Bernstein Network Computational Neuroscience

Bernstein Newsletter

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Simulation Lab Neuroscience / Bernstein Facility for Simulation and Database Technology

Located in long rows next to each other, the large rectangular racks of the supercomputer are reminiscent of an army of flashing metal cabinets. Abigail Morrison stands in front of a large window looking down on the supercomputer JUQUEEN. “The aim of the Simulation Lab Neuroscience is to bridge high performance computing and brain research,” she explains. “Our mission includes both research and support for scientific users.”

The supercomputer JUQUEEN

The Simulation Lab Neuroscience is one of several simulation labs at Jülich Supercomputing Centre. Simulation labs—or SimLabs in short—emerged from the observation that while Jülich is leading in the field of High Performance Computing in Europe, the computers are not always optimally used by scientists. “High Performance Computing is a subject by itself. In a normal academic education, you don’t necessarily learn the corresponding programming models. It’s therefore our job to assist neuroscientists in the use of supercomputers,” Morrison says. As the scientific leader, she has been in charge of building up the SimLab Neuroscience, which now consists of around a dozen employees.

Often, Morrison and her team help by optimizing an existing programming code for its use on high performance computers. In other cases, there is an interesting scientific idea, but no suitable method. “Together with the scientists, we then generate a code to bring the problem to the machine.” This need not necessarily be a Jülich computing machine—the simulation or data analysis can also be done at a local computing center. If external researchers decide to use one of the high performance computers in Jülich, the SimLab assists with the application procedure for computation time.

“Our second pillar is methodological research,” Morrison continues. Among other things, the SimLab advances algorithms and workflows for data acquisition and analysis. The development is done in a hands-on fashion. “Usually, we look for partners with a problem we are working on—although they are not always aware they have a problem,” Morrison says with a friendly grin. In some of these cases, they jointly analyze the workflow of their data analysis: What resources can be used to work more efficiently? Can certain steps of the data analysis be shortened, which represent a temporal bottleneck?

Another research task of SimLab Neuroscience is developing specialized simulation, database and virtual reality technologies for supercomputers. Several employees are actively involved in the development of the simulation software NEST. For this, there is a close collaboration with Markus Diesmann and his group, who are located only a few doors down on the spacious campus of Forschungszentrum Jülich.

Diesmann has been very connected to the SimLab Neuroscience since its beginnings: it was through his initiative that the SimLab became part of the Bernstein Network right since its start in early 2013. Here, it acts as Bernstein Facility for Simulation and Database Technology. “The idea was to provide the network with our particular expertise. Of course, every neuroscientist may rely on our services. However, through the partnership with the Bernstein Network we hope to come into contact with neuroscientists even more easily. Also, there are huge thematic overlaps with Bernstein members regarding simulations and database analyses,” says Morrison.

One example is the collaboration of the SimLab with Petra Ritter in Berlin. Ritter develops the Virtual Brain Simulator within the Project State Dependencies of Learning of the Bernstein Focus Neural Basis of Learning, amongst others. The Virtual Brain is a computer model of the whole human brain that has been created by using different imaging methods. It enables the brain to be analyzed and simulated at different levels. At present, the SimLab and Ritter are developing a software for parallel computing, which allows longer simulations.

Morrison looks through the glass window on the high performance computers. At its inauguration in 2013, JUQUEEN was the fastest supercomputer in Europe. It reaches a maximum computing power of 5.9 petaflops, or floating point operations per second. Put differently: to achieve this performance, every human being of the current world population would have to carry out nearly 800 calculation steps per second. After only two years, JUQUEEN has received new company: right next to it, JURECA has taken its place. The new high-performance computer has been in operation since mid-July. As a cluster computer, it relies on Linux as operating system—which is familiar to many users from their personal computer.

Abigail Morrison has been in charge of building up the SimLab.

“To reduce possible inhibitions for the use of supercomputers as well as to show interested scientists opportunities and possibilities for their research, we organize workshops at regular intervals,” Morrison says, hinting at the next workshop *Supercomputing for Neuroscientists* (see also News and Events). But also besides these occasions one can always get in touch with members of the SimLab Neuroscience: “We are always happy to support interesting projects.”

