Making fine distinctions
By Hubert Filser

LMU immunologist Veit Hornung’s research focuses on how the innate immune system differentiates between endogenous cellular structures and invasive agents. For the complete article, see [www.en.lmu.de/news/insightlmu/2016/04_01.pdf](http://www.en.lmu.de/news/insightlmu/2016/04_01.pdf)

Diverse molecular patterns, highly interconnected functional networks, complex signal relays: Robotic pipetting systems help find the critical checkpoints in the immune system.

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“The GSN has already made its mark” by Clemens Grosse

LMU’s Graduate School of Systemic Neurosciences, which is now 10 years old, focuses on a single issue: How does the brain work? Doctoral students from all over the world are seeking answers to this immensely complicated question.

continued on page 2

Alternatives to TINA by David Lohmann

The phrase ‘There is no alternative’ has been a prominent feature of many political controversies in recent years. LMU political scientist Astrid Séville’s study of the ‘TINA’ phenomenon has now won her a prestigious award.

continued on page 4

Caroline is in control by David Lohmann

Cystic fibrosis is a genetic disease which is relatively rare in Germany. LMU student Caroline Schambeck is one of its victims, but she does not let her illness dominate her life, and was recently awarded a Deutschlandstipendium.

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More news on LMU Munich at [www.en.lmu.de/news](http://www.en.lmu.de/news)
Academics

“The GSN has already made its mark”
by Clemens Grosse

LMU’s Graduate School of Systemic Neurosciences, which is now 10 years old, focuses on a single issue: How does the brain work? Doctoral students from all over the world are seeking answers to this immensely complicated question.

The Mongolian gerbil must localize sounds in double-quick time, for its very survival depends on its ability to process acoustic information. Acoustic signals are picked up by both ears, reaching the one nearer the source a few microseconds earlier. Activation of sensory cells in that ear inhibits their counterparts in the opposite one. The Australian neurobiologist Kiri Couchman is seeking the basis for this mechanism, and has shown that triggering of a small number of receptor cells is sufficient to induce activation/inhibition of the neural circuits involved.

Couchman did her doctoral research as a member of the Graduate School of Systemic Neurosciences (GSN-LMU), which turned 10 years last month. Understanding brain function requires an interdisciplinary approach, and the students and mentors in the GSN come from a variety of backgrounds, ranging from philosophy to biophysics. Neurobiologist Couchman (32) was particularly struck by the emphasis placed on interdisciplinarity at the GSN, having studied Philosophy herself. “In our regular lectures on the various disciplines, we gained fascinating insights and became acquainted with the intriguing issues involved. We learned about questions and fields that we would never have been exposed to if we had focused solely on our own specific area of interest.” She also remembers being very impressed by the infrastructure available in Munich. Having spent 4 years at the GSN, she now works at the Institut Pasteur in Paris.

The Bavarian capital is a force to be reckoned with in the neurosciences, and is home to an array of institutions – including the GSN – that is unique in Germany. These include the Bernstein Center for Computational Neurosciences Munich, the Max Planck Institutes for Neurobiology, Ornithology and Psychiatry, several Collaborative Research Centers in the field and the Helmholtz Zentrum München. All in all, this network offers an exceptional range of research expertise, which is an ideal basis for the training and education of highly talented young investigators. “The GSN is the glue that holds this network together,” says Benedikt Grothe, neurobiology professor and designated speaker for the Graduate School.

“The GSN holds the whole network together”

For the doctoral students who are members of the GSN work in the various affiliated institutions, and as good communicators, they serve to bind the network together, he adds. And that will not change in the coming years, he says, as the School’s future is assured beyond the end of the Excellence Initiative in 2017.

At all events, over the past decade the School has built up an enviable international reputation. It receives applications from highly qualified candidates from around the world and is engaged in a number of collaborative ventures with institutions including Harvard University and the University of Queensland in Brisbane. “We are now trying to limit the number of cooperations we enter into, although we of course remain open to offers. Our postdocs can work anywhere in the world,” Grothe says.

Dr. Kiri Couchman, now based in Paris, is one such postdoc. She recalls with affection the friendships she made during her time at the GSN, which have persisted since she left Munich. “We all got on very well together – both in our own labs and at the weekly meetings with all the other graduate students. And these contacts are still very much alive.”

The School’s academic independence (unlike such schools elsewhere in Germany, it awards its own PhD degrees) is another feature that makes it especially attractive for graduate students from abroad. Benedikt Grothe sees the GSN as an important means of drawing first-rate neuroscientists to the city on the Isar.

