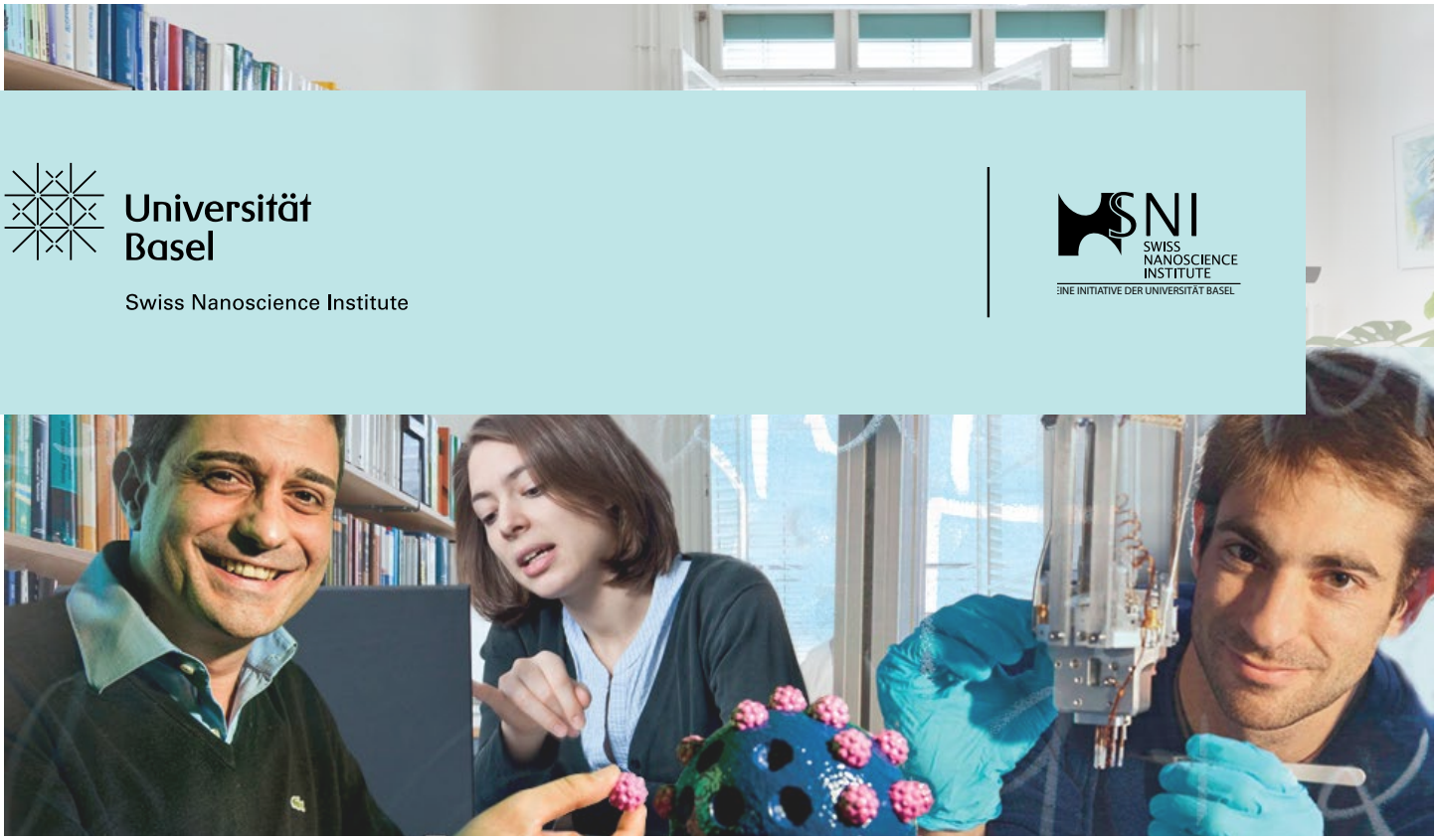
Universität Basel

Swiss Nanoscience Institute

SNI SWISS NANOSCIENCE INSTITUTE
A NANO INITIATIVE DER UNIVERSITÄT BASEL



SNI update May 2016

Editorial

Dear colleagues,

The SNI has experienced a very busy start to 2016. Since the beginning of the year, we have been working tirelessly on plans for the Swiss NanoConvention (SNC) as well as preparing an account of the highlights of 2015 for our annual report.

