LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MUNICH CENTER FOR NEUROSCIENCES

Dr. Wolfgang Heubisch
Bavarian State Minister of
Sciences, Research and the Arts

The Free State of Bavaria is a first-rate location for science and research, where life sciences play an eminent role. They find one of their strongest bases in Munich. The Bavarian capital is home to two great research universities – both winners of the Germany- wide Initiative for Excellence – as well as numerous highly-specialized and well-known non-university research institutions. It is no wonder that Munich is the ideal place for committed scientists to deliver prime scientific results at the highest international level.

Today, top science demands close co-operation – beyond the limits of institutes and disciplines. The "Munich Center for Neurosciences" provides the integrative platform to take the strong interdisciplinary approach the complexity of the different fields of neurosciences asks for. Its being open to integrating perspectives and findings from neighbouring fields of research even allows a holistic reflection of burning neuroscientific questions.

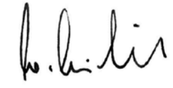
Through various teaching programmes – above all, the Graduate School for Systemic Neurosciences – young scientists are integrated in this excellent research environment and can fully develop their potential. The fact that the Graduate School for Systemic Neurosciences was successful in the first round of the Initiative for Excellence emphasizes that it can serve as a superb role model.

Its brilliant concept has established the "Munich Center for Neurosciences" as a beacon of science in Munich's research environment. The list of its distinguished members, the great amount of third-party funding as well as the high demand for its teaching programmes clearly prove the centre's great success.

All these results are both promising and encouraging. With innovative projects like the "Munich Center for Neurosciences", we can successfully advance the further development of our research landscape and maintain our leading position in the life sciences.

I am sure that the great work of the scientists at the "Munich Center for Neurosciences" will continue its success and wish the centre all the best for the future.

Munich, August 2011



Dr. Wolfgang Heubisch

Prof. Dr. Bernd Huber
President
Ludwig-Maximilians-Universität
München

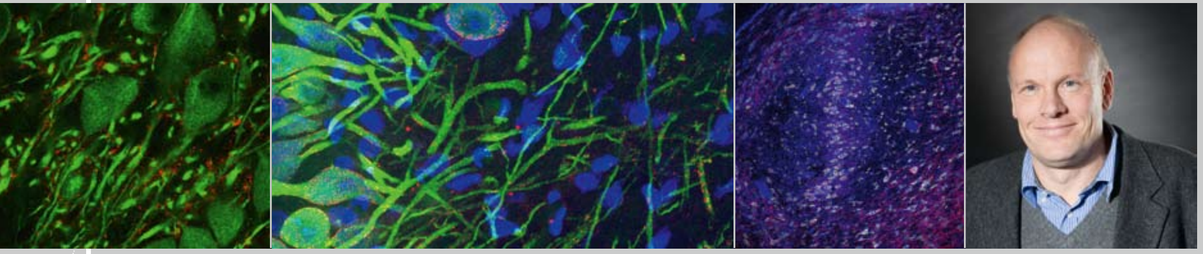
Ludwig-Maximilians-Universität München is one of the leading research intensive universities worldwide, with a more than 500-year-long tradition. It is LMU's mission to combine excellent research with outstanding teaching, to conduct basic research and tackle the grand challenges of our time. The extraordinary research output of the university is based on the exceptional achievements of our researchers and scientists. This is proved by our success in the first round of the Excellence Initiative in 2006. In addition to that, LMU also offers the best possible education for its 46,000 students with degree programs in 150 subjects and thus ideally preparing young people for a career in academia or outside university.

One of LMU's very successful institutions is the "Munich Center for Neurosciences – Brain and Mind (MCN^{LMU})" which contributes essentially to LMU's top position within the life sciences. MCN^{LMU} aims towards building up a network of groups and disciplines with interest in questions of neurobiology, cognition, and "brain and mind". With its interdisciplinary approach, MCN^{LMU} combines various research fields at LMU ranging from the natural sciences to the humanities. Scientists from the field of experimental and theoretical neurosciences, philosophy and psychology do research and teach in the numerous projects and programs within the MCN^{LMU}.

The Center is an excellent example for transferring new and broad knowledge in an emerging field of science to the new student generations: The two specialized Master programs in Neurosciences and Neuro-Cognitive Psychology, funded by the Elite Network of Bavaria, are the successful teaching institutions at MCN^{LMU}. The Graduate School of Systemic Neurosciences which is funded within the German Excellence Initiative promotes young scientists by offering them the best possible framework for doing their first independent research.

One essential requirement for the success of the MCN^{LMU} is the intense cooperation with its partners, the Technische Universität München, different Max Planck Institutes, the Helmholtz Zentrum München and the Bernstein Center for Computational Neuroscience. It also maintains close ties to renowned international partners in Europe, the United States and Australia and thus creates an important global network for the exchange of knowledge. This brochure offers interesting insights into the Munich Center for Neurosciences – Brain and Mind, its research projects and teaching programs as well as an overview on the excellent researchers who are working at the MCN^{LMU}. The multiplicity, interdisciplinarity and internationality of this top-class institution strongly contributes to LMU's vision to address the key areas of research and innovation of the 21 century.

Prof. Dr. Bernd Huber



Prof. Dr. Benedikt Grothe
MCN[LMU] Chair of the Board of Directors

Dear Reader,

Modern sciences increasingly depend on the ability of crossing disciplinary boarders as well as collaborations that allow sharing expertise and infrastructure. This holds particularly true for an area like the neurosciences. The structure and function of the human brain and the question of how its activity relates to our concepts of the mind cannot be studied in isolation, but only through extensive networking. The "Munich Center for Neurosciences – Brain and Mind (MCN[LMU])" was founded in 2005 to create a local network in and around Munich that connects all groups and disciplines with interests related to questions of neurobiology, cognition, and "brain and mind". It provides a platform for interdisciplinary interactions, supports the establishment of new collaborative research programs and has developed a teaching concept that attracts excellent students at all levels of training. The program M.Sc. Neurosciences, generously funded by the Elite Network of Bavaria and the Ph.D. program of the Graduate School of Systemic Neurosciences GSN[LMU], funded by the German Excellence Initiative, are offspring of the MCN[LMU] Teaching Concept (see page 88). The SFB 870: Assembly and Function of Neuronal Circuits in Sensory Processing is a new collaborative research center that resulted from scientific interactions of many members of the MCN[LMU], and several other research and training networks such as the Bernstein Center for Computational Neuroscience (BCCN) Munich or the Research Training Group 1091 Orientation and Motion in Space have profited greatly from established networks within MCN[LMU] and also from its teaching concept. This only begins to exemplify how MCN[LMU] fosters Munich as an internationally attractive site for training and research in the neurosciences.

In Munich, research related to the neurosciences spans a wide spectrum of current areas of investigation, ranging from neural stem cells and the molecular mechanisms of early brain development, via cellular and systems neurobiology (including neurology), neurocognition and behavior (including "theory of mind"), to epistemology, philosophy of science, logic, and ethics. It involves numerous research groups working in various institutes and departments of the LMU (in particular, biology, medicine, philosophy, psychology), most of them in close collaboration with the Max Planck Institutes of Neurobiology, Psychiatry, and Ornithology, the institutes of the HelmholtzCenter Munich (HMGU), several institutes at the Technical University of Munich (TUM; electrical engineering, medicine, physics, life sciences) as well as with the computer industry.

MCN[LMU] was implemented to make Munich, with its multitude of expertise, not only one of the real "hot spots" in the neurosciences, but also one of the few neuroscience hubs where the bridge from experimental neurobiology to the philosophy of brain and mind can be competently spanned.

Prof. Dr. Benedikt Grothe

Prof. Dr. Oliver Behrend
MCN[LMU] Managing Director

Dear Readers,
Dear Members and Friends of the Munich Center for Neurosciences,

This compendium of the Center's activities is meant to reach out to the wider neuroscience community, both nationally and internationally, and also to make individual research interests of the Center's members visible to each other. Furthermore, this publication was designed to communicate some of the richness and sophistication of the neurosciences in the greater Munich area to non-scientists. The LMU-wide Ringvorlesung (Theme Lecture Series) "Der Mensch und sein Gehirn" was already an important step in that direction. Beyond presenting the Center's scientific wealth, this document attempts to clarify the aims of the Center, and the advantages that arise from bringing together such a vast variety of neuroscientific expertise.

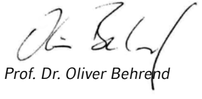
The university's initiativ LMUinnovativ led to the formation of the MCN[LMU]. As a major outcome, the attraction of third party funding (joint grants ~60 million, 2007 – 2011) was facilitated by being able to resort to an extensive group of excellent researchers who have been brought together within the framework of the MCN[LMU] and associated research entities. Significant amounts of research funding were drawn from federal sources (Bundesministerium für Bildung und Forschung, Deutsche Forschungsgemeinschaft), Bavarian-wide initiatives (Elite Network of Bavaria), as well as private organisations and industry (AMGEN). Successful research initiatives that were substantially supported by the Center range from fundamental research on neuronal circuits (Collaborative Research Center 870) to theoretical and computational neurosciences (Bernstein Center for Computational Neuroscience Munich). Beyond the circuit level, the Center's focus is also set on research on cognitive processes. The huge potential for translating results from research into tangible applications becomes evident by successful initiatives applying research to technical systems (Excellence Cluster Cognition for Technical Systems). This holds especially true for those initiatives applying top-notch scientific results directly to the benefit of patients, i.e. within centers that integrate research and treatment (e.g. Integrated Center for Research and Treatment of Vertigo, Systems Neurology Cluster Initative).

These initiatives also have substantial influence on the society's perception of neurosciences and help in forging a general consensus that neuroscience research is critical for a healthy development of our society in the future. A number of initiatives keep Munich as a Center for neurosciences on the screen of local, national, and international neuroscientists. For instance, more than 40 well-recognised researchers were brought to the Center by invitation to participate in the prestigious MCN[LMU] Monday Lecture Series since 2007. Other events, like the envisaged Christmas Lecture in collaboration with the Bavarian Ministry of Science, Research and the Arts will further strengthen the Centers public outreach. In the future, also the online presence of the Center and associated entities will be revised substantially. In order to cover that increasingly important field of public relations, a PR coordinator and IT staff were recently funded by the MCN[LMU], and the implementation of modern means of internal and external communication, e.g. podcasts, iMCN[LMU], is on the agenda for the future. A major aim of the Center will be the creation of an efficient communication structure to promote scientific interaction within the MCN[LMU]. Additionally, MCN[LMU] internal research grants help to set up collaborative interactions between members.

The beauty of the Center is that it combines elaborate efforts in research from world-class scientists with a wide range of teaching measures that cumulate in the Graduate School of Systemic Neurosciences (GSN[LMU]). Here, neuroscience teaching from B.Sc. to Ph.D. is provided in a well-structured form that undergoes continuous evaluation. The teaching within the GSN[LMU] is complemented by undergraduate programmes like the Amgen Scholars Program which provide insight into the Center and its School to international students at an early stage. While these initiatives potentially scout for well educated students from abroad, other complementary MCN[LMU] initiatives on advanced Ph.D. and postdoctoral levels – like the Harvard-LMU Young Scientists' Forum and the QBI-MCN[LMU] Symposium aim to promote an exchange of young scientists with other excellent neuroscience institutions around the world.

To effectively secure a straightforward curriculum with the multitude of options available to students within the MCN[LMU] / GSN[LMU] a teaching coordinator has been appointed, and a student relations coordinator helps students to adjust their path towards graduation on an individual basis. The sound education of future neuroscientists within the Center will help to further develop the Munich area as an outstanding neuroscience hub in the world. On a personal note – enjoy the read!

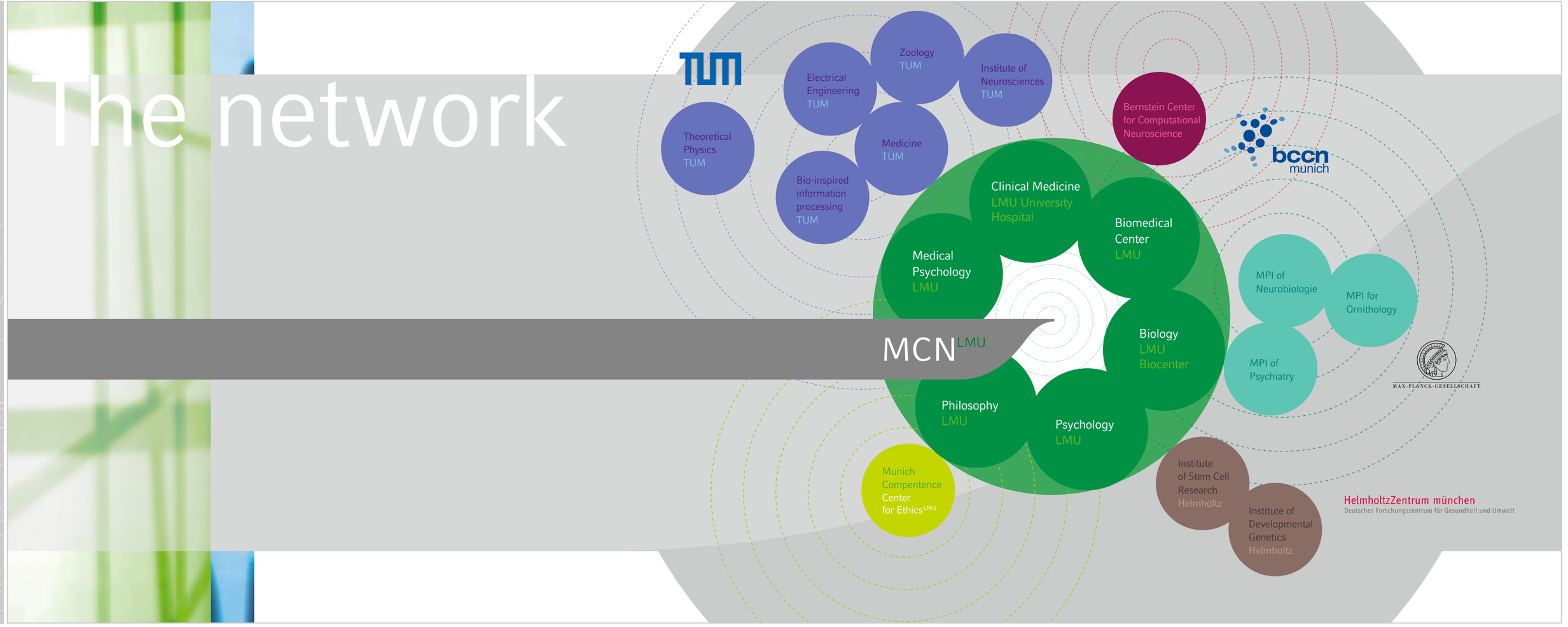
With kind regards,

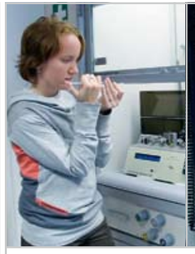


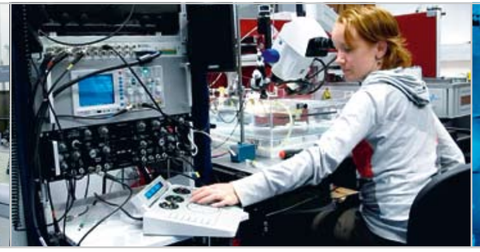
Prof. Dr. Oliver Behrend

The network

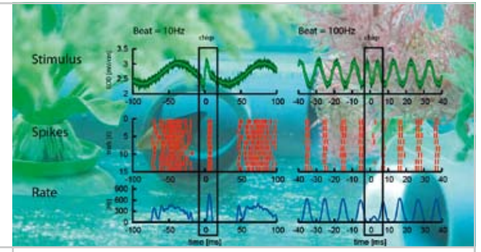
The network


Theoretical Physics TUM
Electrical Engineering TUM
Zoology TUM
Institute of Neurosciences TUM
Medicine TUM
Bio-inspired information processing TUM
Bernstein Center for Computational Neuroscience
bccn münich
Clinical Medicine LMU University Hospital
Biomedical Center LMU
Medical Psychology LMU
MCN LMU
Biology LMU Biocenter
Philosophy LMU
Psychology LMU
Munich Compentence Center for Ethics LMU
MPI of Neurobiologie
MPI for Ornithology
MPI of Psychiatry
MAX-PLANCK-GESELLSCHAFT
Institute of Stem Cell Research Helmholtz
Institute of Developmental Genetics Helmholtz
HelmholtzZentrum münchen
Deutsches Forschungszentrum für Gesundheit und Umwelt





Bernstein Center for Computational Neuroscience Munich



BCCN – Bernstein Center for Computational Neuroscience Munich

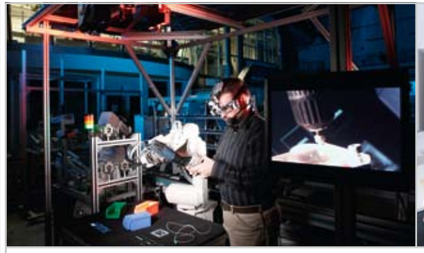
Director: Prof. Dr. Andreas Herz

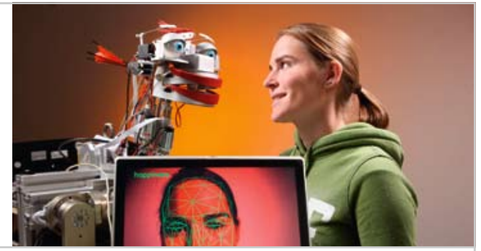
Neuronal representations of space and time are of fundamental importance for cognition and behavior – from localizing prey by auditory cues and visually detecting moving objects to the planning and neuronal control of future movements. Goal-directed self-motion relies on continually evaluating changing sensory inputs in real time and taking previously stored information into account to generate spatially coordinated and appropriately timed motor actions. Our brain solves these challenging computational tasks with apparent ease, using intricate feedback circuits in distributed neural circuits whose functional architecture adapts in time. Pathologies of visuomotor control and age-related navigation deficits reveal that the underlying processes hang in a delicate balance; limitations and failures of current technical applications demonstrate that we have only rather restricted insight into some of the most basic functions of nervous systems. Yet, in recent years, there have been numerous exciting new discoveries about neuronal representations of space-time, as also shown by many publications from BCCN Munich.

Research projects at Bernstein Center Munich cover and connect:

- experiment, data analysis, modeling and theoretical approaches
- neurobiology, clinical neuroscience, biomathematics, physics, computer science, and engineering
- computational modeling on various levels; compartmental models of dendritic trees, simplified single-neuron models, networks of spiking neurons, and models at the systems level
- investigations on auditory, electrosensory, vestibular, and visual information processing
- in-vitro recordings, in-vivo recordings as well as psychophysics and fMRI
- studies in different neuronal structures: brain stem, cortex, as well as insect receptor neurons and interneurons
- scientists from Ludwig-Maximilians-Universität München (LMU), Technische Universität München (TUM), Max-Planck-Institute of Neurobiology (MPI), MED-EL Deutschland, and NPI – Electronic Instruments for the Life Sciences

Together with five other Bernstein Centers, the BCCN Munich forms the core of the National Network Computational Neuroscience (www.nncn.de). Supported by highly competitive start-up funds from the Federal Ministry of Education and Research, more than 20 faculty positions have been newly created within the Network, five of which are located at BCCN Munich.



CoTeSys – Cognition for Technical Systems

CoTeSys is one of the largest projects in providing machines and robots with biology-inspired cognitive capabilities.

The mission of the scientists working in the Cluster of Excellence CoTeSys (Cognition for Technical Systems) is the transfer of cognitive skills which are attributed to animals and humans, to technical systems such as robots, manufacturing systems, and vehicles. They study how robots can perceive their environment and react appropriately to it, how machines can cooperate with people in a way that humans are supported physically and intellectually. This requires that machines can learn. A service-robot in the "cognitive kitchen" learns not only the locations and functions of drawers and cupboards, but also movements, manipulations, grasping, and procedures, e.g., to set a table, bake pancakes. In the "Cognition-enabled factory", an industrial robot equipped with cameras, touch and force sensors, assists humans in the assembly of custom-tailored products.

Cognitive technologies are the crux. They differ from other technical systems as they have cognitive capabilities and hence perform cognitive control. Cognitive control orchestrates reflexive and habitual behaviour towards long term autonomy and intentions. Cognitive capabilities include perception, reasoning, learning, goal-oriented planning, and result in systems of higher autonomy, flexibility, adaptivity, reliability, robustness featuring better interaction with humans and improved collaboration capabilities.

In order for machines and humans to work together, machines must learn to accomplish tasks the way humans do. Only if robots are able to recognize their environment, react flexibly, intuitively, and, to a certain extent autonomously, are they able to assist human beings in an overall manner and spare them the need to write computer programmes for all possible events that may occur.

Be it servicerobots or industrial robots – the scientists in CoTeSys work devotedly on the realization of robots as assistants for many aspects of life. Cognition technology poses all kinds of questions in brain research, psychology and biophysics, computer science, mechanical engineering, control engineering and mechatronics, solutions that are found only in close, interdisciplinary teams. The practical implementation of the theoretical findings is of high importance to CoTeSys. Therefore, all theoretical results have to be demonstrated in technical demonstration scenarios, to verify and validate the superiority of cognitive approaches. These scenarios provide means for applying, integrating, validating and analyzing new research methods in the context of real-world scenarios that are of critical importance economically and to society.

Since 2006, CoTeSys has pooled the expertise of around 100 scientists of the Technische Universität München, the Max Planck Institute of Neurobiology, the Ludwig-Maximilians-Universität München, Universität der Bundeswehr, the German Federal Armed Forces University of Munich and the German Aerospace Center DLR in Oberpfaffenhofen. CoTeSys, therefore, belongs to the largest interdisciplinary research clusters in the field of cognition.

CoTeSys can report numerous success stories giving examples on how to bridge the gap between fundamental research in neurocognition, psychology and informatics, and engineering. CoTeSys attracts top international scientists as new junior and tenured professors and has a significant impact on academia, industry, future societies and the general public. CoTeSys is highly successful in establishing Independent Junior Research Groups and is involved in several educational gender projects, attracting young girls and boys to scientific and technical professions. It is an explicit goal of CoTeSys to promote more women into senior positions. CoTeSys has successfully established two Central Robotics Laboratories CCRL-I in Barerstraße and CCRL-II in Karlstraße, both located in downtown Munich.

CoTeSys is one of the strategic projects supported with federal and state funds through the German Excellence Initiative.

Director: Prof. Dr. Martin Buss

Integrated Center for Research and Treatment of Vertigo, Balance and Ocular Motor Disorders (IFB[LMU])

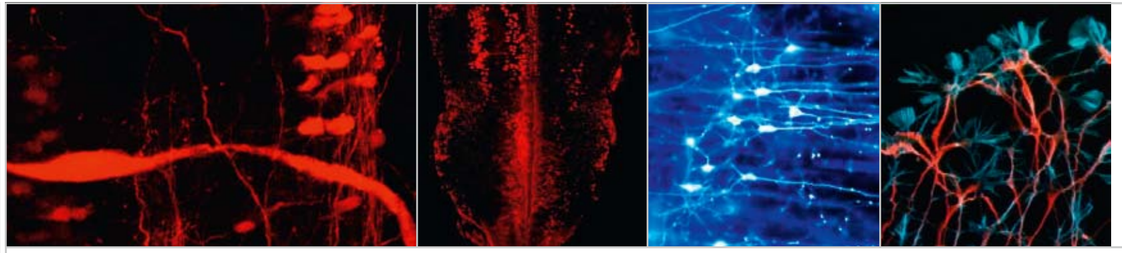
Chief Executive Director: Prof. Thomas Brandt, MD, FRCP
Deputy Director: Prof. Michael Strupp, MD
Chief Administrator: Dr. Andreas Schepermann

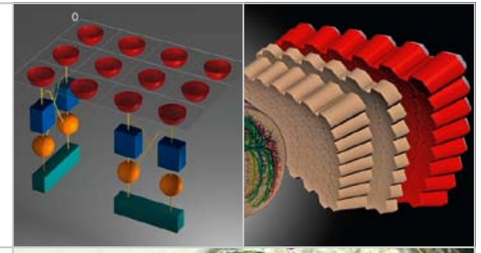
The Integrated Center for Research and Treatment of Vertigo, Balance and Ocular Motor Disorders (IFB[LMU]), established in Munich in 2010, brings a novel approach towards integrating basic research and clinical treatment. During the last decades, Munich has become the site of a unique concentration of leading experts on vertigo, balance and ocular motor disorders, both in the clinical and basic sciences.

Using this unique expertise, the IFB[LMU] seeks (1) to create an independent patient-oriented clinical research centre; (2) to overcome existing clinical and academic barriers separating the traditional specialisations; (3) to establish a standardised interdisciplinary longitudinal and transversal network at one site for the management of patients; (4) to organise the study infrastructure for prospective multicentre clinical studies as well as to free clinical scientists from administrative tasks; (5) to promote translational research with a focus on the innovative topics of molecular, functional and structural imaging, experimental and clinical pharmacotherapy, clinical research of vertigo and balance disorders, mathematical modelling, interaction between biological and technical systems (robotics), and research on functionality and the quality of life; (6) to offer new attractive educational paths and career images for medical doctors, students of the natural sciences, and engineers in clinical research in order to overcome traditional hierarchical structures. This should promote the principles of efficiency and self-reliance; (7) to supplement the existing expertise with up to eight groups of young scientists and up to eight professorships (tenure-track). This should also be seen as an incentive that will attract the best young scientists; (8) to incorporate IFB[LMU] competence into the existing medical and biological graduate schools.