Fine Tuning in the Brain

When newborn babies open their eyes for the first time, they already possess nerve cells specialized in particular stimuli in the visual cortex of their brains – but these nerve cells are not systematically linked with each other. How do neural networks that react in a particular way to particular features of a stimulus develop over the course of time? In order to better understand the steps of this development and explain the complicated processes of reorganization they involve, an international team of researchers has now developed a computer model that precisely simulates the biological processes. The results of the study by Stefan Rotter, Bernstein Center Freiburg (BCF) and Cluster of Excellence BrainLinks-BrainTools of the University of Freiburg, conducted in cooperation with Claudia Clopath from the Imperial College London, England, have now been published in the journals *PLOS Computational Biology* and *PLOS ONE*.

The connections between nerve cells that react to similar stimuli are strengthened as they gain visual experience (thick lines), while other connections are weakened (thin lines). © Stefan Rotter / BCF, 2015

"Our model enabled us to achieve a meaningful combination of typical features of biological neural networks in animals and humans in a computer simulation for the first time ever," reports the neuroscientist Sadra Sadeh from the BCF. "The networks harness the principle of feedback to make nerve cells in the visual system into efficient detectors of features. In addition, they can precisely coordinate the points of contact between the cells – the synapses – in learning processes." It is difficult to combine these two properties in computer models, because it can easily lead to an explosion of activity in the network – similar to an epileptic fit. To keep the activity in the network stable, the researchers integrated inhibitory synapses into the learning process, which control the excitation in the network.

Researchers can now use the computer model to simulate various developmental processes in the brain's visual cortex. Among other things, it will allow them to determine how connections between the nerve cells change the first time they receive stimuli from both eyes after birth. Such processes play a role in early-childhood visual disorders like congenital strabismus (squinting). "In the long term, the model could even enable us to develop better strategies for treating such illnesses," says Rotter.

But why do the neural networks change their structures in the course of visual experience if nerve cells are already specialized in particular stimuli at the moment the eyes first open? The team found an answer to this question in a parallel study. "In a simulation directly comparing inexperienced and fully developed nerve cell networks, we were able to demonstrate that fully developed networks further strengthen components of a stimulus that carry more information by preferring connections of neurons with the same function," explains Rotter. Therefore, while newborns do indeed have the capacity to process all stimuli when they first open their eyes, their perception is greatly improved through the fine tuning of the nerve cell connections.

Sadeh S, Clopath C & Rotter S (2015): Emergence of functional specificity in balanced networks with synaptic plasticity. PLOS Computational Biology 11(6): e1004307.
doi: 10.1371/journal.pcbi.1004307

Sadeh S, Clopath C & Rotter S (2015): Processing of feature selectivity in cortical networks with specific connectivity. PLOS ONE 10(6): e0127547.
doi: 10.1371/journal.pone.0127547

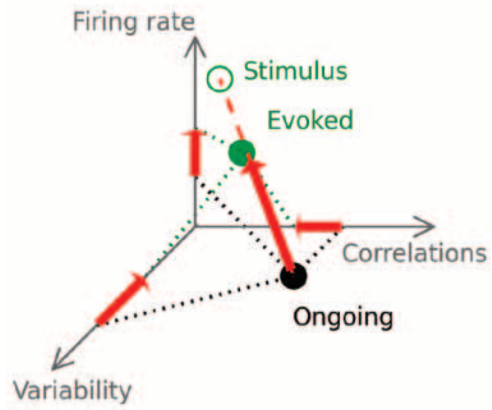
Input matters!

During the perception of sensory input signals, the activities of cortical neurons becomes less noisy and less correlated. These two activity features could be crucial to ensure an optimal representation of sensory information in the brain. The nature of the mechanisms that shape cortical responses to sensory inputs have puzzled scientist for decades.

As Alejandro F. Bujan, Ad Aertsen and Arvind Kumar from the Bernstein Center Freiburg explain in a new article published in the *Journal of Neuroscience*, the statistics of the input signal could play a key role in the generation of cortical responses that ensure an efficient representation of input signals in the brain's activity. To reach this result, they used computer simulations of the spiking activities of single neurons and networks of neurons, and studied the effects of different signal statistics on the responses of cortical neurons.

