



# MAX PLANCK

## News



The Large Hadron Collider at CERN has been hailed as the scientific phenomenon of the year by the journal *SCIENCE*. Guests were given a tour of the installation at its inauguration on September 10, 2008.

### BREAKTHROUGHS IN 2008

## Research That Sets the Pace

Each year, the two major scientific journals *SCIENCE* and *NATURE* single out the publications they consider to be the breakthroughs of the year – those that, in their opinion, have the greatest significance for future research. And once again, Max Planck researchers are among the authors of this year's publications.

For the editors of the respected journal *NATURE* МЕТОД, a subsidiary of *NATURE*, the "Method of the Year" in 2008 was ultrahigh resolution fluorescence microscopy. It has been mainly physicists working at interdisciplinary research institutions who have recently found sophisticated ways to improve light-optical microscopy far beyond the 200-nanometer resolution limit postulated by Ernst Abbé. Stefan Hell, Director at the Max

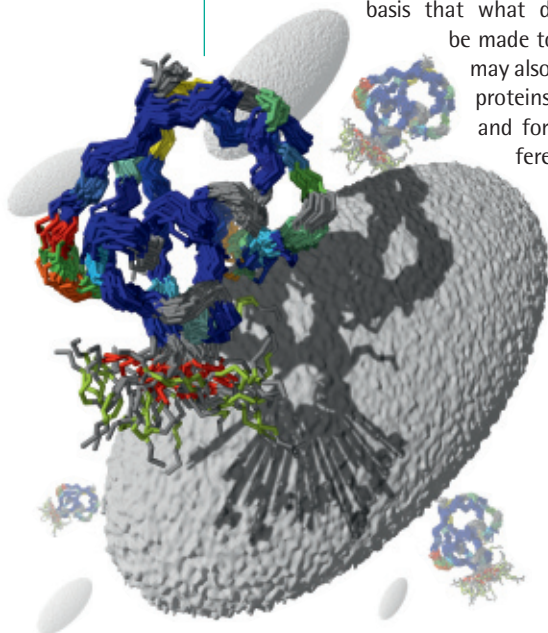
Planck Institute for Biophysical Chemistry in Göttingen, was the first to achieve nanometer-scale resolution using light-optical microscopy.

The STED microscope he developed, which has been manufactured and marketed by Leica-Microsystems since November 2007, makes it possible to distinguish tiny fluorescence-marked protein complexes that are just 20 to 50 nanometers in size – structures that are about a thousand times smaller than the diameter of a human hair. Recently, Hell and his colleagues have made further spectacular improvements that now also enable them to track dynamic processes in individual cells. At a rate of 28 frames per second and a spatial resolution of 65 nanometers, their first video shows living nerve cells working at their task of signal transmission. ▶

PHOTO: CERN

Biochemists have also been observing proteins, the basic building blocks of life, at work. There has been a long-running argument over how proteins bond with their target structures, which are often proteins as well. Many researchers have assumed that the structure of the target molecule forces the protein to adopt a complementary form, on the basis that what doesn't fit must be made to fit. However, it may also be the case that proteins switch back and forth between different conforma-

Researchers have also made great strides in genome sequencing. The new sequencing technologies are faster and less expensive than those used for the human genome project. To sequence the Neanderthal genome, the team headed by Svante Pääbo at the Max Planck Institute for Evolutionary Anthropology in Leipzig used the "Sequencing by Synthesis" technology developed in the US by 454 Life Sciences, following the example of American colleagues who recently used this method to decode 70 percent of the mammoth genome. In August 2008, a team of scientists in Leipzig headed by Johannes Krause displayed the complete



The enzyme ubiquitin marks exhausted proteins as cellular waste. Researchers at the Max Planck Institute for Biophysical Chemistry have revealed how it identifies them.



Bert L. de Groot



Helmut Grubmüller



Christian Griesinger

tions until they have found their target molecule. A group of scientists headed by Helmut Grubmüller, Christian Griesinger and Bert L. de Groot of the Max Planck Institute for Biophysical Chemistry in Göttingen have succeeded in recording protein dynamics over a timescale of microseconds and at atom-scale resolution.

Their observations support the hypothesis that proteins evidently jump around between dozens of conformations. Only when a specific conformation has been selected will the protein, as observed, finally match the point of contact with the target molecule. The investigations carried out by the researchers in Göttingen were focused on the ubiquitin molecule, a (ubiquitous) protein that is present in all eukaryotic cells. It marks damaged or exhausted proteins as cellular waste ready for disposal. In doing so, it changes its form in a matter of microseconds. If one of its forms happens to match one of its partners, the two proteins spontaneously bond together.

