

# Mobile Microscopes Look inside the Brain

Tiny laser scanning microscope records brain cell activity in free-roaming animals



With the aid of microscopes and magnetic resonance tomography, scientists and doctors can look inside our brains – but only as long as we keep very still and do not move. Since this is not normal behavior, however, these methods are of limited value in terms of understanding higher brain functions, such as perception and alertness.

Scientists at the Max Planck Institute for Biological Cybernetics in Tübingen have now developed a mobile laser scanning microscope that is so small that it can be mounted on the head of a rat. Very light in weight and only about three centimeters in size, the microscope uses a high-energy pulsed laser and fiber optics in order to observe several fluorescent cells in the brain simultaneously. It also fixes the exact position of the animal, which can move about at will.

For the first time, researchers are now able to track how brain cells behave in an animal exploring its environment. This technology promises to deliver entirely new insights into our understanding of brain functions.

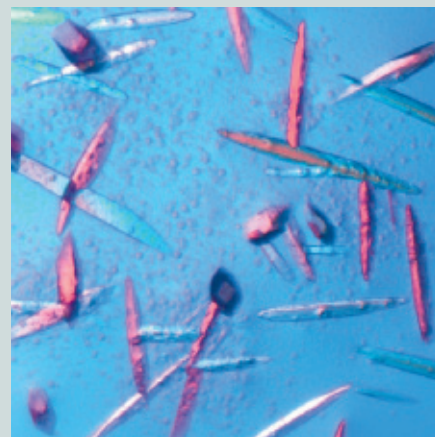
Mini-microscopes facilitate new views in the brains of rats. The tiny devices, weighing just 6 grams and measuring 3 centimeters, can monitor up to 20 nerve cells simultaneously while the animal is free to move around.

Photos: Max Planck Society (bottom), MPI for Biological Cybernetics (top)

## Proteins in 3-D

The proteins present in biological membranes play a part in almost all life-critical processes in cells. New investigative methods are providing fascinating insights into their three-dimensional structure. In order to be able to analyze the structure of a protein, tiny amounts must first be converted into crystalline form – only then are the molecules accessible for examination with the aid of X-rays. The Max Planck Institute for Biophysics in Frankfurt am Main recently established an ultramodern Core Center for Membrane Proteins. It comprises a fully automated crystallization unit to manufacture crystals on a nanoliter scale, two mass spectrometers, two X-

ray diffractometers and a calorimeter. The crystallization unit will significantly accelerate the manufacture and optimization of crystals and the subsequent structural analysis. “The establishment of the Core Center in Frankfurt also gives a boost to Germany’s status as a research location,” emphasizes Hartmut Michel, Director at the Max Planck Institute for Biophysics. The Center was sponsored by the German Federal Ministry of Education and Research and the EU, as well as receiving support from Max Planck Society central funds. The Max Planck Institute for Biophysics manages the infrastructure and provides personnel to maintain continuous operation.



Protein crystals

The Core Center for Membrane Proteins can be used by scientists from throughout Europe.

# “In certain research fields, India is one of the key locations”

On February 3, 2010, German Federal President Horst Köhler joined India's Minister of Research Prithviraj Chavan to inaugurate the Indo-German Max Planck Center for Computer Science at the Indian Institute of Technology in Delhi. In an interview, Max Planck President Peter Gruss explains the Max Planck Society's interest in developing a partnership with India.

*Professor Gruss, why is the Max Planck Society seeking to cooperate with India?*

**Peter Gruss:** There are an increasing number of outstanding Indian institutes working in scientific fields in which Max Planck Institutes are seeking partners the world over. What's more, I expect India to play an increasingly important role in science in the future. A lot of talented young people are already coming to us from India. In the past five years, the Max Planck Society has seen an increase of more than 80 percent in the number of junior and visiting scientists from India – one out of every ten foreign doctoral students at Max Planck Institutes is from there. And the 120 Indian graduate students at our International Max Planck Research Schools constitute the largest overseas group.