Once again, the SNC will take place here in Basel this year and will provide a platform for all players in Swiss nanosciences and nanotechnology. The SNI is organizing the event, together with the Swiss MNT Network and the Commission for Technology and Innovation (CTI). We have succeeded in attracting top-class, internationally renowned scientists to be our keynote speakers, including Michelle Y. Simmons, Daniel Müller, Steven A. Henck, Peidong Yang, Omar M. Yahi, Joanna Aizenberg, Vinothan N. Manoharan, and Thomas Ebbesen. In addition to diverse sessions on current research in the nanosciences, the event will also offer a platform for numerous exhibitors. This means that the SNC 2016 will provide a unique opportunity for an interdisciplinary exchange of ideas between research and industry.

This SNI update contains some choice examples of how fruitful this dialogue between research and industry can be. The Argovia projects that launched at the beginning of the year clearly demonstrate the range of subject areas in which such cooperation can take place. Magnus Kristiansen, who features in this edition's portrait, has extensive experience of knowledge and technology transfer. We also introduce Andreas Reichmuth, a young scientist with a concrete application for his research in his sights. He demonstrated exceptional dedication and perseverance in his search for a Master's thesis at an internationally renowned institute and was rewarded – his Master's thesis has now been voted the best thesis submitted by students in the nanosciences in 2015.

I hope you enjoy learning more about the interesting projects and people at the SNI and I look forward to welcoming you all to the SNC in Basel.

With best regards,

Christian Schönenberger

Director Swiss Nanoscience Institute, University of Basel

Valuable experience at MIT

The award for the best Master's thesis in the nanosciences in 2015 goes to Andreas Reichmuth

At the next SNI Annual Event in Lenzerheide in September, Andreas Reichmuth will receive the prize for the best Master's thesis in nanosciences of the University of Basel. The 26-year-old Swiss national completed his degree in nanosciences in Basel, but wrote his Master's thesis at the Massachusetts Institute of Technology (MIT). In his thesis, he examined nanoparticles that could be used for gene therapy and immunotherapy to treat cancer.

Andreas Reichmuth has gathered valueable experience at MIT.

High school research project in Basel

Andreas Reichmuth, who grew up in Emmen, was already reading about nanotechnology and showing an interest in phenomena such as the lotus effect while still at school. So it made sense for him to write his high school research project about a subject in the field of nanotechnology. His project looked at graphite under a scanning tunneling microscope in Professor Ernst Meyer's team and gave him his first taste of university. He seems to have enjoyed it, as he was one of the new students in nanosciences in the fall semester of 2010. "The degree course in Basel was really cool," Andreas recalls. "You heard something in physics, then something in chemistry or biology, and suddenly the connection was clear. I did have a bit more pressure than some of my colleagues who had opted for a job, but I'd do it again any time!" comments Andreas Reichmuth on his decision to study nanosciences.

Issues in life sciences

Andreas Reichmuth enjoyed the broad spectrum of the degree course as well as the opportunity to work at different institutions. "The block courses, for example, didn't go into depth in any field, but I was able to get a feeling for whether I liked something or not." During his studies, it became increasingly apparent to him that he wanted to use what he had learnt and the technologies available in order to solve problems in life sciences. However, it also seemed to make sense for him to focus on physics first to enable him to apply these basic principles when dealing with issues in biology or medicine, too.

It also became clear to him that he wanted to use his Master's thesis for a period of study abroad. He therefore sent one application after another to various professors – often without ever receiving a reply. "Today, I would approach the postdocs straight away," he says, commenting on his experience. Drawing on the network of his former colleague from Basel, Dr. Kaspar Renggli, he finally succeeded in securing a project on nanoparticles at MIT, which Professor Wolfgang Meier then supervised from Basel. "It was fantastic to learn that I was able to cope well, even when studying at such a renowned institute," Andreas Reichmuth remarks. In addition to the academic work, Andreas Reichmuth enjoyed the openness of the people but also noticed that life was far more competitive and that people's standards of living in the USA are much more strongly linked to their salary than is the case at home in Switzerland.

