Bernstein Network Computational Neuroscience

Bernstein Newsletter

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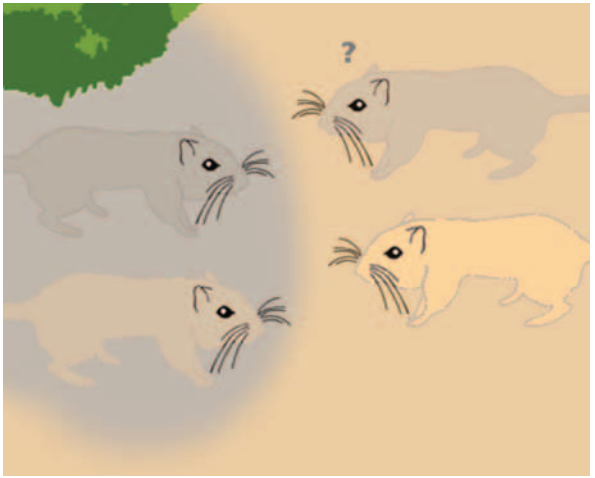
03/2015

How gerbils orient in the light of the setting sun

A green apple is green, but the green is not always the same. In varying light conditions—like at sunset—the spectrum of the light that is reflected by the fruit and falls on our retina, changes. Nevertheless, we continue to perceive the color of the apple as green because the human brain compensates for the influences of illumination by evaluating the color and brightness composition across the entire visual field. This capacity is known as color and brightness constancy and is important for object recognition. Researchers at the Bernstein Center Munich and the LMU Munich, led by Kay Thurley and Thomas Wachter, have now investigated whether rodents also possess this remarkable perceptual ability.



A dark-colored gerbil (top right) recognizes its dark fellow (top left), although due to the shadow the light coming from the fur of the light brown animal (bottom left) has a more similar spectral composition (please see fur color using the aperature mask).

In the study, the researchers showed gerbils colored patches on different colored backgrounds. The animals were looking at a screen while sitting on a sphere that worked like a treadmill. They were thus able to virtually move towards the stimuli and select one of it as their response. During the experiment, half of the animals had to identify the object in which the patch appeared more greenish than its background. The other animals had to identify the object they perceived as bluish compared to its background. When the rodents gave the correct answer, they received a food reward.

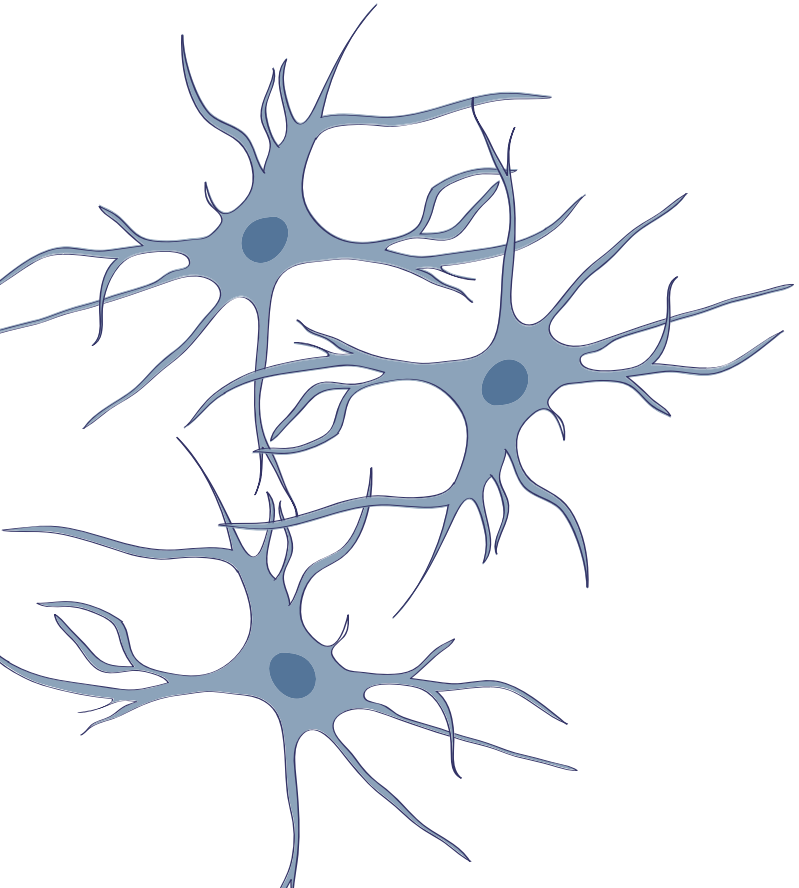
"The gerbils reliably recognized the correct patches despite varying color compositions across the experimental trials," explains Thomas Wachtler. Hence, under different lighting conditions the rodents consistently perceive a green apple or a brown fur as green or brown, respectively. Moreover, they also perceive the brightness of an object as constant, as the researchers demonstrated in another experiment. Gerbils are thus the first rodents shown to have the ability of color and brightness constancy. The result suggests that other animals may possess this perceptual ability, too.