Translational research within the IFB[LMU] is supported by up to eight young scientist groups, working independently and self-reliantly within the IFB[LMU] and up to eight (tenure track) professors. The access to patients and methods is ensured by cooperation contracts among the clinics and institutes involved in the IFB[LMU].

Training within the IFB[LMU] builds on existing scientific training programmes such as the M.Sc. programs in Clinical Epidemiology and Human Functioning Sciences and the Ph.D. program in Neuroscience through the Graduate School of Systemic Neurosciences (GSN[LMU]). The IFB[LMU], furthermore, plans to establish a “Clinical Scientist IFB[LMU]” curriculum which shall be integrated in the degree awarding process for M.Sc. (Epidemiology, Public Health) and M.D./Ph.D. programmes focussed on clinical research.





Collaborative Research Center 870 –
Assembly and Function of Neuronal Circuits in Sensory Processing

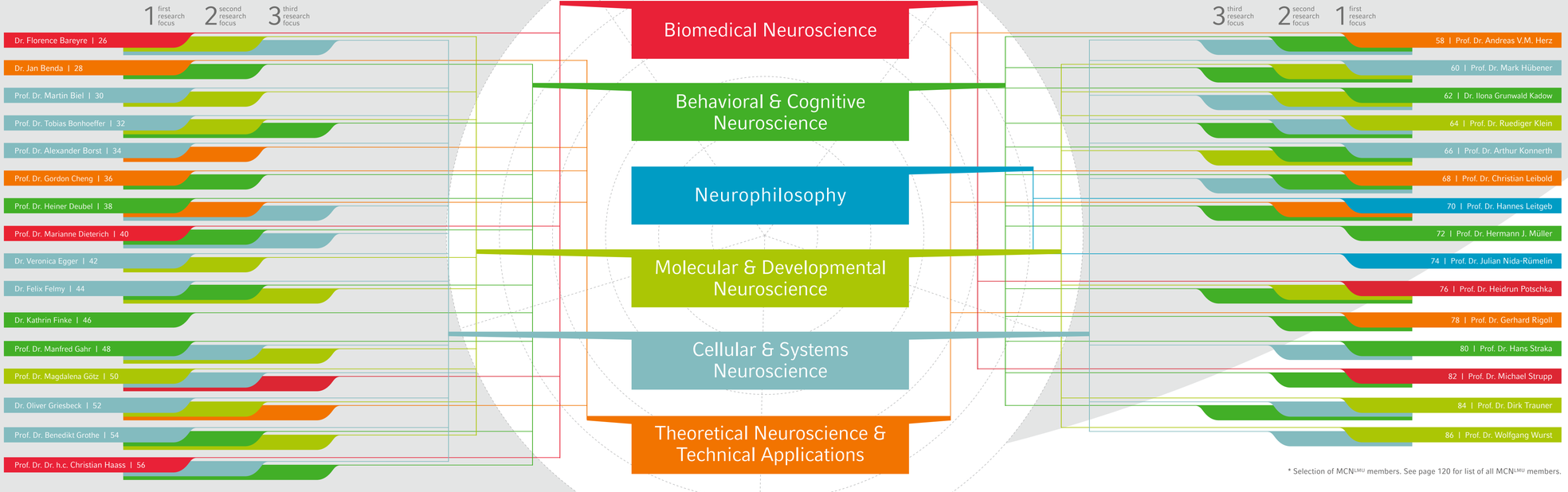
Director: Prof. Dr. Benedikt Grothe
Scientific Manager: Dr. Kristina Vaupel

Along with major success in molecular and cellular neurosciences, over the last decades, brain imaging techniques like fMRI and EEG provided fascinating data. However, the understanding of the brain's complex functions, compartments and interrelations still needs conjoined research efforts: Fundamental, but yet open questions – like the translation of cellular mechanisms into higher brain functions as well as processing of behaviourally relevant information on intermediate levels of brain organisation by specific neuronal circuits and neuronal populations within – remain largely unanswered.

In order to address such questions, the Collaborative Research Center (CRC) 870 'Assembly and Function of Neuronal Circuits in Sensory Processing' comprising 23 scientific projects, aims at elucidating structure-function relationships of neuronal circuits, their dynamics and computations and intends to gain a deeper understanding of the molecular basis of the development, plasticity and regeneration of sensory circuits as well as processing mechanisms for behaviourally relevant information.

For various reasons, neuronal circuits serve as ideal model systems to study the principles of neuronal information processing: First, these circuits process highly specific physical cues, which are present in sensory stimuli and can be tightly controlled in physiological and/or behavioural experiments. Efficient analysis of the information processing in neuronal circuits is facilitated by parallel, anatomically distinguishable pathways specialized for certain sensory stimuli. Moreover, sensory circuits show specific adaptations to structure and functions related to behavioural needs, which help to determine biologically relevant experimental approaches. In addition, advanced model-driven hypotheses about sensory processing combined with new experimental techniques enhance the development of new and more powerful experimental approaches vital for advancing systemic neuroscience. Therefore, several projects in the CRC 870 are investigating new approaches for the manipulation of neuronal activity in specific subpopulations of neurons within neuronal circuits. These include genetic alterations targeting specific subpopulations as well as the use of optically controlled, photo-switchable molecules that can be used to accentuate the activity of single neurons. Such methods will allow for more efficient and conclusive testing of hypotheses about the flow of information within neuronal circuits.

The people*



* Selection of MCN[LMU] members. See page 120 for list of all MCN[LMU] members.

Ludwig-Maximilians-Universität München

Dr. Florence Bareyre

Institute of Clinical Neuroimmunology
www.klinikum.uni-muenchen.de/Institut-fuer-Klinische-Neuroimmunologie
Contact information on page 120

Promoting axonal growth, pathfinding and synapse formation following spinal cord injury

Advanced Professional Degrees

2003	PhD, Brain Research Institute, University and ETH Zurich, Switzerland
1997	Master's biochemistry, University of Paris VII, France

Awards and Professional Affiliations

2009	Independent BMBF Group leader "Spinal cord repair"
2009	Member of the LMU Center of Advanced Studies (CASy)
2007	Junior Research Award of the German Multiple Sclerosis Society (Sobek price)

Publications

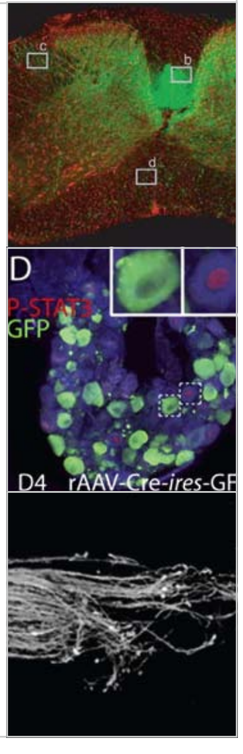
- Bareyre FM, Garzorz N, Lang C, Misgeld T, Büning H, Kerschensteiner M (2011) ***In vivo imaging reveals a phase-specific role of STAT3 during central and peripheral nervous system axon regeneration.*** Proc Natl Acad Sci U S A. 108(15):6282-7.
- Bareyre FM, Kerschensteiner M, Misgeld T and Sanes JR (2005) ***Transgenic tracing of the corticospinal tract: a new tool to study axonal regeneration and remodeling.*** Nature Medicine. 11(12):1355-1360.
- Bareyre FM, Kerschensteiner M, Raineteau O, Mettenleiter TC, Weinmann O and Schwab ME (2004) ***Spontaneous formation of a new axonal circuit in the rat injured spinal cord.*** Nature Neuroscience. 7(3):269-277.

Lab members

Peter Bradley, Claudia Lang, Anne Jacobi, Catherine Sorbara, Fabian Laage-Gaupp, Anja Schmalz

We are studying the neuronal response to traumatic and inflammatory lesions of the spinal cord. In initial studies we have investigated how therapeutic strategies can limit neuronal cell death following CNS injury (Bareyre et al., 1997; 1999; 2000; 2001).

We are currently trying to understand how we can promote axonal repair of surviving neurons by focusing on the molecular and anatomical mechanisms underlying axonal plasticity after traumatic and inflammatory spinal cord lesions (Bareyre et al., 2002; 2004; Kerschensteiner, al., 2004). By microarray analysis, we have identified a number of candidate molecules that might impact axonal outgrowth and pathfinding during post-traumatic recovery (Bareyre et al., 2002). To further understand how spontaneous recovery of function is achieved we study the reorganization of the corticospinal tract after traumatic or inflammatory lesions of the spinal cord. We have shown that the recovery of corticospinal function is achieved by the formation of new intraspinal detour circuits involving propriospinal relay neurons (Bareyre et al., 2004; Kerschensteiner et al., 2004). We are now trying to address the following important questions: (i) how do increase axon growth following SCI, (ii) how do growing axons find the appropriate path to their intraspinal targets and (iii) how do they form and stabilize synapses onto these targets? In order to gain first insight into the principles that can regulate axonal pathfinding and synapse formation, we engineered methods to visualize synapses via tagged peptides (McCann, Bareyre et al., 2005) and generated transgenic mice in which the corticospinal tract is selectively and specifically labelled with a fluorescent protein (Bareyre et al., 2005). Using these mice we have demonstrated that when the main CST tract is lesioned, minor CST components remodel to compensate the lesion. We now combine our expertise on axonal remodeling with emerging imaging techniques that allow the direct visualization of regrowing axons and their path to the target cells in vivo (Misgeld et al. 2007; Nikic et al., 2011). We use this approach in combination with viral gene therapy to dissect the molecular regulation of the neuronal growth response in vivo (Bareyre et al., 2011). We also focus on dissecting the molecules and mechanisms underlying efficient target finding and synapse formation during post-traumatic detour circuit formation.



Ludwig-Maximilians-Universität München

Dr. Jan Benda
Division of Neurobiology
Department Biology II
www.bio.lmu.de/~benda
Contact information on page 120

Function of intrinsic noise in sensory signal processing

Awards and Professional Affiliations
• BMBF Bernstein Award Computational Neurosciene 2007

Publications
• Tilo Schwalger, Karin Fisch, Jan Benda & Benjamin Lindner (2010): ***How noisy adaptation of neurons shapes interspike interval histograms and correlations.*** PLoS Computational Biology, 6(12): e1001026
• Jan Benda, Leonard Maler & André Longtin (2010): ***Linear versus nonlinear signal transmission in neuron models with adaptation-currents or dynamic thresholds.*** Journal of Neurophysiology 104: 2806-2820
• K. Jannis Hildebrandt, Jan Benda & R. Matthias Hennig (2009): ***The origin of adaptation in the auditory pathway of locusts is specific to cell type and function.*** Journal of Neuroscience 29(8): 2626-2636

Lab members
Jan Grewe, Henriette Walz, Jörg Henninger, Anna Stöckl, Charlotte Pix, Franziska Kümpfbeck, Anatoli Ender

The main goal of our research on sensory systems is to identify common principles of signal processing in various neural systems and to investigate their implementation on the cellular level. Our experimental approaches are strongly influenced by theories on neural function as dynamical systems and on information theoretical considerations.
Vice versa, we develop new theoretical concepts that are inspired by our experimental findings. In particular, we perform electrophysiological recordings on the active and the passive electrosensory systems of wave-type weakly-electric fish and on the auditory system of grasshopper and crickets. Both systems have the advantage to allow for comparative studies between related species. We contrast our data with well known properties of canonical integrate-and-fire type models in order to identify non-trivial features of recorded neural responses. Currently, we focus on potentially advantageous roles of intrinsic noise source in sensory processing.

In addition, we characterize the statistics of natural stimuli for the electrosensory systems of weakly electric fish both in well-controlled experiments in the lab and in natural habitats in South-America. For the latter we are developing a grid of electrodes that continuously record the electric fields of the fish. From the data we reconstruct the position as well as the communication signals for each fish individually. This novel method eventually allows us to record natural signals in natural habits on unprecedented spatial and temporal scales. The resulting data will be very important for discussing our findings from the comparative electro-physiological experiments on neural tuning properties.

Ludwig-Maximilians-Universität München

Prof. Dr. Martin Biel

Department of Pharmacy – Center for Drug Research
www.cup.uni-muenchen.de/ph/aks/biel/
Contact information on page 120

Ion channels in the CNS: from genes to disease

Advanced Professional Degrees
- Professor and Chair of Pharmacology, Department of Pharmacy, LMU

Awards and Professional Affiliations
- Honorary Professorship, Fudan University, Shanghai, PR China (2004)
- Fritz-Winter-Preis (1997)
- Heinz Maier Leibnitz Forschungsförderungspreis (1994)

Publications

- Michalakis S, Mühlfriedel R, et al., Biel M, Seeliger MW (2010) *Gene therapy restores missing cone-mediated vision in the CNGA3-/- mouse model of achromatopsia.* Mol Ther 18:2057-2063.
- Wahl-Schott C, Baumann L, Cuny H, Eckert C, Griessmeier K, Biel M (2006) *Switching off calcium-dependent inactivation in L-type calcium channels by an autoinhibitory domain.* Proc Acad Sci.USA 103:15657-15662.
- Ludwig A, Zong X, Jeglitsch M, Hofmann F, Biel M (1998) *A family of hyperpolarization-activated mammalian cation channels.* Nature 393:587-591.

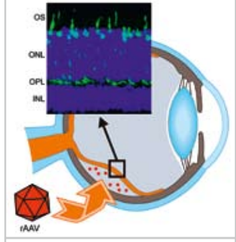
Lab members
Elvir Becirovic, Xiaochun Cao-Ehlker, Stefanie Fenske, Verena Hammelmann, Stylianos Michalakis, Xiangang Zong

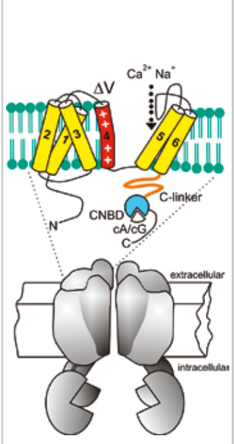
Our laboratory aims at achieving insights into the role of ion channels in normal physiology and disease. Ion channels are protein complexes that confer the flux of ions through cellular membranes. These proteins are vital for virtually every cell in the body. In neurons, ion channels provide the basis for action potential generation and information processing. Dysfunction of ion channels causes acquired or inherited diseases ("channelopathies") including numerous diseases of the nervous system (e.g. epilepsy, migraine, pain disorders, depression).

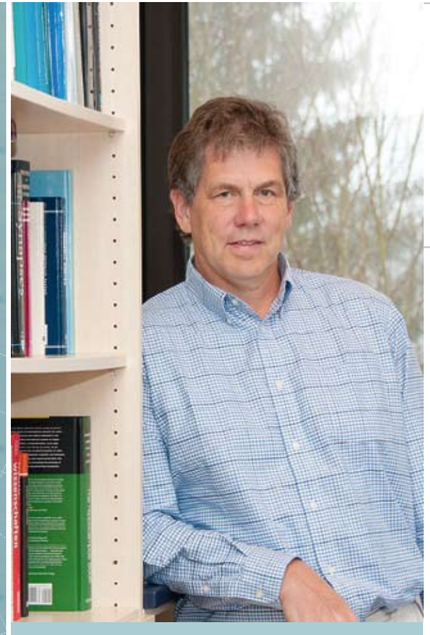
One class of ion channels we are interested in are the cyclic nucleotide-regulated cation channels (CNG and HCN channels). CNG channels are crucial for olfactory and visual transduction. We have characterized several members of this ion channel class and have investigated their physiological relevance using genetic mouse lines produced in our laboratory. We are particularly interested in retinal CNG channels since dysfunction of these channels can lead to visual impairment and even blindness. We recently developed advanced gene therapy approaches to restore vision in a genetic mouse model of a special kind of blindness (achromatopsia).

Another focus of our work is on HCN channels. Our group discovered these ion channels in 1998. HCN channels are activated by membrane hyperpolarization (H) and cyclic nucleotides (CN) and play a crucial role in controlling basic excitability and rhythmic firing of neurons. HCN channels are also involved in other neuronal functions including memory formation, sleep control and dendritic integration. Dysfunction of HCN channels has been associated with epilepsy, ataxia and other neurological diseases. As for CNG channels, we examine the role of HCN channels on the molecular and systemic level using biophysical tools and genetic mouse models.

The third group of ion channels we are studying are calcium channels. Recently our laboratory discovered a novel class of calcium channels (TPCNs "two-pore channels") that are strictly localized in lysosomes which represent the smallest organelles of cells. We found that TPCNs are specifically activated by the novel second messenger NAADP (nicotinic acid adenine diphosphate). Our long-term goal is to achieve a complete understanding of the specific physiological roles of TPCNs.To this end we are developing a variety of tools (including planar patch-clamp approaches) to characterize TPCNs in native lysosomes.







Max Planck Institute of Neurobiology

Prof. Dr. Tobias Bonhoeffer

Department of Cellular and Systemsneurobiology
http://www.neuro.mpg.de/24259/bonhoeffer
Contact information on page 120

Structural correlates of synaptic plasticity

Advanced Professional Degrees
- Professor
- Director at the Max-Planck-Institute of Neurobiology

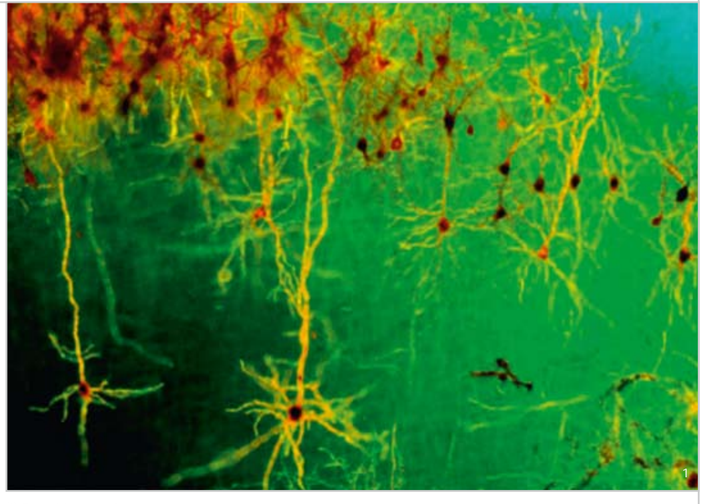
Awards and Professional Affiliations
- Member of the German Academy of Sciences Leopoldina
- Ernst Jung Prize for Medicine
- Associate, Neuroscience Research Program (NRP), The Neurosciences Institute, San Diego, USA

Publications

- Hofer SB, TD Mrsic-Flögel, T Bonhoeffer, M Hübener (2009) *Experience leaves a lasting structural trace in cortical circuits.* Nature 457:313-317.
- Nägerl UV, KI Willig, B Hein, SW Hell, T Bonhoeffer (2008) *Live-cell imaging of dendritic spines by STED microscopy.* Proc. Natl. Acad. Sci. USA 105:18982-18987.
- Hofer, SB, TD Mrsic-Flogel, T Bonhoeffer, M Hübener (2006) *Prior experience enhances plasticity in adult visual cortex,* Nature Neurosci 9:127-132.

Lab members
Cvetalina Coneva, Onur Gökce, Susanne Falkner, Rosa Garcia Verdugo, Mark Hübener, Claudia Huber, Julian Jäpel, Ron Jortner, Georg Keller, Marcus Knopp, Anne Kreile, Marcus Leinweber, Sabine Liebscher, Daniel Meyer, Fiona Müllner, Tobias Rose, Alexandre Ferrao Santos, Volker Scheuss, Anne Schümann, Max Sperling, Volker Staiger, Frank Voss, Corette Wierenga, Pawel Zmarz

The department is investigating the fundamental principles of synaptic plasticity at a number of different levels, ranging from molecular approaches to studies of the intact nervous system. Recent results from the lab have shown that synaptic plasticity is accompanied by structural changes of dendritic spines, they have demonstrated the importance of neurotrophins in synaptic plasticity, and they have revealed the detailed structure of functional maps in the visual cortex.



(1) Pyramidal neurons of mouse cortex

Max Planck Institute of Neurobiology

Prof. Dr. Alexander Borst

www.neuro.mpg.de

Contact information on page 120

Motion processing in the fly visual system

Advanced Professional Degrees

2001 – present Director MPI of Neurobiology
1999 – 2001 Professor at UC Berkeley, ESPM, Division of Biology
1993 – 1999 Junior Group Leader at the FML, Tübingen

Awards and Professional Affiliations

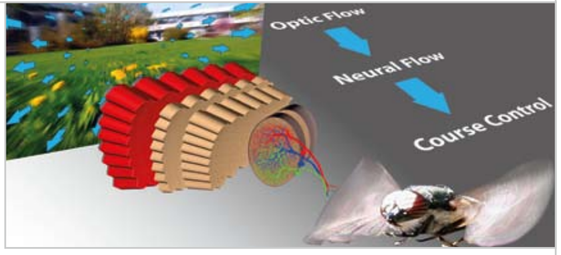
- Otto-Hahn Medal of the Max Planck Society 1989
- Dupont Lecturer, Tucson 2001
- Erasmus Lecturer, Rotterdam 2003
- Human Frontier Science Program (HFSP) Awardee 2006
- Leopoldina 2011
- EMBO 2011

Publications

- Eichner H, Joesch M, Schnell B, Reiff DF, Borst A (2011): *Internal structure of the fly elementary motion detector.* Neuron 70: 1155-1164.
- Joesch M, Schnell B, Shamprasad VR, Reiff DF, Borst A (2010) *ON and OFF pathways in Drosophila motion vision.* Nature 486: 300-304.
- Weber F, Machens CK, Borst A (2010): *Spatio-temporal response properties of optic-flow processing neurons.* Neuron 67: 629-642.

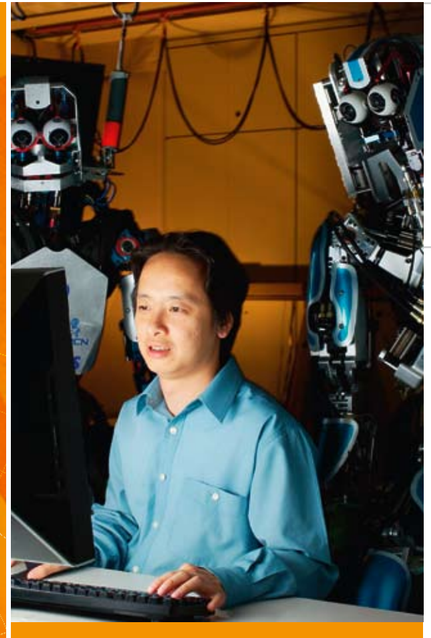
Lab members

Georg Ammer, Alexander Borst, Alexander Arenz, Armin Bahl, Hubert Eichner, Wolfgang Essbauer, Renate Gleich, Jürgen Haag, Väinö Haikala, Elisabeth Hopp, Christoph Kapfer, Isabella Kauer, Romina Kutlesa, Matthew Maisak, Alex Mauss, Matthias Meier, Katarina Pankova, Johannes Plett, Etienne Serbe, Christine Thalhammer, Christian Theile, Franz Weber



Our department is interested in how motion information from the changing retinal images is computed in the fly visual system and how this information is decoded for flight control. In general, this processing is done in two steps: In the first step, local motion vectors are calculated from local changes in retinal brightness. This calculation is done according to the Reichardt model of local motion detection, most likely in the fly's medulla. From the resulting vector fields (the 'neural optic flow'), important course control parameters are extracted in a second step. This is realized in the fly visual system at the level of the lobula plate. Here, tangential cells integrate, by their large dendrites, the output signals of retinotopically arranged local motion-sensitive neurons and, in addition, interact amongst each other. Postsynaptic to these tangential cells, descending neurons become further selective for specific optic flow fields and transmit this information to the neck motor neurons or, via the cervical connective, to motor centers for legs and wings in the thorax.

Our work combines experimental and theoretical analysis ranging from visual responses, membrane properties and pharmacology of individual neurons up to network responses to natural image sequences created by the fly's own flight maneuvers. Our experimental animals are the blow fly Calliphora vicina ('BigFly') and the fruitfly Drosophila melanogaster ('LittleFly'). While the first species allows for intracellular and optical recording from individual neurons, the latter provides in addition a wealth of genetic techniques including tissue specific expression of genetically encoded indicators and blockers of nervous activity. In collaboration with Winfried Denk (MPI for Medical Research, Heidelberg), we also try to fully reconstruct important parts of the optic lobes of both species at the ultrastructural level using his recently developed Serial Block Face Scanning Electron Microscope ('BlueFly'). Biophysically realistic compartmental models of individual neuronBiophysically realistic compartmental models of individual neurons obtained from 2P-image stacks allow us to reconstitute the network of motion processing neurons in computer simulations ('ModelFly'). As a joint project with Martin Buss and Kolja Kuehnlenz (TUM, Munich, sponsored by the BMBF within the excellence cluster CoTeSys), our knowledge about the fly motion vision system goes into the development of miniature airborne vehicles ('RoboFly').