Nanoparticles for gene therapy

At MIT, Andreas Reichmuth spent a year working in the laboratory of the successful professor and entrepreneur Robert Langer. He studied the use of nanoparticles in gene therapy or immunotherapy to treat cancer. The idea behind the method he studied is to teach the immune system to recognize a tumor and to render it harmless.

Andreas Reichmuth first produced lipid nanoparticles. He filled these nanoparticles with messenger RNA (mRNA) containing the information required to produce particular tumor proteins. He injected the loaded nanoparticles into mice. He was able to detect a strong cytotoxic immune response by T lymphocytes

in the mouse model 6-8 days after the injection. This response was directed against the tumor cells and lasted several weeks. Andreas Reichmuth's research was successful: he was able to demonstrate the viability of inducing the immune system to produce an immune response against cancer cells in the mouse model in the mouse model. A rapid immune response to viruses in the body also seems theoretically possible using this method.

Focus on new markers

In the meantime, Andreas Reichmuth has returned to Switzerland and in January 2016 he began his doctoral studies in the Laboratory of Biosensors and Bioelectronics at the Federal Institute of Technology (ETH) Zurich. He has remained true to himself and continues to try to apply his knowledge of physics, chemistry, and biology in combination. In his current work, however, he is not investigating any new therapies but is searching for markers that make it possible to detect cancer at a much earlier stage. "A tumor is supplied with blood, otherwise it cannot grow. So metabolic products, contents or fragments of the tumor cells will also inevitably be found in the bloodstream – and that's what I want to detect and prove," he says, explaining his approach. The research is still at an early stage but Andreas Reichmuth is optimistic that this project, too, will be successful.

We introduce...

Per Magnus Kristiansen supports SNI success through his involvement in the Nano Argovia program

One of the most active scientists in the Nano Argovia program in recent years is Professor Per Magnus Kristiansen. The Swede, who grew up in Switzerland, has been a professor of polymer nanotechnology at the School of Engineering at the University of Applied Sciences and Arts Northwestern Switzerland in Windisch since 2009. Since 2011, he is deputy head of the Institute of Polymer Nanotechnology. His specialist field is the micro- and nanostructuring of polymer surfaces. The possible applications of such functional surface structures are manifold, as reflected not least by the eight different Argovia projects in which he has been involved so far.

Golden combination

Per Magnus Kristiansen became interested in science and math as a teenager in Kilchberg, Zurich. As he approached the end of his schooling, it therefore seemed an obvious choice to consider these subjects when shortlisting possible degree programs. The reason he gives for deciding to study materials science is that it was the "golden combination" of his interests at that time. At ETH Zurich, he acquired a broad education and gained his first practical experience of polymers as a student assistant at the Institute of Polymer Technology. After completing his degree in 2000, he decided to remain true to research and pursue a doctorate in the field of polymer technology. As chance would have it, an application-oriented project at the Institute of Polymer Technology of ETH Zurich in cooperation with the University of Bayreuth and Ciba Specialty Chemicals was waiting for a creative mind. His

Call for PhD projects

Project leaders are invited to submit proposals for PhD projects by May 31, 2016.

For further information please visit:
www.nanoscience.ch/nccr/gradschool

Per Magnus Kristiansen applies large-scale electron radiation for chemical functionalization and sees great potential in this technique.

four-year doctoral studies on the clarification of polypropylene delivered not only scientific insights that have since found their way into textbooks, but also a new Ciba product (clarifiers on the basis of supramolecular trisamides). Six months before he had actually completed his dissertation, Ciba offered Magnus Kristiansen a job in order to guarantee the transfer of know-how and to continue the successful research into this new substance class within the company. Before embarking on working life, however, he and his wife found time for a three-month break in Australia.

Dream job in Windisch

After two years of intensive applied research in supramolecular trisamides, Magnus Kristiansen switched to application technology in 2006, dealing with classic additives (light stabilizers, antioxidants, flame retardants) and effect additives (e.g. scratch-resistant coatings) for the automotive industry. Even before Ciba Speciality Chemicals was taken over by BASF, it became clear to him that it was time for a new challenge. The position of "professor of polymer nanotechnology" advertised by the University of Applied Sciences and Arts Northwestern Switzerland (FHNW) came just at the right time and seemed tailormade for him. Just under a year later, in the fall of 2009, he took up his dream job at the FHNW School of Engineering.