The ubiquitin is thus not forced into a particular form by its partner, as was previously believed. In fact, the protein already possesses many forms, like a bunch of keys, each of which fits a different lock. These latest discoveries now explain why ubiquitin can recognize many different partner proteins with a high degree of specificity. The technique developed by the Max Planck scientists could one day provide new insight into diseases and their mechanisms, and was therefore also hailed as a breakthrough of the year by the editors of SCIENCE.

mitochondrial genome sequence of a 38,000-year-old Neanderthal – a preliminary step toward decoding the entire Neanderthal genome.

SCIENCE reserved the title of "scientific phenomenon of the year" for the Large Hadron Collider (LHC) at CERN in Switzerland. As the US magazine wrote – not without a hint of jealousy at the sheer scale of the project – European countries are getting progressively better at bundling their resources in pursuit of 'big science.' Scientists from the Max Planck Institute for Physics in Munich and the Max Planck Institute for Nuclear Physics in Heidelberg will also be working at the LHC.

The Munich-based physicists are taking part in the Atlas experiment, which aims, among other things, to get a handle on the Higgs particle. According to the Standard Model of particle physics, the Higgs boson is what gives particles mass, and it is hoped that the massive energy unleashed in the LHC will allow its existence to be proven experimentally for the first time. Some of the detectors required for this project originate from the Max Planck Institute for Physics.

Researchers at the Max Planck Institute for Nuclear Physics have also designed other detectors for an experiment code-named LHCb, in which they aim to identify differences between matter and antimatter. They hope to discover why the latter has largely disappeared from the universe, even though it must have been formed on the same scale as matter itself.

PHOTOS: MPI FOR BIOPHYSICAL CHEMISTRY - GUNNAR SCHRÖDER / PRIVATE (3)

## YOUNG PROFESSIONAL AWARD 2008

## “Plenty of scope for creativity”

Much praise for the Max Planck Society: According to a study by the Swedish consultancy Universum Communications, the research organization is the most popular employer among young scientists, heading a field of 130 enterprises.

The consultants surveyed young professionals who had been on the career ladder for an average of four years and were around 31 years of age. The Max Planck Society was rated as the top employer by 20.3 percent of them, ahead of the Fraunhofer-Gesellschaft (14.9 percent) and Roche Diagnostics (13.1 percent).

“I work in a laboratory that is at the absolute cutting edge of the research field that I’m interested in,” says Matias Hernandez of the Max Planck Institute for Biophysical Chemistry in Göttingen. “The people I get to work with are as well trained and highly qualified as can be. Plus, there’s the international flair and friendly working atmosphere at the institute.”

Between July and August 2008, market researchers interviewed around 7,800 professionals working in economics, science and engineering, and information technology. The percentage of women working in IT and engineering was below 25 percent, rising to 51 percent among the scientists.

When it comes to top employers, Germany’s successful research organization is in good company: among economists, Porsche ranked just ahead of Lufthansa and the BMW Group. IT specialists would ideally like to work for search engine Google, the employer of choice picked by 20 percent of those surveyed, replacing last year’s winner SAP. Next in line were IBM Deutschland and the BMW Group. Among engineers, the top three places went to Porsche, BMW and Audi, as in the year before.

Questions about career goals revealed some marked differences between men and women: some 52 percent of men, but only 32 percent of women, have their eye on a management post.

Universum Professional Survey

UNIVERSUM

Building Brands to Capture Talent

Beliebtester Arbeitgeber

2008



Matias Hernandez

In contrast, women attach great importance to the right work-life balance – 61 percent rated it as particularly important. Even among men, 49 percent value a good balance and apparently would not pursue a career at any cost.

Human resources managers are likely to be particularly interested in the fact that three quarters of these young professionals could imagine changing employers in the short or medium term. For the scientists, criteria such as a friendly work environment, attractive basic salary and good opportunities for development are most likely to tip the scales.

“A good work environment and intellectual challenge were the two most important aspects in my choice of job,” agrees Matias Hernandez. “I would never sacrifice these two aspects in return for more money. On the contrary, I would take a cut in lifestyle – albeit not too big a one – in return for a rewarding career experience. That is exactly what I’ve done here in Göttingen.” The biggest barrier to a career move, incidentally, is an unattractive location, which ranked far ahead of an inadequate income.

For those interested, current job offers at the Max Planck Society can be found at: [http://www.mpg.de/english/career\\_opportunities/index.html](http://www.mpg.de/english/career_opportunities/index.html)

## FIRST ADVANCED GRANTS AWARDED

## Success in Brussels

For the first time since taking up its work in 2007, the European Research Council has begun awarding its Advanced Grants, which provide funding of up to 3.5 million euros per applicant. Among the 275 applications to be approved are 5 submitted by Max Planck Directors. With a total of 20 funding applications made by Max Planck Institutes, the success rate of one in four is above average.

erc

In the first round of tenders, the Brussels-based ERC received a total of 2,167 completed applications for Advanced Grants. The applicants, who must be outstanding and established heads of research groups, come from 26 different countries; 12 percent of them are women.