*What forms of cooperation already exist?*

**Peter Gruss:** First, we have Max Planck scientists cooperating with their Indian colleagues within the context of specific research projects. There are currently 40 such research projects in such diverse fields as astronomy, cancer research, plant physiology, criminal law and art history. In addition, we help those foreign guest scientists who have proven themselves at our institutes to establish themselves scientifically in their home countries, in an effort to preserve long-term links between them and the Max Planck Institutes. We support these scientists after their return to their home country through the medium of partner groups. There are currently 12 of these groups in India.

*What is the newly established Max Planck Center in India expected to achieve?*

**Peter Gruss:** The goal is to create a center of excellence that not only engages in top-level research, but also opens up career

opportunities for young scientists in India. India's universities produce 180,000 IT graduates every year. But the country has room for only about 30 of them to study for doctorates, due to the lack of research institutions of the appropriate caliber. The Center is the result of the cooperation between our Max Planck Institute for Informatics in Saarbrücken and a partner group in India. It will initially comprise six Indo-German research groups, to be joined by four more a year later. The German Federal Ministry of Education and Research (BMBF) and India's Department of Science and Technology are each funding the Max Planck Center to the tune of 1.1 and 2 million euros, respectively, spread over five years. This form of cooperation has a certain institutional character and is intended to add further momentum to our work with India.

*The research work at the Max Planck Center will concentrate on computer sciences – why is that?*

**Peter Gruss:** In certain research fields, India is one of the key locations – and that certainly applies to the computer sciences. Kurt Mehlhorn, Director at the Max Planck Institute in Saarbrücken, who will head the Center in New Delhi together with Naveen Garg, says himself that one of his best works was authored jointly with Indian colleagues. In his field of algorithms, this cooperation has been extremely fruitful. And this is not the only such venture: Saarbrücken is already partnering with Mumbai on database systems and with Chennai in the networks field. We have already gained a lot of positive experience.

*In the computer sciences, basic research and application are closely related. During your visit to India you had a meeting*



Peter Gruss also took part in the inauguration of the Max Planck Center in Delhi by the German Federal President.

*with Narayana Murthy, the founder of Infosys Technologies. What did you talk about?*

**Peter Gruss:** Narayana Murthy has distinguished himself not only as an entrepreneur, but as a philanthropist. That is why we talked about how we might expand cooperation between Germany and India with his support – for example through scholarships for doctoral students or the like. Whether we will profit elsewhere from contacts with Infosys – it is, after all, one of the largest IT firms in India, with over 100,000 employees – remains to be seen.

# Federal Chancellor Visits Greifswald

At the start of the Year of Science that focuses on the theme “The future of energy,” Federal Chancellor Angela Merkel visited the Greifswald branch of the MPI for Plasma Physics (IPP). Commenting on the work in Greifswald, she emphasized that, with this project, Germany is writing a new page in the history of fusion.

The IPP is in the fortunate position of being able to implement trial concepts at both its locations aimed at optimizing the magnetic field in a future fusion reactor: the Tokamak ASDEX upgrade at the IPP in Garching, near Munich,

and the Wendelstein 7-X stellarator at its Greifswald site. “Sophisticated technology demands conceptual diversity,” explained Thomas Klingner, the head scientist in Greifswald. The members of the Federal parliament who visited a week

later were also impressed by the scientific and engineering “work of art” that is growing on a daily basis. They promised political support by topping up the project funds for fusion research in Germany’s national budget. Germany’s fusion research institutes intend to use the money to carry out some initial projects in preparation for a demonstration power plant (DEMO) that is due to succeed the ITER trial reactor now under construction and supply fusion-generated power to the national grid for the first time. If everything goes according to plan, the existing coal-fired stations and nuclear power plants could be replaced step by step with clean, safe fusion power stations in the second half of this century. According to forecasts by the Energy Modeling Forum, there could be around 4,000 new power plants supplying a third of the world’s electricity by the year 2100.

Günther Hasinger is pleased about the Federal Chancellor’s visit.



# First Appointments Accepted in Florida

The Max Planck Florida Institute in Jupiter has filled three scientific posts.