Previous proposals of how cortical neuronal responses are shaped during sensory perception suggested that the connectivities between neurons in the activated regions of cortex was the main factor determining the response features. Some of these models, however, had the flaw that they were unable to explain the decrease in the degree of functional coupling (or correlations) between neurons in response to sensory inputs. As Bujan and colleagues argue in their paper, these models had ignored the contribution of the factor that originated the responses in the first place: the sensory input signal!

The computational study of the scientists introduces a novel way to classify the input activity features that help to understand the input's contribution to shaping the cortical response. As the authors point out, some input features have mainly an effect at the level of individual neurons, while others affect groups of neurons. Accordingly, input features affecting individual neuron responses determine the magnitude of the modulation induced by the input, whereas input features affecting populations of neurons define how the cortical activity is modified. They further suggest that this classification of input features can be naturally linked to the way nerve cells send axonal projections into the cortex.



Representation of the cortical response caused by an input signal ("stimulus"). Axes in this scheme define three key features of the neuronal activity. The cortical activity is represented by filled circles. The black filled circle indicates the activity in the absence of a stimulus (also known as "ongoing" activity) and the green filled circle, the activity induced by the stimulus ("evoked"). The dashed red line indicates the "direction" of the modul ation (green empty circle), representing the contribution of the input features to the activity of populations of neurons. The red arrows indicate the magnitude of the change determined by the input features (empty green circle) at the single cell level, given the level of ongoing activity (black filled circle). © Bujan et al., 2015

With their model, Bujan and colleagues propose a new view of cortical neuronal responses, in which stimulus-evoked activity features are shaped both by the connectivity within the cortex and by the connectivity of the input projections carrying the signal to the cortex, to ensure an optimal representation of the input signal in the cortical network activity.

Bujan AF, Aertsen A & Kumar A (2015): Role of input correlations in shaping the variability and noise correlations of evoked activity in the neocortex. Journal of Neuroscience 35(22):8611 – 8625. doi:10.1523/jneurosci.4536-14.2015

Interview: Sonja Grün and Markus Diesmann

Tell us how you became involved in science.

Diesmann: For me, it has somehow always been clear that I wanted to become a scientist. I even told my teachers in primary school. *[short break]*

Grün: Yes, but what were the next steps? It is a long way from primary school to research...

Diesmann: I came into contact with brain research by playing with computers in high school. After graduation, I was wondering what to study to get into this field. At first, I thought the combination of computer science and psychology might be a good basis, but then I considered to study a fundamental science first—which brought me to physics in Bochum. During my exchange year at the University of Sussex I came back to brain research, and I also chose a topic from neuroscience for my diploma thesis.

Grün: For me, it has been less obvious. I can only remember that being a child in elementary school, I once said I wanted to keep on learning for my lifetime—which in retrospect I do interpret in a way that I wanted to become a scientist. After all, that's what you do in science! However, my way has been much less direct than Markus' path. I started with an apprenticeship as an electronics technician at IBM. However, I did not want to repair printers all my life, so I went for the *Abitur* via continuation education. I first came into contact with brain research during a seminar offered by the Max Planck Institute for Biological Cybernetics in Tübingen, when I studied psychology. Although I did quit psychology to switch to study physics soon after, I returned to the MPI *[comment: Max Planck Institute]* during the advanced study period. Later, I prepared my diploma thesis there and fell in love with brain research.

What happened then?

Diesmann: In my thesis I dealt with Moshe Abeles' idea of synfire chains. According to this theory, there are networks in the brain built in such a way that they can support the propagation of precisely matched action potentials. Marc-Oliver Gewaltig and I wanted to model them in simulations. For this we obtained copies of Moshe's lab book in Hebrew. Of course, this was not very comprehensible for us, but with Moshe's help we worked through it. These were the origins of the NEST simulator, which I am still working on today. And this is also when I met Sonja.

Grün: Like I said, I completed my diploma thesis at the Max Planck Institute for Biological Cybernetics under the supervision of Ad Aertsen and Hermann Wagner. I was involved in sound localization in barn owls. We already had some experimental data. My job was to build a model that allowed to model and simulate—or understand—the data. When Ad left to go to Bochum, he offered me position as a doctoral student. After one year, Markus and Oliver came to prepare their diploma theses with him. Markus and Oli were already inseparable at the time.