"For gerbils, which are diurnal and crepuscular animals, the ability to accurately identify objects despite changing lighting conditions is essential for survival. They orient using their sense of vision to forage or recognize conspecifics," says Kay Thurley, main author of the study. The result has significant implications for neurobiology: "Gerbils are a popular animal model in auditory neuroscience. But in contrast to other rodents, gerbils also have well developed vision, making these rodents especially suitable for experiments in virtual realities," Thurley says.

Garbers C, Henke J, Leibold C, Wachtler T & Thurley K (2015): Contextual processing of brightness and color in Mongolian gerbils. Journal of Vision, 15(1), 1 – 13.
doi: 10.1167/15.1.13

Interplay of brain cells

Perceiving, acting, thinking—all these performances result from the coordinated activity of nerve cells. Together with their colleagues, the neuroscientist David Fitzpatrick at the Max Planck Florida Institute and Matthias Kaschube at the Frankfurt Institute for Advanced Studies (FIAS) and the Bernstein Focus Neurotechnology in Frankfurt now describe the development of the neuronal interplay for the first time. Using novel fluorescent proteins—that can be incorporated into nerve cells as "activity sensors"—they have continously observed the crucial development stages in the brain of ferrets.



When ferrets begin with opening their eyes 30 days after birth,the nerve cells that are responsible for seeing respond very vaguely to moving visual stimuli. It is not before the development of a coordinated collaboration between nerve cells that the brain may reliably interpret signals and thus recognize the direction of a movement. The development of neuronal coordination is perfected after one to two weeks. The process may be accelerated by visual stimulation training. Until now, there have only been snapshots of nerve cells during this process. The study of the Frankfurt scientists tracked the development in a continuous fashion for the first time.

For the observation, novel fluorescent proteins that can be inserted into neurons via genetic methods played an important role. They can be visualized using a so-called two-photon microscopy. This allows to observe processes inside individual brain cells in the living animal without inflicting damage. The data obtained at the Max Planck Florida Institute were evaluated under the direction of Matthias Kaschube at the FIAS using statistical models. The findings have been published in the February issue of the journal *Nature Neuroscience*.

Text: Frankfurt Institute for Advanced Studies (mod.)
Translation: BCOS

Smith GB, Sederberg A, Elyada YM, Van Hooser SD, Kaschube M & Fitzpatrick D (2015): The development of cortical circuits for motion discrimination. Nature Neuroscience, 8, 252 – 261. doi:10.1038/nn.3921

Physical exercise keeps the brain young

Sport has tremendous benefits for our mental health: it lifts our spirits, increases our resistance to stress, improves our memory, and slows down the decline of cognitive function in advanced years. Studies in rodents show that physical activity acts intrinsically rewarding: rodents voluntarily run many miles per day if they have access to a running wheel. Researchers headed by Siegrid Löwel at the University of Göttingen and the Bernstein Focus Neurotechnology in Göttingen have now discovered that voluntary running may extend the period of the brain's juvenile adaptability into adulthood.