Diverse tasks and projects

"In Windisch, there was a whole collection of tasks waiting for me," Magnus Kristiansen recalls. Holding lectures, supervising course assignments and projects, initiating research projects, and above all exploring external funding opportunities – the variety of duties was multifaceted from the offset. In addition to this, it was necessary for Magnus Kristiansen and his team to continue developing the necessary tools and replication technologies for structuring polymer surfaces continuously and with foresight. Anyone who enters his laboratory at the Institute of Polymer Nanotechnology (INKA) will clearly see the broad and varied range of research questions being tackled. It is immediately apparent from the eight different Argovia projects in which Magnus Kristiansen has so far been involved, the range of fascinating applications enabled by structured and functionalized polymer surfaces.

Security features can be created on ID cards (Ghost Image), for example, or indoor air filters optimized by making the fibers electrostatically active and enable to filter finer particles (Filtrelec). The surface of bone plates used in cranial and maxillofacial surgery can be structured in such a way that the body is better able to accept the polymer implants (Patcell). Research into new kinds of nano-additives for polymers used in insulation (NAPOHIC) has been on Magnus Kristiansen's agenda for the past few years, as have new lithographic methods for producing semiconductor chips (VERSALITH) or the use of electron beam emit-

Swiss NanoConvention 2016

Don't forget to register for the SNC 2016! The SNC 2016 will be held in Basel from June 30 to July 1, 2016. It is organized by the SNI and is part of the Nano-Week in Basel, which is opened by the Clinam Conference. Entry to the SNC 2016 is free of charge for SNI members.
For further information visit:
http://swissnanoconvention.ch/2016/.

If you have any questions, please contact: outreach-sni@unibas.ch.

ters to modify surfaces chemically so that they repel different kinds of liquids (RepAll). Magnus Kristiansen welcomes the opportunity to be involved in the SNI Nano Argovia program in addition to other projects: "The Argovia projects are a good supplement to industry-based and CTI projects and to projects financed by the Aargau research fund as they have a strong research character and really allow us to strike out new paths."

Publication not always easy

Most of the research projects in Magnus Kristiansen's team are conducted in close collaboration with industry. Unlike the Nano Argovia program, which is included in the SNI Annual Report every year, it is sometimes not easy to publish the findings from completed projects. For example, together with his colleagues, Magnus Kristiansen developed a microfluidic chip that permits various analyses with very small sample sizes. The research was funded directly by the client and is still subject to strict confidentiality obligations until the end of June 2016 – even though this chip has been produced and sold for 3 years now. Of course, this hampers the possibility to use successful projects to open the door to new collaborations; you need a great deal of patience and sometimes perseverance, too. "The real art is being able to place scientific questions in the specific context of a project and to extract the results in such a way that they can be published without violating confidentiality," Magnus Kristiansen observes.

Being critical and open to new ideas Magnus Kristiansen would apply for his current position again any time. "My work is never boring. We break new ground to a certain extent with every project and are constantly learning new things," he comments. He also enjoys encouraging his students to be critical, to question things, and to have the courage to try new approaches. In recent years, he and his colleagues have managed to spread knowledge of INKA, which is headed by himself and Professor Jens Gobrecht, beyond the Swiss borders. They have also contributed to the institute's general overall strong reputation through successful applied projects with industry and scientific publications on their research into structured molding. Magnus Kristiansen now believes the time has come to participate in EU projects. "The funding program Horizon 2020 is very application-oriented and therefore suits the universities of applied sciences," he comments, hoping to find further sources of funding for his research.

Despite his commitment to and enthusiasm for the different applications of structured polymers, Magnus Kristiansen also has a fulfilling private life. He enjoys spending time with his three small children, aged between four and six. And although he no longer has enough time to train four times per week, his regular Shaolin Kung Fu training and the Chinese meditation technique Qigong provide him with a perfect balance.

Quantum and Nano Worlds

On Saturday, May 21 (2016) a varied program about physics and nanoscience will take place in the multipurpose hall in Gelterkinden. The occasion is an initiative by the Department of Physics of the University of Basel and offers a variety of interactive experiments, short talks, things to make and do, and entertainment for both young and old.