Diesmann: Sonja organized desks for us from the director of the institute. This was quite helpful...

Grün: And then I was given a hard time by the director because as a spoiled MPI brat, I had dared to ask for desks for diploma students...

Diesmann: At the beginning, we worked on quite distant topics: Sonja on data analysis and I on abstract synfire chain problems.

acquisition to computer files. If I had not gained this insight, I would not be able to cooperate so well with experimenters today. And, of course, it is great to work with Moshe Abeles. He is creative, has crazy ideas and makes you think really hard.

Diesmann: In 1996, I moved to Freiburg for two years when Ad was offered a professorchip at the university there. After that, I worked as a group leader at the Max-Planck-Institute for Nonlinear Dynamics and Self-Organization under the direction of Theo Geisel. Tom Tetzlaff started his diploma thesis with me, and later Abigail Morrison and Sven Goedeke joined. Substantially, I continued dealing with questions about nerve cell activity in networks. We tried to generate more and more realistic models. Besides that, the collaboration with Sonja continued. Especially the time when Sonja was also at a Max Planck Institute, the MPI for Brain Research in Frankfurt, was very productive.

Grün: Our collaborations intensified when we followed Ad to the Weizmann Institute of Science in Rehovot, Israel. That was in 1994. Together we analyzed experimental and synfire network data using an analysis method that I developed in my PhD thesis. We also became a couple in privat life at this time.

Diesmann: Meanwhile, I had become a graduate student myself. However, our joint stay at the Weizmann Institute did not last long: after Sonja had finished her doctorate, she became a postdoctoral fellow in Moshe Abeles's lab at Hebrew University in Jerusalem.

Grün: That was a very important period in my career. Using multi-electrode recordings, we studied how movement and movement planning are represented in the cortex of the monkey. This way, I got to know the whole chain from the animal to data

Grün: We haven't reached that part yet... When I finished my postdoc in Israel, I joined the Max Planck Institute as a senior postdoctoral fellow in 1998. There, I established my own work group in the Department of Wolf Singer. After my stay with Moshe, I quit doing experiments myself. Instead, I focused on data analysis and development of analysis methods, and collaborated with experimentalists, such as with people from the Singer lab. At the end of 2002, I obtained a research lectureship —a kind of junior professorship—by the *Stifterverband für die Deutsche Wissenschaft*. Randolf Menzel in Berlin had been very supportive of this and he then brought me on board of his Department of Neurobiology at Freie Universität. My group steadily grew bigger over the time, while I contemporaneously also worked on my habilitation. Through my continued contact with Ad Aertsen I completed the teaching parts at the University of Freiburg, where I eventually qualified as a professor in neurobiology and bio-physics in 2003. It took until 2006 before Markus and I managed to work and live in one place again.

Diesmann: Now there is a piece of my life missing... For the build-up of the Bernstein Center, I had gone to Freiburg as a Juniorprofessor at the end of 2003. However, the university was, let's say, hesitant to implement a tenure track. Also, the distance between Sonja in Berlin and me in Freiburg was not a perfect solution in the long run. The RIKEN Brain Science Institute in Wako City, Japan, then happened to offer new positions. Eventually we both applied, pointing out in the cover letters: we only come as a pair—but we want separate work groups...

Group members of Markus Diesmann's and Sonja Grün's labs during a videoconference.

Grün: ...which they wonderfully realized when we went there in 2006. We both had our own groups with separate rooms and budgets. We soon decided, however, to combine our spaces to share the infrastructure such as seminar room and computer cluster. To further deepen the links between our research areas of data analysis and modeling, we held joint lab meetings and journal clubs. At the beginning it was a bit bumpy, of course, as we both had our own styles of heading a group. But ultimately, we did a good job and it was an extremely good time.

Diesmann: It was so productive and fun that we stayed until we got the offer from Jülich in 2011. The *Forschungszentrum* wanted to expand its neuroscience competences by a theory institute. Jülich is an ideal location. Besides the fact that we both have been offered a position, there are not so many places where you can combine neuroscience and supercomputing! Also the mission of the Helmholtz Association to create and maintain research infrastructure in long-term programs fits very well to our interests.