If mice are reared in so-called standard cages, a certain form of adaptability of neuronal circuits in the visual cortex decreases with age. The adaptability process is known as neural plasticity. In mice older than 110 days, it is no longer detectable. "However, when the mice had a running wheel in the cage, they demonstrated this type of plasticity even up to an age of at least 242 days. Interestingly, the plasticity of the visual cortex in the adult mice that had been reared with a running wheel demonstrated the same characteristics as the one in young mice," says Siegrid Löwel, lead author of the study.

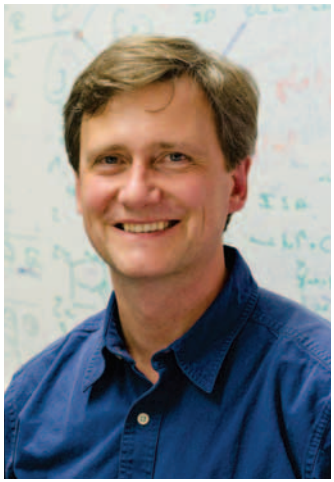
The study further showed that the type of youthful adaptability can be restored in adult mice even at an age in which plasticity of the visual cortex is most often no longer present. "A few days of voluntary training in the running wheel were sufficient to allow plastic changes in the brain again. This shows us that it is never too late to benefit from exercise," says author Franziska Greifzu. The results have been published in the *Journal of Neuroscience*.

Text: Georg-August-Universität Göttingen (mod.)
Translation: BCOS

Kalogeraki E, Greifzu F, Haack F & Löwel S (2014): Voluntary physical exercise promotes ocular dominance plasticity in adult mouse primary visual cortex. Journal of Neuroscience, 34(46), 15476 – 81.
doi: 10.1523/JNEUROSCI.2678-14.2014

Klaus-Robert Müller

"We may not see it, but our brain is still processing the flickering," Klaus-Robert Müller leans back in his office chair and points to the modern LED lamp on his desk. "Using EEG-based brain-computer interfaces—or BCI in short—we have discovered that our brains actively process the discontinuous light emitting of the diode even though we may not consciously perceive the flicker. In a joint project with a large industrial company, we have examined the minimum flicker frequency that is required to allow our brain to 'relax' in the light of an LED lamp." Brain-computer interfaces are one of the major research topics of Klaus-Robert Müller at the Bernstein Center Berlin. With his *Machine Learning* group, he is located at Technische Universität Berlin.



"When you think of BCIs and neurosciences, applications like this one are not the first that may cross your mind," Müller smiles. "However, through the direct access to brain states we can learn a lot about the interaction between humans and machines—also gaining valuable insight for industrial applications." Among others, Müller has dealt with the question of how the brain processes compressed video contents. Ideally, and analogous to the audio coding format MP3, the video signal would be compressed to an extent that does not compromise image quality but requires much less data (fewer bits) to be transmitted: "The development of better video coding standards affects every other bit on the internet, because that much bandwidth is spent for the transmission of videos. A reduction of less than one percent could save the energy of several nuclear power plants."

In addition, the theoretical physicist Klaus-Robert Müller investigates clinical applications of brain-computer interfaces. Since the beginning of the millenium he has been working with the Berlin Brain Computer Interface Team on improving BCIs. "In the past, patients had to train up to 100 hours using biofeedback to change their brain signals in such a way that a sufficiently accurate decoding was made possible. An unreasonable demand for subjects and patients. Our approach was to let the machine learn—and not the patient," Müller says. In 2002, he developed the first BCI that could be calibrated in just ten minutes—a revolution back then. Not only physicians but also psychologists, computer scientists and other researchers could now consider the application of BCIs within the clinical field and beyond. Since then, the BCI research community has grown from approximately a dozen of labs worldwide to more than 400 groups in academia and industry.