Technical University Munich

Prof. Dr. Gordon Cheng
Institute for Cognitive Systems
www.ics.ei.tum.de
Contact information on page 120

Humanoid robotics and neuroscience: science, engineering and society

Advanced Professional Degrees

2001	Ph.D. (Systems Engineering), The Australian National University, Australia
1993	Master of Computer Science, University of Wollongong, Australia
1991	Bachelor of Computer Science, University of Wollongong, Australia

Awards and Professional Affiliations
- IEEE Gennai Medal (2007)
- Center of Excellence (COE) Fellow (2000)
- Japan Science and Technology Agency (STA) Fellow (1998)

Publications
- Gordon Cheng. (2012) ***Humanoid Robotics and Neuroscience: Science, Engineering and Society (Frontiers in Neuroengineering Series).***
- Thierry Chaminade and Gordon Cheng. 2009. ***Social cognitive neuroscience and humanoid robotics.*** Journal of Physiology – Paris, Volume 103, Issues 3-5, Pages 286-295 (May-September 2009).
- Gordon Cheng, Sang-Ho Hyon, Jun Morimoto, Ales Ude, Joshua Hale, Glenn Colvin, Wayco Scroggin, Stephen Jacobsen. (2007). ***CB: A humanoid research platform for exploring neuroscience.*** Journal of Advance Robotics, 21, 10, 1097-1114.

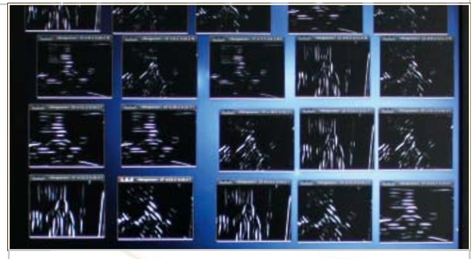
Lab members
Takaaki Kuratate, Samer Alfayad, Andreas Holzbach, Brennand Pierce, Marcia Riley, Ewald Lutscher, Philipp Mittendorfer, John Nassour, Erhard Wieser, Rong Li

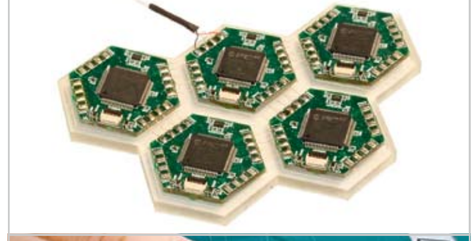
Our research interests fall in line with the notion of "Understanding through Creating", three essential aspects motivate our approach in the area of Humanoid Robotics and Neuroscience: Science, Engineering and Society:

In Engineering – Engineers can gain a great deal of understanding through the studies of biological systems, which can provide guiding principles for developing sophisticated and robust artificial systems.

Scientifically – Building of a human-like machine and the reproduction of human-like behaviours can in turn teach us more about how humans deal with the world, and the plausible mechanisms involved.

For society – In turn we will gain genuine knowledge toward the development of systems that can better serve our society.





Ludwig-Maximilians-Universität München

Prof. Dr. Heiner Deubel
Experimental Psychology, Department of Psychology
http://www.paed.uni-muenchen.de/~deubel/
Contact information on page 120

Sensory-motor integration

Advanced Professional Degrees
- 2005 Professor (apl), Department of Psychology, LMU
- 2007 Academic Director, Department of Psychology, LMU

Publications

- Baldauf, D. & Deubel, H. (2010). ***Attentional landscapes in reaching and grasping – Minireview.*** Vision Research 50:999-1013.
- Jonikaitis, D. & Deubel, H. (2011). ***Independent allocation of attention to eye and hand targets in coordinated eye-hand movements.*** Psychological Science 22(3):339-347.
- Rolfs, M., Jonikaitis, D., Deubel, H., & Cavanagh, P. (2011) ***Predictive remapping of attention before eye movements.*** Nature Neuroscience 14:252-258.

Lab members
Donatas Jonikaitis, Rene Gilster, Saurabh Dhawan, Anna Klapetek, Giulia Manca

The research in our laboratory studies the interplay between mechanisms related to visual perception and mechanisms related to the generation of simple actions such as eye movements, manual reaching, and grasping.

On the one hand, we are interested in precisely how visual information is processed in order to finally allow for a goal-directed movement – in other words, how the visual input projected on the retina is ultimately transformed into an appropriate motor response such as an accurate saccade. On the other hand, our research (along with recent findings from other laboratories) has indicated that the way how visual information is processed depends strongly on the actually planned motor action – that is, what we "see" at each moment in time depends on which actions we currently plan to perform.

One striking example for such a strong relationship between perception and action relates to the role of spatial attention and movement preparation. In a series of recent studies we demonstrated that before the execution of movements such as sequential reaching movements, bimanual movements, and manual grasps, all those regions and objects in the visual field are selectively processed that are relevant for the planned action This results in an "attentional landscape" that closely reflects the requirements of the motor task (Baldauf & Deubel, 2010).

Another research line in our lab concerns mechanisms of oculomotor learning, i.e., the question of how the brain is able to continuously adjust the parameters of eye movements such that they are appropriate over lifetime despite of fatique, disease, and aging. Finally, we investigate why the world is perceived as stable, despite the notorious shifts of the retinal image due to continuous eye and body movements (e.g., Rolfs et al., 2011).

Methods used in our research include various psychophysical procedures, eye and hand tracking, EEG, and transcranial magnetic stimulation (TMS).

Ludwig-Maximilians-Universität München

Prof. Dr. Marianne Dieterich, MD

Head of the Department of Neurology
Department of Neurology
http://klinikum.uni-muenchen.de/de/kliniken/neurologie/index.html
Contact information on page 120

Cortical interaction between different sensory systems in healthy subjects and patients

Awards and Professional Affiliations

2004	Hallpike-Nylén Prize of the International Bárány Society
2000	Elfriede-Aulhorn Prize for Neuro- Ophthalmology
1999	Vertigo-Prize of the German Society of Neurology (DGN)
2011	Award of the German Society of Clinical Neurophysiology and Functional Imaging (DGKN) for outstanding teaching.

Publications

- Strupp M, Zingler V, Arbusow V, Niklas D, Maag KP, Dieterich M, Bense S, Theil D, Jahn K, Brandt T: ***Effects of methylprednisolone, valacyclovir, or the combination in vestibular neuritis.*** New Engl J Med 351: 354-361 (2004).
- Dieterich M, Bauermann T, Best C, Stoeter P, Schlindwein P: ***Evidence for cortical visual substitution of chronic bilateral vestibular failure (an fMRI study).*** Brain 30: 2108-2116 (2007).
- Zu Eulenburg P, Stoeter P, Dieterich M: ***Voxel-based morphometry depicts central compensation after vestibular neuritis.*** Ann Neurol 68(2): 241-9 (2010).

Lab members

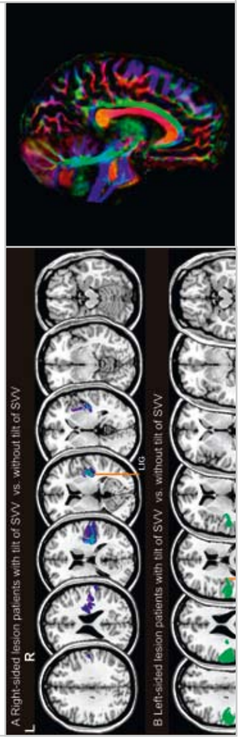
Iskra Stefanova, Sandra Bense, Caroline Cyran, Regina Feuerecker, Thomas Stephan, Rainer Boegle, Mattias Bögelein

Most of our current knowledge of multisensory vestibular brain structures and their functions in humans derive from brain activation studies with PET and fMRI conducted over the past decade [review: Dieterich & Brandt 2008]. The patterns of activations and deactivations during caloric and galvanic vestibular stimulations in healthy subjects have been compared with those in patients with acute and chronic peripheral and central vestibular disorders.

These findings have provided a better insight into the complex cortical interactions between the vestibular system and other sensory systems. Among the most notable findings, it was shown that the central vestibular system exhibits a spontaneous visual-vestibular activation-deactivation pattern in patients with an acute peripheral vestibular disorder (such as vestibular neuritis). This pathological pattern was similar to that described in healthy volunteers during unilateral vestibular stimulation. In the acute stage of vestibular neuritis, the regional cerebral metabolic rate glucose (rCMRglc) increases in the multisensory vestibular cortical and subcortical areas, while decreasing in the visual and somatosensory cortex areas [Bense et al., 2004]. Although we can now begin to attribute particular patterns of cerebral activation and deactivation to the particular functional deficits in distinct peripheral vestibular disorders, the complex puzzle of the various multisensory and sensorimotor functions of the phylogenetically ancient vestibular system is still imperfectly understood. The current project will concentrate on the differential effects of acute ischemic cortical lesions with vestibular signs on multi-modal sensory interactions. Particular emphasis will be placed on functional imaging studies of visual-vestibular interactions (e.g., in patients with lesions within the peripheral or central vestibular system, the visual and somatosensory systems).

References:

- Bense S, Bartenstein P, Lochmann M, et al. Metabolic changes in vestibular and visual cortices in acute vestibular neuritis. Ann Neurol 2004; 56: 624-630.
- Dieterich M, Brandt T. Functional imaging of peripheral and central vestibular disorders. Brain 2008; 131: 2538-52.



Ludwig-Maximilians-Universität München

Dr. Veronica Egger

Division of Neurobiology

http://neuro.bio.lmu.de/research_groups/res-egger_v/index.html

Contact information on page 121

Sensory processing in the olfactory bulb

Advanced Professional Degrees

1999 PhD, Max-Planck-Institute for Medical Research Heidelberg, Germany

1996 Diploma in Physics, Technical University Munich, Germany

Awards and Professional Affiliations

- 2011 Independent BMBF Group leader "Function of reciprocal synapses"
- 2010 Member of the LMU Center of Advanced Studies (CAS)
- 2001 Schloessman Award "Optical Methods in Modern Biology"

Publications

- Abraham N.M., Egger V., Shimshek D.R., Renden R., Fukunaga I., Sprengel R., Seeburg P.H., Klugmann M., Margrie T.W., Schaefer A.T. & Kuner T. (2010) *Synaptic inhibition in the olfactory bulb accelerates odor discrimination in mice.* Neuron 65, 399-411.
- Egger V. *Synaptic spikes in olfactory bulb granule cells cause long-lasting depolarization and calcium entry. (2008)* Eur. J. Neurosci. 27, 2066-2075.
- Egger V., Svoboda K. & Mainen Z.F. *Dendrodendritic synaptic signaling in olfactory bulb granule cells: Local spine boost and global low-threshold spike.* J. Neurosci. 25, 3521-3530 (2005)
- Egger V., Feldmeyer D. & Sakmann B. (1999) *Coincidence detection and changes in synaptic efficacy in pairs of spiny layer 4 neurons of rat barrel cortex.* Nature Neurosci. 2, 1098-1105 (1999)

Lab members

Mahua Chatterjee, Wolfgang Bywalez, Michael Mörschel, Hortenzia Jacobi

While odours appear to be rather simple sensory stimuli, it is, as of yet, unknown how the olfactory code operates: how is an olfactory image synthesized from the structural groups of the odour molecule that are recognized by the odorant receptors?

Our lab is interested in the microcircuitry of the olfactory bulb that processes olfactory sensory information, in particular the role of granule cells. Granule cells are axonless local inhibitory interneurons that represent the largest fraction of the neuronal population of the olfactory bulb and interact exclusively with mitral and tufted cells via dendrodendritic reciprocal synapses.

Methods:

We use two-photon laser scan microscopy in conjunction with whole-cell patch clamp recordings from individual neurons in acute brain slices to study calcium signals and correlated electrical activity in response to sensory-like input from mitral cells. These techniques allow us to optically detect synaptic activity at the level of individual synapses, that are located in large granule cell spines. To be able to investigate release from the reciprocal synapse, we are currently establishing two-photon uncaging of glutamate.

Main current projects:

- Reciprocal action between granule cells and mitral cells: Role of TRPC channels
- Long-term plasticity at the mitral cell – granule cell synapse
- Role of newborn interneurons
- Conditions for release from the granule cell spine

Ludwig-Maximilians-Universität München

Dr. Felix Felmy

Department Biology II, Division of Neurobiology

Contact information on page 121

Cellular physiology of auditory brainstem circuits

Awards and Professional Affiliations

- Otto-Hahn-Medal of the Max-Planck-Society, 2004

Publications

- Porres CP, Meyer EM, Grothe B, Felmy F (2011) *NMDA Currents Modulate the Synaptic Input-Output Functions of Neurons in the Dorsal Nucleus of the Lateral Lemniscus in Mongolian Gerbils.* J Neurosci 31:4511-4523.
- Couchman K, Grothe B, Felmy F (2010) *Medial superior olivary neurons receive surprisingly few excitatory and inhibitory inputs with balanced strength and short-term dynamics.* J Neurosci 30:17111-17121.
- Rautenberg PL, Grothe B, Felmy F (2009) *Quantification of the three-dimensional morphology of coincidence detector neurons n the medial superior olive of gerbils during late postnatal development.* J Comp Neurol 517:385-396.

Lab members

Julian Ammer, Christina Berger, Christian Porres, Lina Yassin

Sounds arriving at the ear contain only information about intensity and frequency, yet our auditory system enables us to build an auditory environment that contains features from detected sound source localizations up to complex speech recognition.

To achieve such a representation of auditory space our auditory system is specialized in extracting all possible features of incoming sounds and computing their correlations for example between left and right ear. These computational features dominate the information processing in sub-cortical circuits starting already in the cochlear and continue throughout the auditory brainstem circuits up to the midbrain. To achieve such computational tasks, neurons that form auditory brainstem circuits have specialized in many ways. To quantitatively understand these morphological and functional specializations will be key to understand how these circuits process sound information.

Our focus is herby on cellular specializations that allow for the exquisite temporal precision that is maintained even at high firing rates of many neurons in the auditory brainstem. Common features of these neurons are for example a very low input resistance to increase the speed of postsynaptic integration or the presence of large synapses that allow synaptic information transfer with little temporal jitter. Using in vitro patch-clamp recordings combined with imaging and light activation techniques we aim to quantitatively understand the strength and time course of synaptic transmission and of postsynaptic integration mechanisms shaped by voltage gated ion channels in auditory brainstem circuits.

Ludwig-Maximilians-Universität München

Dr. Kathrin Finke

General and Experimental Psychology
Neuro-Cognitive Psychology
http://www.psy.lmu.de/exp/people/ma/finke/index.html
Contact information on page 121

Assessment and modification of attentional functions and dysfunctions

Advanced Professional Degrees
- Dr. phil., in Psychology, LMU, Neuropsychology / Max Planck Institute of Psychiatry, Munich
- PD, Venia legendi in Psychology, LMU Munich
- Akademische Oberrätin, LMU Munich, General and Experimental Psychology / Neuro-Cognitive Psychology

Awards and Professional Affiliations
- Max-Planck-Institute of Psychiatry, Munich, Postdoc Stipend
- Assistant Prof., Catholic University Eichstätt/Ingolstadt
- Assistant Prof., LMU Munich, General and Experimental Psychology / Neuro-Cognitive Psychology

Publications

- Finke K, Schwarzkopf W, Müller U, Frodl F, Müller HJ, Schneider WX, Engel RR, Riedel M, Möller HJ, Hennig-Fast F (2011). ***Disentangling the adult attention-deficit hyperactivity disorder endophenotype: parametric measurement of attention.*** J Abnorm Psychol (in press).
- Bublak P, Redel P, Sorg C, Kurz A, Förstl H, Müller HJ, Schneider WX, Finke K (2011). ***Staged decline of visual processing capacity in mild cognitive impairment and Alzheimer's disease.*** Neurobiol Aging 32:1219-30.
- Finke K, Bublak P, Dose M, Müller HJ, Schneider WX (2006). ***Parameter-based assessment of spatial and non-spatial attentional deficits in Huntington's disease.*** Brain 129: 1137–51.

Lab members
Petra Redel, Johanna Funk, Wolfgang Schwarzkopf, Iris Wiegand, Ingo Pals

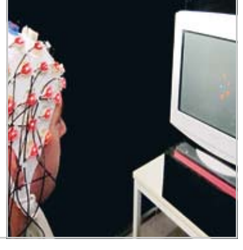
Visual attention enables us to select a limited amount of relevant objects from our environment in order to effectively control behaviour. In our research group, we assess attention by psychophysical experiments, which are analyzed using a mathematically formalized theory.

We describe the attentional functions of a given participant by independent, quantifiable parameters: the speed of visual information uptake and the capacity of visual short-term memory are relevant for fast and parallel uptake of information in a given instant. Selection parameters describe how effectively we can filter specific information on the basis of e.g. colour or location and ignore other, irrelevant information.

Some of these functions are prone to changes across the lifespan. One line of our research focuses on the characterisation of the relative decline of some attentional functions and the relative stability of others in healthy elderly (such as the participant shown in the picture). Having established "normal" attentional parameters, we can use these sensitive parameters for the identification of impairments induced by pathological neural processes. We have shown e.g. a systematic decline of attention in early Alzheimer's disease and even in Mild Cognitive Impairment, a high-risk stage for the development of this disease. Furthermore, we showed that attentional parameters differentiate normal participants from patients with attention-deficit-hyperactivity disorder (ADHD).

In these groups of interest, we also analyse, how the attentional parameters and their changes are related to genetics and to underlying brain structures and activity patterns. We have identified correlations to genetic abnormalities and to metabolic activity (Positron Emission Tomography, PET) in neurodegenerative diseases. Similarly, in ADHD patients, we aim at characterizing their attentional deficits and identifying anatomical deviations in critical brain regions by magnetic resonance imaging (MRI). Using electroencephalography (EEG), we look for specific electrophysiological correlates which reflect the different attentional parameters and EEG-biomarkers of age-related changes.

Recently, we have started to assess whether and how the attentional parameters might be modifiable by changes of the general arousal state of the brain, using e.g. neuropharmacological and electrical stimulation. The aim is to analyze the degree of cognitive plasticity of these attentional functions in healthy and disordered brain systems.



Max Planck Institute of Ornithology

Prof. Dr. Manfred Gahr

http://www.orn.mpg.de/2525/Abteilung_Gahr

Contact information on page 121

Mechanisms of vocal learning and its sex-specific implementation

Advanced Professional Degrees
- Director at Max Planck Institute for Ornithology

Awards and Professional Affiliations
- Scientific member of the Max Planck Society

Publications
- Gahr, M.: ***Sexual Differentiation of the Vocal Control System of Birds.*** Adv Genet., 59: 67-105 (2007).
- Hartog, T. E., Dittrich, F., Pieneman, A. W., Jansen, R. F., Frankl-Vilches, C., Lessmann, V., Lilliehook, C., Goldman, S. A., and Gahr, M.: ***Brain-Derived Neurotrophic Factor Signaling in the HVC Is Required for Testosterone-Induced Song of Female Canaries.*** Journal of Neuroscience 29: 15511-15519 (2009)
- Beckers, G.J.L. and Gahr, M.: ***Neural processing of short-term recurrence in songbird vocal communication.*** PLoS One 5, e11129 (2010) doi:10.1371/journal.pone.0011129

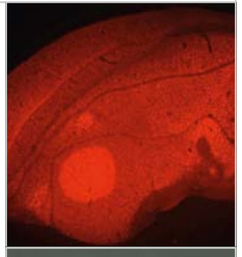
Lab members
Andries ter Maat, Falk Dittrich, Carolina Frankl-Vilches, Wolfgang Goymann, Gabriel Beckers, Moritz Hertel, Albertine Leitao, Vincent van Meir

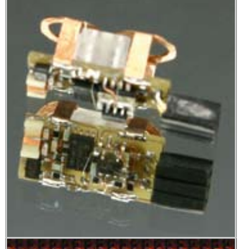
In most bird species, male singing behaviour functions for direct or indirect competition for females, and female mate choice involve vocal performances of the males. In songbirds, songs consist of genetically determined and learned components. Further, learning is changing female preferences for male songs. Thus, learning is crucial for both, the production of sexual signals and the response to sexual signals, i.e. learning is central for vocalization-based sexual selection in songbirds. The acquisition of auditory memories, the transformation of auditory memories into, and the use of motor memories is influenced by the physiological conditions and/or the socio-sexual experience of an individual. This suggests that vocalization-based sexual selection in songbirds is anchored on the life-history of males and females.

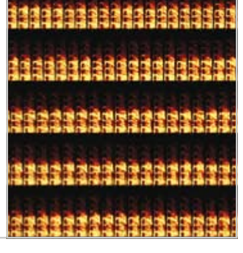
In order to produce learned sounds, birds need a “songbird” genetic background and sex steroids (androgens and estrogens) to develop the neural vocal control system into a male or female configuration, which differs between species. Song production in adulthood is sensitive to sex steroid hormones (androgens and estrogens) and other endocrine systems (e.g. melatonin) that signal environmental changes (ecological and socio-sexual) to the vocal control.

The anatomical and functional distinctness of the vocal system of songbirds as well as the large data base on natural behaviour of songbirds makes the vocal system very attractive to study the genetic and environmental causes of neural sex differences and its consequences for sexual behavior (sex specific functions). The projects are multidisciplinary and integrate works on the level of behavior, of endocrinology, of neuroanatomy, of gene-expression, and of electro-physiology in constrained, semi-natural, and natural conditions.

Projects:
- The molecular mechanisms that determine the differentiation of the song control system
- Sex hormones and cellular mechanisms of song learning
- Hormone-dependent development and importance of gender-specific brain structures
- Electrophysiological studies of hormone dependent song learning and production
- Song development under semi-natural conditions
- Evolutionary and environmental physiology







Ludwig-Maximilians-Universität München and Helmholtz Center Munich

Prof. Dr. Magdalena Götz
LMU – Physiological Genomics
Helmholtz Center Munich, Institute Stem Cell Research
http://www.genom.physiol.med.uni-muenchen.de/index.html & see below
http://www.helmholtz-muenchen.de/en/isf/members/index.html
Contact information on page 121

Neurogenesis in the developing and adult brain; neuronal repair after brain injury

Advanced Professional Degrees

2001	Habilitation in Zoology
2004	Director Institute of Stem Cell Research
2004	Full Professor for Physiological Genomics

Awards and Professional Affiliations
- Gottfried-Wilhelm Leibniz Award 2007
- Leopoldina Member 2008
- Breuer Price 2008

Publications

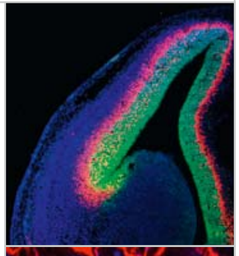
- Ninkovic J., Pinto L., Petricca S., Sun J., Rieger M.A., Schroeder T., Cvekl A., Favor J. and Götz M. (2010) *The transcription factor Pax6 regulates survival of dopaminergic olfactory bulb neurons via crystallin* A. Neuron 68, 682-694.
- Beckervordersandforth R., Tripathi P., Ninkovic J., et al. and Götz M. (2010) *In vivo fate mapping and expression analysis reveals unique molecular hallmarks of prospectively isolated adult neural stem cells.* Cell Stem Cell 7, 744-58. highlighted by Faculty of 1000
- Robel, S., Berninger, B. and Götz M. (2011) *The stem cell potential from glia – lessons from reactive gliosis.* Nature Reviews Neuroscience 12, 88-104.

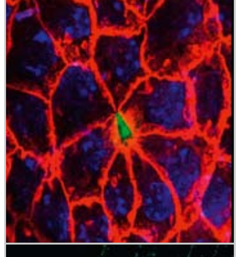
Lab members
Beckervordersandforth, Cappello, Dimou, Fischer, Gascon, Haupt, Heinrich, Johansson, Ninkovic, Sirko, Barbosa, Bardehle, Behrendt, Deshpande, Lerch, Murenu, Petricca, Petrone, Pilz, Simon, Stahl, Walcher

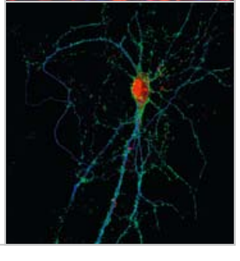
Our research aims to elucidate the key mechanisms of neurogenesis in the developing and adult brain. In contrast to organs such as the skin, the small intestine or the hematopoietic system, most cells in the adult mammalian nervous system are permanently postmitotic, such as the neurons and the oligodendrocytes, and are not turned over nor regenerated once they die. Neurogenesis persists only in very few regions of the adult mammalian forebrain, and neurons degenerated after acute or chronic injury are not replaced in the adult mammalian brain. To overcome this, we study neurogenesis when and where it works with the aim to reactivate these mechanisms and re-instruct neurogenesis after brain injury.

Our key questions are:
- What are the intrinsic determinants of neurogenesis and how can they be re-activated again in the adult brain to reconstitue neurons in adult brains?
- What are the intrinsic and extrinsic differences between radial glial cells endowed with stem cell properties and the majority of ependymal cells and astroglial cells, the closest relatives of radial glia, in the remainder of the brain?
- Why do most astrocytes in the adult mammalian brain fail to generate neurons after injury in vivo?
- What are the key mechanisms specifying neuronal subtypes?

