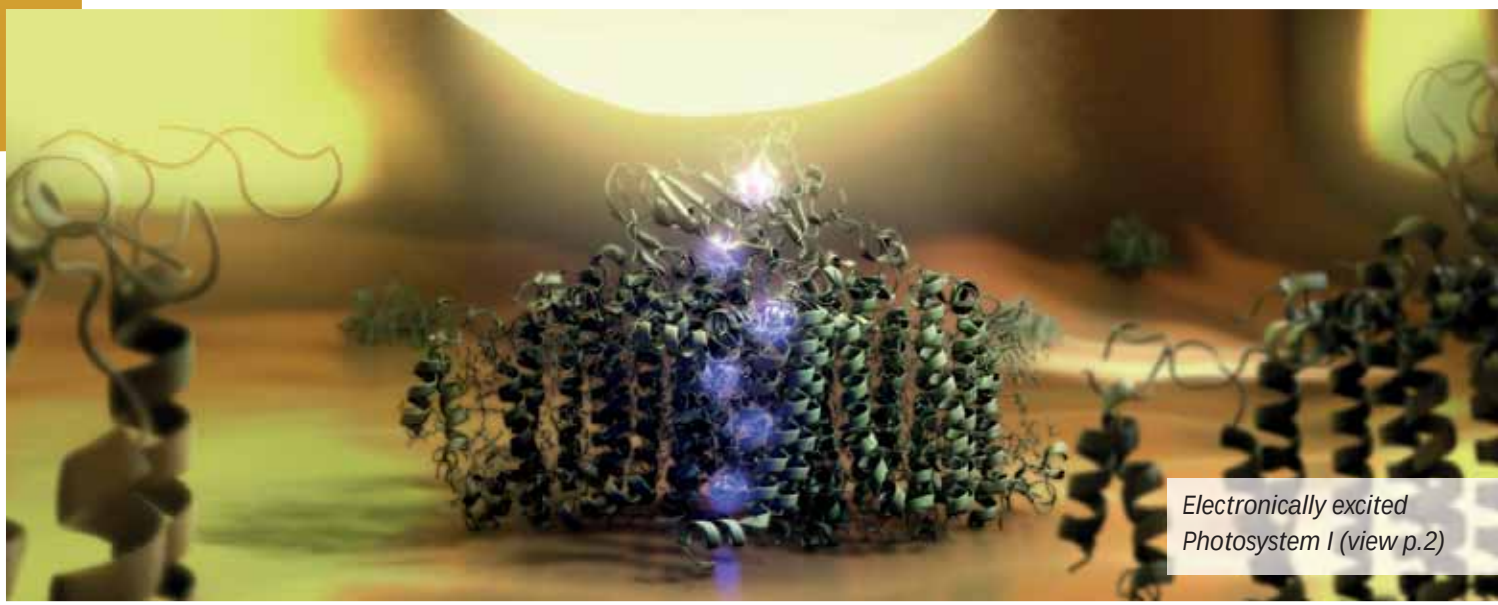


Electronically excited Photosystem I (view p.2)

Nanosystems NEWS

With success into the next round

In November 2012, NIM began its second funding period with renewed vigor

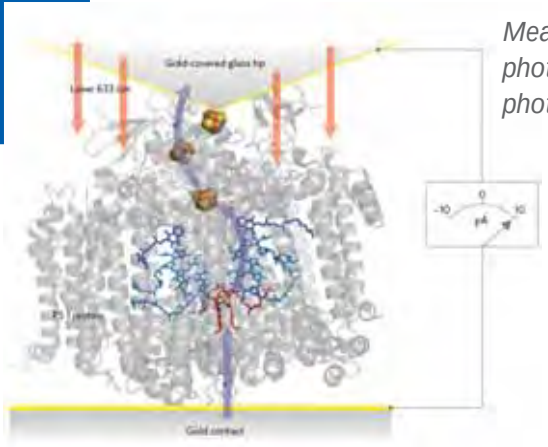
For NIM, 2012 was the "year of decision." After the presentation of the cluster at the DFG in Bonn in January, NIM-scientists had to wait tensely. To the great pleasure of the NIM-family, continuation of sponsorship of the cluster was announced on June 15th, an occasion which was duly celebrated with a festive summer party.
Officially, NIM began its second funding period (2012 - 2017) on November 1st, 2012. With a number of new members, the cluster's focus on five trendsetting fields of research will be further developed (view p. 9-11). One example is the "new" research area "Nanosystems for Energy Conversion," which can already be credited with a number of outstanding scientific successes (p. 2-3).

Last but not least, social events (where results of the latest research are shared with colleagues and the public) are an important component of scientific life. For this reason, several popular and successful event series were resumed with a new kick. These include the NanoDay in the "Deutsches Museum" (p.6), the Nanobiotechnology Symposium, 2012 held in Kyoto (p.7), and the Winter School 2013, which took place in Tyrol, this time in cooperation with the Danish nanocenter iNano (p. 7).