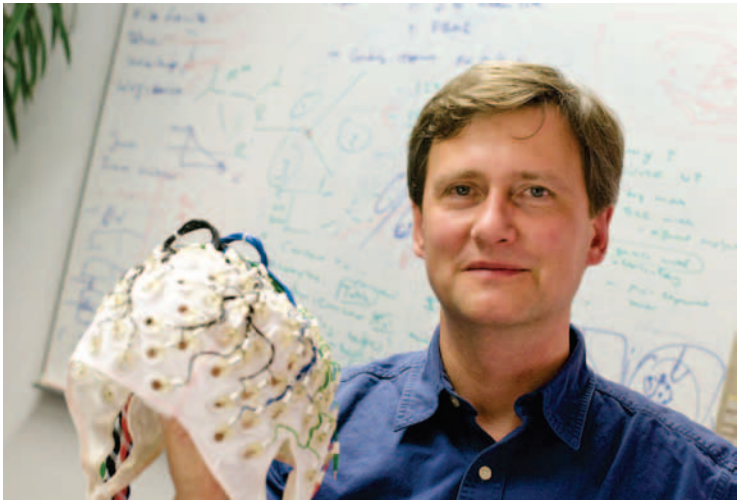
"We apply machine learning methods for further developing BCIs. With their help we are able to classify high-dimensional, multivariate data in a robust way," Müller describes his tools. "For this, we use quite different techniques, such as Support Vector Machines, linear methods, and artificial neural networks." With the latter, the native of the Baden region first came into contact during his PhD in Wolfram Menzel's lab in Karlsruhe. Even before the end of his doctorate, Müller was offered a group leader position at the Institute FIRST by the Society for Mathematics and Data Processing (GMD) in Berlin (later Fraunhofer FIRST). "I was delighted by this offer. At the same time I was keen to spend time abroad—which was then made possible by the GMD."

After establishing the Intelligent Data Analysis Group at the GMD-FIRST for two years, Klaus-Robert Müller moved to Shun'ichi

Meet the Scientist

Amari's lab at the University of Tokyo in 1994. His wife, who holds a PhD in Japanese Studies, worked at the Waseda University. "This was a huge step in my scientific career," Müller recalls. "Through Amari I met very interesting people and many doors opened." Vladimir Vapnik, the "father" of the Support Vector Machine, also became his mentor at this time. Together they worked on the new method of Support Vector Machines, which was about to replace neural networks as the standard technique. Back at GMD-FIRST in Berlin, Klaus-Robert Müller and his group continued working on Support Vector Machines. It was serendipity that got him involved with brain research: "In 1995, one of the Tokyo professors started to work on neuroscience. I found this very exciting. He offered to invite me to a conference in Japan if I applied my theoretical knowledge in the analysis of neuroscientific data." Motivated by this opportunity, Müller called colleagues at the Charité, who had sleep EEG data. "Ever since, working with EEG data has been so much fun, that I stuck with it."

In 1999, Klaus-Robert Müller obtained an C3 professor position at the University of Potsdam, in 2003 he was appointed C4 professor. Three years later, he became professor at Technische Universität Berlin. From the very first hour, Müller has been closely connected with the Bernstein Network. Over time, he has been coordinator of the Bernstein Focus Neurotechnology in Berlin, coordinator of the German-Japanese collaboration *Robust, adaptive BCI for nonstationary environments*, as well as founding member of the Bernstein Center Berlin and the Bernstein Collaboration *Neurovascular coupling*. "While being part of the Bernstein Focus, for example, I applied many EEG analysis techniques to situations outside of the lab," the neuroscientist recalls. Since 2012, Klaus-Robert Müller has become member of the Leopoldina – National Academy of Sciences. Last year he was honored with the Berlin Science Award of the Governing Mayor.



In addition to brain-computer interfaces, Klaus-Robert Müller has developed further research interests. He deals with applications of machine learning in genetics, cancer research and materials science. "During the last 10 years, I have started to become heavily involved in Big Data. Together with other researchers, we are currently building the Berlin Big Data Center, which has a similar structure to the Bernstein Center Berlin." Also, with the emergence of novel, faster and more precise techniques, the amount and quality of data has increased in such a way that experimental researchers and also industry are reaching the limits of their analysis possibilities. Müller explains: "People now realize that it is not only important to invest ressources in improved measurement procedures, but that data analysis needs to be professionalized, as well. Clearly, a specialized data analyst can extract and understand more from given data. Training such a new generation of data analysts with experiences in scientific and industrial application fields as well as in databases and machine learning has thus become highly important. With our efforts, Berlin has been establishing itself as a prime location in the field."

