

# The Bernstein Network

The Bernstein Network Computational Neuroscience is an international research network in the field of computational neuroscience. It unites different scientific disciplines in the endeavor to understand how the brain functions. The close combination of neurobiological experiments with theoretical models and computer simulations allows scientists in the Bernstein Network to pursue innovative approaches. The scientists can rely on central infrastructural facilities located in Germany, which support the scientific dialogue.

The network is named after the German physiologist and biophysicist Julius Bernstein (1839-1917), whose „Membrane Theory“ provided the first biophysical explanation of how nerve cells encode and transmit information via electrical currents.



Be part of the  
Bernstein Network!



## Get in Touch

<https://bit.ly/SDL-Neuroscience>

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## Follow Us

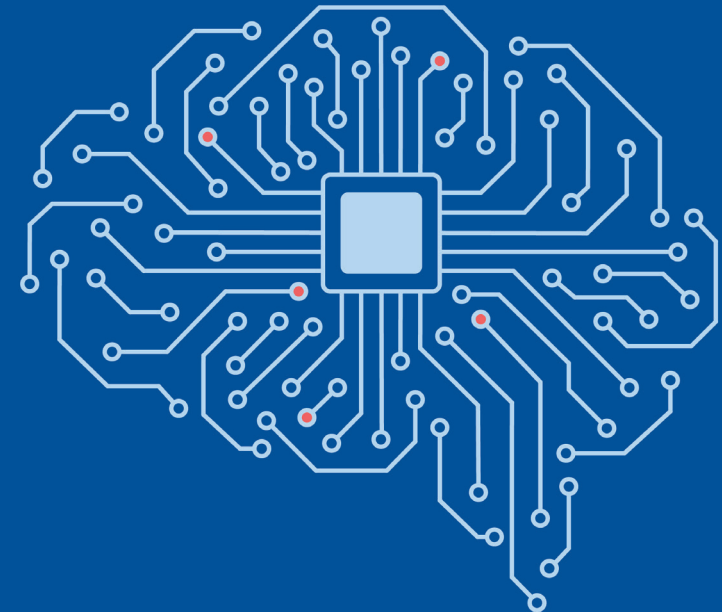


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Advancing your Neuroscientific  
Research to the Next Level



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## Large Scale Simulation & Neuromorphic Systems

We are key contributors to the neural network simulators NEST and Arbor. Execution performance and maintainability are our primary concerns. Simultaneously, we enhance usability by eliciting user requirements and developing domain specific languages to express neural models, for example the NEST modelling language NESTML. On the hardware side, we investigate novel neuromorphic systems which promise accelerated simulations of neural networks and new computational paradigms.

## Meta-optimization for Bio-inspired Networks

We develop high-throughput software tools and innovative methods for the optimization of neuroscience simulations with particular focus on high-dimensional parameter spaces, biologically inspired meta-learning, and dynamic connectivity generation.

## Multiscale Simulation & Design

We bring high performance computing (HPC) expertise to brain simulation software at the interfaces between scales: embodied robotics, whole brain, point neuron, and morphologically detailed scales. We design and develop tools

for the deployment of complex co-simulation workflows combining multiple simulators into connected systems.

## Machine Learning & Data Analytics for Neuroimaging

We adapt neuroimaging methods and workflows originally developed for workstations or small clusters to scale up to HPC systems at the Jülich Supercomputer Centre. These workflows include classical image processing methods, complex modelling steps such as diffusion tensor reconstruction, and modern machine learning techniques such as deep learning models.

## About SDLN

The Simulation and Data Lab Neuroscience (SDLN) is one of three facilities of the Bernstein Network Computational Neuroscience. As the Bernstein Facility for High Performance Simulation and Data Analysis, SDLN brings neuroscience and HPC closer together through comprehensive support oriented to the need of the neuroscience community.

- Bernstein Centers
- Ⓝ Bernstein Nodes
- Ⓑ Bernstein Coordination Site (BCOS)
- Ⓖ Bernstein Facility for Research Data Management (G-Node)
- Ⓢ Bernstein Facility for High-Performance Simulation and Data Analysis (SDLN)
- Sites of Bernstein members



## Our Services

We provide expertise in both neuroscience and HPC based on in-house research and development, as well as collaborative joint projects with national and international partners. We develop simulation, data analysis and visualization technologies for the neuroscience community. We port and optimize codes for efficient use of modern and future supercomputers.