We tackle these questions at three levels: during development, at early postnatal stages when neurogenesis comes to an end and gliogenesis peaks in the mammalian forebrain, and in the adult brain, where neurogenesis is restricted to two specific regions, the subependymal zone of the lateral ventricle and the dentate gyrus of the hippocampus. In order to better understand the physiology after injury and the mechanisms of neurogenesis, we implement a broad range of genetic, genomic, cell biological, molecular and physiological techniques.







Max Planck Institute of Neurobiology

Dr. Oliver Griesbeck

http://www.neuro.mpg.de/24427/griesbeck

Contact information on page 121

Probing cells and tissues with fluorescent proteins

Advanced Professional Degrees
- PhD Awarded July 3, 1997
- Habilitation Awarded June 3, 2009

Awards and Professional Affiliations
- HFSP Young Investigator Award 2007

Publications

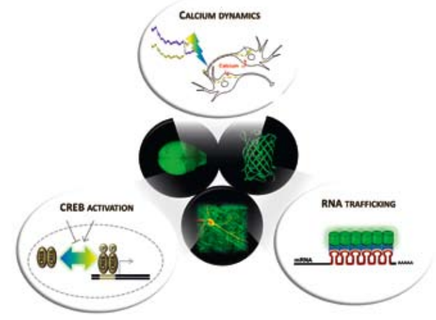
- Q.-T. Nguyen, L. F. Schroeder, M. Mank , A. Muller, P. W. Taylor, O. Griesbeck, D. Kleinfeld (2010). *An in vivo biosensor for neurotransmitter release and exogenous receptor activity.* Nature Neuroscience 13: 127-32.
- M.W. Friedrich, G. Aramuni, M Mank, J. Mackinnon, O. Griesbeck (2010). *Imaging CREB activation in living cells.* J. Biol. Chem. 285:23285-95.
- M. Mank, A. Ferrao Santos, S. Direnberger, T. Mrsic-Flögel, S. Hofer, V. Stein, C. Levelt, D.F. Reiff, T. Hendl, A. Borst, T. Bonhoeffer, M.Hübener, O. Griesbeck (2008). *A genetically encoded calcium indicator for chronic in vivo two photon imaging.* Nature Methods 5: 805-811.

Lab members
Jonathan MacKinnon, Gayane Aramuni, Stefan Direnberger, Anja Schulze-Schenke, Thomas Thestrup, Martina Schifferer, Julia Litzlbauer, Anselm Geiger, Birgit Kunkel, David Ng, Michael Rehman

One of the greatest challenges in neuroscience has been to monitor activity and biochemistry in populations of identified neurons in vivo and to relate their activity patterns to behaviour. Previous work on new microscopy techniques has moved the field considerably further in that direction. In particular the combination of modern imaging technology and genetic labeling methods heralds a bright future for neuronal circuit analysis. Our work complements these efforts on the “indicator side” by providing probes for key events crucial for an understanding of neuronal function and plasticity and aims at overcoming long-standing limitations in the ability to monitor neuronal activity and biochemistry in intact tissues.

The fluorophore we use is the Green Fluorescent Protein (GFP) and its related variants from other organisms.

Our preferred approach is the design and engineering of genetically encoded biosensors, from the cuvette via imaging of single cells in culture to the generation of whole transgenic indicator organisms which harbor the biosensor of choice in the cells and tissues that one wishes to study. This opens up new avenues for the study of structure-function relationships of intact neuronal circuits.



Ludwig-Maximilians-Universität München

Prof. Dr. Benedikt Grothe
Division of Neurobiology, Department Biology II
http://neuro.bio.lmu.de/
Contact information on page 121

Auditory Processing
Structure and Function of Neuronal Circuits
Spatial Orientation

Advanced Professional Degrees

1996	Dr.rer.nat.habil (LMU)
1991	Dr.rer.nat. (LMU Munich)
1988	Diploma in Biology (LMU Munich)

Awards and Professional Affiliations
- Chair of Neurobiology (LMU Munich) since 2003
- Head of Graduate School of Systemic Neurosciences (LMU Munich) since 2007
- Dean, Faculty of Biology (LMU Munich) 2009-2011

Publications

- Grothe B, Pecka M, McAlpine D (2010) *Mechanisms of sound localization in mammals.* Physiol Rev 90: 983-1012
- Magnusson AK, Park TJ, Pecka M, Grothe B, Koch U (2008) *Retrograde GABA signaling adjusts sound localization by balancing excitation and inhibition in the brainstem.* Neuron 59:125–137
- Brand A, Behrend O, Marquardt T, McAlpine D, Grothe B (2002) *Precise inhibition is essential for microsecond interaural time difference coding.* Nature 417: 543-547

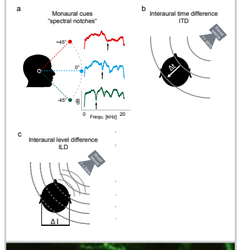
Lab members
Felix Felmy, Todd Jennings, Alexander Kaiser, Lars Kunz, Ursula Koch, Mike Myoga, Michael Pecka, Susanne Radtke-Schuller, Ida Siveke, Lutz Wiegrebe, Mario Wullimann

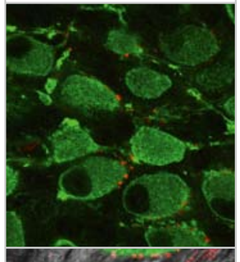
Auditory neurons concerned with temporal processing are the most precise time analyzing units in the mammalian brain. Some auditory neurons exhibit time resolutions of only a few µs. We are interested in the neuronal mechanisms of temporal auditory processing and their evolution in mammals. In particular, our studies are concerned with the role of neural inhibition in temporal processing. Inhibition has been more or less neglected as a possible player in neuronal filtering of temporal cues. However, recent results from several groups indicate a link of age related hearing deficits in temporal processing, age related down-regulation of the inhibitory transmitters GABA and glycine, and the role of inhibition in temporal filtering as found in the bat and gerbil auditory brainstem. The analysis of temporal cues of sounds is important for the two basic tasks of sound localization and sound recognition.

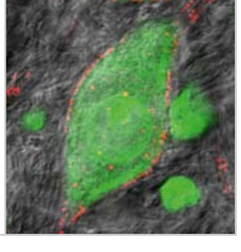
Approaches and Techniques

We use a comparative approach investigating animals living in different ‚auditory worlds' (high frequency specialists like bats; models for ancient mammalian hearing like short tailed opossums; low frequency specialists like gerbils; mice and rats as "standard" models for hearing in modern placental mammals. Additionally, we are using transgenic mice to study developmental mechanisms.

Teniques include
- extracellular recording single unit techniques in vivo combined with acoustic stimulation (dichotic and free-field)
- manipulation of early auditory experience (combined with anatomical and/or physiological investigations)
- multi-electrode recordings
- patch-clamp recording techniques in vitro (acute brain slices and in vivo)
- immunohistochemistry (confocal microsopy)
- classical anatomical techniques (e.g. tracing studies)
- transgenic mice (collaboration with Wolfgang Wurst, HelmholtzZentrum München)
- modeling of spatial and temporal auditory processing
- human and animal psychoacoustics
- behavoral approaches







Ludwig-Maximilians-Universität München

Prof. Dr. Dr. h.c. Christian Haass
Adolf Butenandt Institute, Biochemistry
http://www.biochemie.abi.med.lmu.de
Contact information on page 122

Cellular mechanisms of neurodegeneration

Advanced Professional Degrees
- Assistant Professor of Neurology/Harvard Med. School
- Professor (C3) of Molecular Biology/Heidelberg
- Professor (C4) of Biochemistry/LMU

Awards and Professional Affiliations
- Gottfried Wilhelm Leibniz-Award of the Deutsche Forschungsgemeinschaft
- Potamkin Award of the American Academy of Neurology MetLife Foundation Award for Medical Research

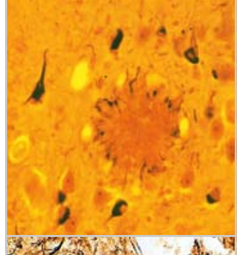
Publications
- Steiner et al., Nat. Cell Biololgy, 2, 848, 2000
- Edbauer et al., Nat. Cell Biology, 5, 486, 2003
- Willem et al., Science, 314, 646, 2006

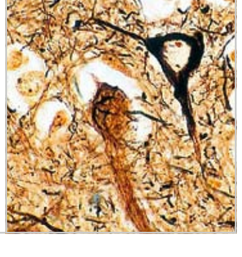
Lab members
Anja Capell, Bettina Schmid, Harald Steiner, Michael Willem, Sven Lammich, Regina Fluhrer, Akio Fukumori, Richard Page, Dorothee Dormann, Domink Paquet, Frauke van Bebber, Matthias Voss, Daniel Fleck, Eva Bentmann, Nicole Exner, Laura Hasenkamp, Barbara Solchenberger, Katrin Strecker

In my laboratory we focus on the generation of Alzheimer's disease (AD) Amyloid ß-peptide (Aß), which accumulates during aging in our brains and becomes deposited as insoluble aggregates called amyloid plaques.

Back in 1992 I made the very surprising observation that Aß is produced constantly throughout life. These observations changed the concept of AD pathogenesis, and it is now clear that AD constitutes a major part of normal aging. Since Aß has a central role in AD pathology, we investigate the cellular mechanisms behind its generation. Aß is generated by proteolytic processing involving two types of proteases, ß-, and γ-secretase. Our work on γ-secretase focuses on its identification, function, assembly, and reconstitution. It turned out that γ-secretase cleaves its substrates multiple times within the membrane.

Moreover, by identifying the active site motifs of the γ-secretase activity in presenilins, we were able to define a completely novel class of aspartyl proteases of the GxGD type. By using C. elegans and zebrafish as a model system in combination with biochemical and cell biological technologies, we could demonstrate that presenilins are directly involved in the Notch signaling pathway. However, PS alone could not perform proteolysis and we could demonstrate that a complex composed of four different proteins is required to reconstitute γ-secretase activity in yeast. Currently we are investigating the assembly of the γ-secretase complex and the interaction sites of the individual components. In parallel we are studying the function and regulation of ß-secretase (BACE1). Here we are specifically interested in regulative mechanisms, which may be responsible for the increased ß-secretase activity during aging. First evidence suggests a posttranscriptional mechanism via the 5' untranslated region of the ß-secretase mRNA. The function of ß-secretase and its homologues is investigated in zebrafish and mice. We could demonstrate that ß-secretase is required for myelination via neuregulin signaling. More recently we also started to investigate the cellular mechanisms of frontotemporal lobar dementia with ubiquitin positive deposits as well as amyotrophic lateral sclerosis. Here we are again interested how genetically inherited mutations in the genes encoding for example TDP-43, FUS and Progranulin cause neurodegeneration.





Ludwig-Maximilians-Universität München

Prof. Dr. Andreas V.M. Herz
Department Biology II
Bernstein Center Munich
http://neuro.bio.lmu.de/
Contact information on page 122

Computational neuroscience: Cellular biophysics, network dynamics, and neural information processing

Advanced Professional Degrees

2007 – present	Chair for Computational Neuroscience, LMU München
1996 – 2008	Chair for Theoretical Neuroscience, Humboldt-Universität zu Berlin
1996 – 1997	C3-Professor for Theoretical Biophysics, Bremen University

Awards and Professional Affiliations
- Speaker, National Bernstein Network for Computational Neuroscience
- Coordinator, German Node, International Neuroinformatics Coordinating Facility

Publications

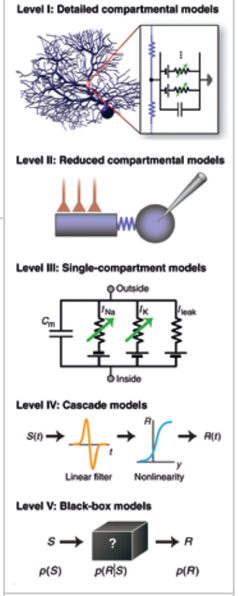
- Herz AVM, Gollisch T, Machens CK, Jaeger D (2006) ***Modeling single-neuron dynamics and computations: a balance of detail and abstraction.*** Science 314:80-85.
- Gollisch T, Herz AVM (2005) ***Disentangling sub-millisecond processes within an auditory transduction chain.*** PLoS Biology 3:e8.
- Machens CK, Gollisch T, Kolesnikova O, Herz AVM (2005) ***Testing the efficiency of sensory coding with optimal stimulus ensembles.*** Neuron 47:447-456.

Lab members
Arne Hartz, Alex Loebel, Alexander Mathis, Johannes Nagele, Johannes Nehrkorn, Dinu Patirniche, Martin Stemmler

The brain is, without any doubt, one of the most complex biological systems. Thoroughly understanding its fascinating dynamics and information processing strategies remains a great challenge. The theory of non-linear dynamics, complex systems, and stochastic processes, together with methods from theoretical biophysics, computer science, and statistical physics offers a broad spectrum of concepts and techniques to answer the question of how living organisms (have learnt to) solve hard computational problems.

Vice versa, we can use the results of these investigations to further our basic concepts of "computing" and create novel paradigms that surpass the limits of traditional algorithms. This double role of Computational Neuroscience has led to major scientific advances and will have a large impact on the future development of theoretical biophysics, neuroscience, computer science and various technical application domains. Using grasshopper communication as a model system, we have addressed a whole range of biophysical and neurobiological questions: How do sensory systems integrate information over multiple time scales to solve complex pattern recognition tasks? How are external signals analyzed in real time despite the constant influx of large quantities of new sensory inputs? Is firing-rate adaptation a spurious byproduct of neural dynamics or does it serve a computational purpose? How do neural systems handle the dilemma of "insulation versus interaction" inherent to any distributed information processing? Which biophysical mechanisms allow robust computations in an animal whose temperature may fluctuate by more than ten degrees within a few minutes? What is the neural basis for time-warp invariant sequence recognition? More recently, we have started to investigate spatial navigation in rodents and learning in bees and flies and currently focus on these two topics.

We also develop novel experimental approaches, e.g., to find the most relevant set of stimuli for a given neuron or to disentangle its intrinsic processing steps. To do so, test stimuli are adapted in response to the measured neural behavior, on-line and while the neurophysiological experiment is running. From a conceptual point of view, our approach extends traditional concepts to describe neural response patterns, such as "tuning curve" or "optimal stimulus", into the information theoretic domain, and introduces concepts well known in psychology to neurophysiology, such as the notion of iso-response manifolds in stimulus space.



Examples for five levels of single-cell modeling. I: Detailed compartmental model. The dendritic tree is segmented into electrically coupled Hodgkin-Huxley–type compartments (level III). II: Two-compartment model. The dendrite receives synaptic inputs and is coupled to the soma where the neuron's response is generated. III: Hodgkin-Huxley model, the prototype of single-compartment models. The cell's inside and outside are separated by a capacitance and ionic conductances in series with batteries describing ionic reversal potentials. IV: Linear-nonlinear cascade. Stimuli S(t) are convolved with a filter and then fed through a nonlinearity to generate responses R(t), typically time-dependent firing rates. V: Black-box model. Neglecting biophysical mechanisms, conditional probabilities p(R|S) describe responses R for given stimuli S.
(Herz et al., Science 314:80-85 (2006))

Max Planck Institute of Neurobiology

Prof. Dr. Mark Hübener

http://www.neuro.mpg.de/24276/huebener

Contact information on page 122

Development, plasticity and function of the mammalian visual system

Advanced Professional Degrees
- Habilitation, Faculty of Biology, LMU
- Affiliate Professor of Zoology, LMU

Awards and Professional Affiliations
- Research Group leader "Visual System Development", Dept. of Cellular and Systems Neurobiology, MPI of Neurobiology

Publications

- Keck T, Scheuss V, Jacobsen RI, Wierenga CJ, Eysel UT, Bonhoeffer T, Hübener M (2011) *Loss of sensory input causes rapid structural changes of inhibitory neurons in adult mouse visual cortex.* Neuron 71:869-882
- Hofer SB, TD Mrsic-Flogel, T Bonhoeffer, M Hübener (2009) *Experience leaves a lasting structural trace in cortical circuits.* Nature 457:313-317
- Mrsic-Flogel TD, Hofer SB, Ohki K, Reid RC, Bonhoeffer T and Hübener M (2007): *Homeostatic regulation of eye-specific responses in visual cortex during ocular dominance plasticity.* Neuron 54: 961-972
- Hofer, SB, TD Mrsic-Flogel, T Bonhoeffer, M Hübener (2006) *Prior experience enhances plasticity in adult visual cortex,* Nature Neurosci 9:127-132

Lab members
Susanne Falkner, Alexandre Ferrão Santos, Rosa Garcia-Verdugo, Ron Jortner, Georg Keller, Anne Kreile, Marcus Leinweber, Sabine Liebscher, Frank Voss

During development, specific connections among neurons within the visual cortex as well as its in- and outputs are formed, ultimately leading to a functional network enabling fine grain analysis of the visual world. While the basic circuitry is set up early in life, the visual cortex of adult animals displays some degree of plasticity, too. We study the cellular and synaptic mechanisms underlying circuit formation and plasticity in the visual cortex during development and in adult animals. To address these questions at the functional as well as the structural level, we make use of imaging techniques, such as two-photon microscopy and intrinsic signal imaging.

In mouse visual cortex, plasticity can be readily induced by closing one eye for a few days. This intervention, termed monocular deprivation (MD), shifts the balance between the representation of the two eyes in the visual cortex, such that inputs from the deprived eye are weakened, while open eye inputs gain influence. We could recently show that the visual cortex retains a lasting memory of this experience: If an animal undergoes a second episode of MD many weeks later, the shift in eye balance is induced much faster and lasts longer than in naïve mice. Thus, the animal has learned to learn, reminding us of our own experience that exposure to an altered sensory environment, a new sensorimotor task, or a foreign language makes for easier learning of the similar information later in life.

In order to unravel the cellular mechanisms underlying this enhanced plasticity by prior experience, we studied the fine structure of neurons in the visual cortex. Repeated two-photon imaging of neurons expressing green fluorescent protein demonstrated that MD increased the number of dendritic spines, tiny protrusions that correspond to synaptic inputs. We believe that these newly formed synapses mediate the strengthening of open eye inputs seen after MD. Importantly, the added spines did not disappear after reopening of the temporary closed eye, suggesting that they might form a lasting structural trace which mediates the enhanced plasticity seen after a second MD. Indeed, a second closure of the eye did not result in the further addition of spines, despite the fact that the shift in eye representation occurred even faster than in inexperienced mice. These experiments indicate that specific structural modifications serve to store information about past experiences, thereby endowing the cortex with an improved ability to adapt to similar experiences in the future.

Max Planck Institute of Neurobiology

Dr. Ilona Grunwald Kadow
www.neuro.mpg.de
Contact information on page 122

Development and function of neural circuits in the olfactory system

Advanced Professional Degrees
- PhD Neurobiology
- Dr. rer. nat.
- Master of Biology

Awards and Professional Affiliations
- Career development award
- Otto Hahn Medal
- Emmy Noether Grant

Publications

- Hartl, M, Loschek LF, Stephan D, Siju KP, Knappmeyer C and Grunwald-Kadow, IC (2011) ***A New Prospero and microRNA-279 Pathway Restricts CO2 Receptor Neuron Formation.*** J Neurosci 2011 Nov 2;31(44):15660-73.
- Cayirlioglu P*, Grunwald Kadow I*, Zhan X, Okamura K, Gunning D, Lai EC, Zipursky SL (2008). ***Hybrid Neurons in a microRNA mutant are putative evolutionary intermediates in insect CO2 sensory systems.*** Science, 319: 1256-1260 * These authors contributed equally
- Jones WD, Cayirlioglu P, Grunwald Kadow I,.Vosshall LB (2007). ***Two chemosensory receptors together mediate carbon dioxide detection in Drosophila.*** Nature 445: 86-90
- Grunwald IC*, Korte M*, Adelmann G, Plueck A, Kullander K, Adams RH, Frotscher M, Bonhoeffer T, Klein R (2004). ***Hippocampal plasticity requires postsynaptic ephrinBs.*** Nat Neurosci 7: 33-40 * These authors contributed equally

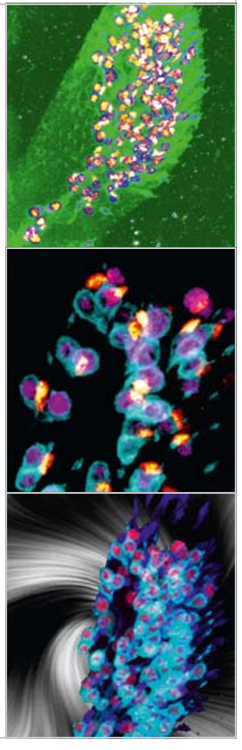
Lab members
Daniel Stephan, Marion Hartl, Juhi Sardana, Lasse Braecker, Laura Loschek, Siju Purayil, Christiane Knappmeyer, Mo Zhang, Habibe Ucpunar, Laurence Lewis, Yukiko Yamada-Ho

The sense of smell allows discrimination of a large number of odorants using precisely wired projections from neurons in the periphery expressing specific olfactory receptors to neurons in higher brain centers that process the information. The ability to recognize a particular odor and to activate the appropriate neurons in the brain is instrumental in driving important behaviors.

We are interested in the genetic program that controls the formation and function of olfactory neuronal circuits. One aim is to identify the genes that specify neuronal identity, link them to the connectivity of a neuron, and ultimately to its integration into functional nervous systems. The neural networks that control olfactory behavioral responses and other innate behaviors remain largely unknown in any animal or human. Therefore, another important goal of our research is the identification of neural processing centers and eventually single neurons that underpin different innate behaviors. Ultimately, we aim to understand how neural circuits and genetic programs have changed during evolution to give rise to nervous systems that are perfectly adapted to the specific biological niches of different species.

To this aim, we mainly use the fruitfly *Drosophila* with its rich, unmatched repertoire of genetic tools and robust innate behaviors. We combine genetics with behavioral testing, state of the art anatomy, in vivo electrophysiology, and imaging.

Different insects feed on different kinds of food, aim at attracting only mating partners of their species, and face very specific dangers in their environment. Therefore, olfactory systems of different insect species were subject to evolutionary pressure and change. The detection of CO_2 plays a specific role in the life of many insect species. The malaria vector mosquito is attracted to CO_2 and uses it to find human hosts. In contrast, *Drosophila melanogaster* flies detect CO_2 as part of the so-called stress odor, and thus are strongly repelled by it. We are addressing how genes and gene networks have changed to give rise to the olfactory system of different insects. We look at behavioral and structural divergence between species, and by using *Drosophila* genetics, we aim at finding the responsible genes that were critical for development and evolution of these differences.



Max Planck Institute of Neurobiology

Prof. Dr. Ruediger Klein, PhD

www.neuro.mpg.de

Contact information on page 122

Finding their way – Axon guidance in the spinal cord

Advanced Professional Degrees

1993 – 2001	Group Leader at the European Molecular Biology Laboratory, Heidelberg, Germany
2001 – present	Director and Scientific Member at the Max-Planck-Institute of Neurobiology, Martinsried, Head of Department of Molecular Neurobiology

Awards and Professional Affiliations

2008	Remedios Caro Almela Prize for Research in Developmental Neurobiology
2006 – present	Honorary Professor, Faculty of Biology, Ludwig-Maximilian-University of München
2005	Family-Hansen-Prize

Publications

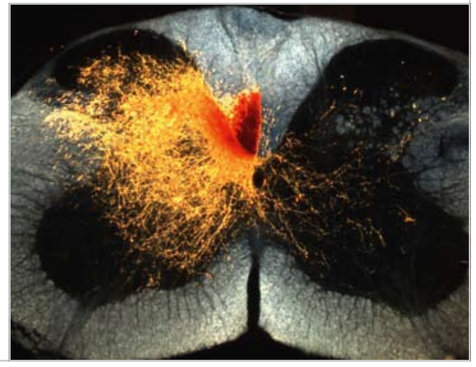
- Yamagishi S, et al. (2011). ***FLRT2 and FLRT3 act as repulsive guidance cues for Unc5-positive neurons.*** EMBO Journal, in press.
- Dudanova, I., et al. (2010). ***GDNF acts as a chemoattractant to support ephrinA-induced repulsion of limb motor axons.*** Current Biology 20: 2150-2156.
- Filosa, A., et al. (2009). ***Neuron-glia communication via EphA4/ephrinA3 modulates LTP through glial glutamate transport.*** Nature Neuroscience 10:1285-92.

Lab members

Aarathi Balijepalli, Graziana Gatto, Falko Hampel, Pontus Klein, Jorg Körner, Hakan Kücükdereli, Daniel Nagel, Andreas Schaupp, Daniel del Toro, Irina Dudanova, Tom Gaitanos, Jingyi Gong, Christine Hassler, Archana Mishra, Sonia Paixao, Maria Sakkou, Senthil Thyagarajan, Louise Gaitanos, Pilar Alcala, Gönül Seyit, Jana Lindner, Kristin Reuter

Our neurons are cells highly specialized in processing and transmitting information. To establish networks of communication, they extend long, fine processes – also called axons – which establish physical contact with their targets, such as other neurons or muscle cells. Finding the correct target is essential for the development of neuronal networks – but how do neurons achieve that? This is not only the founding question of the axon guidance field, but also a major research topic of our group.