Now we have reached the present. What are your current research foci?

Diesmann: One of my main interests is NEST, a simulation tool for spiking neuronal networks. Our goal is to simulate networks in natural size. A cubic millimeter of cortical tissue already comprises about 100,000 neurons and a billion synapses. This is a lot. However, if we take the largest supercomputer, we can today even simulate a billion neurons with NEST. Since the beginning, the basic principle of NEST has been that its technological development must be guided by neuroscience research. We only take the next developmental step if there is a concrete use case or problem to solve. Today, NEST has become the leading simulation tool for large networks and is one of the simulation engines of the Human Brain Project.

Regarding neuroscience questions, we try to understand the layered structure of the cortex. How are structure and dynamics of a local circuit linked to larger brain structures? To a large extent, a local circuit is determined by synaptic input from other brain areas. We study networks that include both microscopic and macroscopic levels and analyze how brain areas are interconnected. This is where Sonja's research comes into play. She examines data that have been recorded simultaneously in different brain areas using multi-electrode arrays.

Grün: You need to mention that the animal shows a complex behavior during the recording—it is the network interactions during natural behavior that are the most interesting part about it!

Diesmann: Right. Towards the end of our time in Japan a new insight emerged from this. At that time, Sonja analyzed data from very complex studies and we realized that we were reaching a complexity barrier. Due to the numerous different steps, there are analysis chains that are hard to document and can run for weeks, putting the reproducibility at risk. *Forschungszentrum Jülich* wants to put the data analysis and reproducibility on a more firm footing. Sonja deals with the development of the analysis toolbox *Elephant* for the neurosciencific community and the more general problem of reproducibility.

Grün: Well, I would say, my research is roughly divided into three areas. First of all, I deal with the development of analysis methods for multi-channel data. In respect to statistics, it is not easy to discover correlations between activities in different brain areas or between neuronal activity and behavior. The second field are the close cooperations with experimental groups for which we do analyses. For instance, we collaborate with Alexa Riehle in Marseille and with Hiroshi Tamura in Osaka, Japan. And my third research pillar is the reproducibility of analyses. Over time, data analysis has reached such a degree of complexity that it is almost impossible to regenerate what others have done. In the simplest case this risk arises when a graduate student leaves the lab. We work on development of neuroinformatics tools that allow all members in a lab to evaluate the data with identical software. *Elephant* is an open source community project, which also allows scientists to integrate their own tools. Another aspect of this work is the gathering and representation of meta-data required to make the raw experimental data a meaning. One of my long-term goals is to establish a software that can analyze both experimental data as well as simulated data from Markus.

How would you describe your everyday research?

Diesmann: Our research is based on communication. Here in the institute, we try to make arrangements to facilitate this. For example, there is an extra wide hallway, whiteboards are everywhere, and we have several videoconferencing systems. We always try to work together with many people on a common problem. One of our ideas is that in future we can only make progress if we learn to work in larger groups. Thus, the characteristic feature of our everyday work is to organize communication. Sonja, do you want to add something to this?

Grün: No, you have described it quite well.

Diesmann: Programming on my own is definitely falling short at the moment.

Grün: This holds for me unfortunately as well.

What do you do in addition to research?

Diesmann: Is there really a scientist who does not work all the time…?

Grün: I like yoga, which I have been doing now for a long time. And besides that, I enjoy my garden, which helps me to relax and clear my mind.

Diesmann: I don't do yoga—I anyway have a heart rate of 50 Hertz…

Personalia

Julia Fischer (BCCN and DPZ Göttingen) was elected to the German Research Foundation (*Deutsche Forschungsgemeinschaft*, DFG) Senate by the DFG General Assembly. Furthermore, she is the spokesperson of the new Research Training Group *Understanding of Social Relations*.
www.nncn.de/en/news/nachrichten-en/julia-fischer-dfg-senate
www.nncn.de/en/news/nachrichten-en/graduiertenkolleg-goe

Herta Flor (BCCN Heidelberg-Mannheim, ZI Mannheim) receives a honorary doctorate from VU University Amsterdam in recognition of her exceptional contributions to science and society.
www.nncn.de/en/news/nachrichten-en/flor-honorary-doctorate