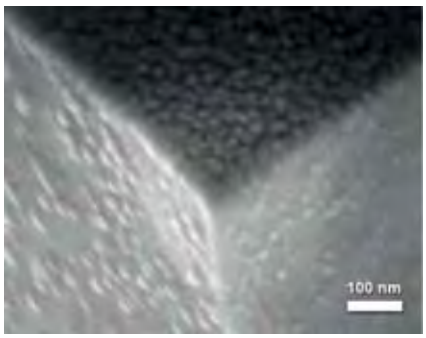
Prof. Friedrich Simmel
Co-coordinator of NIM

In addition, NIM-scientists also led the way in the solar energy initiative of the Free State of Bavaria "Solar Technologies Go Hybrid" – a very good example of the "added value" which was generated by the cluster of excellence (p.4).

Content



Measurement of the photo electricity of the photosystem I - proteins



Picture of scanning electron microscopy of the glass tip after coating it with about 20 nm of gold

A molecule – a solar cell

A single protein complex creates electricity

No artificial process has yet achieved the efficiency by which nature extracts energy from light via photosynthesis. This is largely the impetus for the interest of many scientists in studying the details of this seemingly optimal process. NIM-physicist Prof. Alexander Holleitner, together with colleagues from the TU Munich and the University of Tel Aviv, examined the electrical current through one of the central components of photosynthesis – the photosystem I (PSI).

Minimal electrical flow

This protein complex consists of, among other things, many pigments, such as chlorophyll molecules and carotenoids. These pigments absorb the light and thereby release electrons, which are then transferred to the reaction center of the photosystem. The scientists have succeeded in developing a new way to measure the minimal electrical current that arises and flows through the complex of proteins by using a near-field microscopy scheme.

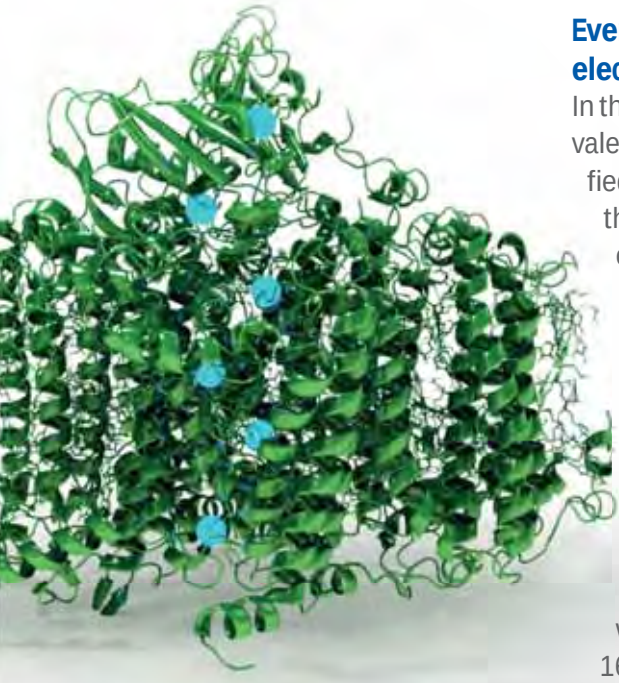
Every 16 nanoseconds an electron is flowing

In the experiment, the proteins are covalently bound at one end via a modified cysteine group to a gold surface that is used as an electrode. The other end of the protein is in contact with a gold-plated glass tip that serves as the second electrode as well as a light source. The physicists direct the light through the inside of the glass tip to the protein in order to measure the optically activated charge currents. The measured photocurrents are about 10 pA, which means that about every 16 nanoseconds an electron flows through the photosystem.

Operation in nano circuits

The successful experiment on single photosystems proves that such proteins can be integrated and activated as components in photoactive nano circuits. The protein complex thereby keeps its optical features and can serve as a current generator in tiny electrical elements, as they are needed in optoelectronics.

The project was carried out together with Joachim Reichert and Johannes Barth of the TU Munich and with Itai Carmeli of the University of Tel Aviv. ■



Molecular structure of photosystem I, based on crystallographic data

Publication

Photocurrent of a single photosynthetic protein

D. Gerster, J. Reichert, H. Bi, J. V. Barth, S. M. Kaniber, A. W. Holleitner, I. Visoly-Fisher, S. Sergani and I. Carmeli. Nature Nanotechnology 7, 673–676, September 30th 2012

