



EBRAINS

# The EBRAINS Interactive Workflows for Cellular Level Modeling (CLSI)

Luca Leonardo Bologna (CNR)

*lucaleonardo.bologna@cnr.it*

EBRAINS Tools for Teaching: Leveraging EBRAINS Open Science Tools for Neuroscience Education  
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# The EBRAINS CLSI for Teaching

<https://www.ebrains.eu/>

<https://ebrains-clsi-interactive.github.io/index.html>

EBRAINS  
Cellular Level Simulation  
**Interactive Workflows and Use Cases**  
Build data-driven brain models  
DISCOVER



Ecosystem of Workflows and Use Cases for cellular level simulation and analysis

# The EBRAINS CLSI for Teaching

## Build, reconstruct, and simulate data-driven brain models

- Build single cell and small circuits
- Perform data analysis on recorded and simulated neural activity
- Run the models on EBRAINS HPC resources
- Share your results and code with the scientific community via the EBRAINS platforms

## Prerequisites for students

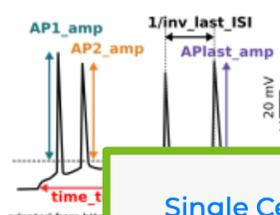
- EBRAINS account (register at <https://www.ebrains.eu/page/sign-up>)

## No programming skill is required

- Familiarity with Python Jupyter Notebooks might be helpful if you want to modify the tools yourself and for your own needs

# EBRAINS CLSI: multiple tools for multiple scales

### Trace Analysis



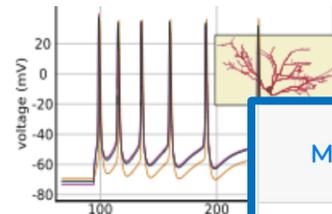
#### NeuroFeatureExtract

Extracts electrophysiological features; trace can be from HBP/EBRAINS or uploaded

### Single Cell Modeling

#### Hodgkin-Huxley Neuron Builder

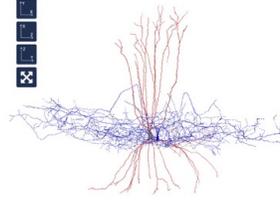
Use the eFEL and BluePyOpt libraries to go



### Morphology

#### Morphology visualization

Display neuron morphology in 3D

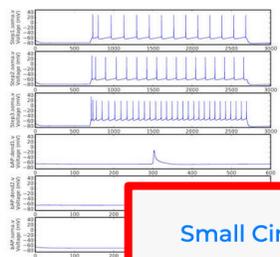


CA1\_int\_cNAC\_990611HP2\_2019032816  
 Rattus norvegicus > Hippocampus CA1  
 CA1\_int\_cNAC\_990111HP2\_2019032915  
 Rattus norvegicus > Hippocampus CA1  
 CA1\_int\_cNAC\_980513B\_201903291555  
 Rattus norvegicus > Hippocampus CA1

Credits: Genrich Ivaska

### Single Cell In Silico Experiment

#### Single cell in silico experiments under current clamp



Rattus norvegicus > Hippocampus CA1 > interneuron > CA1\_int\_cNAC\_990111HP2\_20190329155703  
 Rattus norvegicus > Hippocampus CA1 > interneuron >

### Small Circuit In Silico Experiment

#### Mouse O1 - Scaffold Somatosensory Cortex Microcircuit for Mouse



This model combines specific datasets obtained for mouse somatosensory cortex, models of neuronal electrophysiology constrained to mouse primary visual cortex data from the Allen Cell Types Database, and datasets that were algorithmically transformed from rat to mouse.

Credits: Michael W. Reimann (michael.reimann@epfl.ch) Eilif Muller (eilif.mueller@epfl.ch) Srikanth Ramaswamy (srikanth.ramaswamy@epfl.ch)

