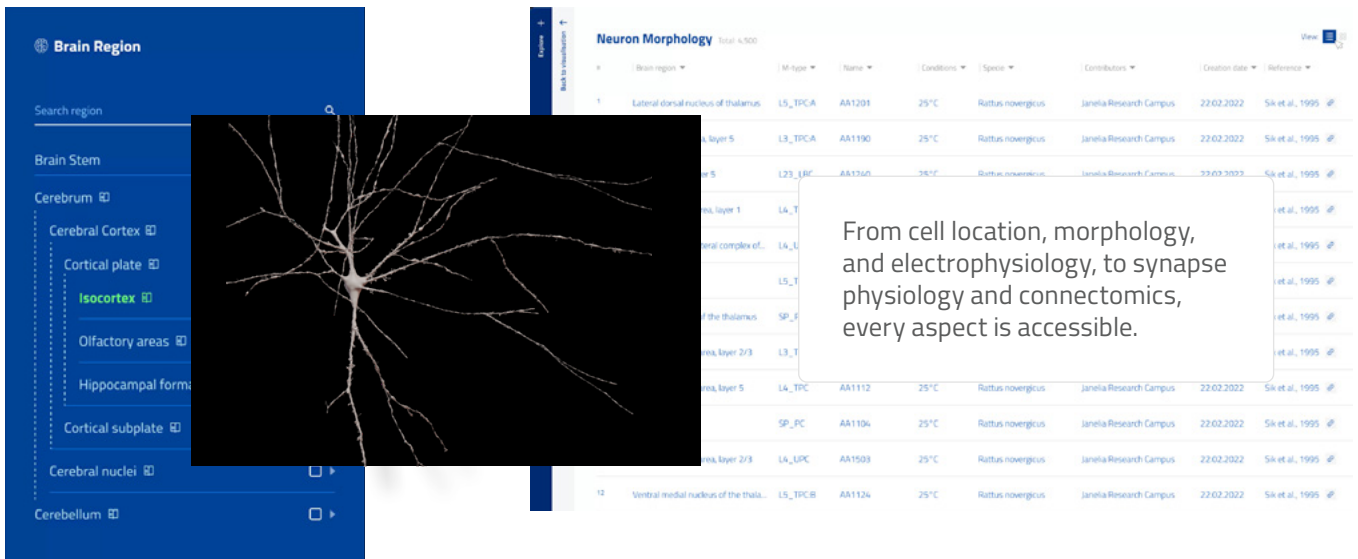
- Provides users with a comprehensive brain-guided atlas exploration of experimental, model, and simulation data, while mining and integrating open-access articles.
- Enables users to configure virtual labs, tailor brain models to their specifications, and conduct simulations.
- Offers virtual labs to promote data-driven insights among neuroscientists through different collaborative projects in order to accelerate the understanding of the underlying mechanisms of brain function and disease.
- Provides an AI-driven supportive tool for drafting manuscripts based on user's explorations, models and simulations.

Leveraging Simulation Neuroscience

www.openbluebrain.com

Explore

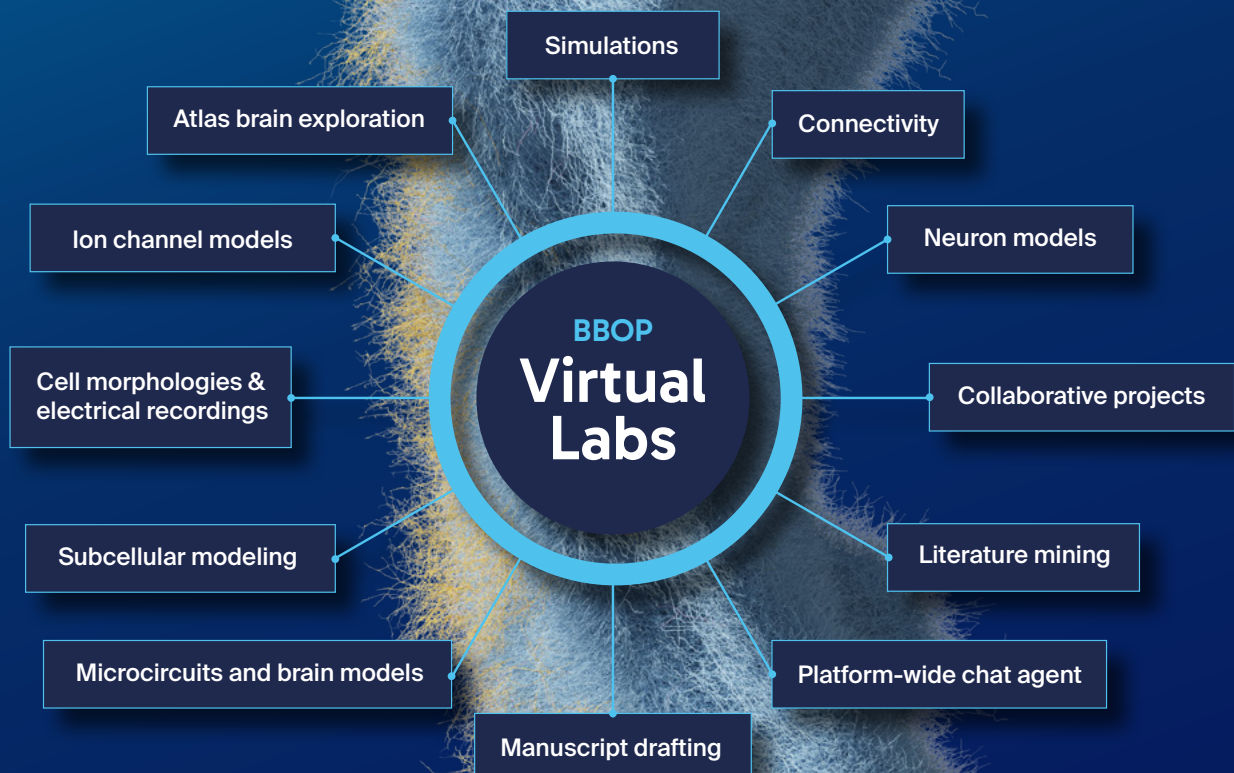
Examine neuronal models and virtual simulations through 3D interactive exploration and literature searches.