For further information visit:
www.nccr-nano.org/nccr/events

SNI Annual Meeting

The next SNI Annual Event takes place in Lenzerheide on September 15 and 16, 2016. Please enter this date in your diaries.

New Argovia projects

The beginning of 2016 again saw the launch of some new Argovia projects, which we will be presenting in this and the next edition of SNI update. In the Nano Argovia program, scientists from at least two different academic research institutions in the SNI network collaborate on a topic of applied research with a partner from industry.

More stable implants using nano ink

In the Argovia project CerInk, a team of scientists from the University of Applied Sciences and Arts Northwestern Switzerland (FHNW), the Paul Scherrer Institute (PSI), and the Aargau firm Medicoat AG (Mägenwil) is researching a new method to improve the mechanical stability of bioceramic bone replacement materials. To this end, the project manager, Philippe Chavanne, and the team of scientists add a ceramic "nano ink" during an optimized 3D printing process, which increases the density of the material in the subsequent processing stages, resulting in increased stability in certain areas of the implant.

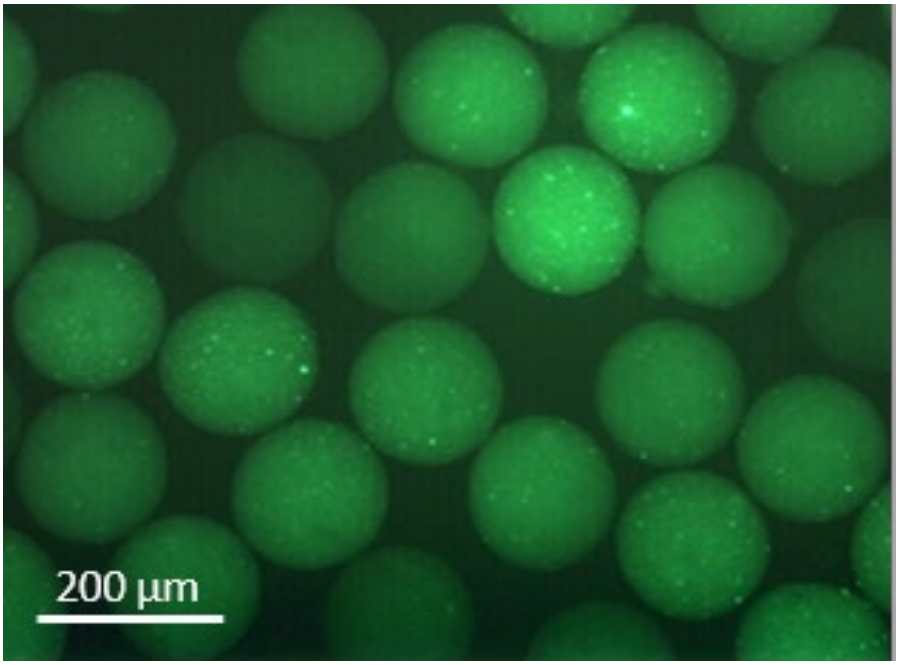
Accidents, infections or tumors often result in damage to bones, thereby necessitating the use of bone replacement materials. In numerous cases, individually tailored bone implants that are very similar to natural bone promise good chances of recovery for patients. Bioceramic implants, which can be produced individually by means of 3D printing, seem to be highly promising in this respect. They have good biocompatibility and are integrated well by the body. However, so far there have often been problems due to the poor mechanical stability of these materials.

The team of scientists from FHNW, PSI and Medicoat have already gained valuable experience in this field. In a 3D printing procedure, they combine bioceramic materials with polymers in order to imitate natural bone. In the current Argovia project they add ceramic nanoparticles (nano ink) during the printing process. In a downstream sintering process, this nano ink increases the density of the structure and therefore improves the mechanical stability.

The researchers are able to add the nano ink in different doses depending on the desired structure of the implant. This allows them to create areas with different densities within an implant. Using this method, they expect to imitate natural bone very closely and to overcome the problems of poor mechanical load-bearing capacity.