**Michael D. Ehlers** of Duke University Medical Center will become Scientific Director and CEO. Professor Ehlers currently heads the Department of Neurobiology at Duke University, a private university in Durham, North Carolina. His research is devoted to the structure and connectivity of neurons in the brain. In addition, he is also concerned with the role played by neurons, for example in learning.

**Samuel M. Young** will head a research group focusing on the cellular and molecular mechanisms of synapse functions. He will be studying the

highly specialized contact points in the brain via which neurons exchange electrical and chemical signals. Young most recently headed a research group in the Department of Membrane Biophysics at the Max Planck Institute for Biophysical Chemistry in Göttingen.

**Jason Christie** will head up a research group devoted to the physiology of synapses. Using electrical recording and imaging methods, he aims to discover how the transfer of information between two cells or within larger groups of cells is altered by temporary activity.

These new fields will complement the research work already achieved by the team headed by Bert Sakmann. The winner of the Nobel Prize for Medicine and his colleagues are working on a program intended to create a three-dimensional map of the brain.

The various cell types are identified with special fluorescent markers so that the distribution of neurons can then be mapped and quantified. This work will form the basis for future studies of neurodegenerative diseases, such as Alzheimer’s.

## Curiosos Por Las Ciencias – Curious about Science



With the Science Tunnel touring South America, all of the issues of MAX magazine are now available in Spanish.

The official opening of the Science Tunnel took place at the Palacio Pizzurno in Buenos Aires, the headquarters of the Argentine Ministry of Education, on March 8, 2010. In addition to the Argentine Ministers of Foreign Affairs, Science and Education, the cere-

mony was attended by President Cristina Fernández de Kirchner and Germany's Foreign Minister Guido Westerwelle. The multimedia exhibition showcasing the latest in science and technology was open to visitors until April 20th. For more detailed background information, our MAX magazines were also made available: with active support from the German Academic Exchange Service DAAD, all of the BIO-, GEO- and TECHMAX issues published to date (a total of 40) were translated into Spanish and printed with the assistance of German businesses and Spanish scientific institutions.

Spanish edition of GEOMAX 9

## MAXPLANCKRESEARCH on FSC Paper

Starting with this issue, the Max Planck Society's science magazine is being printed on paper certified by the Forest Stewardship Council. The FSC was established in 1993 to promote sustainable forest development. The organization aims to achieve this goal not only through protection orders, but above all through responsible management. The FSC is an interna-

tional not-for-profit organization based in Bonn with national working parties in 43 countries. It is supported by environmental organizations (including WWF, Greenpeace, NABU, Robin Wood), societies and numerous business enterprises.



### On the Net



#### Lab Log

Science journalist Marcus Anhäuser, who also writes for Max-PlanckResearch, completed a laboratory internship at the Max Planck Institute for Molecular Cell Biology and Genetics in Dresden last year. He recorded his impressions and experiences in a blog (in German). Those wishing to learn more about such subjects as "Men in white coats," "Meshugge microtubules" or "How to stick fission fungi back together" will find it here – amusement guaranteed:

<http://www.scienceblogs.de/labortagebuch/>

#### How Do We Know What We Know?

The Internet exhibition "Evidence" mounted by the Exploratorium in San Francisco offers a graphic explanation of how science works. It focuses on the work of the Max Planck Institute for Evolutionary Anthropology in Leipzig. The Institute studies the origins of mankind, for example by comparing the cognitive abilities of humans and other primates, seeking out the differences

in the genomes of Neanderthals and *Homo sapiens*, and investigating the diversity of human speech. For a fascinating excursion into the working methods and methodologies of scientists, visit:

<http://www.exploratorium.edu/evidence/>

#### Expedition into the World of Energy

From May 20th to August 29th the island of Mainau in Lake Constance will offer knowledge hunters the chance to embark on a voyage of discovery. Scientific experiments, simulations and exciting exhibits all about energy will be housed in a total of 20 pavilions, including two designed by the Max Planck Society – one dedicated to material sciences within the field of hydrogen technology, the other devoted to fusion research. The exhibition "Entdeckungen/Discoveries" is a three-year series of events: last year the subject was "Water". In 2011 the focus will be on research into the field of health.

<http://www.mainau-entdeckungen.de/>