The screenshot shows a digital brain atlas interface. On the left, a sidebar titled "Brain Region" lists various brain areas, with "Isocortex" highlighted. In the center, a 3D model of a neuron is displayed. On the right, a table titled "Neuron Morphology" lists experimental data. A text box overlaid on the table states: "From cell location, morphology, and electrophysiology, to synapse physiology and connectomics, every aspect is accessible."

	Brain region	Model type	Name	Conditions	Species	Contributors	Creation date	Reference
1	Lateral dorsal nucleus of thalamus	L5_TPCA	AA1201	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995
	layer 5	L3_TPCA	AA1190	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995
	layer 5	L23_LPC	AA1326	25°C	Rattus norvegicus	Janelia Research Campus	23.02.2022	Sik et al., 1995
	layer 1	L4_T						Sik et al., 1995
	lateral complex of thalamus	L4_L						Sik et al., 1995
		L5_T						Sik et al., 1995
	of the thalamus	SP_F						Sik et al., 1995
	area, layer 2/3	L3_T						Sik et al., 1995
	area, layer 5	L4_TPC	AA1112	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995
		SP_PC	AA1106	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995
	area, layer 2/3	L4_LPC	AA1503	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995
12	Ventral medial nucleus of the thalamus	L5_TPCB	AA1124	25°C	Rattus norvegicus	Janelia Research Campus	22.02.2022	Sik et al., 1995

A Digital Brain Atlas offers a guided exploration of the experimental data and the model-inferred data, as well as of the literature-based knowledge of the brain.



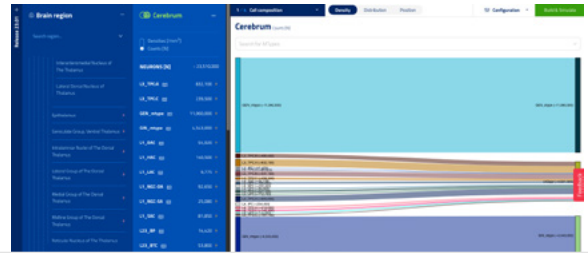
Build

Build your own brain configurations by customizing cell compositions, neuronal models, and connectivity metrics.

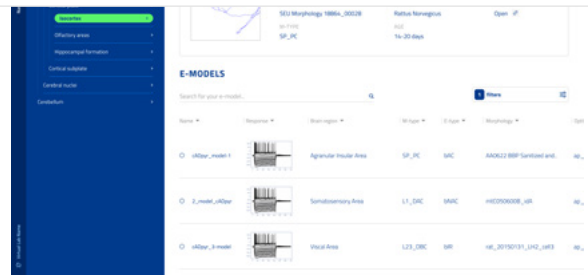
Employing the same intuitive atlas-based navigation, modifications can be integrated at all levels of the model.



Tailored brain configurations are constructed by adjusting default cell compositions, assigning neuronal models, and configuring the desired connectivity patterns. This empowers users to recreate disease models or probe and redefine hypotheses related to specific brain function and dysfunction.