The UK accounted for the greatest number of successful applicants, followed by Germany and France. When counting only the female applicants, Germany came out on top. The field of engineering and sciences comprised 41.5 percent of approved applications, the life sciences 30.5 percent, and the humanities 17.5 percent, while 10.5 percent were for interdisciplinary research projects.

The Science Council of the ERC anticipates that a total of 275 grants with a total value of 542 million euros will be disbursed. Unlike applications made under the EU research programs, the ERC does not specify the subjects for which its grants are awarded. Its object is rather to promote research on the frontiers of knowledge.

As was the case when the Starting Grants for junior scientists were awarded, due to budget restrictions, some of the Advanced Grant applications were positively assessed but will neverthe-

less not receive funding. This was the fate of some of the participating Max Planck Institutes: 20 submitted applications, 10 of which were positively assessed – so 50 percent; however, only 5 research projects will actually be funded. Still, for the Max Planck Society, this is a success rate of 25 percent, compared with an average of just under 13 percent (of 2,167 Advanced Grant applications, 275 will be funded). Those applications that were positively assessed but did not receive funding failed by only a very small margin, as the Brussels office of the Max Planck Society has learned.

The following Max Planck scientists will receive an Advanced Grant:

Markus Antonietti (Max Planck Institute for Colloids and Interfaces), Christian Griesinger (Max Planck Institute for Biophysical Chemistry), Johannes Lelieveld (Max Planck Institute for Chemistry), Svante Pääbo (Max Planck Institute for Evolutionary Anthropology) and Peter H. Seeberger, who was recently appointed to the Max Planck Institute for Colloids and Interfaces and submitted a successful application while still a Professor at the ETH Zurich.

Funding is also being granted to an External Scientific Member of the Max Planck Institute for Psycholinguistics: Pieter C. Muysken, who works primarily at the Centre for Language Studies at Radboud University in Nijmegen but has close ties to the MPI for Psycholinguistics. Incidentally, this should soon also be the case for astrophysicist Michael Kramer and the Max Planck Institute for Radio Astronomy: the scientist is currently teaching at the University of Manchester, but has just accepted an appointment in Bonn. He, too, will bring ERC funding with him. ●

The funds awarded by the European Research Council are financed by the EU Commission in Brussels. The photo shows the Berlaymont building.



Photo: AP

## SYMPOSIUM IN MUNICH

## Plasma Crystal in Space

For ten years now, German and Russian scientists have been jointly researching complex plasmas onboard the space station ISS – reason enough to sum up progress so far. In November, the Max Planck Institute for Extraterrestrial Physics in Garching organized a symposium to present and discuss the results of this research into complex plasmas.

periment. At the end of 2005, the PKE-Nefedov laboratory was replaced by PK-3 Plus.

In addition to electrons and ions, a complex plasma also comprises electrically charged macroscopic particles and is formed at relatively low temperatures. Its particular properties make it a model system for the study of solids, liquids, gases and natural plasmas and enable investigations at the level of individual atoms. This, in turn, has led to some entirely new insights into microscopic physics.

On Earth, however, gravity interferes with interaction between the larger component particles in complex plasmas. Therefore, this research work is far better carried out in conditions of weightlessness. In fact, some experiments can be conducted only in zero gravity. This applies especially to the formation of plasma crystals in which the charged particles form neatly arranged lattice structures. With the interference of gravity, it is barely possible to even observe this process.

The discoveries made in space have since been reported in 40 scientific publications – and were duly celebrated at the two-day symposium in Garching. "We had an interesting discussion that shed light on these projects from every angle," relates Hubertus Thomas, who works as a project scientist at the Max Planck Institute for Extraterrestrial Physics. "We talked about the technology and shared our experiences in working with complex plasmas under zero gravity." One of the high



Plasma research in zero gravity: In March 2008, cosmonaut Yuri Ivanovich Malenchenko carried out experiments with the PK-3 Plus apparatus onboard the International Space Station ISS.

The joint German-Russian venture was first established in 1998, when Russian Minister of Research Vladimir Fortov suggested, during a visit with Gregor Morfill, Director at the Max Planck Institute for Extraterrestrial Physics, that the two sides share in an experiment on complex plasmas aboard the Russian space station MIR. Morfill was delighted to accept the offer: with financing from the German Aerospace Center (DLR), researchers at the MPI in Garching worked together with the aerospace industry to build the PKE-Nefedov laboratory that fits inside a container the size of a rain barrel.

However, MIR came to an end before the apparatus was completed – so the study of complex plasmas became the first scientific project onboard the International Space Station ISS, where it has since also become the most successful ex-

periments of the symposium was a report by cosmonaut Pavel Vinogradov on his scientific work onboard the ISS.