Personalia

Andreas Draguhn (BCCN Heidelberg-Mannheim, University of Heidelberg) is spokesman of the new Collaborative Research Center (CRC) *Functional "ensembles": Integration of cells, genesis of activity patterns, and plasticity of groups of co-active neurons in local networks* that is funded by the German Research Foundation (*Deutsche Forschungsgemeinschaft, DFG*) with approximately € 9.5 million.
www.nncn.de/en/news/nachrichten-en/new-crc-in-heidelberg

Herta Flor (BCCN Heidelberg-Mannheim, Central Institute of Mental Health, Mannheim) receives € 1.2 mio over five years from the Reinhart Koselleck Programme of the German Research Foundation (*DFG*) for her project *Body representation and sensorimotor functions modulate the reorganization of the brain and behavioral changes: from chronic pain to immobility and dementia*.
www.nncn.de/en/news/nachrichten-en/herta-flor-dfg-funding

Klaus-Robert Müller (BFNT and BCCN Berlin, BCOL vaskular coupling, D-J Collaboration, Technische Universität Berlin) received the Berlin Science Award 2014 of the Governing Mayor.
www.nncn.de/en/news/nachrichten-en/science-award

Fred Wolf (BCCN and BFNT Göttingen, BFNL visual learning, BCOL action potential encoding, MPI for Dynamics and Self-Organization and Georg-August-Universität of Göttingen) was elected as Fellow of the American Physical Society (APS). With the fellowship, the APS honors exceptional contributions to the physics enterprise.
www.nncn.de/en/news/nachrichten-en/fred-wolf-aps-fellow

Gottfried Wilhelm Leibniz Prize for Tobias Moser

Tobias Moser (BCCN, BFNT and University of Göttingen) was selected by the German Research Foundation (*Deutsche Forschungsgemeinschaft, DFG*) as one of eight Gottfried Wilhelm Leibniz Prize winners 2015.

Tobias Moser is world leading in the investigation of the inner ear synapses and an internationally renowned researcher in the field of physiology and pathophysiology of the inner ear. Recently, he and his team succeeded in using optogenetic tools to optically excite the auditory nerve fibers. This finding promises a major advancement of hearing research and a substantial improvement in a new generation of cochlear implants that will be developed in the future.

"Through his work, Tobias Moser has substantially contributed to a better understanding of synaptic processes in the inner ear and therefore the basis of hearing. His new conceptual, technical and experimental approaches have set standards that are now being recognised with the Leibniz Prize", explains the DFG in the explanatory statement for the prize.

The Gottfried Wilhelm Leibniz Prize is annually awarded by the DFG since 1986. With up to € 2.5 million, it is the most highly remunerated German research award.
www.nncn.de/en/news/nachrichten-en/leibniz-prize-moser
www.idw-online.de/de/news617736

11th Bernstein Conference takes place in Heidelberg

The Bernstein Conference is the Bernstein Network's central forum that has developed over time into the largest annual Computational Neuroscience conference in Europe and attracts an international audience from across the world.

This year's Bernstein Conference will be organized by the Board of Directors of the BCCN Heidelberg-Mannheim and will take place in Heidelberg from September 14—17. For the third time, the Bernstein Conference will host a series of *satellite workshops* taking place on September 14. The workshops provide an informal forum for the discussion of timely research questions and challenges. Controversial issues, open problems, and comparisons of competing approaches are encouraged. The main conference will be held from September 15—17, and is followed by the Bernstein PhD Symposium on September 17—18.

As in past years, the Bernstein Award will be officially announced and presented at the beginning of the main conference. In 2015, the Federal Ministry of Research and Education (*Bundesministerium für Bildung und Forschung, BMBF*) will confer the tenth annual Bernstein Award to an excellent junior scientist with outstanding research ideas in the field of Computational Neuroscience. The Award is endowed with up to € 1.25 Mio for a period of five years and allows young scientists to establish an independent research group at a German university or research institution. A press conference will provide journalists the opportunity to get information about the awardee and his/her research.