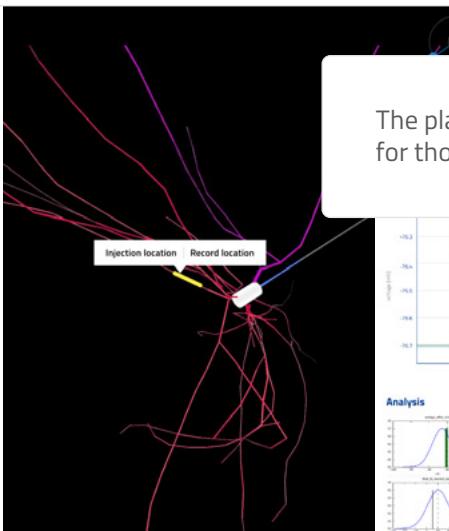
Use or edit reference digital brain tissue; single neurons, paired neurons, synaptomes, microcircuits, brain areas, brain regions, brain systems and whole brains.



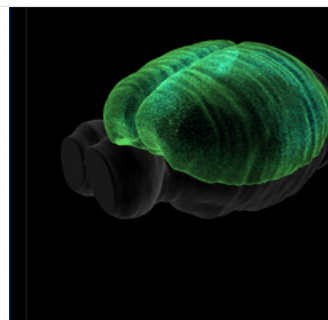
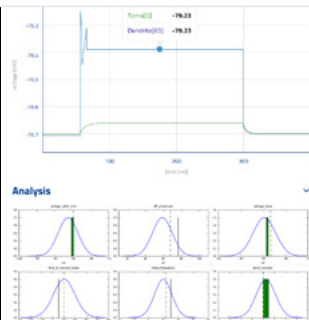
Simulate

Run your own virtual experiments and simulations.

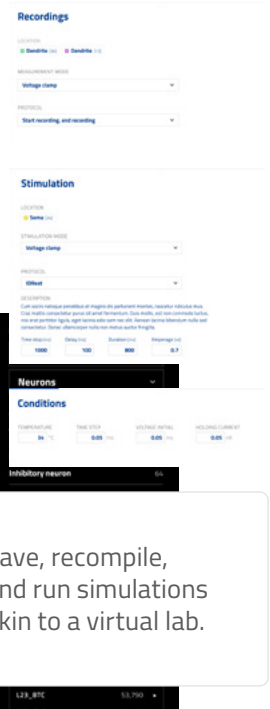
Atlas-based experiments that mimic biological experiments are both designed and executed, utilizing either the default configuration or your custom edits. Parameters can be controlled and the code itself can be adapted.



The platform also features integrated analysis tools for thorough examination of results.



Save, recompile, and run simulations akin to a virtual lab.



Capabilities

Modeling of synapses

- Modeling of synapse dynamics
 - stochastic release
 - multivesicular release
- Modeling of synapse types
- Modeling of gap junction
- Modeling of volumetric transmission

Modeling of neurons

- Skeletonization of the EM volumes
 - extraction of neuron skeletons
 - extraction of neuron spines
- Repairing slicing artifact
- Automatic neuron classification
- Automatic neurite classification
- Dendrite synthesis
- Axon synthesis (including long range)
- Automatic optimization of electrical models
 - automatic extraction of spiking features
 - automatic fitting to spiking features
 - automatic quality assurance of generalized models
- Enhancing diversification of neuron morphologies (cloning)

Visualization & Analysis

- Real-time visualization for large morphologically detailed circuits and simulations
- Generation of bio-realistic meshes from neuron skeletons
- Scientific analysis of simulations and campaigns
- Tools for large scale connectome analysis (connectome utilities)

Data Knowledge Engineering

- Ontology

Subcellular

- Blood flow
- Metabolism

Modeling of biorealistic connectivity

- Connectivity from anatomical constraints (touch detection)
- Simplified connectivity models
- Long range connectivity between brain regions at cellular resolution

Modeling of brain regions and circuits

- Atlasing
 - atlas alignment and smoothing
 - atlas interpolation
 - atlas region refinement (adding layers and barrels)
 - flatmapping
- Derivation of neuronal composition from literature constraints
- Realistic placement of morphologies

Machine Learning

- Literature search
- E-type classification
- Feature recognition
- Paper generator
- Parameter literature mining using Language Models

Ion Channel Models

- Channelpedia
- Systematic modeling of ion channel kinetics under different temperatures

NGV

- Modeling of vasculature
- Astrocyte synthesis
- End foot generation
- Simulation

Simulation

- Simulate any neuron in the mouse brain, neocortical: mouse, rat, human
- Highly memory and CPU efficient simulation of neuron compartmental models
- Powerful in silico experimentation and parameterization
- Flexible tools for circuit manipulation
- Simulation of functional plasticity
- Simulation of neuromodulation

General Enquiries

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