Rapid selection of the best producers

Another Argovia project was initiated by Professor Georg Lipps (FHNW) to improve the development of cell lines that are used to produce antibodies. Together with his project partners, Dr. Martin Held (D-BSSE, ETH Basel) and Dr. Rene Pelaux (FGen GmbH, Basel), Georg Lipps wants to develop nanoparticle sensors that can characterize cell lines with regard to their productivity in high-throughput screening procedures and help select the best producers.



Nanoliter reactors with fluorescent sensor materials activated to different extents (Foto: René Pellaux).

Numerous antibodies are used today to treat diseases. Therapeutic antibodies, for example, bind specifically to inflammatory factors (important for treating autoimmune diseases) or to cellular receptors (cancer treatment). These antibodies are produced by mammalian cells in very complex procedures. A common major goal of research is to select the most productive cell lines and to optimize them. The project team is now devising an effective high-throughput method to be able to perform this selection rapidly using tiny sample sizes.

To do this, the researchers are developing particle sensor materials which are immobilized in nanoliter reactors (NLR). If the tested cell line produces the desired antibody in the tiny reactor, the sensors bind the antibodies. The binding process causes a change in the structure of the sensor, thereby triggering a fluorescence signal. The intensity of the fluorescence is proportional to the amount of antibody produced. A major advantage of the method studied is that no other reagents have to be added, processing steps can be omitted, and the fluorescence signal delivers conclusions about the amount of antibody produced in situ. This means that the scientists are able to select the best producers in a short time and then further optimize them.

New microscope supports structure determination

The scientists in the Argovia project HPD4FED plan to build an innovative electron microscope with a camera, which, with the aid of a new detector, will be able to measure the electron diffraction of minute amounts of natural molecules. The two project leaders, Professor Jan Pieter Abrahams from PSI and C-CINA of the University of Basel and Dr. Tim Grüne from PSI, are working on this along with other colleagues from PSI and the University of Basel, together with the company DECTRIS (Baden-Dättwil).

To analyze proteins and other large molecules in their natural environment, special methods are required that do not destroy the sensitive biomolecules and have as little impact as possible on the three-dimensional arrangement of the molecules. For this kind of study, the team led by Jan Pieter Abrahams uses high-energy electron beams that can be diffracted in a specific way depending on the arrangement of the atoms, thereby permitting conclusions regarding the structure of the sample.

The teams of scientists involved in the Argovia project HPD4FED are modifying a detector that was developed by PSI and commercialized by the company DECTRIS by investigating the use of different sensors. The optimized detector will then be integrated into an electron microscope and tested using various nano samples. By using different sensors, the participating researchers from C-CINA of the University of Basel, PSI and the company DECTRIS hope to be able to solve three-dimensional structures of the samples in atomic and molecular resolution, even when only minute amounts of the sample are analyzed.

SeminBar of NCCR MSE

The next public “seminar in the bar” of NCCR Molecular Systems Engineering will be held at Ackermannshof on Tuesday, May 10, 2016, from 6 pm. This time Philipp Holliger will be speaking about “A Synthetic Biology Approach to Abiogenesis”. After the talk and the moderated discussion, the “British Pub Night” will take place from 9 pm onward. Entrance is free.

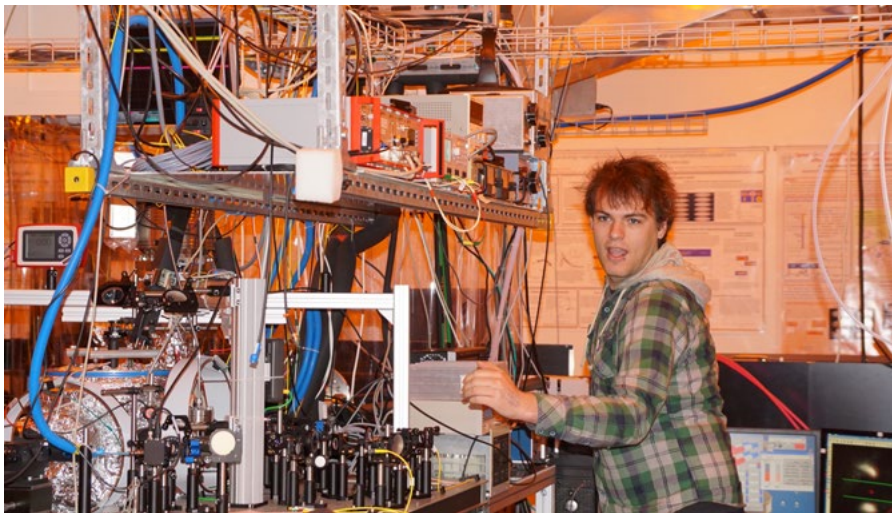
For more information visit:
www.nccr-mse.ch/en/public-events/seminbar-public-lecture/