And in light of the healthcare challenges posed by ageing populations, the need for breakthroughs in neurobiology is becoming ever more urgent.

Translation: Paul Hardy
Quantum Optics

A passion for precision
Interview by Hubert Filser

LMU’s Nobel Laureate Theodor Hänsch, who has recently celebrated his 75th birthday, talks about creativity in physics, Steve Jobs’ soldering skills, and the secrets of precision metrology.
For the complete article, see www.en.lmu.de/news/insightlmu/2016/04_02.pdf

Botany

Ants and epiphytes:
A longstanding relationship

Many species of ants live in symbiosis with specific plants and both partners profit from these relationships. One of the most remarkable of these interactions is that between the ant species Philidris nagasau and at least six members of the epiphytic plant genus Squamellaria on the Fiji Islands: As LMU botany professor Susanne Renner and her collaborator Guillaume Chomicki have now shown, the ants actively cultivate their plant partners. The tiny ants begin their careers as gardeners by collecting seeds from Squamellaria and “planting” them in fissures in the bark of the host tree, where the seeds germinate. As epiphytes, Squamellaria species cannot draw on soil as a source of inorganic nutrients. However, the hypocotyl of the seedling forms a specialized tuber with a preformed hole – the so-called domatium – which allows ants to enter the seedling and defecate, thereby fertilizing the young plant. As the plant grows, the domatium becomes larger, forming a network of galleries connected to the outside, which the ants colonize. In contrast to other instances of symbiosis between plants and ants, the interaction between Squamellaria and Philidris nagasau has become so specialized that neither partner can survive on its own. The LMU researchers were able to date the beginnings of the ant-plant symbioses by using the degrees of difference between homologous DNA sequences in both plants and ants as independent molecular clocks. The results indicate that the mutualistic relationship between Philidris and Squamellaria was initiated about 3 million years ago, probably as a result of the evolution of reciprocally beneficial adaptations.

Physics

From the atomic to the nuclear clock

The second is our basic unit for the measurement of time, and is tied to the oscillation period of electrons in the atomic shell of the element cesium (Cs). The best atomic clock currently in use boasts a relative precision of $2 \times 10^{-18}$. “With a so-called nuclear clock, based on oscillations in the atomic nucleus itself rather than oscillations in the electron shells surrounding it, we would be able to enhance this accuracy by a factor of about ten” says LMU physicist Peter Thirolf. However, of the more than 3300 known types of atomic nuclei, only one potentially offers a suitable basis for a nuclear clock: the nucleus of the thorium isotope with atomic mass 229 (Th-229) – and direct detection of this isomer has never been achieved. “So far, the evidence for its existence has been purely indirect,” says Thirolf. Now, however, he and his colleagues have succeeded in detecting the elusive nuclear transition in a complex experiment. They made use of U-233 as a source of Th-229m, which is produced in the radioactive alpha decay of the uranium isotope. In an experimental tour-de-force, the scientists isolated the isomer as an ion beam. “Using a microchannel plate detector, we were then able to measure the decay of the excited isomer back into the ground state of Th-229 as a clear and unambiguous signal. This constitutes direct proof that the excited state really exists,” Thirolf explains. “This breakthrough is a decisive step toward the realization of a working nuclear clock.” The next step is to characterize the properties of the nuclear transition more precisely. These data will allow laser physicists to set to work on a laser that can be tuned to the transition frequency, which is a prerequisite for optical control of the transition.
Alternatives to TINA
by David Lohmann

The phrase ‘There is no alternative’ has been a prominent feature of many political controversies in recent years. LMU political scientist Astrid Séville’s study of the ‘TINA’ phenomenon has now won her a prestigious award.

One might expect political discussions in liberal democracies to focus on the relative merits of alternative courses of political action. However, over the past decade, politicians have often asserted that ‘there is no alternative’. Angela Merkel invoked the pithier German term alternativlos in the context of Greece’s public finances, while the former European Commissioner for Monetary Affairs, Olli Rehn, used it during the Euro crisis and Christine Lagarde, Head of the International Monetary Fund, did so in relation to budgetary discipline.

According to Dr. Astrid Séville, a researcher at LMU’s Geschwister Scholl Institute for Political Science, the phrase has become a mantra: “In recent years, European prime ministers have repeatedly used Margaret Thatcher’s catchphrase ‘There is no alternative’, which earned her the nickname TINA.” Séville was puzzled by politicians’ recourse to such rhetoric – and chose to explore the issue in her doctoral thesis. Her dissertation entitled Sachzwang und Alternativlosigkeit. Eine politische Anamnese (Constraints and the Absence of Alternatives: A Political Case History) has now won the Körber Foundation’s Deutsche Studienpreis, worth 25,000 euros. The Prize will be presented to her by Norbert Lammert, President of the Bundestag at the end of this year.