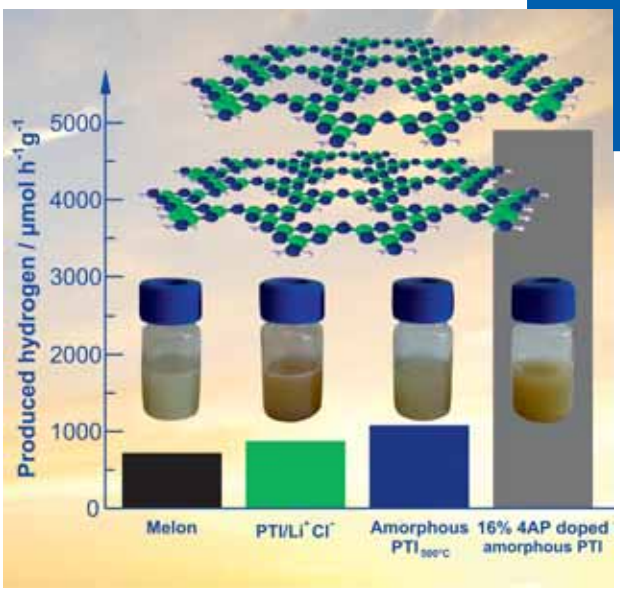
New catalyst for solar water splitting

New catalyst for solar water splitting

Hydrogen is considered one of the most promising energy sources of the future. However, science must first find a way to produce the gas in a cheap and environmentally clean fashion. The splitting of water with the help of sunlight is particularly intriguing. This reaction, however, only runs with the help of a photocatalyst. For reasons of cost and energy efficiency, a new generation of photocatalysts is required to replace the expensive, heavy metal-based systems currently in use.

A new generation of catalysts: Two-dimensional carbon nitrides

"Soft" materials such as carbon nitrides are attractive candidates for photocatalysis: "As a result of their interesting electronic properties the use of such polymeric semiconductors is promising," says NIM scientist Professor Bettina Lotsch. The chemist leads the "Functional Nanostructures" research group at the LMU, as well as a group at the Max Planck Institute for Solid State Research in Stuttgart. Carbon nitrides are chemically and thermally stable, lightweight, and can be synthesized at low cost.



Light-induced hydrogen evolution by different carbon nitride photocatalysts

Significantly increased photocatalytic activity

Lotsch has developed a new class of carbon nitride photocatalysts with her group and colleagues from Munich and Bayreuth. The activity of the new photocatalyst in the visible range of the solar spectrum is significantly higher than that of "Melon," the most studied carbon nitride material up to now. The new catalyst is based on poly(triazine imide) (PTI), which has a two-dimensional layered structure. The scientists achieved a significant enhancement by addition of a molecular dopant – this gave rise to an activity increase for hydrogen evolution with respect to pristine PTI by five to six times.

"Photocatalysts are not yet efficient enough to be used on a large scale," Bettina Lotsch explains. "Nevertheless, the polymeric catalyst we have developed opens up new directions in this exciting research area." ■

Publication

Triazine-based Carbon Nitrides for Visible-Light-Driven Hydrogen Evolution

K. Schwinghammer, B. Tuffy, M. B. Mesch, E. Wirnhier, C. Martineau, F. Taulelle, W. Schnick, J. Senker, B. V. Lotsch. Angew. Chem. Int. Ed. 2013, 52, 2435 –2439

SOLAR TECHNOLOGIES GO HYBRID

Free State fosters solar energy research

Bavarian joint project "Solar Technologies go Hybrid" has started

In Bavaria there are many top-class research groups that advance energy extraction from sunlight through photovoltaics and photocatalysis. To concentrate their expertise, the Free State of Bavaria has established the research network "Solar Technologies go Hybrid" to connect the key labs of five Bavarian universities. In a two-day symposium, representatives of science and politics celebrated the start of the network on October 17th, 2012, in the "Münchner Künstlerhaus."

NIM initiates new network

Involved are the universities of Bayreuth, Würzburg and Erlangen-Nürnberg as well as the LMU and the TU Munich. Both of the universities in Munich are already well established in the area of solar energy research (Research Area III) via the cluster of excellence NIM. The cluster was the lead partner in the coordination and planning of the network project. Over a period of five years, the Free State is providing the key labs with 50 million euros. Included are the costs for a new building in Würzburg and the new NIM building in Munich.

New material systems

The research of the key labs focuses on organic and hybrid material systems. The scientists in Bayreuth and Würzburg are engaged in organic nanostructures, while their colleagues from Erlangen specialize in carbon-based combinations like graphenes and fullerenes. In Munich the expertise lies in inorganic and hybrid nanosystems. The cooperation will further the development of sustainable solar energy systems while internationally promoting Bavaria in the field of solar research.

Up-to-date technology at NIM

In the second period of the Excellence Initiative, NIM will invest a significant part of its funding into various new, ultra-modern devices. Two examples: a new, high-speed atomic force microscope (AFM) will be installed this year in the Center of Nanotechnology and Nanomaterials (ZNN) of the TU Munich in Garching. The purchase of a new transmission electron microscope (TEM) at the chair of Thomas Bein (LMU) is planned for 2014.

Down to the smallest detail

New electron microscope provides extremely high resolution

To look at nanostructures, scientists work with sophisticated transmission electron microscopes (TEM) in which samples are screened with a high-energetic electron beam. A new apparatus of this kind will be purchased at the chair of Prof. Thomas Bein (LMU); e.g. for research in the area of nano-optics and the directed release of active agents. Novel electron-optical components will enable spatial images, as well as spectroscopy on the atomic scale. Furthermore, exact insights into the chemical bonds of nanostructures will be possible. The LMU will take part in financing with extra capital.