This research into complex crystals is of significance not only for physics, but also for medicine. The Garching-based scientists are able to create plasmas at temperatures of around 30 degrees Celsius. Such plasmas are gentle enough to treat wounds that refuse to heal, as the ionized gases in the plasmas kill off bacteria. In order to develop plasma instruments for medical applications, the scientists in Garching are drawing on the experience they have gained in experiments aboard the ISS, which are still ongoing. Physicists have high hopes for future advances in the study of solids, fluid dynamics and soft matter, which, like sand, exhibits some of the characteristics of both fluids and solids. ●

PHOTO: RKK-ENERGIA

## Pinboard

**ANTJE BOETIUS WAS AT HOME** two days before Christmas when an e-mail arrived in her computer's inbox: You've won the Leibniz Prize! A tremendous surprise – after all, the award presented by the German Research Council carries 2.5 million euros in prize money. That is enough to fund a lot more studies of the seas, a subject not normally at the center of general scientific interest. "I am delighted that microbial ecology has been singled out for such an award. There is so much still to discover. But because we study minute living beings that are invisible to the naked eye, the importance of this research is lost on many people," explained the oceanographer. The 41-year-old scientist, the only woman among all Leibniz Prize winners for 2008, studies the microbiology of the marine methane cycle. She has worked at the Max Planck Institute for Marine Microbiology in Bremen since 1999, where she heads a research group with nearly 30 members. She is also a professor at the private Jacobs University in the city, and a project head in the MARUM excellence cluster at Bremen University. Antje Boetius has also just taken over the leadership of what is known as the 'bridging group' formed by the Helmholtz Association and the Max Planck Society. This is a joint project dedicated to deep-sea ecology and technology being conducted by the Alfred Wegener Institute for Polar and Marine Research and the Max Planck Institute in Bremen. In the future, the project will increasingly concentrate on the ecosystems of the deep Arctic Ocean.

**ANOTHER LEIBNIZ PRIZE** winner was cause for further celebration at the Max Planck Society. Karl Lenhard Rudolph, a 39-year-old doctor of medicine, is head of the Max Planck research group investigating stem cell aging that has been established for over a year now at the Ulm University Institute of Molecular Medicine. The Ulm-based group has also just set up a Max Planck Partner Group at the Institute of Laboratory Animal Sciences operated in Beijing by the Chinese Academy of Medical Sciences and the Peking Union Medical College. Rudolph's team works mainly with naturally occurring adult stem cells in an effort to understand the mechanisms that restrict the function of these cells in old age. It

might then be possible to develop active pharmacological agents to counteract this process.

**A HUMOROUS**, whimsical and affectionate production – that is how the jury assessed the photo entitled "Ball Lightning," submitted by Norbert Michalke as his entry for the Technology Journalism in Word and Image award presented for the fourth time by the German Academy of Science and Engineering (Acatech). Working for Max-PlanckResearch (issue 2/2008, page 35), the Berlin-based photographer photographed two staff members as they set off an electrical discharge in the laboratory at the Max Planck Institute for Plasma Physics. The jury also went on to say that the photo depicts a technically sophisticated subject, captured with impressive skill, awarding Michalke first prize in the single photo category. The award, which is intended to promote the understanding and appreciation of technical innovations, carries a total of 20,000 euros in prize money.



**Leibniz Prize winners:** Antje Boetius, Research Group leader at the Max Planck Institute for Marine Microbiology in Bremen, and Karl Lenhard Rudolph, head of the Max Planck Stem Cell Aging Research Group at the Ulm University Institute of Molecular Medicine.

**THE RECENT OPEN ACCESS** conference, this time hosted jointly with Heinrich Heine University in Düsseldorf, was the sixth in this series of events organized by the Max Planck Society. The conference focused on the far-reaching changes taking place in scientific communication and publication. The number of initiatives being undertaken and the innovative publication models presented at the conference underscore the fact that Open Access is already inseparably linked with the latest developments in scientific research. Open Access is actively supported both by such sponsors as the German Research Council and by the EU. Some of the projects supported by the latter are actually obliged to publish

their results in a freely accessible form. Dieter Imboden, who is soon to become President of EuroHORC (the European Heads of Research Councils), announced his intention to make Open Access a central theme of his presidency. The fact that he made this announcement in Düsseldorf shows the importance that decision-makers in the world of science attach to the conference, which upholds the tradition of the Berlin Declaration. The Max Planck Society was also a co-initiator of the Berlin Declaration and has been committed to the issue of Open Access for many years. ●

PHOTOS: MPI FOR MARINE MICROBIOLOGY (ABOVE) / ULM UNIVERSITY (BELOW)