Tobias Moser (BCCN, BFNT and University Medical Center Göttingen) and **Matthew Larkum** (associated with BCCN Berlin, HU Berlin) have successfully applied for Advanced Grants of the European Research Council (ERC). For their projects, the researchers will receive up to € 2.5 million over the next five years.
www.nncn.de/en/news/nachrichten-en/moser-larkum-erc-grant

Marcel Oberländer (BCCN Tübingen, MPI for Biological Cybernetics, Tübingen) has been selected by the European Research Council (ERC) as one of the Starting Grant recipients. For his research, he now receives € 1.5 million over five years.
www.nncn.de/en/news/nachrichten-en/marcel-oberlander-erc

Walter Stühmer (BCCN, BFNT Göttingen and MPI for Experimental Medicine, Göttingen), together with two more scientists, was awarded with the 2015 Kenneth S. Cole Award of the American Biophysical Society. He is being recognized for his pioneering contributions to structure-function studies of voltage-gated sodium channels.
www.nncn.de/en/news/nachrichten-en/kenneth-s-cole-award

Paul Szyszka (BFNL ephemeral memory, University of Konstanz) receives a Program Grant by the Human Frontier Science Program (HFSP) amounting to $ 1,35 Mio. for the investigation of the olfactory discrimination of insects.
www.nncn.de/en/news/nachrichten-en/paul-szyszka-grant

Workshop: Supercomputing for Neuroscientists

Neuroscience today is attacking problems of increasing complexity and scale leading to the evolution of projects including computationally intensive simulations and the analysis of huge data sets. This requires adapting software and theory from PCs and local clusters to high-performing computing (HPC) systems. The workshop *Supercomputing for Neuroscientists* aims at bringing neuroscientists interested in using HPC technology for their projects together with experts from the Simulation Lab Neuroscience at the Jülich Supercomputing Centre, whose main goal is to bridge the gap between Computational Neuroscience and HPC. The workshop will take place at Jülich Supercomputing Centre, Research Centre Jülich, on November 3, 2015.
www.fz-juelich.de/ias/jsc/scn

Bernstein Coordination Site visits Research Centre Jülich

Following a joint initiative of Markus Diesmann (Director of the Institute of Neuroscience and Medicine 6 Computational and Systems Neuroscience (INM-6) at Research Centre Jülich) and Andreas Herz (Spokesman of the Bernstein Network, LMU Munich), Sebastian M. Schmidt, member of the board of directors of Jülich, offered to fund the Bernstein Coordination Site (BCOS) in accordance with the mission of the Helmholtz Association. This long-term commitment for BCOS, central contact point of the Bernstein Network, is a key step towards its sustainability. Starting September 1st, 2015, BCOS will constitute a working group—headed by Andrea Huber Brösamle—at INM-6. The University of Freiburg will continue to provide the office space. Thus, as a branch office of Jülich, BCOS will remain at its traditional location at the Bernstein Center Freiburg (BCF).

On this occasion, the BCOS team visited Jülich on May 4, 2015. The team was cordially welcomed by Sebastian M. Schmidt and Markus Diesmann. During the visit, new contacts were established and already existing ones intensified. This will facilitate a smooth transition of BCOS to become a unit of a national research institution.

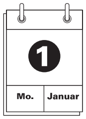
BCOS was launched in 2007 with Ulrich Egert (BCF) as coordinator and funded by the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF). Over the whole funding period, the BMBF supported BCOS with start-up funds of approximately € 2.6 million.
www.nncn.de/en/news/nachrichten-en/bcos-juelich

The Bernstein Coordination Site (BCOS) team visits the Research Centre Jülich. F.l.t.r.: Sebastian M. Schmidt, Andrea Huber Brösamle, Petra Stromberger, Kerstin Schwarzwälder, Mareike Kardinal, Markus Diesmann.

7th Bernstein Sparks Workshop: Active Perceptual Memory

The 7th Bernstein Sparks Workshop on the topic *Active Perceptual Memory* will take place in Berlin from October 26 – 27, 2015. Organizers of the workshop are Martin Rolfs, Sven Ohl (both BCCN and HU Berlin), Henning Sprekeler (BCCN and TU Berlin) and the Bernstein Coordination Site.