Opening Lecture
Karl Deisseroth

Novel Approaches to Data Analysis in Neurophysiology and Neuroimaging
Emery N. Brown
Liam Paninski
Sheila Nirenberg

Computational Neuroscience of Psychiatric and Neurological Conditions
Ray Dolan
Ed. T. Bullmore
Klaas Enno Stephan

Bernstein Conference 2015

Genes and Neural Network (Dys-)Function
Ofer Yizhar
Torfi Sigurdsson

Information Processing in Prefrontal-Hippocampal Networks
Ila Fiete
Loren M. Frank
Francesco P. Battaglia

Public Lecture
Christian Büchel

In 2014, the prize giving ceremony of the Valentino Braitenberg Award—that is biannually conferred for outstanding research achievements—had to be rescheduled. Thus, the prize giving ceremony including a talk of the awardee Alexander Borst (MPI of Neurobiology) will take place during the Bernstein Conference 2015.

Also the sixth prize giving ceremony of the Brains for Brains Young Researchers' Computational Neuroscience Award conferred by the Bernstein Association for Computational Neuroscience will take place within the framework of the Bernstein Conference 2015.

In an evening lecture with Christian Büchel (University Medical Center Hamburg-Eppendorf), the general public is invited to learn more about new research findings. The lecture takes place on September 15.
www.bernstein-conference.de

Lower Saxony's Prime Minister visited Bernstein Center Göttingen

On Monday, December 8, 2014, Lower Saxony's Prime Minister Stephan Weil visited the Bernstein Center Göttingen. Through the presentation of an intelligent prosthesis and an autonomous robot, the Prime Minister of Lower Saxony learned more about the innovative fundamental research of the Center and its applications. Besides a patient with a prosthetic hand, Prime Minister Weil also met Amos—a six-legged robot that may overcome obstacles by autonomous control.

www.nncn.de/en/news/nachrichten-en/goettingen

Four Bernstein members elected into NWG executive committee

In the beginning of 2015, the members of the German Neuroscience Society (NWG) have elected the society's new executive committee for the 2015—2017 term. The following Bernstein members were elected:

President:

- Hans-Joachim Pflüger, BCCN Berlin

Spokespersons of the Sections:

- Computational Neuroscience:
  Stefan Rotter, Bernstein Center Freiburg
- Cognitive Neurosciences:
  Herta Flor, BCCN Heidelberg-Mannheim
- Systems Neurobiology:
  Tobias Moser, BCCN and BFNT Göttingen

www.nncn.de/en/news/nachrichten-en/executive-committee

New D-J Collaborations in Computational Neuroscience

In 2011, the German Federal Ministry of Education and Research (*Bundesministerium für Bildung und Forschung, BMBF*), the German Research Foundation (*Deutsche Forschungsgemeinschaft, DFG*) and the Japan Science and Technology Agency (JST) set up the joint funding measure *Germany-Japan Collaboration in Computational Neuroscience*. The funding measure has the objective to establish transnational research projects and aims at deepening already existing collaborations between researchers of these two countries and raising them to a new level. On the German side, D-J Collaborations in Computational Neuroscience are part of the Bernstein Network. The third call for applications was published in 2013. The following projects are granted funding since 2014:

- **Autonomous learning of active depth perception: from neural models to humanoid robots**, Jochen Triesch (Frankfurt am Main), Sungmoon Jeong (Komatsu), funded by BMBF and JST.
- **The development of the functional organization of the visual cortex**, Matthias Kaschube (Frankfurt am Main), Kenichi Ohki (Fukuoka), funded by BMBF and JST.
- **Decoding of in vivo two-photon imaging data in mouse motor cortex**, Takashi Sato (Tübingen), Yukiyasu Kamitani (Kyoto), funded by DFG and JST.
- **Testing computational models of learning from social, real, and fictive feedback in human and nonhuman primates**, Markus Ullsperger (Magdeburg), Masaki Isoda (Hirakata), funded by DFG and JST.