Watching nanomachines while they are working

High-Speed-AFM visualizes dynamical processes

Special atomic force microscopes (AFMs) have been so quick lately in their sample imaging that it is possible to map the dynamics of a process from rapidly taken pictures. At the chair of Prof. Friedrich Simmel (TUM) such a High-Speed-AFM will be used to study dynamic DNA-assemblies in future. Hence, it will be mainly concerned with molecular machines, which are composed of artificial DNA strands ("DNA-Origami"). Furthermore, the tool is interesting for single molecule measurements and the analysis of the dynamics of molecules on surfaces.

News from young academics

Winter meeting of the NIM graduate program

The new student board (from left to right): Isabella Almstätter (TUM, Prof. Plank), Bernhard Fichtl (Universität Augsburg, Prof. Wixforth), Ida Pavlichenko (LMU, Prof. Lotsch), Christian Ziegler (LMU, Prof. Scheu), Fabian Ziegler (TUM, Prof. Rief)

A successful year lies behind the student board of the NIM graduate program (NIM-GP). At the winter meeting on February 5th, 2013, in the senate hall of the LMU, the five Ph.D. students reviewed the past activities and took a vote for their subsequent team. The guest speaker, the president of the University of Augsburg, Prof. Sabine Doering-Manteuffel, appeared to be taken with the spiritedness of the NIM-GP and encouraged further networking among the Ph.D. students between departments.

Guest speaker Prof. Sabine Doering-Manteuffel

Guest speech "Networking of humanities and natural sciences"

In her speech, "Networking of humanities and natural sciences," the president referred to the theory that networks were the main source of productivity. For this reason, the University of Augsburg is attempting to consolidate various research efforts in new purpose-built centers. An already existing example is the Environmental Science Center in Augsburg. Here, representatives from different disciplines collaborate to develop new strategies of energy management.

Regarding the variety of research fields within NIM, Prof. Doering-Manteuffel gave the Ph.D. students the following advice: "You must make sure that you understand each other in your concepts and your way of thinking. And it is important that you think in terms of complex questions and not in terms of single solutions."

Retrospection NIM-GP 2012

The annual review showed how much engagement and interesting events the five previous Ph.D. student representatives have contributed to the NIM-GP life. The most important event was the three-day long self-organized Summer Retreat which took place in June 2012 above Garmisch-Partenkirchen in the "Forsthaus Graseck." The days were filled with an advanced scientific program, soft-skill seminars concerning teamwork and media competence, as well as enough time to build up personal contacts beyond institutes and universities.

The seminars and business visitations, spread over the year, were in high demand and were already booked after a few hours. These included the workshops "Paper Writing," "Business Studies for Scientists," the course "Microfluidics" as well as visits at BMW in Munich and Siemens HealthCare in Erlangen. The program highlight from the perspective of the students was a guided tour through the production line of the magnetic resonance tomography (MRT) coils (see picture below).

Business visit: Production line of MRT-systems (Siemens)

The members of the Student Board have gained a lot from this year, as the spokeswoman Daniela Aschenbrenner explains: "In the context of the Student Board it is easier to approach others, especially the professors – so you get to know many people automatically. Besides, it was very fascinating to co-chair the executive committee of NIM and to gain insight into university politics. As a nice side-effect, this job presumably looks good on your CV and it definitely brings you a lot of fun."

New Ph.D. representatives

Motivated by the work of the student board, seven Ph.D. students presented themselves as candidates to be the new representatives. After a very close vote, the previous team announced the names of their five successors (view photo above). Just like their predecessors, the new representatives are always looking forward to discussions and event proposals from all NIM-GP members. ■

More than just “nanosocks”

The NIM-NanoDay 2012 demonstrated the diversity of nanosciences

Nano silver in socks, nano finish for cars, nanoparticles in sun lotion: nanoparticles are found in many products. However, there is a lot more behind “nano” and the nanosciences. Organic solar cells, quantum computers, new remedies... These are all topics in which the scientists of the cluster of excellence, NIM, are doing research. With the regular NanoDay NIM wants to show the public the variety of nanosciences being studied in an entertaining and lucid way.

The interest of the people in Munich is great: more than a thousand visitors streamed into the Center for New Technologies (ZNT) of the “Deutsches Museum” on Saturday September 8th, 2012.

Physics comedian

They followed the talks of NIM-scientists with interest, gaining insight into current nano-research. In between Dr. Georg “Grög!” Eggers, physics comedian, explained the nano world to the audience in his own way. Teeny weeny became really big: chains of balloons replaced DNA strands, the stuffed animal Anna Möbe represented the world of protozoas. Using the tip of an enormous atomic force microscope, a surface profile of the heads of the audience emerged. “Science must be perceptible and understandable – only then it gets rid of its nimbus of being inexplicable and impeccable,” Georg Eggers explains. In his own cabaret program, “The physics of failure,” he specifically explores scientific fallibility.