We focus on the Eph/ephrin signal transduction pathway, a receptor-ligand system essential for correct guidance of neuronal processes. Ephs and ephrins sit in the plasma membrane of axons and their target cells, respectively. If an axon comes along and contacts a potential target, Ephs bind to ephrins; this initiates a signal transduction cascade, followed by negative, repulsive cellular response: Eph-containing axons turn away from ephrin-expressing cells, and continue searching for another, potentially correct target. Now, what happens if the Eph/ephrin system is not functioning properly? Let's take a look at the spinal cord, a part of the nervous system we are especially interested in. There, two neuronal circuits control the locomotor, or walking behavior of the mouse, our favorite model system. During development, these two circuits are kept separate by the Eph/ephrin system, so they can finally function independently from each other and control the movement of the left and right hindleg, respectively. This is why a healthy mouse walks by moving its hindlegs in an alternate manner: First the left hindleg, then the right, then again the left, and so on. However, if the Eph/ephrin systen is not functioning properly, these circuits contact each other by mistake, and lose their autonomy. Can you guess what this means for the walking behavior of the mouse? Indeed, an Eph or ephrin deficient animal moves both hindlegs in a synchronous manner, thereby hopping like a little rabbit. This is a beautiful example for the fundamental role the Eph/ephrin signaling system plays during development of neuronal networks.



Technical University Munich

Prof. Dr. Arthur Konnerth
http://www.ifn.me.tum.de/new/
Contact information on page 122

Cortical circuits; Cerebellar function; Dendritic signaling; Neurodegeneration; In vivo 2P-Imaging

Advanced Professional Degrees

2005 – present	Full Professor, Endowed Friedrich-Schiedel-Chair of Neuroscience, TU Munich
1983	MD Dissertation, MPI Psychiatrie and LMU
1975 – 1981	Undergrad. Medicine, LMU

Awards and Professional Affiliations

- Gottfried Wilhelm Leibniz Prize
- Max Planck Prize
- Carl-von-Linde Fellow of the Institute for Advanced Study TUM

Publications

- Chen X, Leischner U, Rochefort N, Nelken I and Konnerth A (2011) *Functional mapping of single spines in cortical neurons in vivo.* NATURE 475, 501-505.
- Jia H, Rochefort N, Chen X and Konnerth A (2010) *Dendritic organization of sensory input to cortical neurons in vivo.* NATURE 464, 1307-1312.
- Busche MA, Eichhoff G, Adelsberger H, Abramowski D, Wiederhold KH, Haass C, Staufenbiel M, Konnerth A and Garaschuk O (2008) *Clusters of Hyperactive Neurons Near Amyloid Plaques in a Mouse Model of Alzheimer's Disease.* SCIENCE 321, 1686-1689.

Lab members

Helmuth Adelsberger, Nathalie Rochefort, Jana Hartmann, Jia Hongbo, Xiaowei Chen, Zsuzsanna Varga, Albrecht Stroh, Valerie Bonfardin, Dan Hill, Christine Grienberger, Elvira Shariffulina, Ulrich Leischner, Rosa Maria Karl

Cellular and molecular mechanisms of cortical circuit function

We use in vivo two-photon calcium imaging in different areas of the mouse cortex (visual, auditory, sensorymotor) combined with targeted patch-clamp recordings and optogenetics to study electrical signaling and plasticity of specific types of neurons in behaviorally-defined conditions. Molecular mechanisms of cortical circuit function are determined by analyzing various genetically-modified mouse lines.

Cerebellar function and plasticity

We are interested in synaptic mechanisms, including the roles of mGlu receptors, TRPC channels, calcium signaling as well as in cerebellar sensory integration. We use various mutant mouse lines, in which specific types of cerebellar neurons (e.g. Purkinje cells) are genetically modified.

Dendritic signaling and integration in vivo

Our major aim is the visualization and mapping of sensory-evoked signals on the level of individual synaptic inputs in defined neurons of the mouse cortex. We investigate the dendritic mechanisms that determine the neurons' output signals.

In vivo neurophysiology of Alzheimer's disease

We focus on the impairments in synaptic signaling of cortical and hippocampal neurons in mouse models of Alzheimer's disease. Of special interest are the molecular and cellular mechanisms underlying both neuronal silencing and neuronal hyperactivity observed in the diseased brain.

Development of imaging technology

We develop and implement two-photon imaging devices with a high spatial and temporal resolution for the functional analysis of networks, cells and subcelullar compartments in vitro and in vivo. Recent developments include the implementation of a new two-photon imaging variant, named LOTOS (low power temporal oversampling), that is highly sensitive and minimizes phototoxic damage, allowing functional imaging of individual spines in vivo.

Ludwig-Maximilians-Universität München

Prof. Dr. Dr. Christian Leibold
LMU Biocenter Martinsried
www.neuro.bio.lmu.de
Contact information on page 123

Models of learning and memory in recurrent neuronal networks

Advanced Professional Degrees
- Dr. rer. nat. (theoretical physics, TU Munich)
- Diploma in Physics (TU Munich)

Awards and Professional Affiliations
- Editor-in-Chief Network: Computation in Neural Systems
- Coordinator Bernstein Focus Neural Basis of Learning

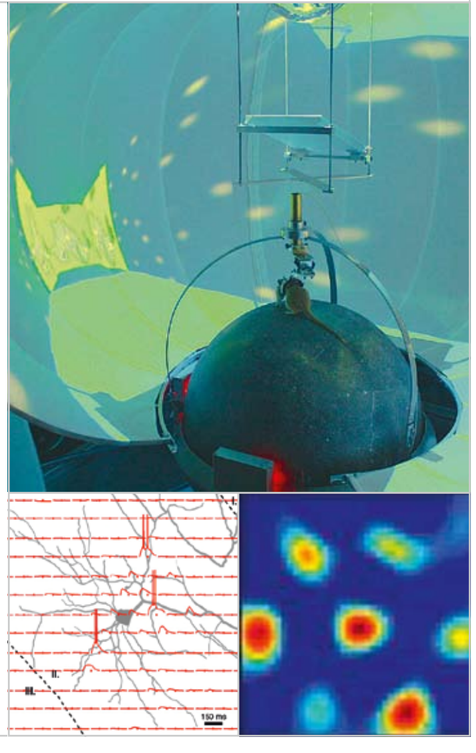
Publications
- Maier N, Tejero-Cantero A, Dorrn A, Winterer J, Beed P, Morris G, Kempter R, Poulet JF, Leibold C, Schmitz D (2011) ***Coherent phasic excitation during hippocampal ripples*** Neuron 72:137-152
- Lüling H, Siveke I, Grothe B, Leibold C (2011) ***Frequency-Invariant Representation of Interaural Time Differences in Mammals*** PLoS Comput Biol 7: e1002013

Lab members
Simon Lehnert, Li Lu, Hannes Lüling, Axel Kammerer, Sven Schörnich, Alvaro Tejero Cantero, Kay Thurley, Chun-Wei Yuan

Recurrent neuronal networks are thought to serve as a physical basis for learning and memory. For example, the recurrent networks in the hippocampus exhibit the replay of stored sequences of previously experienced events. This replay is accompanied with field potential-phenomenon of sharp wave-ripple complexes. We study the mechanistic basis of this phenomenon on the cellular and population level.

This includes the development of data analysis methods for electro-physiological recordings and for local connectivity measurements in brain slices. We also develop a behavioral virtual reality setup for rodents that allows recordings of memory-related brain activity in-vivo. The goal of the research group is to use dynamical, structural, and functional constraints to build computational models of recurrent networks and in particular to gain understanding of the computations that are performed by the recurrent connections.

Current projects include: Analysis of postsynaptic currents in an in-vitro model of sharp-wave ripples and their relation to models of replay and preplay of hippocampal memory sequences; Modelling readout of spatial representations in the hippocampal formation; Formation of grid fields in the entorhinal cortex; Assessment of the computational performance of recurrent networks.



Ludwig-Maximilians-Universität München

Prof. Dr. Hannes Leitgeb

Faculty of Philosophy, Philosophy of Science and Study of Religion
http://www.philosophie.uni-muenchen.de/lehreinheiten/logik_sprachphil/

Contact information on page 123

Mathematical Philosophy: Logical and Mathematical Methods in Philosophy and Cognitive Science

Advanced Professional Degrees
- Ph.D., Philosophy, University of Salzburg, 02/07/01
- Ph.D., Mathematics, University of Salzburg, 09/07/98
- M.Sc., Mathematics, University of Salzburg, 20/02/97

Awards and Professional Affiliations
- Chair in Logic and Philosophy of Language
- Alexander von Humboldt Professorship, Alexander von Humboldt Foundation, 2010.
- Friedrich Wilhelm Bessel Research Award, Alexander von Humboldt Foundation, 2007.
- Philip Leverhulme Prize, Leverhulme Trust, 2007.

Publications
- ***"An Objective Justification of Bayesianism I: Measuring Inaccuracy"*** (with R. Pettigrew), Philosophy of Science 77/2 (2010), 201-235.
- ***Inference on the Low Level. An Investigation into Deduction, Nonmonotonic Reasoning, and the Philosophy of Cognition, Dordrecht:*** Kluwer, 2004, 384 pp.
- ***"Nonmonotonic Reasoning by Inhibition Nets"***, Artificial Intelligence 128[1-2] (2001), 161-201.

Lab members
For members of the Munich Center for Mathematical Philosophy, see http://www.philosophie.uni-muenchen.de/lehreinheiten/logik_sprachphil/personen/index.html

"Mathematical philosophy" means the application of logical and mathematical methods to various questions and problems in philosophy and cognitive science. Amongst others, I use such methods in order to shed new light on
- formal theories of truth that avoid notorious semantical paradoxes
- the logic, semantics, and pragmatics of conditionals (if-then statements)
- the representation of logical inference with conditionals in artificial neural networks
- formal systems of inductive logic, belief revision, and metacognition
- justifications for the probability calculus
- structuralist foundations of mathematics.

Ludwig-Maximilians-Universität München

Prof. Dr. Hermann J. Müller

General & Experimental Psychology / Neuro-cognitivePsychology, LMU
http://www.psy.lmu.de/exp/index.html
Contact information on page 123

Mechanisms of attention in perception, cognition, and action

Advanced Professional Degrees
- Ph.D., Dipl. Psych.

Awards and Professional Affiliations
- Wilhelm Wundt Prize 2010 of the Wilhelm Wundt Society, awarded "for excellent achievements in fundamental psychological research" (2010)
- Member of the CASLMU Center for Advanced Studies (2007 –)
- LMUexcellent Research Professorship (2007 –)
- Elected "DFG Fachgutachter" (DFG Special Reviewer) for experimental and physiological psychology (1999 – 2003)

Lab members
Markus Conci, Heiner Deubel, Kathrin Finke, Thomas Geyer, Dragan Rangelov, Torsten Schubert, Zhuanghua Shi, Paul Taylor, Thomas Töllner, Agnieszka Wykowska, Michael Zehetleitner, etc.

From the vast amount of information reaching the senses at any point in time, only a small fraction becomes available for conscious report and the control of voluntary actions. Attention refers to a set of principles and mechanisms that realize this function of perceptual 'selection' in the pursuit of behavioral goals. One principle is that attention biases processing by enhancing representations that are goal-relevant, and/or suppressing representations that are irrelevant. Attention may be biased either by stimuli encountered in the environment or by our action intentions. Intentional, or `top-down´ control relies on a set of executive functions that coordinate perceptual with action systems in what is referred to as 'task set'.

Over the years, my group has made major contributions to this field. Regarding perceptual selection, we have contributed to elucidate the principles governing selection as space-, object-, and feature -based. One highlight of this work has been the clarification of the links between spatial selection and the planning of sequential motor actions, e.g., target-directed hand and eye movements. Another highlight is the theory of 'dimension weighting', which describes how encountering particular perceptual events (e.g., a particular target in a visual scene) biases the perceptual system to 'expect' similar events in the next instant of time, leading to facilitated processing of similar events or compromised processing of changed events. We have shown that these biases operate at early, preattentive levels of visuo-cortical processing (though they are top-down modulable), but influence also post-selective levels of attentional stimulus analysis and translation of stimuli into choice responses. Further, we have shown that the weight sets for performing particular tasks are buffered across task switches, and that the sets are task-component-specific, i.e., separate tasks sharing the same components share the same weight sets. On this basis, we have proposed a multiple-weighting-systemsframework, with independent weight systems operating at all levels of the cognitive hierarchy. We have shown how the weighting principle operates at the behavioral and brain levels, and we have started to develop computational accounts of its operation. One further highlight has been our work on the simultaneous performance of dual or, more generally, multiple tasks, the limitations in multi-tasking, and the executive-coordinative processes that may be optimized as a result of multi-tasking practice.

Ludwig-Maximilians-Universität München

Prof. Dr. Julian Nida-Rümelin

Former Federal State Minister for Culture and the Media
Lehrstuhl für Philosophie IV
www.philosophie.uni-muenchen.de/lehreinheiten/philosophie_4
Contact information on page 123

Advanced Professional Degrees
- Chair of Political Philosophy and Theory at the Faculty of Philosophy of the Ludwig-Maximilians-University, Munich
- Professor of Political Theory and Philosophy at the Geschwister-Scholl-Institut at the Faculty of Social Sciences, Ludwig-Maximilians-University, Munich

Awards and Professional Affiliations
- Since July 2006 Visiting Professor for Political Theory and Philosophy at the University of St. Gallen, Switzerland
- Since 2005 Chairman of the board of trustees at the Centre for Ethical Research and Teaching (Münchner Kompetenzzentrum Ethik), Ludwig-Maximilians-University, Munich
- President of the German Society of Philosophy

Publications
- ***"Über menschliche Freiheit".*** Stuttgart: Reclam (Universal-Bibliothek Nr. 18365) 2005.
- ***Reasons against naturalising epistemic reasons,*** in: A. Carsetti (Hrsg.), "Causality, Meaningful Complexity and Embodied Cognition", Spinger Verlag, 2010.
- ***"Demokratie und Wahrheit".*** C. H. Beck Verlag, München 2006.

Rational Choice Theory
What role do reasons play in decision making and which is the importance of rational choice theory for practical philosophy in general?

Metaethics
Can we conceive of a metaethical realism without controversial ontological implications?

Ethics
Research interests in animal, environmental and bioethics as well as the ethics of science and risk-management.

Political Theory and Philosophy
What are the normative assumptions of democracy and the modern theory of political authority?

Anthropological Implications of the Lifesciences
Can reasons be naturalized and is there such thing as free will?

Ludwig-Maximilians-Universität München

Prof. Dr. Heidrun Potschka

Inst. of Pharmacology, Toxicology and Pharmacy
www.pharmtox.vetmed.uni-muenchen.de/personen/ag_potschka/potschka
Contact information on page 123

Pharmacology and pathophysiology of epilepsy

Advanced Professional Degrees

2006 – present	Professor and Chair, Inst. of Pharmacology, Toxicology, and Pharmacy, Faculty of Veterinary Medicine, LMU
2004 – 2006	Juniorprofessor and Privatdozentin, Dept. of Pharmacology, Toxicology, and Pharmacy Vet. School Hannover

Awards and Professional Affiliations

2009 – present	Chair of the Basic Research Task Force of the International League against Epilepsy
2006	Falk Medical Research Trust Award (US Foundation CURE)
2005	International Award of the Michael Foundation

Publications

- Potschka H (2010) ***Targeting regulation of ABC efflux transporters in brain diseases: a novel therapeutic approach.*** Pharmacol Ther. 125:118-127.
- Schlichtiger J, Pekcec A, Bartmann H, Winter P, Fuest C, Soerensen J, Potschka H (2010) ***Celecoxib treatment restores pharmacosensitivity in a rat model of pharmacoresistant epilepsy.*** Br J Pharmacol 160:1062-1071.
- Löscher W, Potschka H (2005) ***Drug resistance in brain diseases: role of drug efflux transporters.*** Nat. Rev. Neurosci. 6:591-602.

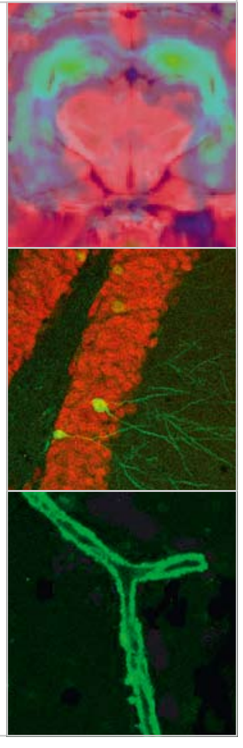
Lab members

Janine Avemary, Natalie Seeger, Christina Zellinger, Mehrnoosh Jafari Khaled Abadi, Thomas Licko, Eva-Lotta von Rüden, Vera Rußmann, Josephine Salvamoser, Christina Michler, Marion Fisch, Sieglinde Fischlein, Katharina Gabriel, Angela Vicidomini, Andrea Wehmeyer

Epilepsy represents one of the most common chronic neurological disorders. Pharmacological treatment concepts are currently limited to symptomatic approaches with suppression of seizure activity by chronic administration of antiepileptic drugs. Unfortunately, multidrug resistance remains a major problem in clinical epileptology with more than thirty percent of patients not adequately responding to pharmacotherapy.

Research of the group aims to identify mechanisms of drug resistance. In this context, recent experimental data substantiated the 'transporter hypothesis' indicating enhanced active efflux of several antiepileptic drugs at the blood-brain barrier. Currently, we develop innovative therapeutic approaches to overcome transporter-associated drug resistance. These approaches are validated using in vitro and in vivo testing procedures including chronic rodent models with selection of drug-resistant animals. Translational development is based on functional studies using patient tissue dissected during epilepsy surgery. In collaboration with positron emission tomography experts imaging tools are developed for the prediction of drug sensitivity in patients rendering guidance for personalized therapeutic concepts. Considering that transporter-associated drug resistance seems to play a role in various central nervous system diseases the imaging tools as well as the novel therapeutic approaches are of interest for different neurological conditions.

Another focus of the group is the prevention of symptomatic epilepsies which can occur following brain insults such as traumatic brain injury, hypoxia, ischemia, tumors or infection. Mechanisms of epilepsy development (epileptogenesis) are elucidated in chronic rodent models. Preventive approaches target neuronal plasticity, neuronal cell loss, inflammatory reactions and blood-brain barrier alterations. For instance we currently assess the potential of novel peptide mimetics which mimic selected effects of complex 'parent' molecules such as erythropoietin, adhesion molecules, or neurotrophic factors. In collaboration we analyze whether targeting of the endocannabinoid system can interfere with the development of a hyperexcitable epileptic network. Considering that psychiatric comorbidities and cognitive impairment might increase the burden in a subgroup of epilepsy patients, it is also tested whether respective approaches interfere with the development of behavioral alterations and cognitive deficits in experimental models.



Technical University Munich

Prof. Dr. Gerhard Rigoll

TUM, Institute for Human-Machine Communication
www.mmk.ei.tum.de
Contact information on page 124

Multi-Modal Human-Machine Interaction

Advanced Professional Degrees

2002 – present Professor (C4) for Human-Machine Communication, TUM
1993 – 2001 Professor (C4) of Technical Informatics, Uni Duisburg
1992 – 1993 Visiting Scientist, NTT Human Interface Laboratories, Tokio, Japan

Awards and Professional Affiliations

- Member of the Overview Editorial Board of the IEEE Signal Processing Society (since 2009)
- IEEE Senior Membership; Acoustics, Speech, and Signal Processing Society (1998)
- Heisenberg-Stipendium, DFG (1993)

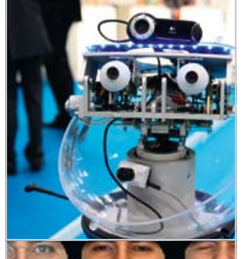
Publications

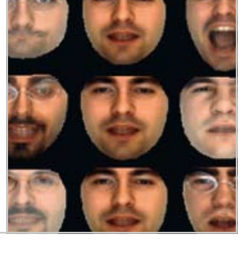
- Kroschel K., Rigoll G., Schuller B.: ***Statistische Informationstechnik. Signal- und Mustererkennung, Parameter- und Signalschätzung.*** Springer-Verlag, 2011.
- Schenk J, Rigoll G: ***Mensch-Maschine-Kommunikation, Grundlagen von sprach- und bildbasierten Benutzerschnittstellen.*** Berlin: Springer-Verlag, 2010.
- Rigoll G, Schuller B, Müller R, Ablassmeier M, Reifinger S, Poitschke T: ***"Speech Communication and Multimodal Interfaces"***. In: Advanced Man-Machine Interaction. Editor: Kraiss KF. 2005; 141 – 190.

The research activities of Gerhard Rigoll are in the area of multi-modal human-machine communication, covering areas such as speech and handwriting recognition, gesture recognition, face detection & identification, action & emotion recognition and interactive computer graphics.

The most important scientific basis for these activities is the area of pattern recognition, where a signal that shall be recognized (e.g. a speech signal or a handwritten letter) is first transformed into a suitable feature representation using methods from signal processing and then classified to one of a large variety of possible classes (e.g. words or letters in speech or handwriting recognition) by methods from statistical pattern recognition. In most cases, the classifier parameters are automatically trained from collected samples with machine learning techniques, such as e.g. Neural Networks, Hidden-Markov-Models or Probabilistic Graphical Models. Statistical machine learning techniques are also mostly used for the fusion of different modalities. A popular example for information fusion is the combination of speech and gestures for interaction in smart environments, such as e.g. intelligent houses or smart meeting rooms. In this case, the user might control a device such as a TV by voice commands and typical hand gestures, for instance to point to one of several devices while speaking a command to switch a TV channel. In this case, the acoustic modality is augmented by the visual communication channel and the problem is to fuse the combined information coming from both channels. These information streams will be asynchronous in time, since hand gestures will be most likely performed not exactly at the starting or ending points of voice commands.

Learning the asynchronous relation between the streams and resolving the semantic meaning resulting from decoding both streams simultaneously is typically a very complex problem in machine learning. Other typical application scenarios for this recognition and fusion problem can be e.g. found in human-driver dialogues for infotainment applications in the car or interaction of a user within virtual environments.





Ludwig-Maximilians-Universität München

Prof. Dr. Hans Straka

Department Biology II, Faculty of Biology
http://neuro.bio.lmu.de/members/systems_neuro_straka/straka_h/index.html
Contact information on page 124

Functional organization and plasticity of sensory-motor transformation for gaze and posture control

Advanced Professional Degrees

1989	PhD (Dr. rer. nat.) in Zoology
1995	Habilitation to Dr. rer. nat. habil. in Zoology
2009	Professor for Systemic Neurosciences

Awards and Professional Affiliations

2003 – 2007	Chargé de Recherche (CNRS), Université Paris Descartes
2007 – 2009	Directeur de Recherche (CNRS), Université Paris Descartes
2009 – present	Professor for Systemic Neurosciences at the Faculty of Biology, LMU Munich

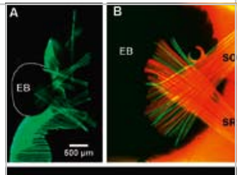
Publications

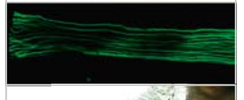
- Straka H., Vibert N., Vidal P.P., Moore L.E. and Dutia M.B. (2005) ***Intrinsic properties of vertebrate vestibular neurons: function, development and plasticity.*** Prog. Neurobiol. 76: 349-392.
- Lambert F.M., Beck J.C., Baker R. and Straka H. (2008) ***Semicircular canal size determines the developmental onset of angular vestibulooocular reflexes in larval Xenopus.*** J. Neurosci. 28: 8086-8096.
- Straka H. (2010) ***Ontogenetic rules and constraints of vestibulo-ocular reflex development.*** Curr. Opin. Neurobiol. 20: 689-695.