www.nncn.de/en/news/nachrichten-en/new-d-j-collaborations

Leibniz Science Campus in Göttingen

A Leibniz Science Campus on the subject of "Primate Cognition" will be established in Göttingen. On November 28, 2014, the Senate of the Leibniz Association has approved the necessary funding. For the next four years € 900,000 will be given annually to the research consortium. The founding members are the German Primate Center (DPZ), the University of Göttingen and the Bernstein Center for Computational Neuroscience in Göttingen. In interdisciplinary projects, the scientists want to explore the cognitive abilities of monkeys and humans. The intensive cooperation should create a permanent, international competence network in this area of research.

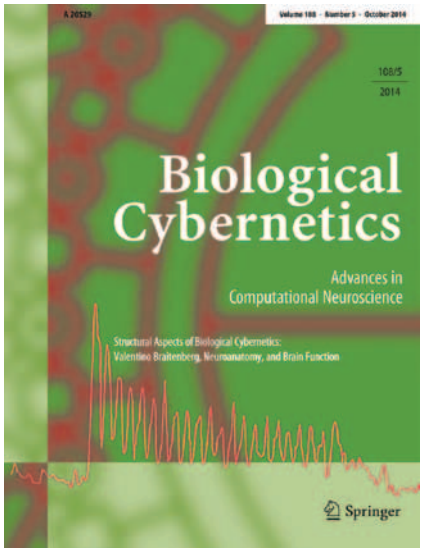
www.nncn.de/en/news/nachrichten-en/science-campus

www.dpz.eu/en/news/news/single-view/news/vom-denken-zum-handeln-leibniz-wissenschaftscampus-in-goetingen-eingerichtet.html

Special issue of *Biological Cybernetics* dedicated to Valentino Braitenberg

In October 2014, a special issue of the scientific journal *Biological Cybernetics* entitled *Structural Aspects of Biological Cybernetics: Valentino Braitenberg, Neuroanatomy, and Brain Function* was published. It is dedicated to Valentino Braitenberg and was edited by Leo van Hemmen (Bernstein Center and Technische Universität München), Almut Schüz (MPI for Biological Cybernetics, Tübingen), and Ad Aertsen (Bernstein Center and University of Freiburg).

The special issue contains reviews and original contributions that connect to Valentino Braitenberg's multifaceted life's work.



Topics are Hebb's theory from a modern perspective, the neuronal mechanisms of speech and other higher cognitive activities, orientation selectivity in the visual cortex, the role of different propagation velocities in the white matter, the function of the cerebellum, motor learning, learning in ALS-patients, mechanisms of stimulus-specific adaptation, and a novel analysis of magnetoencephalographic data for identifying coordinated activity between cortical areas. Many of the contributions also express the bridge between natural sciences and humanities, characterizing also Braitenberg's life's work, as for instance in the contribut-ions on robot psychology, on psychiatry and on the role of mathematics in the neurosciences. The collection starts with an exposé on Braitenberg's specific research approach. The special issue also contains a reprint of Valentino Braitenberg's timeless *Manifesto of Brain Science*, followed by an extensive list of publications.

J. Leo van Hemmen, Almut Schüz, Ad Aertsen (Eds.): Structural Aspects of Biological Cybernetics: Valentino Braitenberg, Neuroanatomy, and Brain Function. Biological Cybernetics (2014) 108(5):517-525, the Foreword that includes Braitenberg's *Manifesto of Brain Science*. The whole special issue consists of thirteen ensuing papers, pp. 527-712.

First edition of Bernstein calendar

At the beginning of 2015, the first edition of the Bernstein wall calendar has been published. The calendar contains selected impressions from the field of computational neuroscience, which were provided by members of the Bernstein Network and the Bernstein Association for Computational Neuroscience. The calendar for the year 2015, which was made possible through kind support by Springer and the Bernstein Association, is the start of a calendar series that will continue in future years and appears only as a limited edition. The individual 2015 calendar pictures can be found on the Bernstein Network website under the following link:
www.nncn.de/en/news/nachrichten-en/bernstein-calendar-2015

Bernstein events during the Brain Awareness Week 2015

The Brain Awareness Week (BAW) is the global campaign to increase public awareness of the progress and benefits of brain research. The BAW was founded by the Dana Alliance for Brain Initiatives and unites the efforts of partner organizations from around the world in a week-long celebration of the brain every March. Partners, such as universities, hospitals, schools, advocacy groups, government agencies, service organizations, and professional groups organize creative and innovative activities in their communities to educate and excite people of all ages about the brain and the promise of brain research.