Clever questions

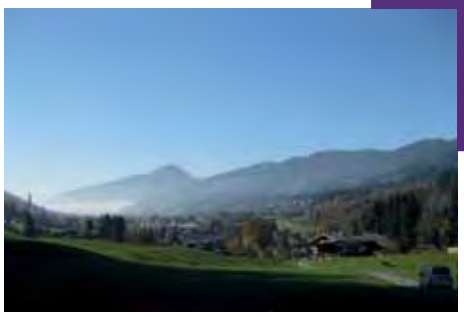
NanoDay visitors immersed themselves in science at the information stands of the junior scientists. More than 40 Ph.D. students of different NIM work groups presented their research with a lot of interaction and encouraged the guests to experiment. For many of the students their job at the NanoDay was a totally new experience. “I was inspired by the level of interest with which the visitors discussed science,” says Steffen Rulands, Ph.D. student at the chair for Theoretical Biophysics (LMU). “Especially the clever questions of the children made me look at my work from a different perspective.”

Catching electrons

The palette of the stands comprised the entire spectrum of topics at NIM: from information technology to energy conversion techniques to nanomedicine. Visitors were able to catch electrons with an enormous laser trap, conduct nanodrops with a joystick and “virtually” fold proteins with the help of a computer program. Also popular was the detection of nanoparticles in the smoke of cigarettes at the stand of the work group of Prof. Eickelberg (view p. 10). Those who could isolate their own DNA in the visitor`s laboratory in particular had the feeling of being real researchers. The younger visitors took part in the nanoquiz and learned hand papermaking. ■

Nanosystems connecting Bavaria and Denmark

NIM winter school in Kirchberg in Tirol in 2013



A novelty characterized the NIM winter school in 2013: for the first time it was arranged in cooperation with the Interdisciplinary Nanoscience Centre (iNano), based in the Danish city Aarhus. In the conference hotel Alpenhof in Kirchberg, Tirol, about 100 participants listened to 26 presentations, covering all research areas at NIM. More than 50 Ph.D. students presented and discussed their research results at two poster sessions. The best were awarded a prize.

Some of the speakers in particular made an impression with exciting and accessible presentations. Victor Klimov, for example, of the Los Alamos National Laboratory showed that the energy problem of humanity can realistically be solved through the transformation of solar energy into electrical or chemical energy. All that would be required is an increase in efficiency and a reduction in costs. The experts in solar cells were particularly interested in his work on the multiplication of excitonic stimulations.

Furthermore, the presentation of Andrea Morello was trendsetting. He showed how a quantum computer could be constructed in principle and that its components could be produced with the same technology as today`s computer chips. Morello himself is already working on the implementation of simple logical operations with coupled spin-qubits made of single atoms. ■

Around the world with NIM

Nanobiotechnology-Symposium in Kyoto

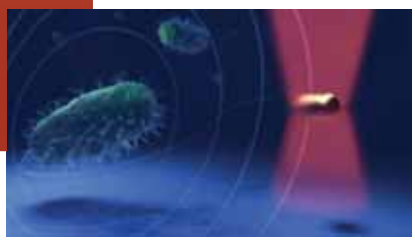
At the end of 2012, eight Ph.D. students took the opportunity to travel with three NIM-professors to the 6th International Nanotechnology-Symposium at the Institute for Integrated Cell-Material Sciences (iCeMS) at the Kyoto University in Japan. The subject matter of the meeting, to which the NIM-professors Ernst Wagner, Tim Liedl and Vasilis Ntziachristo contributed with presentations, was “Cell Material Integration.”

Manifold lecture program

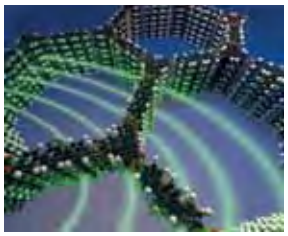
The scientists of Munich presented their current research in the sessions “Material Biology,” “Nano-Meso Therapeutics” and “Nano-Meso Imaging.” Professors of the University of Kyoto, the Yonsei University (South Corea), the CEA-LETI (Laboratoire d`electronique des technologies de l`information) in Grenoble (France) as well as the Linköping University and the Karolinska-Institute (Sweden) gave further contributions.

New cooperation

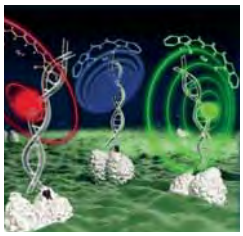
The symposium was especially successful for the NIM student Thomas Geislinger from Augsburg (chair Prof. Wixforth). A collaboration with the Karolinska-Institute spontaneously evolved out of a discussion about his poster. The young academic wants to go there to research this very year.
Since 2010, NIM is co-organizer of the symposiums and had organized the meeting in NIM’s first year in Munich. At that time, the main focus was “Nanotheranostics.” In autumn 2013, the specialists will again have the possibility to discuss the latest research projects of nanobiotechnology. This time the meeting is going to take place in Bristol (England) at the Centre for Nanoscience and Quantum Information (NSQI). ■



“Nano-ear“ - Feature graphic for The-Scientist.com 02/2012



“Microwave COF“- Cover graphic for CrystEngComm 02/2013



“Biotin“ - Cover graphic for ChemPhysChem 04/2012

“Spinwaves“ - Feature graphic for PhysikJournal 02/2013

Four questions for the media designer of NIM

To make invisible things visible is a central challenge in nanosciences. Many an object can be “uncloaked” with high-resolution microscopes. Yet, a lot of structures on this scale continue to elude detection; some of them even exist only as theoretical constructs. The NIM-scientists are lucky: since March 2010, Criss Hohmann has been reinforcing the team of the NIM administrative office and has brought many research objects out of the depths of the nanoworld to light. In several cases, he has helped to produce scientific publications which were chosen as cover stories for famous magazines (see pictures).