“The TINA argument has itself become a political tool,” says Séville, even though there is always an alternative. (For instance, the UK could have chosen to remain in the EU.) Moreover, in a particularly alarming development, opposition parties have begun to present their own programs as “the only possible alternative” to government policies. In Séville’s view, this is a recipe for political apathy, which can only strengthen extremists.

Conflicts are the lifeblood of a democracy

The most prominent reaction in Germany to the dominance of the TINA argument during the Euro crisis has undoubtedly been the rise of the populist Alternative für Deutschland (AfD). “Its very name refers to the alleged absence of political alternatives offered by the established party system,” as Séville points out. The AfD was founded in response to dissatisfaction with the actions of EU governments during the Euro crisis and the adoption of liberal social policies by the conservative parties CDU/CSU, and disappointment following the eclipse of the liberal party FDP. Meanwhile, many conservative voters have turned to the AfD, she says. “Even the Social Democratic Party no longer adequately reflects the views of lower middle class voters.”

In order to break out of the TINA mindset and combat the widespread distrust of politics, Séville suggests, it is time to strengthen the position of oppositional voices. “One of our problems is that parliamentary opposition has been blunted, because there is a broad consensus on many of the issues,” she says. In addition, each of the major parties needs to develop a more distinctive political profile. They have to be able to say: This is our program – and that is what the other parties propose to do. She also argues that voters must grasp the idea that conflicts are part of a healthy democracy, because decisions between alternatives need to be made. “We need public debate on the issues.” Furthermore, political decisions must be well-founded and they must be accepted by the opposition. “There is nothing wrong with ideological arguments as such, and they should not be discredited in everyday political discourse.”

www.en.qsi.lmu.de/people/academic/seville

Translation: Paul Hardy
Cystic fibrosis (CF) is a chronic metabolic disease. In Germany, some 200 babies are diagnosed with the disease each year. The hallmark of the disease is the production of highly viscous mucus in multiple organs (the disease is commonly called ‘mucoviscidosis’ in Germany), which is particularly problematic in the case of the lungs and the pancreas. But although she is fully aware of the fact that there is no effective long-term treatment for her condition, Caroline has never lost her determination to live her life to the full.

Caroline, not her condition, is in control

Caroline, who began to study Earth Sciences in 2012, must take special care during the winter months. Even when she is feeling well, she has to take drugs regularly, do breathing exercises and use an inhaler for up to 90 minutes every day. Otherwise minor ailments can be live-threatening for her, and she must increase the drug dosage. “Tablets can be knocked back quickly,” she says and there are plenty of places at LMU to which she can withdraw with her inhaler during the day. She uses the inhaler in the mornings when she is still drowsy, gets through her breathing exercises while watching TV and goes to a physiotherapist once a week. Most of her time, she says, is devoted to what she jokingly calls “my real passion” – pumping iron in the physiotherapist’s practice across the street from her home. When that session is over, she’s ready to review the day’s lectures.

There has been some recent progress in the search for ways to ameliorate CF, but there is still no cure in sight. Currently, the only real option – in Caroline’s case too – is lung transplantation. She underwent the necessary preliminary tests in 2014. “My lung is in such bad shape that I really need a new one,” she says. But suitable donor lungs are scarce and the waiting list is long. Thanks to the training regime she has had to follow since she was very young, the 26-year-old has learned to cope with her illness. “My parents never tried to keep me wrapped up in cotton wool,” she remembers. In retrospect, she is grateful: “That is the real reason why I am still feeling well although my medical readings are not all that good.”

From therapy to thesis

Caroline is studying Geosciences in a program jointly designed by LMU and the Technical University of Munich. “I have always been interested in geochemistry,” she says. “What I find fascinating is that the subject has so many facets – taking in the mining and processing of ores, environmental and sustainability issues as well as classical geological topics like volcanology. Her experiences at both universities have been very positive, she adds. All her professors acknowledge the special difficulties posed by her illness and help her master them – even during excursions in mountainous terrain or when she is forced to miss lectures. “When I am going through a bad patch, I may have to spend a fortnight in hospital.” In such cases it has always been possible for her to postpone exams and catch up on course work.