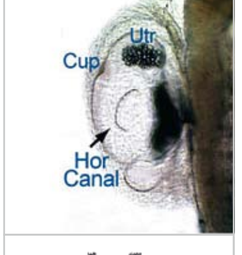
Lab members

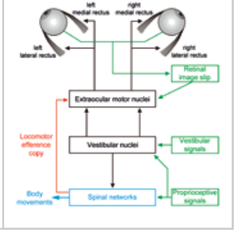
Boris Chagnaud, Francisco Branoner, Michael Faust, Johanna Schuller, Haike Dietrich, Roberto Banchi, Carlana Ramlochansingh

All vertebrates, whether running, swimming or flying, are confronted with the effects of their locomotor actions on the ability to perceive their surrounding environment. Potential consequences of self-generated body motion include head movements that cause retinal image displacements with a resultant degradation of visual information processing. In order to maintain visual acuity during locomotion, retinal image drift must be counteracted by dynamic compensatory eye and/or head-adjustments that derive from vestibulo-ocular, optokinetic and proprioceptive reflexes. In addition, efference copies of rhythmic neural signals produced by locomotor CPG circuitry within the spinal cord of larval *Xenopus* are conveyed to the brainstem extraocular motor nuclei and potentially contribute to gaze stabilization during locomotion. The use of inherent feed-forward and sensory feedback signals to counteract the visual consequences of self-motion has major implications for understanding gaze control in general. Our central project concerns the interaction and developmental plasticity of CPG-derived intrinsic signals and visuo-vestibular sensory feedback in the amphibian model *Xenopus laevis*. This requires understanding of how individual network components are ontogenetically assembled and how spatial and dynamic specificity is established. The delayed developmental onset of semicircular canal-evoked vestibulo-ocular reflexes compared to otolith-evoked responses renders differentiation between tilt and translational acceleration impossible and opens the question of how an appropriate intrinsic reference frame for body-motion in space is centrally formed. The transition from larval to adult frogs involves a drastic restructuring of central circuitry that correlates with the switch from an undulatory swimming in tadpoles to a limb-based propulsion in adult frogs along with corresponding changes in gaze-stabilizing eye movements. This raises general neurobiological questions on adaptive plasticity of cellular properties and network connectivity. These questions are studied by a variety of morpho-physiological approaches that mostly employ isolated, semi-intact brain preparations with intact sensory organs and motor components of *Xenopus laevis*. Intra- and extracellular recordings, Calcium-imaging together with morphological reconstructions allow determining the functional organization and plasticity of sensory-motor circuit formation and reconfiguration during ontogeny.









Ludwig-Maximilians-Universität München

Prof. Dr. Michael Strupp
Professor of Neurology and Clinical Neurophysiology, MD
Department of Neurology and IFB[LMU]
http://www.klinikum.uni-muenchen.de
Contact information on page 124

When the world goes round: diagnosis and treatment of vertigo, eye movement disorders and nystagmus

Advanced Professional Degrees

1988	MD, RWTH Aachen
2003	Professor of Neurology and Clinical Neurophysiology, LMU Munich

Awards and Professional Affiliations

2003	Robert-Wartenberg Lecture and Award
2005	Hans-Jörg-Weitbrecht Award for clinical neuroscience
2010	Award of the German Neurological Society, belonging to the five best teachers of the last five years of the Academy

Publications

- Strupp M, Kalla R, Claassen J, Adrion C, Mansmann U, Klopstock T, Freilinger T, Neugebauer H, Spiegel R, Dichgans M, Lehmann-Horn F, Jurkat-Rott K, Brandt T, Jen JC, Jahn K (2011) ***A randomized trial of 4-aminopyridine in EA2 and related familial episodic ataxias***
- Strupp M, Schüler O, Krafczyk S, Jahn K, Schautzer F, Büttner U, Brandt T (2003) ***Treatment of downbeat nystagmus with 3,4-diaminopyridine: a placebo-controlled study.*** Neurology 61:165-170
- Strupp M, Zingler V, Arbusow V, Niklas D, Maag KP, Dieterich M, Bense S, Theil D, Jahn K, Brandt T (2004) ***Methylprednisolone, valacyclovir, or the combination for vestibular neuritis.*** N Engl J Med 351:354-361

Lab members

Roger Kalla, Jens Claassen, Katharina Hüfner, Olympia Kremmyda, Roman Schniepp, Caroline Fischer, Stefan Teufel, Katharina Feil, Otmar Bayer

Pharmacotherapy of vertigo, dizziness, ocular motor disorders and nystagmus

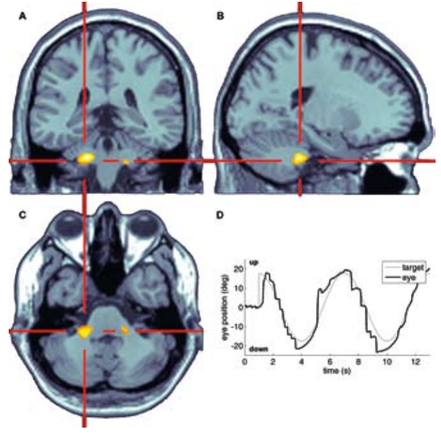
One of my major interests is developing and evaluating new therapeutic principles. We are, therefore, currently performing prospective randomized trials a) on the treatment of Menière's disease with high dosages of betahistine, b) on how to improve central vestibular compensation in acute vestibular neuritis, and c) on central disorders such as vestibular migraine, downbeat nystagmus, episodic ataxia type 2 and cerebellar gait disorders.

Role of viral infections in acute unilateral vestibular failure

There is some evidence that vestibular neuritis is caused by the reactivation of a latent herpes simplex virus 1 infection. The underlying patho-physiology and mechanisms leading to the damage are not clear and are therefore evaluated by virological techniques.

Interaction between the vestibular system and the hippocampus

We demonstrated an atrophy of the hippocampus and impaired spatial navigation and memory in patients with a bilateral loss of vestibular function. The cause and the consequences are now further evaluated by multimodal imaging techniques.



Ludwig-Maximilians-Universität München

Prof. Dr. Dirk Trauner

Department of Chemistry
http://www.cup.uni-muenchen.de/oc/trauner/

Contact information on page 124

Optochemical Genetics

Advanced Professional Degrees

2008 – present	Professor (Chair) for Chemical Biology and Genetics, Dept. of Chemistry, LMU
2006 – 2010	Associate Professor (Tenure), Dept. of Chemistry, UC Berkeley
2000 – 2006	Assistant Professor, Dept. of Chemistry, UC Berkeley

Awards and Professional Affiliations

- Japanese Society for the Promotion of Science (JSPS) (2010)
- European Research Council Advanced Investigator Grant (2011)
- From 2011 on: Member ÖAW (Österreichische Akademie der Wissenschaften)

Publications

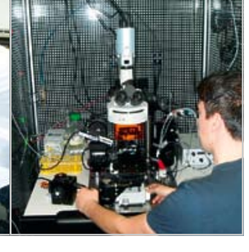
- Mourot A, Kienzler MA, Banghart MR, Fehrentz T, Huber FME, Stein M, Kramer RH, Trauner D (2011) *Tuning Photochromic Ion Channel Blockers.* ACS Chem Neurosci 2:536–543.
- Banghart MR, Mourot A, Fortin DL, Yao JZ, Kramer RH, Trauner D (2009) *Photochromic Blockers of Voltage-Gated Potassium Channels.* Angew Chem Int Ed 48:9097-9101.
- Volgraf M, Gorostiza P, Numano R, Kramer RH, Isacoff E, Trauner D (2006) *Allosteric Control of an Ionotropic Glutamate Receptor with an Optical Switch.* Nature Chem Bio 2:47–52.

Lab members

Johannes Broichhagen, Timm Fehrentz, Elena Herrero-Gómez, Florian Huber, Holger Moroder, Alwin Reiter, Matthias Schönberger, Philipp Stawski, Marco Stein, Martin Sumser

Transmembrane receptors allow a cell to communicate with its environment in response to a variety of input signals. These can be changes in the concentration of ligands (e.g. hormones or neurotransmitters), temperature, pressure (e.g. via acoustic waves or touch), transmembrane potential, or light intensity. Many important receptors have now been characterized in atomic detail and our understanding of their functional properties has markedly increased in recent years.

As a consequence, these sophisticated molecular machines can be reprogrammed to respond to unnatural input signals. Arguably, the most useful of these signals is light. Both ligand-gated ion channels, and G-protein coupled receptors, as well as voltage-gated ion channels, can be manipulated with synthetic photoswitches to become light-sensitive. The resulting hybrid photoreceptors can be used to optically control neurons with very high precision. They have been used to dissect neural networks and might find applications in the restoration of vision and the control of other sensations (such as pain). This combination of synthetic photoswitches and receptor proteins augments the field of Optogenetics and adds a new functional dimension to Chemical Genetics.
As such, we propose to call it “Opto-chemical Genetics”.



Helmholtz Center Munich

Prof. Dr. Wolfgang Wurst
Institute of Developmental Genetics
http://www.helmholtz-muenchen.de/en/idg/
Contact information on page 125

Generation and analysis of animal models for neuropsychiatric diseases

Advanced Professional Degrees

1988	Ph.D. Thesis at the Max-Planck-Institute of Immunobiology, Freiburg and at the Department of Immunogenetics, University Goettingen, Germany, Prof. E. Guenther (grade: summa cum laude)
04 / 1983	State Examination in Biology and Chemistry

Awards and Professional Affiliations
Since May 2002 Professor of Developmental Genetics, Dept. of Life Sciences, Technical University Munich; Director of the Institute of Developmental Genetics, Helmholtz Zentrum München, Munich / Neuherberg, Germany

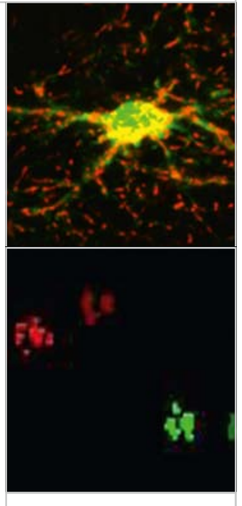
Publications

- Di Salvio M, ..., Prakash N*, Wurst W*, Simeone A: *Otx2 controls neuron subtype identity in ventral tegmental area and antagonizes vulnerability to MPTP.* Nat. Neurosci. 13, 1481-1488 (2010).
- Meyer M, Hrabé de Angelis M, Wurst W, Kühn R: *Gene targeting by homologous recombination in mouse zygotes mediated by zinc finger nucleases.* Proc. Natl. Acad. Sci. USA 107, 15022 15026 (2010).
- Piccoli G, ..., Vogt-Weisenhorn DM, Wurst W, Gloeckner CJ, Matteoli M, Sala C, Ueffing M. *LRRK2 controls synaptic vesicle storage and mobilization within the recycling pool.* J Neurosci.31(6):2225-37 (2011).

Lab members
Group Leaders: Andrea Huber Broesamle, Chichung Lie, Jochen Graw, Andreas Hörlein
Teamleaders: Jan Deussing, Thomas Floss, Jens Hansen, Sabine Hölter-Koch, Ralf Kühn, Nilima Prakash, Damian Refojo, Joel Schick, Daniela Vogt Weisenhorn

In view of a steadily increasing life expectancy, the amount of older people within the society becomes greater than ever. As a consequence the prevalence of chronic age-related diseases of the nervous system such as degenerative diseases (i.e. Parkinson's Disease, Alzheimer's Disease as well as chronic depression and other psychiatric diseases will be gradually rising with serious personal but also societal and economical impacts.

Thus, OUR VISION is to help improving the quality of life for patients suffering from psychiatric (depression) and neurological diseases (Parkinson's Disease, dementia) by contributing to the development of new therapies and preventive measures. Since it is apparent that these neurological and psychiatric diseases are multifactorial disorders, an integrative research approach is needed to understand the etiopathogenesis of the diseases – a prerequisite to develop novel preventive and/or therapeutic strategies. Therefore, our goal is to unravel the molecular basis of the pathoetiology of psychiatric and neurological diseases by generating and comprehensively analysing genetic animal models. In doing so, we specifically take into account the role of environmental factors on the etiology and progress of the diseases. As a consequence the IDG is structurally divided into two research areas. Within the IDG different groups in the Research Area "Disease Modelling" are approaching the central question of the pathoetiology of neuropsychiatric diseases from different angles using systemic, cellular and molecular approaches. In this context the IDG is focusing specifically on synaptic, mitochondrial, and neuroendocrino-logical dysfunction and its consequence on behaviour. The IDG also integrates groups which are dedicated to the understanding of the mechanisms underlying plasticity and regeneration in the central nervous system. Here the focus is put on developmental signalling pathways and mechanisms which potentially are neuroprotective and/or support neurogenesis in the adult brain. The Mouse Genetics Teams generate targeted mouse mutants for internal scientific projects and external collaborations. The Large Scale Mutagenesis Team participates in the international EUCOMM large scale mutagenesis program to create a genome-wide resource of conditional targeted ES cells and mice. Within the national DIGTOP (disease genes to proteins) project the proteomic interactions of disease-related genes in stem cells and mice are analysed. The Technology Development and Animal Model Generation teams develop new mutagenesis tools and provide infra-structure and a provide infrastructure for the generation of mouse mutants.



Generation (top: genetic modification) and analysis of animal models for neuropsychiatric diseaes at the molecular, cellular (2nd: mitochondria in a neuron and 3rd: dopaminergic neuron) and systemic (4th: sagital mouse brain section, 5th and 6th: behavioural analysis of mouse mutants, i.e. gait analysis)

Teaching

Teaching

MCN[LMU]

GSN[LMU] GRADUATE SCHOOL OF SYSTEMIC NEUROSCIENCES

Undergraduate
AMGEN Scholars Program
FUN Faculty for Undergraduate Neuroscience

Bachelor of Science Programs

PhD Systemic Neurosciences

EliteNetzwerkBayern MSc Neurosciences

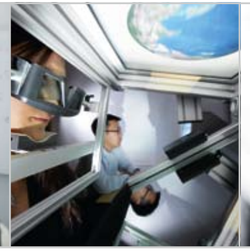
EliteNetzwerkBayern MSc NeuroCognitive Psych.

IMPRS-LS International Max-Planck Research School for Molec. & Cell. Life Sciences

RTG 1091 DFG Research Training Group Orientation and Motion in Space

RTG 1373 DFG Research Training Group Brain Signaling: From Neurons to Circuits

Postdoctoral Level
Harvard/LMU Young Scientists/ Forum (YSF)
Queensland Brain Institute/ MCN[LMU] Symposium



Graduate School of
Systemic Neurosciences
LMU Munich

Graduate School of Systemic Neurosciences

The hub of neuroscience education in Munich

The Graduate School of Systemic Neurosciences GSN^{LMU} is the teaching entity for neuroscience education in Munich. In tight collaboration with the master programs Neurosciences and Neurocognitive Psychology the GSN^{LMU} offers an integrated teaching program taking students from their bachelor to a master or PhD degree. The proposal for the GSN^{LMU} was successful in the first round of the Excellence Initiative in 2006. With the tailwind of the innovative drive ignited by the Excellence Initiative, the GSN^{LMU} was established as an interdisciplinary institution of LMU Munich which is governed independently and awards a doctoral degree independently from the traditional faculty structure of the universities.

LMU excellent

Director: Prof. Dr. Benedikt Grothe
Management & Administration: Lena Bittl (beginning October 2011),
Dr. Alexandra Stein (until October 2011)

The School's Objective
Under the umbrella of the MCN^{LMU} the GSN^{LMU} links research groups from cellular and systems neuroscience, computational neuroscience, neurocognitive psychology and neurophilosophy, thus providing a stimulating environment for novel formulations and concepts. A special PI lecture series introduces the various key topics and methods to all students in the GSN^{LMU}. Thus, students keep a broad scope even though their own research is getting more and more focussed. A special stipend program was initiated by GSN^{LMU} to promote especially those PhD research projects which go along the boundaries between subdivisions, bearing a higher risk but also high potential. The field of neurophilosophy for example is still developing in Germany. While the MCN^{LMU} promotes this development by inviting very renowned visting professors to support the local teaching, the GSN^{LMU} declares special stipends for up to five new neurophilosophy PhD projects each year.

From the beginning, the GSN^{LMU} set out to become the hub for neuroscience education in Munich. After five years ~100 students are enrolled in the program, numbers rising. This is possible as the GSN^{LMU} is a distinct institution of LMU governed independently and independently awarding the doctoral degree, thus making GSN^{LMU} not only on a working basis, but also from a formal point of view, truly interdisciplinary. Implementing GSN^{LMU} as an independent, degree awarding institution was the key innovation in the original concept. Another key feature is the fact that the doctoral degree the GSN^{LMU} awards is the internationally compatible PhD. For international students this is a very important issue when choosing the location for their education. A proportion of currently almost 40% international students (aiming for 50%) GSN^{LMU} demonstrates its attractiveness.

What makes the GSN^{LMU} so attractive?
First of all, the scientific environment in which the GSN^{LMU} operates is one of the neuroscience hot-spots worldwide. Besides the excellent research opportunities the structure of the degree program at GSN^{LMU} has many advantages to a traditional doctorate. All GSN^{LMU} students have thesis advisory committees (TACs) rather than single supervisors. These TACs comprise 3 or more researchers from different fields and may include junior faculty as well as external members. In regular meetings with student and TAC individual research plans are developed and documented (Training Objectives). At least once a year the Training Objectives have to be evaluated and updated. This leads to maximal transparency in the process and to maximal security of "staying on track". What has proven to be best practice in educating and supervising doctoral students in over the past years, has found implementation in the PhD regulations for the GSN^{LMU}. Next to the TAC supervision, students need to earn credit

point by acquiring a variety of competencies required for scientific working next to methodological expertise: participating in regular lab meetings and progress reports, going to conferences to present their work, visiting summer school, gain own teaching and supervision experience. The GSN^{LMU} defines the minimum amount of credit points to be earned with qualification measures. The content is individually defined for each student together with the TAC and also recorded in the training objectives. All this leads not only to close supervision for the research project, but automatically extends to very individual career advice. Of course science is not all in life. The GSN^{LMU} has vivid interactions between members. Regularly GSN^{LMU} organizes informal get-togethers like a summer barbeque or an annual dinner when the new cohort arrives. Also events like hiking, theatre, museum and movie nights regularly take place. Being a part of GSN^{LMU} is being part of a community.

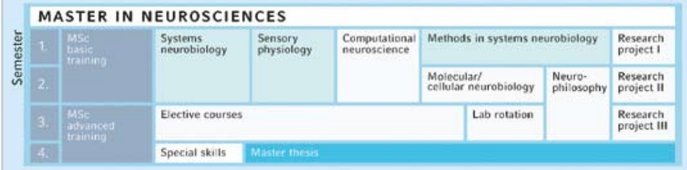
Fast-track education

While still many students especially from Germany and other European countries enter the program with a MSc or equivalent degree, the GSN^{LMU} offers the opportunity to enter the program with a BSc degree in neuroscience related areas. During the first two semesters students go through a preparatory year receiving basic training in neuroscience in close collaboration with the master programs Neurosciences and Neurocognitive Psychology. A special advisory commission with permanent members close watches the achievements of the fast-track students. Personal mentors from the GSN^{LMU} faculty give additional individualized advice to the students. After the preparatory year, the advisory committee, together with the student a decision is made to continue in the MSc or PhD track.

Next to the awarded degree, the structure of the program is highly compatible to other programs worldwide. Especially the different entry points to the program and flexibility to change the course as students go along. Whether suitable candidates come with a BSc degree a MSc or Diploma in related field or come as career changers with a MSc or Diploma from more distant fields, the GSN^{LMU} can offer an individually tuned program, making sure that in the end all students leave GSN^{LMU} with profound knowledge in different areas of neuroscience.

As neuroscience is a rapidly developing field bringing up new topics and methods, GSN^{LMU} will respond by integrating these new developments into the teaching concept. To structure this large variety of participating researchers, methods and topics, the GSN^{LMU} defined scientific sections and each faculty member is assigned to a section. These sections are Behavioural and Cognitive Neurosciences, Cellular and Circuit Neurosciences, Clinical Neuroscience, Computational Neuroscience, Developmental Neuroscience, Molecular Neuroscience and Neurophilosophy.

Elite Network of Bavaria



Master of Science in Neurosciences

Basic and individual teaching in a dynamic and interdisciplinary scientific field

The LMU Master Program in Neurosciences is supported by the Elite Network of Bavaria (http://www.elitenetzwerk-bayern.de) and is, together with the LMU master program Neurocognitive Psychology, embedded into the Graduate School of Systemic Neurosciences. It provides a basic and individual teaching concept for bachelor and master students with an educational backgound in neurosciences but also from other related field like life sciences, math, physics, computational sciences, engineering and as an Munich speciality also philosophy.

Contact infomation:
Our Master Program Neurosciences always starts every year in winter semester term. Applications will only be accepted as online aplications from December 1st until February 1st.
Homepage: www.mcn.lmu.de
email: master-neurosci@lmu.de

Munich – An important international center for neurosciences
The essential question in modern neurosciences is to understand how the human brain is functioning on all levels from molecules to cognition. In order to approach these questions researchers and thinkers in Neurosciences develop and use a wide spectrum of experimental and analytical methods from a broad variety of disciplines. As the techniques and the thinking are mostly interdisciplinary, it is not suprising that the demand of researchers and thinkers with an interdisciplinary and integrative educational background is increasing permanently. Based on its strong history and today proficient expertise in neurosciences, Munich is by all measures one of the most important centers for neurosciences worldwide and thus, an important international site for interdisciplinary research and education in the field.

In order to implement the standardization of European university education according to the Bologna consensus, the strong neuroscience community of the LMU immediately developed and implemented a program in neurosciences, which nowadays serves as an educational role model. Right from the beginning, the LMU master program in neurosciences was supported within the the exclusive Elite Network by the government of Bavaria and was launched in the winter term of 2007. After the end of the first funding period the program was re-evaluted in June 2011, with excellent statements of the scientific reviewers and the government of Bavaria. Initiated by the Bavarian State Government, the Elite Network of Bavaria contributes to excellent education for highly qualified students at top facilities. Selected students receive intensive individual tutoring and get the chance to study in a challenging scientific environment.

Teaching Concept – Career Tailored Education
Based on their teaching and research expertise, the members of our teaching faculty, which are also part of the Graduate School of Systemic Neurosciences or guest lecturers from external institutions, believe that the overwhelming complexity of the human brain can only be explained by applying different approaches and methods of the disciplines in neuroscience. Thus, our progam will constantly work on educating a new generation of neuroscientists starting at the level of graduate students. With an exellent understanding of the molecular, the cellular and the systemic principles of neurobiology, our students acquire a deeper knowledge of neuron-neuron interaction, the dynamics of neuron-glia interaction, the rules of information transfer in simple and complex circuits of single brain centers, the interaction of different brain centers, and the function of the human brain. This educational concept of the Master Program in Neurosciences is reflected in the key focus areas, which include:

- Systems Neurobiology
- Sensory Physiology
- Computational Neuroscience
- Molecular and Cellular Neurobiology
- Neurophilosophy
- Complementary Skills

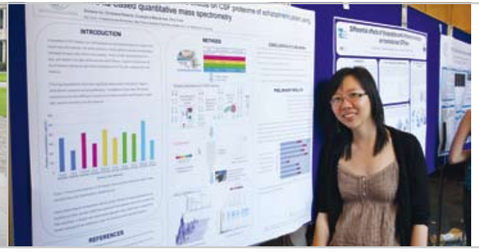
In order to guide our students in acquiring excellent knowledge and practical proficiency in our key focus areas, our teaching concept is based on four major measures (see also schematic of curriculum):

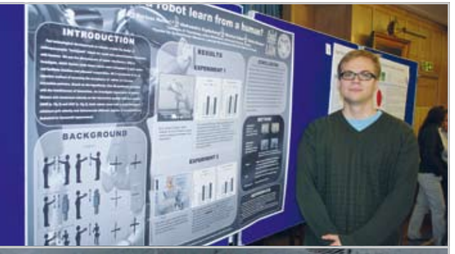
1. **General education:** The educational program is based on four main scientific topics: systems neurobiology, molecular and cellular neurobiology, computational neuroscience and neurophilosophy. Our curriculum takes the students on a “round trip” providing a profound understanding of the biological principles in brain structure and neuron-neuron communication before broadening the scope towards cognition and higher brain functions, computational methods and philosophical aspects in neurosciences. The main part of the general education takes place in the first two semesters and includes also GSN^{LMU} Fast Track Students and students from the GSN^{LMU} PhD program with unrelated backgrounds.

2. **Individual research training:** In each semester, the student has to complete an individual research project. This will guarantee hands-on research training from the very beginning and gives students the opportunity to become acquainted with participating laboratories and researchers. In addition, besides the mandatory general courses, the students can choose from a broad spectrum of methods and interdisciplinary courses. Finally, of course, the students complement their education in neuroscience with their master thesis.

3. **Complementary Skills:** Our training concept would not be complete without the training of complementary skills, which supplement our core curriculum and help to optimally prepare students for their future career goals. In their second year our students obtain first practice (and credits) in teaching by tutoring their younger fellows. In addition to the scientific education, the Master Program includes modular workshops on general working techniques in science such as communication training, presentation skills, scientific writing, and time management.

4. **Mentoring:** Each student has his or her own mentor from the GSN^{LMU} faculty. The mentors serve as academic advisors, helping the students plan their educational career and facilitate contacts to collaborating insitutions. In mainly informal meetings the students have an excellent opportunity to discuss problems, receive guidance or have an informative scientific chat.





Amgen Scholars European Undergraduate Summer Research Program

Faculty Director: Prof. Dr. Benedikt Grothe
Program Director: Lena Bittl
Program Administrator: Liz Atwood

www.amgenscholars.mcn.uni-muenchen.de
www.amgenscholars.eu

Amgen Scholars – From Molecules to Behavior
Amgen Scholars at LMU Munich engage in 8 weeks of intensive laboratory research. Each summer up to 25 undergraduate students gain exposure to cutting edge science in laboratories at LMU's HighTechCampus offering a unique academic and scientific life science environment with numerous renowned life science research institutions and world leading scientists.