Hi Criss, what is your main business at NIM?

First of all, I design cover suggestions for scientific journals. I use the illustrations from the publications of our scientists as a foundation, but in most cases I sit together with them to conceptualize ideas. Usually the ideas develop into computer generated three-dimensional images. From time to time I also grab the camera and take “real” photos.

How does it work with the cover proposals?

If a scientist publishes his or her research results in a professional journal, he usually has the chance to submit a cover picture, which matches the topic. This is where I come in. If the editorial office likes my picture, it will appear on the cover, which makes a cover story out of the corresponding article. This is very good publicity for the scientist, as well as for NIM. So far, 75 percent of my layouts have been printed – I hope I can keep up this rate.

To whom does your offer address?

As a rule, all NIM-scientists and their Ph.D. students can approach me. There have also been requests from the industry (for instance spin-off companies of former scientists).

What does your occupation additionally include, besides the creation of three-dimensional images and animations?

NIM not only supports research directly, but also arranges many events, scattered throughout the year. They serve as publicity on one hand, like for example the NanoDay (view p. 6), but also for communication between scientists worldwide (e.g. the NIM Winter School, see p.7). There is always a great demand for flyers, posters and brochures for those events. I also undertake the documentation of these events by means of photos and videos. Oh, and finally I also design this newsletter, together with Birgit Gebauer, who writes the texts and is responsible for the editorial side. ■

Criss Hohmann is responsible for the visual contents at NIM

Honors

No less than three NIM-scientists are looking forward to a generous endowment from the European Research Council (ERC):

Prof. Thomas Bein (LMU) was awarded with an ERC Advanced Grant (an award worth about 2.5 million euros).

Prof. Alexander Holleitner (TU Munich, picture on the right side) and Prof. Lode Pollet (LMU) each received an **ERC Starting Grant** at the amount of 1.3 million euros.

Prof. Immanuel Bloch (LMU) received the **Hector Science Award 2012** of 150,000 euros among other things for his research in the field of quantum simulation with ultracold atoms.

Prof. Hendrik Dietz (TUM) received the **Hoechst Academic Award** from the Aventis Foundation, designated by the fund of the chemical industry for his work on biomolecular nanostructures.

NIM-coordinator Prof. Jochen Feldmann (LMU) was accepted at the **National Academy of Science Leopoldina**. Its members represent German science nationally and internationally.

Prof. Vasilis Ntziachristos (TUM) received the **Gottfried Wilhelm Leibniz-Prize** for 2.5 million euros. The bioengineer was given this award for the development of an optical imaging procedure with which he can track the path and effect of drugs in healthy tissue and in tissue infected with cancer.

Prof. Joachim Rädler (LMU) is leading the new **Collaborative Research Center SFB 1032** in the field of biophysics under the title "Nanoagents for Spatiotemporal Control of Molecular and Cellular Reactions."

The Bavarian Academy of Science has honoured Dr. Ulrich Rant (TUM) with the **Robert-Sauer-Prize**. One of his most active areas of research deals with highly sensitive molecular-specific biosensors.

The international **Controlled Release Society (CRS)** has elected Prof. Ernst Wagner (LMU) to the scientific advisory board. The approximately 1.600 members of CRS want to advance research into the transport of active components. Wagner coordinates the research area "Biomedical Nanotechnology" at NIM.

The work group of Prof. Friedrich Simmel (TUM) and Prof. Tim Liedl (LMU) are partners of the EU training program for young academics "**European School of DNA Nanotechnology**" (EScoDNA) which was launched in February 2013.

Prof. Gerhard Abstreiter (TUM) is the new director of the **Institute for Advanced Study** at TU Munich. Since 1987, Abstreiter has been professor in the physics department of TUM as well as founding director of the Walter Schottky Institute and of the Center for Nanotechnology and Nanomaterials.

New at NIM

NIM welcomes the following new associated members:

Dr. Dina Fattakhova-Rohlfing (chair Bein, LMU)

Dr. Michael Hartmann (chair Zwerger, TUM)

Dr. Gregor Koblmüller (chair Abstreiter, WSI / TUM)

Prof. Dr. Peter Müller-Buschbaum
(chairholder "Functional Materials," TUM)

Dr. Jessica Rodríguez Fernández (chair Feldmann, LMU)

Accepted calls

Dr. Eva Weig (chair Kotthaus, LMU) has accepted a professorship at the University of Konstanz..