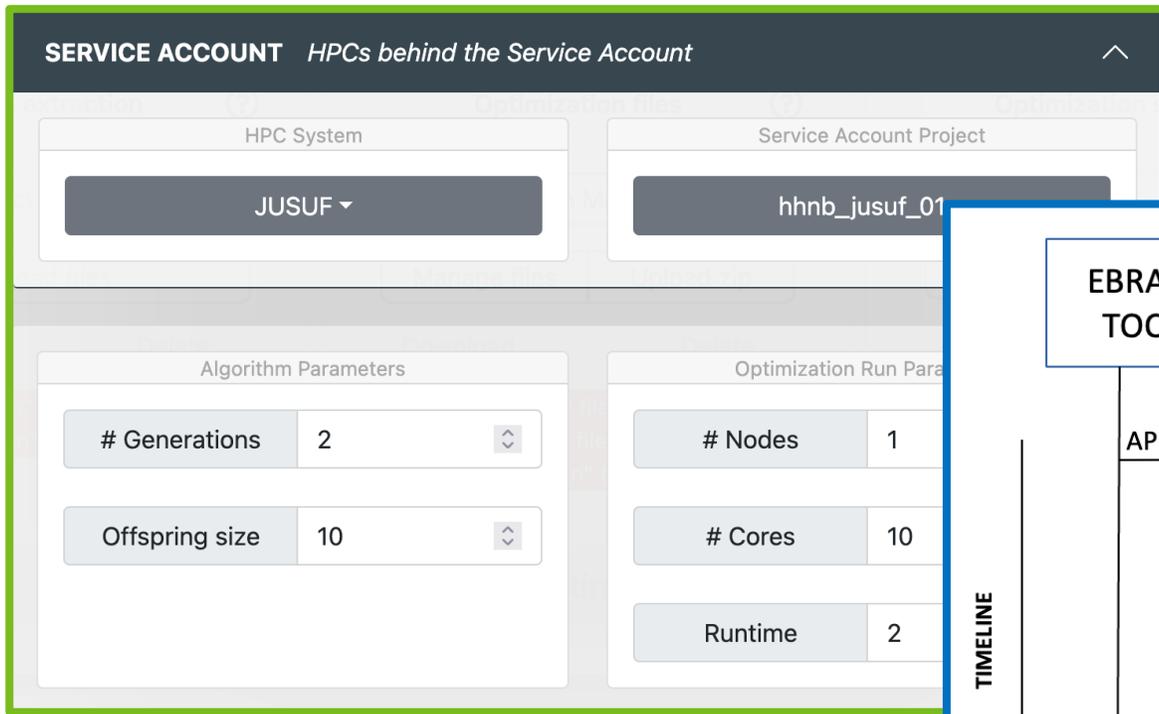
# EBRAINS CLSI: multiple tools for multiple scales

The screenshot shows the NeuroFeatureExtract interface. At the top, it says "EBRAINS NeuroFeatureExtract Trace selection". Below this, there is a section for "Cell properties: rattus-norvegicus > 970509hp2 > 97509009". A blue box labeled "Data Analysis" is overlaid on the interface. Below the cell properties, there is a "Settings" dropdown menu and a graph showing membrane potential (mV) over time (ms) for various current injections (1.00 nA, 0.80 nA, -0.80 nA, -1.00 nA).

The screenshot shows a neuron model page for "Rattus norvegicus > hippocampus > interneuron > CA1\_int\_cAC\_980120A\_20190328160925". It features several plots of membrane potential over time, a 3D reconstruction of the neuron morphology, and a "Description" section with fields for "brain\_structure", "cell\_soma\_location", "morphology", and "id". A green box labeled "Model optimization" is overlaid on the page. Below the description, there is a "Credits" section and a "Contributors" section with contact information for Rosanna Migliore.