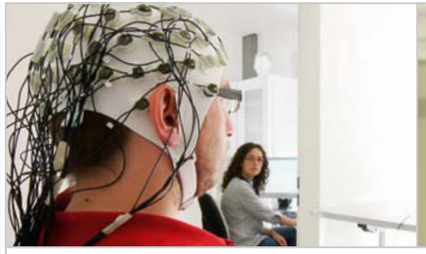
Participants conduct mentor-guided, hands-on research in the fields of biochemistry, structural, molecular, cell, and developmental biology, neurobiology, computational neuroscience, cancer research and physiological sciences. The research program includes:

- 4 day orientation retreat in the Bavarian countryside
- Weekly lectures and workshops on state-of-the-art research topics and methods, bioethics, poster presentation, abstract writing and scientific career paths
- 8 weeks of hands-on research in a host laboratory under the supervision of an assigned faculty mentor
- Participation at the European Amgen Scholars Summer Symposium at the University of Cambridge
- Networking events with local graduate students and extra-curricular excursions
- Concluding local symposium with poster presentations

The Amgen Scholars Program aims to create balanced top-level educational opportunities across Europe by supporting the mobility and networking of academics at a very early stage, thus enhancing the interest of the participants in a scientific career.

Target Group
Selected undergraduate students from relevant fields; only European countries (according to the European Higher Education Area (EHEA))

In Europe the program is conducted in partnership with the University of Cambridge (UK) and the Karolinska Institutet (Sweden). The program is financed through the generosity of the Amgen Foundation.



FUN – Faculty for Undergraduate Neuroscience (U.S.A.) Summer Course

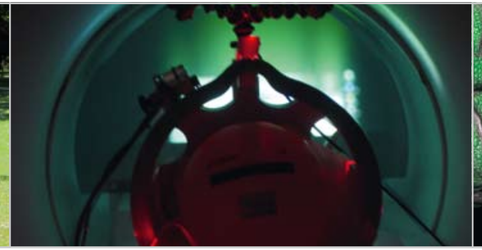
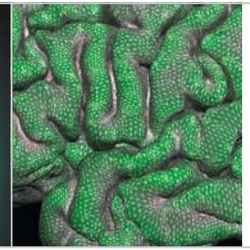
In 2011 the GSN[LMU] launched a cooperation with the Faculty For Undergraduate Neuroscience (U.S.A.) FUN is an international organization that is focused on neuroscience education and research at the undergraduate level. FUN's members and supporters include businesses and organizations; private liberal arts colleges, state and research university departments and programs; and individual faculty and students, all sharing a common interest in undergraduate neuroscience.

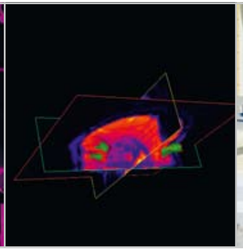
The mission of FUN is:

- Enhancing undergraduate participation in research and the presentation of research at the SFN meeting (Society for Neuroscience, U.S.A.)
- Disseminating innovations in undergraduate neuroscience education
- Recognizing excellence in undergraduate neuroscience education
- Developing national and regional networks that enhance undergraduate neuroscience education and research and faculty development

In order to further develop and enhance the international neuroscience network, in June 2011 undergraduate students and faculty members of FUN visited Munich and Berlin each for a 2-week summer school on Neuroscience. The courses included lecturers, practical course work and lab visits throughout the faculty of the Graduate School of Neurosciences in Munich and the Graduate School of Mind and Brain in Berlin. In additon to the scientfic education, the students had many opportunities to socialize with local sudents and faculty members and visit local and regional attractions, like alpine excursions, city tours and, of course, beer gardens. The summer school was a great success for students and faculty and will be continued on an annual basis.

To get a glance about the long-lasting impression and enthusiasm the summer school evoked in the students, view our photos and video at http://blogs.cofc.edu/germanneuro/ and http://blogs.cofc.edu/germanneuro/about




RTG 1091 – DFG Research Training Group Orientation and Motion in Space

Head: Prof. Dr. Andreas Straube
Coordinator: Maj-Catherine Botheroyd

The DFG Research Training Group Orientation and Motion in Space is supported by scientific groups from different disciplines and faculties of the Ludwig Maximilians University Munich (biology, clinical neurology, psychology), together with neurobiological groups from the Max Planck Institute for Neurobiology in Martinsried.

The participating senior scientists, together with their co-operating group members, provide optimal training, education and support for doctoral students from various fields (Biology, Computer science, Engineering, Medicine, Physics and Psychology).

We cooperate closely with the Graduate School of Systemic Neuroscience (GSN^{LMU}), the International Max-Planck Research School "From Biology to Medicine" and the Bernstein Center for Computational Neuroscience (BCCN). We offer challenging research topics of high biological relevance and permit the detailed investigation of complex central nervous processes. These also include the essential sensory inputs (acoustic, vestibular, visual), as well as the psychophysical and motor reactions in regard to the control of movements and balance in space.

The latter are investigated in normal subjects and patients, whereas animal experiments with optical and extra cellular single unit recordings are planned in order to study information processing within the central nervous system. Attention and memory are also decisive factors for adequate orientation and movement in space. These topics are specifically addressed by projects in the program. We also investigate the effect of lesions on orientation and motion analysis in patients and animal experiments. Thus, with the different scientific backgrounds the participants are working on a common theme, using different approaches and problem-solving strategies.

Furthermore, a wide spectrum of methods is available. These include extra cellular recordings from individual neurons, optical recordings to establish maps in central nervous structures, as well as eye movement recordings and psychophysics.

The common scientific theme, combined with different backgrounds and the wide range of methods, gives the graduate students a unique opportunity to apply interdisciplinary approaches and broaden their scientific view. A major goal of the training group is to look beyond the narrow topic of the individual project. These are the best preconditions for better problem solving strategies and new approaches. There is a tight link to clinical problems such as Ataxia and dizziness.

Last but not least, the students can choose from a whole range of specially organised soft skill courses, lectures and workshops we organise for them.

RTG 1373 – DFG Research Training Group

Brain Signaling: From Neurons to Circuits

Head: Prof. Dr. Arthur Konnerth

The Research Training Group 1373 Brain signaling: from neurons to circuits focuses on basic and disease-related neuroscience. Neuroscience promises to improve our strategies to treat neurological disorders, which in aging societies present an ever-growing problem. New technologies enable us to explore brain signaling with unprecedented precision, but also require increasingly complex and diverse interdisciplinary skills. The special requirements of the multi-disciplinarity inherent in neuroscience mandate the establishment of new, formalized training programs for young neuroscientists-to-be. Our Research Training Group aims to provide such specialized training, while at the same time addressing central questions in neuroscience with cutting-edge in vivo technology.

The scientific aim of this Research Training Group is to elucidate the cellular and molecular signaling underlying brain function in health and disease. A special focus is to relate physiological processes to disturbances of signaling in neurological disease conditions. For this purpose, members of the Research Training Group analyze animal models utilizing high-resolution in vivo imaging techniques and electrophysiological methods. Complementary efforts of other groups focus on the analysis of molecular mechanisms of brain function, including the development of new mouse models. Finally, imaging and electrophysiology approaches that can be applied to small animal models as well as human patients form a technological bridge towards clinical translation.

The educational concept of our Research Training Group will specialize in providing in-depth scientific training to students with a medical background, as well as offering disease-related research opportunities to young scientist from natural science disciplines. Training will be conducted in the form of a study program directly inspired by the successful M.D./Ph.D. programs that present the gold standard for training of clinician-scientists. Over the past years, this program has proven a sounding success with exceptionally talented students applying in large numbers. Renewal of this Research Training Group will provide us the opportunity to consolidate the pioneering efforts of our first funding period and expand our research program aimed at elucidating brain signaling in health and disease. Thus, multi-disciplinary training in disease-related neuroscience will be firmly established at our partnering universities.

LMU-Harvard Young Scientists' Forum (YSF)

The LMU-Harvard Young Scientists' Forum (YSF) seeks to unite Ph.D. students and postdoctoral fellows from Harvard University and the Ludwig-Maximilians-Universität (LMU) with core faculty from the two universities to create a framework for an interdisciplinary exchange of ideas.

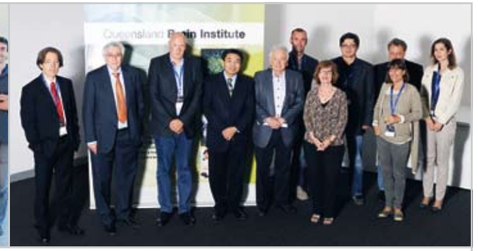
The first conference of the series was held at LMU Munich in June 2009, followed by a conference at Harvard University in 2010.

LMU-Harvard YSF was held in 2011 at the Center for Advanced Studies (CAS^{LMU}) of the LMU Munich.

Speakers in 2011:

LMU Munich:
Prof. Tobias Bonhoeffer
Prof. Thomas Carell
Prof. Christian Haass
Prof. Matthias Mann

Harvard:
Prof. Catherine Dulac
Prof. Venkatesh Murthy
Prof. Eric Rubin
Prof. William Shih



QBI-MCN^{LMU} Symposium

The inaugural symposium on Systems Neuroscience between the Queensland Brain Institute (QBI) and the Munich Center for Neurosciences (MCN^{LMU}) took place at the University of Queensland, Brisbane, QLC, Australia in September 2011. The symposium brings together leading researchers from both universities in sensory, cognitive, cellular and molecular neuroscience to share their recent findings with the Australian neuroscience community including student participants from LMU Munich. Further joint efforts will include a second symposium in 2012, a Summer School in 2013, long term student exchange (1-2 years) and on-going short-term exchange (2-3 weeks) between faculty members and advanced researchers from both institutions.

Speakers at the 2011 QBI-MCN^{LMU} Symposium included:

From MCN^{LMU}:
Prof. Benedikt Grothe, Director MCN^{LMU}
Prof. Heiner Deubel
Prof. Magdalena Götz
Prof. Mark Hübener
Prof. Rüdiger Klein
Prof. Christian Leibold
Prof. Lutz Wiegrebe

From QBI:
Prof. Perry Bartlett, Director QBI
Prof. Geoff Goodhill
Prof. Ottmar Lipp
Prof. Justin Marshall
Prof. Linda Richards
Prof. Pankaj Sah

Community outreach

Community outreach

MCN[LMU] Central office

Awards

- Young Scientist Award
- LMU/Scopus Neuroscience Award
- Scopus Young Neuroscientist Award
- Brain Navigator Award

Lectures & Events

- LMU Lecture Series ("Ringvorlesung")
- MCN[LMU] Monday Lecture Series
- MCN[LMU] Christmas Lecture
- Neurohistory Workshop



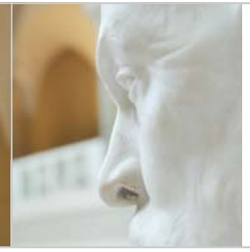

Lectures & Events

The ultimate goal of the "Munich Center for Neurosciences – Brain and Mind" is to create a network bringing together all groups and disciplines with interests related to questions of neurobiology, cognition, and "brain and mind". In addition to direct support of teaching initiatives and research collaborations, the center also strives to bring publically relevant issues and topics within neuroscience to the greater community by organizing lectures open to both the neuoscience community and the general public:

During the 2010/2011 academic year, a university-wide, interdisciplinary series of 15 lectures titled "Der Mensch und sein Gehirn" was co-organized by MCN^{LMU}. Topics included the evolutionary basis of the human brain, brain development and regeneration, epilepsy, the vestibular system which controls balance, learning and plasticity, logic, Alzheimer's Disease, and ethics. For more details see www.lmu.de/ringvorlesung

The Monday Lecture Series, open to the neuroscience community, features high-profile local and international experts covering an interdisciplinary spectrum of current research. Lectures take place monthly during both academic semesters on Munich's high-tech Campus in Martinsried. See the MCN^{LMU} website for more information.

Upon invitation by the Bavarian State Ministry of Science, Research and the Arts, the MCN^{LMU} has coorganized the upcoming inaugural lecture of the Munich Christmas Lecture Series to be held yearly at the Residenz in Munich. The Christmas Lecture Series is inspired by the traditional Christmas Lecture of the British Royal Institution. The first lecture will be held on December 19th, 2011 by Wolfgang Klein from the Max Planck Institute for Psycholinguistics in Nijmegen (Netherlands) on beauty and aesthetics.



Neurohistory Workshop

Neurohistory: How Can Neuroscience Help Us Understand the Past?

This question was addressed at a workshop held 6-7 June 2011 at the Rachel Carson Center in Munich, Germany. The interdisciplinary workshop focused on ways that neuroscience might help us to understand history (and, ideally, vice versa).

Four main questions were addressed:

1. What ideas and methods have neuroscientists developed that historians can use to shed new light on the past (and vice versa)?
2. What new research questions can neuroscience suggest for historians (and vice versa)?
3. What are the biggest challenges to developing neurohistory as a field, and how can they be overcome?
4. How might neurohistory shed light on the interaction between people and their environment in the past and present?

Awards

In 2010, the GraduateCenter-LMU, the Munich Center for Neurosciences and Elsevier assigned four awards between 1500 and 5000 Euros for excellent publications in the life sciences/ neurosciences to young scientists from Munich.

The "LMU Young Life Scientist Award" is dedicated to doctoral candidates of LMU Munich from the life sciences (including biology, biochemistry, bioinformatics and medicine), while the remaining three awards ("LMU/ Scopus Neuroscience Award", "Scopus Young Neuroscientist Award" and "Brain Navigator Award") are restricted to young researchers from the neurosciences.

Awardees in 2010

LMU/Scopus Neuroscience Award:
Dr. Jovica Ninkovic, Helmholtz Zentrum Munich, for his publication "The transcription factor Pax6 regulates survival of dopaminergic olfactory bulb neurons via crystallin aA."
(Ninkovic J, Pinto L, Petricca S, Lepier A, Sun J, Rieger M, Schroeder T, Cvekl A, Favor J and Götz M (2010), Neuron 68(4)).

Scopus Young Neuroscientist Award:
Hongbo Jia, Technische Universität München for his publication "Dendritic organization of sensory input to cortical neurons in vivo."
(Hongbo J, Rochefort NL, Chen X and Konnerth A (2010), Nature 464).

The Brain Navigator Award:
Dr. Tobias Bittner, LMU Munich, for the publication "Microglial CX3CR1 knockout prevents neuron loss in an Alzheimer's disease mouse model"
(Fuhrmann M*, Bittner T*, Jung CKE, Burgold S, Page RM, Mitteregger G, Haass C, LaFerla FM, Kretzschmar H and Herms J (2010), Nature Neuroscience 13(4)).

The LMU Young Life Scientist Award:
Dorota Zielinska, Max Planck Institute for Biochemistry / LMU Munich for her publication "Precision Mapping of an In Vivo N-Glycoproteome Reveals Rigid Topological and Sequence Constraints"
(Zielinska DF*, Gnad F*, Wisniewski JR and Mann M (2010), Cell 141(5)).

Appendix

B

Dr. Florence Bareyre | Page 26
Institute of Clinical Neuroimmunology
Ludwig-Maximilians-Universität München
Marchioninistraße 17
81377 Munich
Phone +49 (0)89 / 2180 78279
E-mail Florence.Bareyre@med.uni-muenchen.de
www www.klinikum.uni-muenchen.de/Institut-fuer-Klinische-Neuroimmunologie

Dr. Gabriel Beckers
MPI für Ornithologie
Eberhard-Gwinner-Straße Haus Nr. 6
82319 Seewiesen
Phone +49 (0)8157 / 932-273
E-Mail Beckers@orn.mpg.de
www http://www.orn.mpg.de/mitarbeiter/beckers.html

Prof. Dr. Jürgen Beckmann
TUM Fakultät für Sportwissenschaften
Lehrstuhl für Sportpsychologie
Connollystraße 32
80809 Munich
Phone +49 (0)89 / 289-24540
E-Mail beckmann@sp.tum.de
www www.sp.tum.de

Prof. Dr. Oliver Behrend
LMU,Department Biologie II, MCN[LMU]
Grosshaderner Straße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74363
E-Mail o.behrend@lmu.de
www www.mcn.lmu.de

Dr. Jan Benda | Page 28
LMU, Department Biologie, BCCN
Großhaderner Straße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74137
E-Mail benda@bio.lmu.de
www www.bio.lmu.de

Prof. Dr. Martin Biel | Page 30
Ludwig-Maximilians-Universität München
Department of Pharmacy – Center for Drug Research, Pharmacology
Butenandtstraße 7, Building C
81377 Munich
Phone +49 (0)89 / 2180-77327
E-mail mbiel@cup.uni-muenchen.de
www http://www.cup.uni-muenchen.de/ph/aks/biel/

Prof. Dr. Tobias Bonhoeffer | Page 32
Department of Cellular and Systemsneurobiology
Max-Planck-Institute of Neurobiology
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578-3750
E-Mail tobias.bonhoeffer@neuro.mpg.de
www http://www.neuro.mpg.de/24259/bonhoeffer

Prof. Dr. Alexander Borst | Page 34
MPI für Neurobiologie – Abteilung Systems und Computationale Neurobiologie
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578-3251
E-Mail borst@neuro.mpg.de
www www.neuro.mpg.de

Prof. Dr. Dr. h.c. Thomas Brandt, FRCP
LMU, Klinikum Großhadern, Institut für Neurologie
Marchioninistraße 15
81377 Munich
Phone +49 (0)89 / 7095 2570
E-Mail thomas.brandt@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Thomas Buchheim
Fakultät für Philosophie der LMU, Philosophie Department, Lehrstuhl III
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-2004
E-Mail Thomas.Buchheim@lrz.uni-muenchen.de
www www.thomas-buchheim.de

Prof. Dr. Ulrich Büttner
LMU, Klinikum Großhadern, Institut für Neurologie
Marchioninistraße 15
81377 Munich
Phone +49 (0)89/ 7095 2560
E-Mail ulrich.buettner@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

C

Prof. Dr. Gordon Cheng | Page 36
TUM, Kognitive Systeme
Barer Straße 21
80290 Munich
Phone +49 (0)89 / 289-01
E-Mail gordon.cheng@ieee.org.

Prof. Dr. Jörg Conradt
TUM, Neurowissenschaftliche Systemtheorie
Barer Straße 21
80333 Munich
Phone +49 (0)89 / 289-26925
E-Mail conradt@tum.de
www www.lsr.ei.tum.de

PD Dr. Paul Cumming, PhD
LMU, Medizinische Fakultät, Dept. f. Nuklearmedizin
Marchioninistraße 15
81377 Munich
E-Mail nikum.uni-muenchen.de/perschemie.php

D

Prof. Dr. Heiner Deubel | Page 38
LMU, Fakultät für Psychologie und Pädagogik, Department Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180 5282
E-Mail heiner.deubel@psy.lmu.de
www www.paed.uni-muenchen.de

Prof. Dr. Martin Dichgans
LMU, Klinikum Großhadern, Institut für Neurologie
Marchioninistraße 15
81377 Munich
Phone +49 (0)89 / 7095-3670 (-6670)
E-Mail Martin.Dichgans@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Marianne Dieterich | Page 40
LMU, Klinikum Großhadern, Institut für Neurologie
Marchioninistraße 15
81377 Munich
Phone +49 (0)89 / 7095 2571
E-Mail direktion.neurologie@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

PD Dr. Christoph Draxler
LMU, Fakultät für Sprach- und Literaturwissenschaften
Schellingstraße 3
80799 Munich
Phone +49 (0)89 / 2180-2807
E-Mail draxler@phonetik.uni-muenchen.de
www http://www.esp.phonetik.uni-muenchen.de/personen/professoren/draxler/index.html

E

Dr. Veronica Egger | Page 42
Physiologisches Institut der LMU
Pettenkoferstraße 12
80336 Munich
Phone +49 (0)89 / 2180-75572
E-Mail Veronica.Egger@lrz.uni-muenchen.de
www www.eggerlab.web.med.uni-muenchen.de

Dr. Ulrich Ettinger
Emmy Noether Research Group Leader, Department of Psychiatry and Psychotherapy and Department of Psychology
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 343856
E-Mail u.ettinger@iop.kcl.ac.uk

F

Dr. Felix Felmy | Page 44
LMU, Department Biologie II, Abteilung Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74308
E-Mail Felmyf@gmail.com
www www.bio.lmu.de

Dr. Thomas Fenzl
MPI für Psychiatrie – Abteilung Neurogenetik des Schlafes
Ingolstädter Landstraße 1
85764 Neuherberg
Phone +49 (0)89 / 30622-498
E-Mail tomf@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

Dr. Kathrin Finke | Page 46
LMU, NCP, Department für Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-6779
E-Mail finke@psy.uni-muenchen.de
www www.psy.lmu.de

Prof. Dr. Frank Fischer
LMU, Fakultät für Psychologie und Pädagogik, Department Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-5146
E-mail frank.fischer@psy.lmu.de
www www.psy.lmu.de/

G

Prof. Dr. Manfred Gahr | Page 48
MPI für Ornithologie
Eberhard-Gwinner-Straße
82319 Seewiesen
Phone +49 (0)8157 / 932-276
E-mail gahr@orn.mpg.de
www http://www.orn.mpg.de/2525/Abteilung_Gahr

Dr. Steffen Gais
Emmy Noether-Group „Memory Consolidation" General and Experimental Psychology
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-9828
E-mail gais@psy.lmu.de

PD Dr. Stefan Glasauer
Zentrum für Sensomotorik, Neurologische Klinik und Poliklinik der LMU
Marchioninistraße 23
81377 Munich
Phone +49 (0)89 / 7095 4839
E-mail sglasauer@nefo.med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Helmut Glünder
TU Darmstadt, Elektrotechnik und Informationstechnik
Dreimühlenstraße 9
80469 Munich
Phone +49 (0)89 / 7466 4169
E-mail H.Gluender@lrz.uni-muenchen.de
www http://www.rtr.tu-darmstadt.de/rtr/unserteam/mitarbeiter_rtr/details_5125.de.jsp

Prof. Dr. Georg Goldenberg
TUM, Klinikum München Bogenhausen, Abteilung Neuropsychologie
Englschalkingerstraße 77
81925 Munich
Phone +49 (0)89 / 92702106
E-mail Georg.Goldenberg@extern.lrz-muenchen.de
www www.kh-bogenhausen.de

Prof. Dr. Magdalena Götz | Page 50
Fakultät für Medizin der LMU, Physiologische Genomik
Pettenkoferstraße 12
80336 Munich
Phone +49 (0)89 / 2180-75252
E-mail magdalena.goetz@lrz.uni-muenchen.de
www www.physinst.web.med.uni-muenchen.de

Dr. Oliver Griesbeck | Page 52
Max-Planck-Institute of Neurobiology
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578 3270
E-mail griesbeck@neuro.mpg.de
www http://www.neuro.mpg.de/24427/griesbeck

Prof. Dr. Benedikt Grothe | Page 54
LMU, Department Biologie II, Lehrstuhl Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180 74 302
E-mail grothe@lmu.de
www www.bio.lmu.de

H

Prof. Dr. Dr. h.c. Christian Haass | Page 56
Adolf Butenandt Institut der LMU,
Department für Biochemie
Schillerstraße 44
80336 Munich
Phone +49 (0)89 / 2180-75 471
E-mail chaass@med.uni-muenchen.de
www www.med.uni-muenchen.de/haass/

Prof. Dr. Jonathan Harrington
LMU, Fakultät für Sprach- und Literaturwissenschaften
Schellingstraße 3
80799 Munich
Phone +49 (0)89 / 2180-2758
E-mail jmh@phonetik.uni-muenchen.de
www http://www.en.esp.phonetik.uni-muenchen.de/personen/professoren/harrington/index.html

Prof. Dr. Werner Hemmert
TUM, Bioanaloge Informationsverarbeitung
Boltzmannstraße 11
85748 Garching
Phone +49 (0)89 / 289 10853
E-mail werner.hemmert@tum.de
www www.imetum.tum.de

Prof. Dr. Jochen Herms
Fakultät für Medizin der LMU,
Zentrum für Neuropathologie und Prionforschung
Feodor-Lynen-Straße 23
81377 Munich
Phone +49 (0)89 / 2180-78010
E-mail jochen.herms@med.uni-muenchen.de
www www.znp-muenchen.de

Prof. Dr. Joachim Hermsdörfer
Klinikum Bogenhausen der TUM, EKN,
Arbeitsgruppe Sensomotorische Störungen
Dachauer Straße 164
80335 Munich
Phone +49 (0)89 / 15 77 895
E-mail joachim.hermsdoerfer@extern.lrz-muenchen.de
www www.lrz-muenchen.de/~EKN/pjh.html

Prof. Dr. Andreas V. M. Herz | Page 58
LMU, Department Biologie II,
Computational Neuroscience
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180 74 138
E-mail herz@bio.lmu.de
www www.bio.lmu.de

Prof. Dr. Franz Hofmann
Fakultät für Medizin der TUM,
Institut für Pharmakologie und Toxikologie
Biedersteiner Straße 29
80802 Munich
Phone +49 (0)89 / 4140 3260
E-mail hofmann@ipt.med.tu-muenchen.de
www www.ipt.med.tu-muenchen.de