Dr. Enrico da Como (chair Feldmann, LMU) has accepted the nomination as reader at the University of Bath (UK).

In Transit in the Cluster-Universe

Ulrich Heiz – Nanocatalysis with metal clusters

The noble metal platinum is not only in demand for jewellery but also for industrial use. Platinum can serve as an excellent catalytic converter, for instance during the production of the energy-carrier hydrogen through photocatalytic water splitting.

Tailor-made nanoclusters

Platinum is expensive, however, and the industry is looking for ways to use the material so parsimoniously spread that nearly all atoms sit on the surface. The industry is receiving support from Prof. Ulrich Heiz. The native-born Swiss has been in charge of the chair for Physical Chemistry at the TU in Munich since 2004 and has been a member of NIM since 2012.
Heiz and his colleagues are specialists in the size-specific fabrication of metal clusters, aggregates as large as 100 atoms. The properties of the clusters vary, somewhat irregularly, in their dependence on the number of the atoms. Larger structures behave similar to a solid state body. The scientists are mainly interested in how stable and mobile the clusters are. Which catalytic, optical and photochemical properties do they exhibit? And how do their characteristics depend on their size?

Prof. Ulrich Heiz

NIM-cross-linked optimally

In collaboration with the chair of the NIM-coordinator Prof. Jochen Feldmann (LMU), Heiz and his colleagues placed various platinum clusters on cadmium sulfide nano-rods. By doing this, they discovered that clusters made of exactly 46 atoms catalyze the light-induced production of hydrogen most efficiently (Nanoletters 2012). Dr. Markus Döblinger, a specialist for electron microscopy in the NIM-group of Prof. Christina Scheu (LMU), helped to make the approximately one nanometer small clusters visible (view p. 4)

A new dimension of the periodic system

The position of the atoms in the cluster also influences their morphology: e.g. are they stacked, or do they lie flat beside one-another? There are as many behavior patterns as there are variants. "Basically, the behavior of the clusters with respect to size opens up a new dimension within the periodic system," explains Heiz.

Since October 2013, the chemist has been expecting a further challenge. He is going to be the scientific director of the Catalysis Research Center (CRC) of the TUM that was founded in 2008 and will soon be able to move into its own building beside the faculty. ■

Air to breathe

Oliver Eickelberg – The pulmonary specialist has been a new member at NIM since 2012

Just to take a deep breath – this is the wish of all people who are suffering from a lung disease. Diseases of the lung are the second most common cause of death worldwide, with rising incidence, says Prof. Dr. Oliver Eickelberg. The physician-scientist has the vision to counteract this trend by doing translational research and raising awareness for lung diseases. Since 2008, the 44-year-old academic has been chairman of the Comprehensive Pneumology Center (CPC) in Munich, chair of Experimental Pneumology at the LMU and director of the Institute of Lung Biology and Disease (iLBD) at the Helmholtz Zentrum München. Together with his colleagues from the NIM research area V, "Biomedical Nanotechnology," Eickelberg develops active agent systems, which can systematically infiltrate diseased cells, an approach referred to as nanotherapeutics.

High research requirements

The cause of most lung diseases is unknown. This complicates their diagnosis and treatment, as does the fact that pulmonary research has been neglected for a long time, partly for historical reasons. Up to the middle of the 20th century, the treatment of tuberculosis dominated this specific field. This widespread disease was mainly treated in sanatoriums in remote quarantine, á la "Magic Mountain" by Thomas Mann, disconnected from academic research up to the 1960s.

Proximity to patients is important


Prof. Oliver Eickelberg

An important function of the CPC is to bring together research and clinical work. Munich is very well suited for this. On the ground floor of the CPC is the outpatient unit; the research laboratories are located on the two levels immediately above. Visible from the laboratories is the LMU university hospital Großhadern with the second biggest center for lung transplantation in Germany. "This makes it easy to investigate patient material directly," according to Eickelberg. "Furthermore, the proximity to the patients is a great motivation for the scientists in their laboratory. Likewise, translational research is beneficial to the patients' treatment as well."

Visions of nanomedicine

The complexity of the lung (with more than 40 different types of cells) presents a constant challenge for the CPC scientists. Yet, in close collaboration with colleagues from NIM, they are able to gain more and more detailed insights on a single cell level. Among other methods, this is mainly possible with the high resolution microscopy of living cells, for which there is already great expertise in the research area V. Together with the groups of Prof. Thomas Bein and Prof. Ernst Wagner, the lung specialists are also working on wrapping up active agents in nano-capsules for transport and delivery, under control, to the targeted cells. Eickelberg is convinced of the success of nanomedicine: "These advancements will finally be to the benefit of our patients, who are suffering from an incurable disease with no immediate hope for relief at this point in time. We trust that together we will be successful to deliver exactly that hope for cure." ■

In search of the synthetic primordial cell

Petra Schwille – cell division in a minimal system

It is curiosity that motivates Petra Schwille every day. The object of her curiosity is the marvel of cells. The professor for physics has been head of the department "Cellular and Molecular Biophysics" at the Max-Planck-Institute for Biochemistry in Martinsried since 2011, and she has been a member of NIM since 2012.