This year, the BAW will take place from March 16–22 and Bernstein members will also actively participate. In Berlin, lectures, workshops on various topics, a discussion, a movie screening with subsequent expert discussion, and a symposium are organized with participation of the Bernstein Center Berlin. Members of the German – US- American Bernstein collaboration project *Effects of weak applied currents on memory consolidation during sleep* organized a museum exhibition in Lübeck on the topic *Sleep, Neuroplasticity and Environment*, which is open until October 25, 2015.

A detailed overview of the BAW events that are organized by Bernstein members is published on the following website:
www.nncn.de/en/news/events/baw-2015

Dates

Date	Title	Organization	URL
Mar. 2 – 4, 2015, Paris, France	„Are we building the right thing? – Requirements from theory for simulation environments and neuromorphic computing“	A. Davison, J. Muller, J. Eppler, D. Lester, A. Morrison (BFSD Jülich) and M. Diesmann (Bernstein Center Freiburg) in collaboration with the European Institute for Theoretical Neuroscience (EITN)	http://eitnconf-020315.sciencesconf.org
Mar. 13–15, 2015, Tokyo, Japan	2015 International Clinical Brain-Machine Interface Workshop (CBMI 2015)	N. Birbaumer (BFNT Freiburg-Tübingen), J.L. Contreras-Vidal, L.R. Hochberg, K. Kanasaku, M. Kawato, S.R. Soekadar (BFNT Freiburg-Tübingen)	www.bmi2015.org
Mar. 16 – 22, 2015, throughout Germany	Bernstein Events during Brain Awareness Week 2015	Members of the Bernstein Network are (Co-) Organizers	www.nncn.de/en/news/events/baw-2015
Mar. 17, 2015, Berlin	Symposium: Neurophysics: Physical approaches to deciphering neuronal information processing within the framework of the 79th Annual Meeting of the DPG (Deutschen Physikalischen Gesellschaft) and DPG Spring Meeting	T. Geisel (BCCN Göttingen), G. Güntherodt	www.nncn.de/en/news/events/symposium-neurophysics
Mar. 18 – 21, 2015, Göttingen	NWG 2015: Bernstein Network Contributions	German Neuroscience Society	www.nncn.de/en/news/events/nwg-2015-bernstein-network
June 8–10, 2015, Antibes – Juan les Pins, France	1st International Conference on Mathematical NeuroScience	W. Stannat (BCCN Berlin) is member of the Program Committee	http://icmns2015.inria.fr
June 24 – 25, 2015, Tutzing	Bernstein Sparks Workshop: Multi-modal closed-loop stimulation and virtual realities	K. Thurley, L. Wiegrebe (BCCN Munich)	www.bccn-munich.de/talks-events/workshop-multi-modal-closed-loop-stimulation-and-virtual-realities
June 27 – July 12, 2015, Bangalore, India	Summer CAMP@Bangalore: Short course in Computational Approaches to Memory and Plasticity	U. Bhalla, A. Kumar (Bernstein Center Freiburg), R. Narayanan	https://camp.ncbs.res.in

News and Events

Dates

Date	Title	Organization	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. 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

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).

Imprint

Published by:
Coordination Site of the
National Bernstein Network Computational Neuroscience
www.nncn.de, info@bcos.uni-freiburg.de

Text, Layout:
Mareike Kardinal, Andrea Huber Brösamle,
Kerstin Schwarzwälder (News and Events)

Editorial Support:
Coordination assistants in the Bernstein Network

Design: newmediamen, Berlin
Print: Elch Graphics, Berlin

Title image:

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Federal Ministry
of Education
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