Events

Building bridges between university and school

In March, an information event for teachers of secondary schools in the local area was held for the second time, with the SNI and the Departments of Physics and Chemistry providing interested teachers with an overview of research activities and the respective degree programs. This occasion offered an ideal opportunity, especially for teachers who had not yet visited the SNI regularly with their classes, to engage with current research in an informal atmosphere.

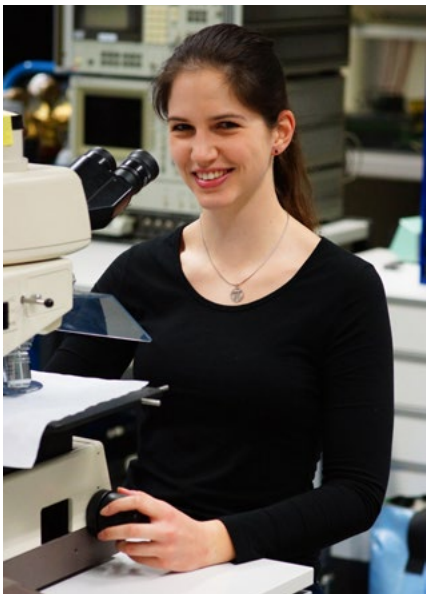
During the popular visits to the SNI laboratories by groups of school pupils – many of which have taken place in the last few weeks and months – it is mainly PhD students and students of the nanosciences who share their experiences with the young people.



During a lab tour, SNI PhD student Ian Rouse gives an introduction to his research.

In addition, there are also young scientists who pass on their enthusiasm for science outside the SNI activties. Elise Aeby, for example, who is studying for a master's degree in nanosciences, recently answered questions from girls in their final year at secondary school at a meeting organized by "Women in Science and Technology" (WINS). The lecture that Elise Aeby held in Fribourg in March dealt less with details about the degree program and more with her personal experiences on the road to becoming a scientist. Women's opportunities and possibilities in science were discussed, as well as challenges and issues faced by young women in the world of science.

WINS is a University of Fribourg project supported by the State Secretariat for Education, Research and Innovation (SERI), in which girls in their final year at secondary school spend two days working in various laboratories. Elise Aeby herself took part in the project while she was still at school and has now had the opportunity to share her positive experiences, breaking down prejudices with her entertaining lecture, and actively encouraging young women to become interested in science.



Elise Aeby shares her personal experience.

Annual Report 2015

The SNI Annual Report 2015 is ready and can be ordered or downloaded from the SNI website.

www.nanoscience.ch/nccr/media/brochure

Prizes and honors

Christoph Gerber recognized with various awards

Christoph Gerber was awarded for his contributions to the development of scanning probe microscopy. (Photo: IBM)

In the past few months, Professor Christoph Gerber has received several awards recognizing his major contributions to the development of scanning probe microscopy. In March 1986, Gerd Binnig, Calvin Quate, and Christoph Gerber first presented the atomic force microscope to the public in Physical Review Letters. The editorial of Nature Nanotechnology 11 (2016) is dedicated to this important anniversary (www.nanoscience.ch/nccr/media/press_coverage_data/press_coverage_items/press_item_556/press_item_556.pdf), which is a clear testimony to the importance of this invention.

In mid-April 2016, the International Society for Nanoscale Science, Computation, and Engineering (http://www.isnsce.org) recognized Christoph Gerber's research by awarding him their Nanoscience Prize. Christoph Gerber accepted the prize at the annual Foundations of Nanoscience (FNANO) conference in Snowbird, Utah, and gave the main keynote lecture.

Christoph Gerber was invited by the president of the Tokyo Institute of Technology in Japan to act as a "Tokyo Tech Advisor Research". From April 2016, Christoph Gerber will be advising the renowned institute in all kinds of research issues.