Prof. Petra Schwille

Masters of cell division

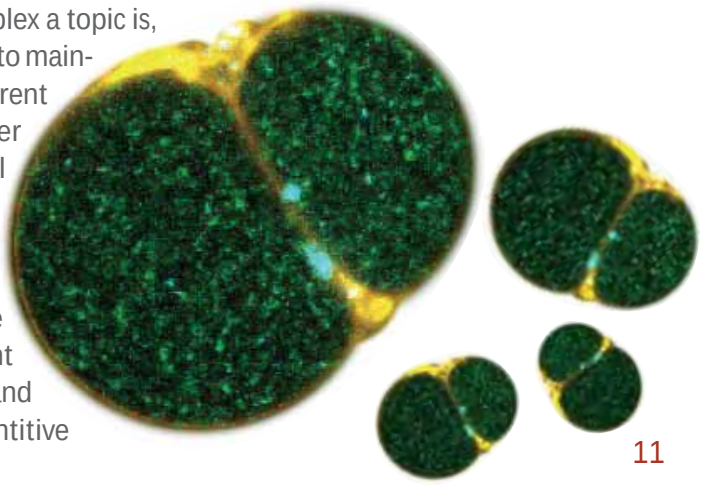
Bacteria are true masters of reproduction. Accordingly, the cell division machinery within the bacteria cells is highly optimized. Understanding this complex interaction better is one of the research projects of Petra Schwille and her work group. The 45-year-old scientist has been working with biological systems for many years. Though her reasoning is shaped by physics, "Biological systems obtain too many open parameters and something like that is usually no fun for physicists," Schwille explains.

The synthetic primordial cell

Hence, her goal is to simplify the system of cell division as much as possible and to build a minimalist model, a quasi-synthetic primordial cell. Self-assembled lipid membranes are a key ingredient, as they imitate the cell membrane. In addition, Schwille and her team isolate native proteins, which serve a crucial role within the cell division process, especially those that are responsible for the formation of a so-called contractile ring. The more complex a topic is, the more important it is to maintain dialogue with different groups. NIM offered her a nearly perfectly ideal professional surrounding, says Petra Schwille enthusiastically: "In the NIM-cluster we have found many important partners for dialogue and cooperation on quantitive modelling of our synthetic bio system as well as for the establishment of new nanoscopic methods for their characterization on a molecular level."

Laser laboratory in the greenhouse

The provisional laboratories are quite crowded with the variety of methods and the 25 colleagues at the moment, however the working group will be moving to a new building in two years. Then, the staff will have to do without one former highlight: what is, most likely, the only laser laboratory in the world built within a former greenhouse. ■



Outlook

July 3rd - August 29th, 2013
Summer Research Program
Twelve master students from all around the world are going to be guests at NIM-work groups for eight weeks. They will get a glimpse into current research projects opening the possibility to return to Munich as a PhD student.

LMU München / Technische Universität München / Universität Augsburg

September 9th - 13th, 2013
Conference on Resonator QED
International conference, organised by the network "Circuit and Cavity Quantum Electro Dynamics" and NIM. www.ccqed.eu/conferences/Munich2013

Kardinal Wendel Haus, Munich

September 9th - 13th, 2013
Workshop - Frontiers of Nanomechanics
The main emphasis of this workshop co-organised by NIM is the lectures regarding nanoelectronical and nanooptomechanical systems in hybrid and integrated structures.

Triest (Italy), International Centre for Theoretical Physics (ICTP)

October 4th - 5th, 2013
Munich Lung Conference 2013
Molecular Mechanisms and Clinical Relevance (www.mlc2013.de)

Leonardo Royal Hotel, Munich

November 7th - 9th, 2013
7. Internationales Nanobiotechnologie-Symposium
For the seventh time, experts are going to meet on the Nanobiotechnology-Symposium in which NIM also will be represented by lectures and members (amongst others: Ph.D. students; also view p. 7).

University of Bristol (England), Centre for Nanoscience and Quantum Information (NSQ))

About NIM

Since its foundation in 2006, the Nanosystems Initiative Munich – NIM, for short – has established itself as a leading international nano center. The design and the control of artificial and multifunctional nanosystems are the keystone of the scientific program of the Cluster of Excellence which brings together scientists from nanophysics, chemistry and the life sciences. The integration of these functional nanosystems in complex and realistic surroundings is the central research aspect at NIM within its second funding phase of the Excellence Initiative. Artificial nanosystems have a wide range of potential applications in areas like information- and biotechnology, as well as in the efficient use of solar energy.

Cluster coordinator: Prof. Jochen Feldmann

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Schellingstraße 4
80799 München, Germany
Tel.: +49 (0) 89 2180 5091
www.nano-initiative-munich.de

Editor
Dr. Birgit Gebauer (V.i.S.d.P.)
birgit.gebauer@lmu.de

Graphic Designer
Christoph Hohmann
christoph.hohmann@lmu.de