At the beginning of this term she picked up an infection and had to spend time in hospital. So she now has to work twice as hard, and she has an obligatory laboratory practical coming up in preparation for her Master’s thesis. When she has finished her studies she would like to work in a lab. “I can’t work fulltime, and then there is the problem of whether I should mention my illness in job applications,” she says, before answering the question for herself: “I have never tried to hide my illness and that has never done me any harm.” And if a potential employer expects the same level of performance from me as from a person in normal health, then he will just have to do without me, she adds. “I have to look after myself – it’s the only way I can maintain my quality of life.”

LMU Office for Disability Services

The LMU Office for Disability Services advises and supports disabled students and helps them cope with everyday life on campus.

Translation: Paul Hardy
Leibniz Prize for LMU’s Karl-Peter Hopfner

Biochemist Karl-Peter Hopfner studies how cells detect and repair the damage to their DNA that is an inevitable consequence of environmental factors and enzymatic errors. The Deutsche Forschungsgemeinschaft (DFG) has now acknowledged Karl-Peter Hopfner’s contributions to research by awarding him a Leibniz Prize. According to the citation, the award is conferred on Hopfner “for his outstanding work in structural biology and genome biology, which has made ground-breaking contributions to the fields of DNA repair and the cellular recognition of foreign nucleic acids.” The DFG goes on to point out that Hopfner has made crucial discoveries relating to the repair of DNA double-strand breaks and the recognition mechanism employed by a sensor of DNA damage, as well as providing essential insights into the process by which components of the innate immune system sense the presence of viral and bacterial DNAs in infected cells. The Leibniz Prize is regarded as the most important German award for research. This year the DFG has selected 10 researchers for the Prize. The winners each receive 2.5 million euros which they can use for up to 7 years to finance their research.

www.hopfner.genzentrum.lmu.de

Living tissue from the 3-D printer

A team of students from LMU and the Technical University of Munich (TUM) took the laurels at the international Genetically Engineered Machine Competition (iGEM) in Boston – for developing a method for 3-D printing of living tissue. The Munich iGEM Project was prompted by the ongoing scarcity of donor organs for transplantation into patients who urgently need them. The students involved essentially reconfigured a conventional 3D printer that normally molds plastics to serve as a 3-D bioprinter. The crucial feature is that specially designed surface proteins on the cells interact with each other in accordance with the lock-and-key principle. This allows that tissues to be built up layer by layer, just as the printer would normally stack molded and polymerized plastics on top of one another. The iGEM competition is an international initiative to stimulate innovation in the burgeoning field of synthetic biology. In addition to taking first prize overall, the team came out on top in several subcategories, winning the awards for the best software and the best hardware, for example. Over 300 teams from 42 countries took part in this year’s competition – a dozen of them from Germany.

http://2016.igem.org/Team:LMU-TUM_Munich

New Allianz Guest Professors

Designed to foster dialog between Jewish and Islamic cultures, LMU’s first Allianz Guest Professorships were awarded in 2003. This winter semester, LMU has welcomed Mark Cohen as Professor for Jewish-Islamic History and architectural historian Zeynep Kuban. Zeynep Kuban is Professor for the History of Architecture at the Technical University of Istanbul (ITU). Her research interests center on the architectural heritage of the whole of modern Turkey and its relationship to the history of Anatolia through the ages. Mark R. Cohen is the Khedouri A. Zilkha Emeritus Professor of Jewish Civilization in the Near East in the Department of Near Eastern Studies at Princeton University in New Jersey. His work focuses on the history of Jewish-Muslim relationships in the Middle Ages.

New CRC: Rationality and competition

The new Transregio Collaborative Research Center on “Rationality and Competition: The Economic Performance of Individuals and Firms” (TRR 190) funded by the Deutsche Forschungsgemeinschaft (DFG) will investigate theoretically and empirically the significance of behavioral biases of individuals in competitive environments. Among the issues that will be tackled is the question of how systematic misconceptions influence economic decision-making by private households in the areas of education and health. But the researchers will also look at individual decision-making in the commercial sphere, and analyze how firms react to the behavior of their employees and their customers and how these decisions are influenced by competition. Coordinator of the new transregional CRC is Klaus Schmidt, who holds the Chair of Economic Theory at LMU. “Our goal is to identify the conditions under which systematic distortions in the formation of expectations, preferences and decisions have a significant effect on market outcomes, but also the circumstances under which standard economic models adequately account for individual behavior,” Schmidt says. The researchers also hope to obtain new insights relating to the efficiency of markets and the efficacy of various economic policy tools, for example in the field of taxation and the regulation of financial markets. Berlin’s Humboldt University will also participate in the CRC.

Any questions or comments? insight@lmu.de