Bernstein Sparks Workshops are a forum for intensive dialogue between renowned experts on current research topics in which major developments are currently taking place. They are meant to contribute to kindling key scientific processes that could trigger breakthroughs in research or in assessing new application fields.
www.nncn.de/en/news/events/active-perceptual-memory



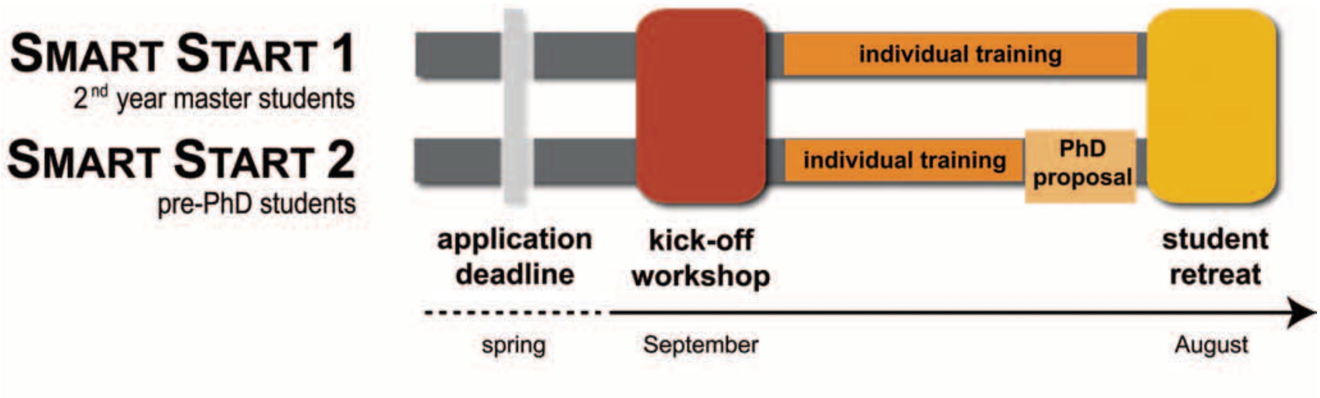
A SMART START into Computational Neuroscience

Ambitious research requires well-qualified scientists. To promote young academics in Computational Neuroscience as early as possible, the Bernstein Network and the Volkswagen Foundation have now launched the joint training program SMART START.

The two-phase program aims at second-year master students (SMART START 1) and soon-to-be doctoral candidates who are in the process of choosing and beginning a dissertation project (SMART START 2). Candidates may come from a variety of disciplines, such as physics, mathematics, biology, computer sciences, engineering, psychology or medicine.

The aim is to teach participants basic concepts, theories and techniques of Computational Neuroscience. Together with a mentor, students develop an individual training program to supplement their previous experience. For this, they may choose from a wide range of activities such as workshops, courses and lab rotations. These activities take place at numerous locations of the Bernstein Network as well as at further locations throughout Germany. In addition, participants of the SMART START 2 program are eligible for a scholarship that enables them to select and plan a PhD project during this time. A joint kick-off workshop with all participants and researchers and a final student retreat complement the two year long training programs.

SMART START will start in the winter term 2016/2017. The deadline for applications will be in spring 2016.
www.nncn.de/en/study-training-options/smart-start-1



Multilateral Collaboration in Computational Neuroscience: Germany – USA – Israel – France

On August 10, 2015, the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF) published the guidelines of the funding scheme *Multilateral Collaborations in Computational Neuroscience: Germany – USA – Israel – France*.

The funding scheme *Multilateral Collaboration in Computational Neuroscience: Germany – USA – Israel – France* is a transnational initiative for supporting collaborative research between Germany, USA, Israel and France. It is jointly funded by the German Federal Ministry of Education and Research (BMBF), the US-American funding organization National Science Foundation (NSF), the United States – Israel – Binational Science Foundation (BSF) as well as the Agence Nationale de la Recherche (ANR).