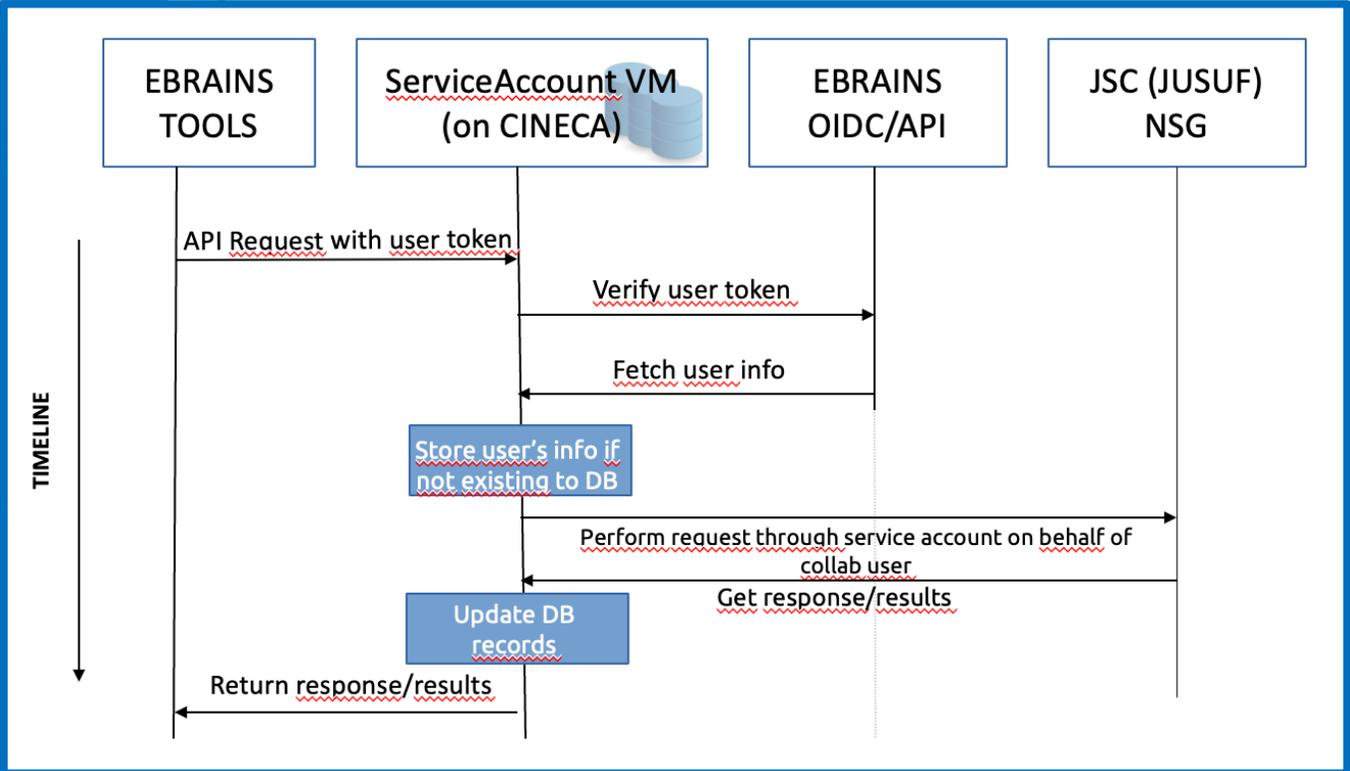
The screenshot shows a neuron model simulation interface. The main window displays a 3D reconstruction of a neuron morphology in red. A blue box labeled "Model simulation" is overlaid on the morphology. To the right, there is a "Simulation" panel with a "Params" section and a "Graph" showing voltage (mV) over time (ms) for "soma[0]\_0". The graph shows a step change in voltage followed by a series of oscillations. At the bottom, there are "Cancel" and "Register in Model Catalog" buttons.

# EBRAINS CLSI: use EBRAINS HPC resources via the service account



## No need for HPC credentials ...

... just **SIGN UP** on **ebrains.eu**



# EBRAINS tools in a classroom context

- Success factors and challenges regarding the use of open science tools in a classroom setting:
  - Shared results and methodology
  - Concurrent access and brainstorming
  - Time constraint -> work together, work alone, share results
  
- Future goals for the tools in the context of its use for teaching
  - Fetch increasingly more resources from public online platforms
  - Foster students' contribution to the tools and to the scientific community

# EBRAINS tools in a classroom context

Yearly: EBRAINS Brain Simulation School (2025 <https://conf.snn.ro/ebrains/>)



The banner features a blue header with four logos: the European Union flag with 'Finanziato dall'Unione europea NextGenerationEU', the Italian Ministry of University and Research, the 'Italiadomani' logo with 'PIANO NAZIONALE DI RIPRESA E RESILIENZA', and the 'Consiglio Nazionale delle Ricerche' logo. Below the header, the text reads: 'Progetto EBRAINS-Italy - Missione 4, Componente 2, Linea di investimento 3.1 del PNRR Finanziato dall'Unione europea - NextGeneration EU (CUP B51E22000150006)'. The main title is 'EBRAINS-Italy Brain Simulation Training Workshop Brasov (Romania), 27-29 May 2025'. The description states: 'The school will introduce the students to the EBRAINS-Italy Research Infrastructure workflows for Computational Neuroscience, with the main aim to extend access to this field and related tools to the average user from a variety of scientific communities. After the course, students will have a deeper understanding on the techniques and the scientific issues underlying the implementation of multiscale computational models or neurons and networks; students will also be able to use the Platform and access supercomputer systems to configure and run simulations and visualize/analyze the results.'



# EBRAINS

# Thank you

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[www.ebrains.eu](http://www.ebrains.eu)

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Head office  
Chaussée de la Hulpe 166  
B-1170 Brussels - Belgium

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