Prof. Dr. Reinhard Hohlfeld
Klinische Immunologie, Klinikum Grosshadern der LMU
Marchioninistraße 15
81377 Munich
Phone +49 (0)89 / 7095-4780 (-4781)
E-mail reinhard.hohlfeld@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Mark Hübener | Page 60
MPI für Neurobiologie
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578-3697
E-mail mark@neuro.mpg.de
www http://www.neuro.mpg.de/24276/huebener

Prof. Dr. Axel Hutter
Fakultät für Philosophie der LMU, Philosophie II
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-2488
E-mail Axel.Hutter@lmu.de
www www.philosophie.uni-muenchen.de

K

Dr. Ilona Grunwald Kadow | Page 62
Max-Planck Institute of Neurobiology
Sensory Neurogenetics Research Group
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578 3159
E-mail ikadow@neuro.mpg.de
www www.neuro.mpg.de

Dr. Alexander Kaiser
LMU, Department Biologie II, Abteilung Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74182
E-mail kaiser@zi.biologie.uni-muenchen.de
www www.zi.biologie.uni-muenchen.de

Prof. Dr. Ruediger Klein, PhD | Page 64
MPI für Neurobiologie, Department für Moleculare Neurobiologie
Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578 3151
E-mail rklein@neuro.mpg.de
www www.neuro.mpg.de

Prof. Dr. Florian Kolb
Fakultät für Medizin der LMU, Department für Physiologie
Pettenkoferstraße 12
80336 Munich
Phone +49 (0)89 / 2180-75-224
E-mail f.kolb@lmu.de
www www.physinst.web.med.uni-muenchen.de

Prof. Dr. Arthur Konnerth | Page 66
TUM, Institute of Neuroscience
Biedersteiner Straße 2
80802 Munich
Phone +49 (0)89 / 4140-3370
E-mail arthur.konnerth@lrz.tu-muenchen.de
www http://www.ifn.me.tum.de/

Prof. Dr. Stephan Kröger
Fakultät für Medizin, Institut für Physiologie
Schillerstraße 46
80336 Munich
Phone +49 (0)89 / 2180-75526
E-mail skroeger@lmu.de
www www.stephan-kroeger.de

PD Dr. Lars Kunz
Department Biologie II der LMU, Division of Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74299
E-mail lars.kunz@biologie.uni-muenchen.de
www www.neuro.bio.lmu.de

L

Prof. Dr. Rainer Landgraf
MPI für Psychiatrie, Verhaltensneuroendokrinologie
Kraepelinstraße 2
80804 Munich
Phone +49 (0)89 / 30622-495
E-mail landgraf@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

Prof. Dr. Christian Leibold | Page 68
LMU, Department Biologie II, Computationale Neurowissenschaften
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180 74309
E-mail leibold@zi.biologie.uni-muenchen.de
www www.bio.lmu.de

Prof. Dr. Dr. Hannes Leitgeb | Page 70
LMU, Chair of Logic and Philosophy of Language,
Head of the Munich Center for Mathematical Philosophy
Ludwigstraße 31
80539 Munich
Phone +49 (0)89 / 2180 6171
E-mail Hannes.Leitgeb@lmu.de
www http://www.philosophie.uni-muenchen.de

Prof. Dr. Harald Luksch
Wissenschaftszentrum Weihenstephan der TUM,
Lehrstuhl für Zoologie
Hochfeldweg 2
85350 Freising-Weihenstephan
Phone +49 (0)8161 / 712800
E-mail harald.luksch@wzw.tum.de
www www.wzw.tum.de

M

Prof. Dr. Kaspar Matiasek
Institut für Tierpathologie
Veterinär Str. 13
80539 Munich
Phone +49 (0)89 / 2180-2530
Fax +49 (0)89 / 2180-2544
www http://www.patho.vetmed.uni-muenchen.de/

Dr. Aye Mint Mu
Klinik für Psychiatrie und Psychotherapie der LMU,
Laborfachgruppe
Nussbaumstraße 7
80336 Munich
Phone +49 (0)89 / 5160 3433
E-mail AyeMu.Myint@med.uni-muenchen.de
www www.pni-net.de

Prof. Dr. Ulises Moulines
Fakultät für Philosophie der LMU, Lehrstuhl Philosophie, Logik und Wissenschaftstheorie
Ludwigstraße 31
80539 Munich
Phone +49 (0)89 / 2180-3320
E-mail moulines@lrz.uni-muenchen.de
www www.philosophie.uni-muenchen.de

Prof. Dr. Hermann J. Müller | Page 72
Fakultät für Psychologie der LMU, Allgemeine und Experimentelle Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180 5327-5212
E-mail mueller@psy.uni-muenchen.de
www www.psy.lmu.de

Prof. Dr. Norbert Müller
Klinik für Psychiatrie und Psychotherapie der LMU
Nussbaumstraße 7
80336 Munich
Phone +49 (0)89 / 5160-0
E-mail Norbert.Mueller@med.uni-muenchen.de
www www.psywifo.klinikum.uni-muenchen.de

N

Prof. Dr. Julian Nida-Rümelin
Former Federal State Minister for Culture and the Media | Page 74
Lehrstuhl für Philosophie IV
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-9020
E-mail Sekretariat.Nida-Ruemelin@lrz.uni-muenchen.de
www www.philosophie.uni-muenchen.de/lehreinheiten/philosophie_4

P

Prof. Dr. Reinhard Pekrun
Department Psychologie der LMU
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-5148
E-mail pekrun@edupsy.uni-muenchen.de
www www.psy.lmu.de

Prof. Dr. Ernst Pöppel
Fakultät für Medizin der LMU, Institut für Medizinische Psychologie
Goethestraße 31
80336 Munich
Phone +49 (0)89 / 218075-650 (-651)
E-mail ernst.poeppel@med.uni-muenchen.de
www www.imp-muenchen.de

Prof. Dr. Heidrun Potschka | Page 76
Institut für Pharmakologie, Toxikologie und Pharmazie der LMU
Königinstraße 16
80539 Munich
Phone +49 (0)89 / 2180-2663
E-mail potschka@pharmtox.vetmed.uni-muenchen.de
www www.pharmtox.vetmed.uni-muenchen.de

R

Prof. Dr. Gerhard Rigoll | Page 78
Fakultät für Elektrotechnik der TUM,
Lehrstuhl für Mensch-Maschine-Kommunikation
Arcisstraße 21
80333 Munich
Phone +49 (0)89 / 289-28541
E-mail rigoll@tum.de
www www.mmk.ei.tum.de

Prof. Dr. Till Roenneberg
Fakultät für Medizin der LMU,
Institut für Medizinische Psychologie
Goethestraße 31
80336 Munich
Phone +49 (0)89 / 2180-75608
E-mail Roenneberg@lmu.de
www www.tpsec.de

Prof. Dr. Dan Rujescu
Klinik für Psychiatrie und Psychotherapie der LMU
Nußbaumstraße 7
80336 Munich
Phone +49 (0)89 / 5160-5756
E-mail Dan.Rujescu@med.uni-muenchen.de
www psywifo.klinikum.uni-muenchen.de/

S

PD Dr. Mathias Schmidt, PhD
MPI für Psychiatrie, Abteilung Moleculare Physilogie
Kraepelinstraße 2-10
80804 Munich
Phone +49 (0)89 / 30622-519
E-mail mschmidt@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

Prof. Dr. Werner Schneider
Universität Bielefeld, Fakultät für Psychologie und Sportwissenschaft
Postfach 100131
33501 Bielefeld
Phone +49 (0)521 / 1064502
E-mail wxs@uni-bielefeld.de
www http://www.uni-bielefeld.de/psychologie/

Prof. Dr. Torsten Schubert
Fakultät für Psychologie der LMU, Allgemeine und Experimentelle Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-5216
E-mail schubert@psy.lmu.de
www www.psy.lmu.de

Prof. Dr. Gerd Schuller
Department Biologie II der LMU, Abteilung Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180 74307
E-mail gschuller@lmu.de
www www.bio.lmu.de

PD Dr. Markus Schwarz
Klinik für Psychiatrie und Psychotherapie der LMU, Abteilung Neurochemie
Nussbaumstraße 7
80336 Munich
Phone +49 (0)89 / 5160-2761
E-mail Markus.Schwarz@med.uni-muenchen.de
www www.pni-net.de

Prof. Dr. Stephan Sellmaier
Fakultät für Philosophie der LMU, MKE
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180 - 6082
E-mail stephan.sellmaier@lrz.uni-muenchen.de
www www.philosophie.uni-muenchen.de

Prof. Dr. Beate Sodian
Fakultät für Psychologie und Pädagogik der LMU, Department Psychologie
Leopoldstraße 13
80802 Munich
Phone +49 (0)89 / 2180-5155
E-mail sodian@edupsy.uni-muenchen.de
www www.paed.uni-muenchen.de

Prof. Dr. Hans Straka | Page 80
Department Biologie II der LMU, Abteilung Neurobiologie
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74307
E-mail straka@lmu.de
www http://neuro.bio.lmu.de/members/systems_neuro_straka/straka_h/index.html

Prof. Dr. Andreas Straube
Neurologische Klinik und Poliklinik der LMU, Forschungsgruppe Kopfschmerz
Marchioninistraße 15
83177 Munich
Phone +49 (0)89 / 7095 3900
E-mail Andreas.Straube@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Michael Strupp | Page 82
Neurologische Klinik und Poliklinik der LMU, Department für Neurologie
Marchioninistraße 15
81377 Munich
Phone +49 (0)89 / 7095-3678
E-mail michael.strupp@med.uni-muenchen.de
www www.nefo.med.uni-muenchen.de

Prof. Dr. Bernd Sutor
Physiologisches Institut der LMU, Department Physiologische Genomik
Pettenkoferstraße 12
80336 Munich
Phone +49 (0)89 / 5996-234
E-mail bernd.sutor@lrz.uni-muenchen.de
www www.uni-muenchen.de

T

Dr. Chadi Touma
MPI für Psychiatrie
Kraepelinstraße 2
80804 Munich
Phone +49 (0)89 / 30622-228
E-mail touma@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

Prof. Dr. Dirk Trauner | Page 84
Chemische Biologie, Department Chemie der LMU
Butenandtstraße 5-13
81377 Munich
Phone +49 (0)89 / 2180-77800
E-mail dirk.trauner@cup.uni-muenchen.de
www www.cup.uni-muenchen.de

Prof. Dr. Christoph W. Turck
MPI für Psychiatrie
Kraepelinstraße 2
80804 Munich
Phone +49 (0)89 / 30622-317
E-mail turck@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

U

Prof. Dr. Rainer Uhl
Bio Imaging Zentrum
Am Klopferspitz 19
82152 Martinsried
Phone +49 (0)89 / 899232-22
E-mail uhl@botanik.biologie.uni-muenchen.de
www www.botanik.biologie.uni-muenchen.de

V

Prof. Dr. Leo van Hemmen
TUM, Physik Department T35
James-Franck-Straße
85748 Garching
Phone +49 (0)89 / 289-12362
E-mail LvH@tum.de
www www.t35.ph.tum.de

Prof. Dr. Albrecht von Müller
Parmenides Foundation
Kardinal-Faulhaber-Straße 14
80333 Munich
Phone +49 (0)89 / 255-40896
E-mail albrecht.von.mueller@parmenides-foundation.org
www www.parmenides-foundation.org

Prof. Dr. Wilhelm Vossenkuhl
Fakultät für Philosophie, Lehrstuhl für Philosophie I
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-2386
E-mail vossenkuhl@lmu.de
www www.philosophie.uni-muenchen.de

W

Prof. Dr. Lutz Wiegrebe
Fakultät für Biologie, Department Biologie II der LMU
Großhadernerstraße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74314
E-mail lutzw@lmu.de
www www.biologie.uni-muenchen.de

PD Dr. Carsten Wotjak
MPI für Psychiatrie, AG Neuronale Plastizität
Kraepelinstraße 2
80804 Munich
Phone +49 (0)89 / 30622-652
E-mail wotjak@mpipsykl.mpg.de

PD Dr. Mario Wullimann
LMU, Department Biology II
Großhaderner Straße 2
82152 Martinsried
Phone +49 (0)89 / 2180-74322
E-mail wullimann@zi.biologie.uni-muenchen.de
www www.bio.lmu.de

Prof. Dr. Wolfgang Wurst | Page 86
Helmholtz Zentrum München, Institut für Entwicklungsgenetik
Ingolstädter Landstraße 1
85764 Neuherberg
Phone +49 (0)89 / 3187-4110
E-mail wurst@helmholtz-muenchen.de
www www.helmholtz-muenchen.de

Z

Prof. Dr. Wolfram Ziegler
TUM, Entwicklungsgruppe Klinische Neuropsychologie EKN
Dachauer Straße 164
80992 Munich
Phone +49 (0)89 / 1577474
E-mail wolfram.ziegler@extern.lrz-muenchen.de
www www.lrz-muenchen.de

Prof. Dr. Walter Zieglgänsberger
MPI für Psychiatrie, Klinische Neuropharmakologie
Kraepelinstraße 2
80804 Munich
Phone +49 (0)89 / 30622-350
E-mail wzg@mpipsykl.mpg.de
www www.mpipsykl.mpg.de

MCN Management & Administration

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MPI for Brain Research

Berlin School of Mind and Brain Humboldt-Universität zu Berlin

Address Luisenstraße 56, Haus 1
10099 Berlin
Phone +49 (0)30 / 2093-1707
Fax +49 (0)30 / 2093-1802
www http://www.mind-and-brain.de/

Bernstein Center for Computational Neuroscience Ludwig-Maximilians-Universität München (LMU) | Page 16

Address Grosshaderner Straße 2
82152 Planegg-Martinsried
Phone +49 (0)89 / 2180-74801
E-mail herz@bio.lmu.de
www http://www.bccn-munich.de/

Bernstein Center for Computational Neuroscience Munich

Center for Advanced Studies

Address Seestraße 13
80802 Munich
Phone +49 (0)89 / 218072080
E-mail info@cas.lmu.de
www www.cas.lmu.de

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Biocenter
Ludwig-Maximilians-Universität Munich (LMU)
Address Grosshaderner Straße 2
82152 Planegg-Martinsried
Phone +49 (0)89 / 2180-74166
E-mail vaupel@bio.lmu.de
www www.sfb870.mcn.uni-muenchen.de/

SFB 870 Neuronal Circuits

CoTeSys – Cluster of Excellence Cognition for Technical Systems | Page 18

Technical University Munich (TUM)
Address Barer Straße 21
80290 Munich
Phone +49 (0)89 / 289-25723
E-mail info@cotesys.org
www www.cotesys.org

Deutsches Zentrum für Neurodegenerative Erkrankungen in der Helmholtz-Gemeinschaft (DZNE)

c/o Adolf Butenandt Institute, LMU
Address Schillerstraße 44
80336 Munich
Phone +49 (0)89 / 2180-75469
www http://www.dzne.de

DZNE Deutsches Zentrum für Neurodegenerative Erkrankungen in der Helmholtz-Gemeinschaft

DFG RTG 1091, Orientation and Motion in Space Neurologische Klinik und Poliklinik, Zentrum f. Sensomotorik, Neurologisches Forschungshaus | Page 102

Address Marchioninstraße 23
81377 Munich
Phone +49 (0)89 / 70954823
E-mail mc.botheroyd@lrz.uni-muenchen.de
www http://www.klinikum.uni-muenchen.de/Graduiertenkolleg-1091/de/

Graduiertenkolleg 1091

DFG RTG 1373, Brain Signaling: From Neurons to Circuits

Address Institute of Neurosciences
Technical University Munich (TUM)
Biedersteiner Str. 29
80802 Munich
Phone +49 (0) / 4140 3351
E-mail office-konnerth@lrz.tum.de
www www.rtg.me.tum.de

Elite Network of Bavaria – Bavarian State Ministry of Sciences, Research and the Arts | Page 96

Address Salvatorstraße 2
80333 Munich
Phone +49 (0)89 / 2186-2319
E-mail elitenetzwerk-bayern@stmwfk.bayern.de
www https://www.elitenetzwerk.bayern.de

Elite Network of Bavaria

Graduate School of Systemic Neurosciences | Page 92

Biocenter
Ludwig-Maximilians-Universität Munich (LMU)
Address Grosshaderner Straße 2
82152 Planegg-Martinsried
Phone +49 (0)89 / 2180-74178
E-mail gsn@lmu.de
www www.mcn.lmu.de/gsn

Graduate School of Systemic Neurosciences
LMU Munich

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Harvard Center for Brain Science Harvard University | Page 106

Address 52 Oxford Street
Cambridge, MA 02138
USA
www http://cbs.fas.harvard.edu/

Helmholtz Zentrum München Institute of Stem Cell Research

Address Ingolstädter Landstraße 1
85764 Neuherberg
Phone +49 (0)89 / 3187-3751
Fax +49 (0)89 / 3187-3761
www http://www.helmholtz-muenchen.de/en/research/institutes-research-facilities/stem-cell-research-isf/index.html

HelmholtzZentrum münchen
Deutsches Forschungszentrum für Gesundheit und Umwelt

Helmholtz Zentrum München IDG – Institut of Developmental Genetics

Address Ingolstädter Landstraße 1
85764 Munich / Neuherberg
Phone +49 (0)89 / 3187 4110
Fax +49 (0)89 / 3187 3099
www http://www.helmholtz-muenchen.de/en/idg/home/index.html

Institute of Neuroscience (TUM)

Address Biedersteiner Straße 29
80802 Munich
Phone +49 (0)89 / 4140 3351
E-mail office-konnerth@lrz.tum.de
www www.ifn.me.tum.de

Integrated Center for Research and Treatment of Vertigo, Balance and Ocular Motor Disorders Klinikum der Universität München | Page 20

Address Marchioninistraße 15
81377 Planegg-Martinsried
Phone +49 (0)89 / 7095-6980
E-mail esser@nefo.med.uni-muenchen.de
www http://www.klinikum.uni-muenchen.de/IFB-Schwindel/de

IFB[LMU]

International Max Planck Research School for Molecular and Cellular Life Sciences

Address Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578-2281
E-mail info@imprs-ls.mpg.de
www www.imprs-ls.de

IMPRS From Biology to Medicine

Ludwig-Maximilians-Universität München

Address Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-0
E-mail office-konnerth@lrz.tum.de
www http://www.uni-muenchen.de

LMU Ludwig-Maximilians-Universität München

Max Planck Institute of Neurobiology

Address Am Klopferspitz 18
82152 Martinsried
Phone +49 (0)89 / 8578-1
www http://www.neuro.mpg.de

Max Planck Institute for Ornithology

Address Eberhard-Gwinner-Straße
82319 Seewiesen
www http://www.orn.mpg.de/

Max Planck Institute of Psychiatry

Address Kraepelinstaße 2-10
80804 Munich
Phone +49 (0)89 / 30622-1
E-mail info@mpipsykl.mpg.de
www http://www.mpipsykl.mpg.de

Max Planck Society

Address Hofgartenstraße 8
80539 Munich
Phone +49 (0)89 / 2108-0
E-mail post@gv.mpg.de
www http://www.mpg.de

MAX-PLANCK-GESELLSCHAFT

Munich Center For Integrated Protein Science (CIPSM)

Address Butenandtstraße 5 - 13
81377 Munich
Phone +49 (0)89 / 2180-77661
E-mail oliver.baron@lmu.de
http://www.cipsm.de

CIPSM

Münchner Kompetenz Zentrum Ethik

Address Ludwig-Maximilians-Universität München
Geschwister-Scholl-Platz 1
80539 Munich
Phone +49 (0)89 / 2180-6083
Fax +49 (0)89 / 2180-16 464
www http://www.kompetenzzentrumethik.uni-muenchen.de/index.html

The Amgen Foundation | Page 98

Address One Amgen Center Drive
Thousand Oaks, CA
USA ≠91320
Phone +1 805-447-4056
E-mail amgenfoundation@amgen.com
www http://www.amgen.com/citizenship/foundation.html

AMGEN

The Queensland Brain Institute The University of Queensland | Page 107

Address QBI Building (#79)
St Lucia, QLD 4072
Australia
Phone +61 7 3346 6300
Fax +61 7 3346 6301
www http://www.qbi.uq.edu.au

Technische Universität München (TUM)

Address Arcisstraße 21
80333 Munich
Phone +49 (0)89 / 289-01
Fax +49 (0)89 / 289-22000

TUM – Institute of Neuroscience

Address Biedersteiner Straße 29
80802 Munich
Phone +49 (0)89 / 4140 3351
Fax +49 (0)89 / 4140 3352
www http://www.ifn.me.tum.de/new/

TUM – Department of Electrical Engineering and Information Technology

Address Arcisstraße 21
80333 Munich
www http://www.ei.tum.de/index_html_en

TUM – Department of Physics

Address James-Franck-Straße 1
85748 Garching
Phone +49 (0)89 / 289-12492
Fax +49 (0)89 / 289-14474
www http://www.ph.tum.de/

TUM – Faculty of Medicine

Address Ismaninger Straße 22
81675 Munich
Phone +49 (0)89 / 4140-4022
Fax +49 (0)89 / 4140-4935
www http://www.med.tum.de/

Imprint

Project Management
Lena Bittl
Munich Center for Neurosciences – Brain & Mind
Ludwig-Maximilians-Universität München
Grosshaderner Strasse 2
82152 Munich

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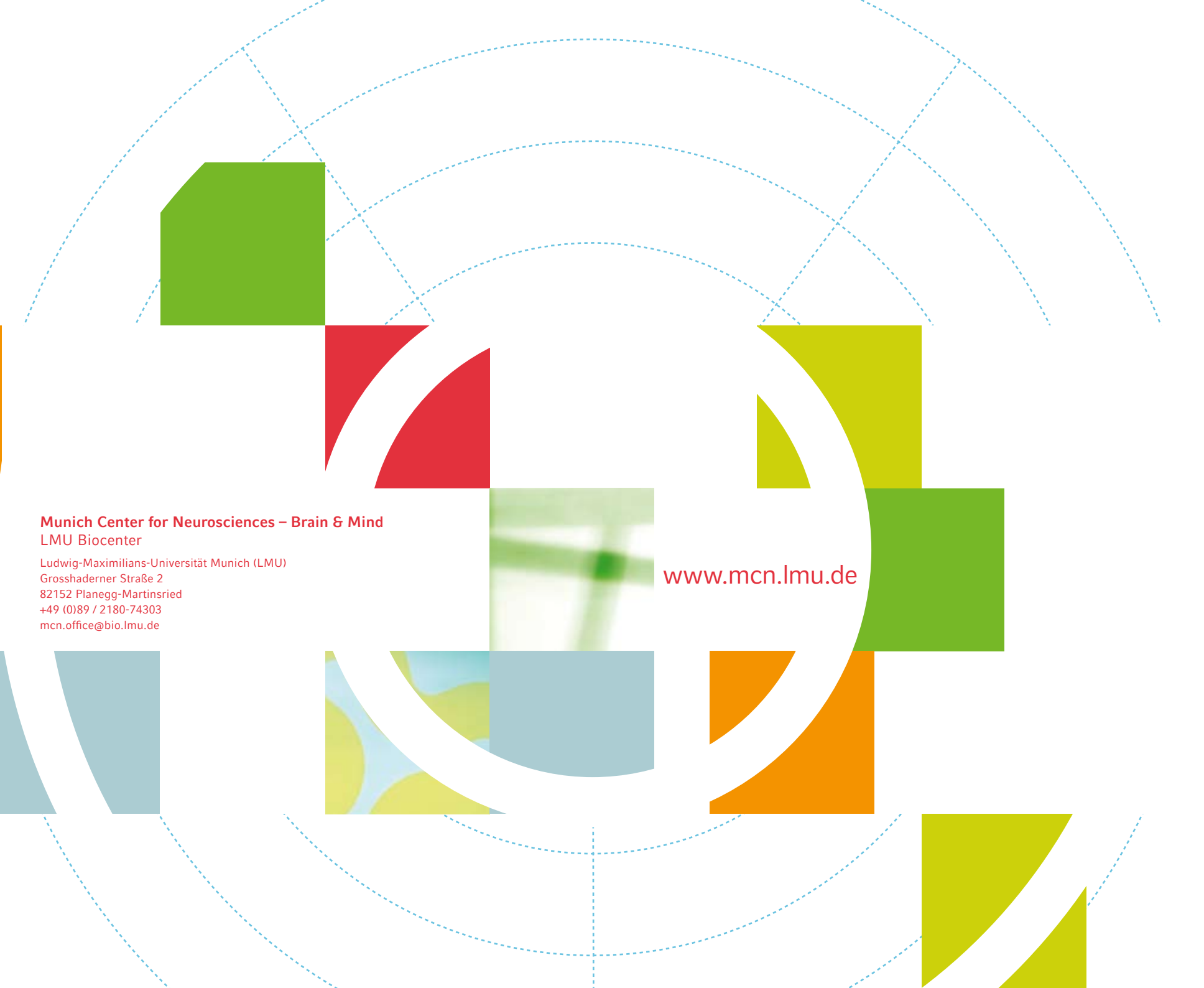

Munich Center for Neurosciences – Brain & Mind
LMU Biocenter

Ludwig-Maximilians-Universität Munich (LMU)
Grosshaderner Straße 2
82152 Planegg-Martinsried
+49 (0)89 / 2180-74303
mcn.office@bio.lmu.de

www.mcn.lmu.de