Within the framework of the funding scheme, proposals for the collaboration between German and US-American research groups, proposals of German, US-American, and Israeli research groups, proposals of German, US-American and French research groups as well as proposals for the collaboration of German, US-American, Israeli and French research groups can be submitted. Deadline for first stage proposals is October 29, 2015.
www.nncn.de/en/news/nachrichten-en/neue-ausschreibung

Pro-Test Germany informs about animal testing

Together with others, young scientists from laboratories of Bernstein Network members established the initiative *Pro-Test Germany*.

The initiative *Pro-Test Germany* originates from young Tübingen researchers and lends a voice to science. Its goal is to elucidate scientific, ethical, legal, social and psychological aspects of animal research. To this end it provides information for everyone and helps to understand the role of animals in research and its benefits to society.

First, *Pro-Test Germany* will build a website that collects data and facts on the subject and provides space for personal statements (e.g. of researchers and patients). The website can be found under
www.pro-test-deutschland.de

Furthermore, there is a social media campaign. In due course, also further activities are planned, such as information booths and events, lecture series, open letters, announcements etc. *Pro-Test Germany* will pursue its objectives with the help of a support association, which is currently in the start-up process.
www.nncn.de/en/news/nachrichten-en/pro-test

Upcoming Events

Date	Title	Organizers	URL
Aug. 31. – Sept. 5, 2015, Munich	G-Node Summer School: Advanced Scientific Programming in Python	T. Zito and Z. Jedrzejewski-Szmek for G-Node, C. Roppelt, C. Hartmann, J. Jordan	https://python.g-node.org/wiki
Sept. 2 – 12, 2015, Göttingen	13th Göttingen Summer Course on Computational Neuroscience – Theoretical perspectives on neural assemblies	R. Engelken, J. Liedtke, A. Palmigiano, M. Puelma Touzel, M. Schottdorf, BCCN Göttingen	www.bccn-goettingen.de/events/cns-course
Sept. 14 – 18, 2015, Heidelberg	Bernstein Conference 2015 Satellite Workshops: Sept. 14, 2015 Main Conference: Sept. 15 - 17, 2015 PhD Symposium: Sept. 17 - 18, 2015	BCCN Heidelberg-Mannheim, Bernstein Coordination Site	www.bernstein-conference.de
Oct. 4 – 9, 2015, Freiburg	BCF/NWG-Course: Analysis and Models in Neurophysiology	S. Rotter, U Egert, R. Schmidt, C. Mehring, B. Ahrens (all Bernstein Center Freiburg)	www.bcf.uni-freiburg.de/events/conferences-workshops/20151004-nwgcourse
Oct. 7 – 8, 2015, Berlin	International Workshop on Symbiotic Interaction	B. Blankertz (BFNT Berlin), G. Jacucci	http://symbiotic2015.org
Oct. 17 – 21, 2015, Chicago, USA	Bernstein Network Information Booth at SfN 2015	Society for Neuroscience	www.nncn.de/en/news/events/sfn-2015
Oct. 26 – 27, 2015, Berlin	7th Bernstein Sparks Workshop: Active Perceptual Memory	M. Rolfs, S. Ohl, H. Sprekeler (all Bernstein Center Berlin), Bernstein Coordination Site (BCOS)	www.nncn.de/en/news/events/active-perceptual-memory
Nov. 2 – 3, 2015, Tübingen	2015 Tübingen MEG Symposium	Co-Organizer: C. Braun (BFNT Freiburg-Tübingen, BCOL Movement associated activation)	http://meg.medizin.uni-tuebingen.de/2015
Nov. 3, 2015, Jülich	Workshop: Supercomputing for Neuroscientists	A. Do Lam-Ruschewski, S. Graber, A. Lührs, A. Morrison, B. Orth, A. Peyser (all Simulation Laboratory Neuroscience / Bernstein Facility for Simulation and Database Technology)	www.fz-juelich.de/ias/jsc/scn

The Bernstein Network

Chairman of the Bernstein Project Committee: Andreas Herz

The National Bernstein Network Computational Neuroscience (NNCN) is a funding initiative of the Federal Ministry of Education and Research (BMBF). Established in 2004, it has the aim of structurally interconnecting and developing German capacities in the new scientific discipline of computational neuroscience and, to date, consists of more than 200 research groups. The network is named after the German physiologist Julius Bernstein (1835–1917).

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