Shigeki Kawai receives the Kazato Prize

Dr. Shigeki Kawai, a former postdoc in Professor Ernst Meyer's team at the Department of Physics and the SNI of the University of Basel, was presented with the Kazato Prize from the Kazato Research Foundation in Japan in February 2016.

The Kazato Prize is awarded to promising young scientists for their outstanding research in the field of electron microscopy, related technology and its application in research. Shigeki Kawai was honored for developing a high-resolution, bimodal atomic force microscope and for his study of mechanical and structural properties of molecules using this microscope.

For further information about the Kazato Prize visit: www.kazato.org/english/

News from the SNI

A new Nano Imaging Group is being set up at the SNI, bringing together parts of the Center for Microscopy (ZMB) and the Nanotech Service Lab (NSL). The five-member team headed by Dr. Markus Dürrenberger provides a wide variety of microscopic analyses for both external and internal research groups.

Interview with Christian Schönenberger

Ralf Dümpelmann and Nadine Nikulski from i-net recently interviewed Christian Schönenberger, the director of SNI.

The interview can be found at: http://www.i-net.ch/blog/today-it-is-possible-not-only-to-understand-nanoparticles-but-also-to-design-them/

Media releases and uni news from SNI members

University of Basel, 02.05.2016. Quantum Sensors for High-Precision Magnetometry of Superconductors
Scientists at the Swiss Nanoscience Institute and the Department of Physics at the University of Basel have developed a new method that has enabled them to image magnetic fields on the nanometer scale at temperatures close to absolute zero for the first time. They used spins in special diamonds as quantum sensors in a new kind of microscope to generate images of magnetic fields in superconductors with unrivalled precision. In this way the researchers were able to perform measurements that permit new insights in solid state physics, as they report in "Nature Nanotechnology".

University of Basel, 02.05.2016. Nuclear Pores Captured on Film
Using an ultra fast-scanning atomic force microscope, a team of researchers from the University of Basel has filmed "living" nuclear pore complexes at work for the first time. Nuclear pores are molecular machines that control the traffic entering or exiting the cell nucleus. In their article published in "Nature Nanotechnology", the researchers explain how the passage of unwanted molecules is prevented by rapidly moving molecular "tentacles" inside the pore.

University of Basel, 25.04.2016. European Funding for Four Investigators From the University of Basel
Four researchers of the University of Basel have been awarded the prestigious ERC Advanced Grants by the European Research Council (ERC). The neurobiologists Prof. Silvia Arber and Prof. Peter Scheiffele as well as chemist Prof. Thomas R. Ward and geneticist Prof. Rolf Zeller each receive 2.5 Million Euros of funding.

University of Basel, 21.04.2016. The Atom Without Properties
The microscopic world is governed by the rules of quantum mechanics, where the properties of a particle can be completely undetermined and yet strongly correlated with those of other particles. Physicists from the University of Basel have observed these so-called Bell correlations for the first time between hundreds of atoms. Their findings are published in the scientific journal "Science".

University of Basel, 06.04.2016. Silicone Films for Artificial Muscles
Researchers of the University of Basel and Empa have gotten a step closer to engineering artificial muscles: they have developed a method to generate nanometer-thin silicone films.

University of Basel, 29.03.2016. Reliability of Quantum Mechanical Simulations Tested
Scientists from the University of Basel have tested the reliability of quantum mechanical simulations for the calculation of material properties. In an open worldwide collaborative effort with more than 30 universities involved, the main developers of electronic structure codes have joined forces to compare and validate their codes. The results of the most accurate codes were recently published in "Science" and showed very good agreement. Among these codes was the BigDFT code developed in the group of Prof. S. Goedecker

University of Basel, 11.03.2016. Soap Bubbles for Treating Stenosed Blood Vessels
Liposomes are currently used as drug delivery vehicles but recognized by the immune system. Scientists from the universities of Basel and Fribourg have shown that special artificial liposomes do not elicit any reaction in human and porcine sera as well as pigs. The study was published in the Journal "Nanomedicine: Nanotechnology, Biology, and Medicine".

University of Basel, 26.02.2016. Graphene Slides Smoothly Across Gold
Graphene, a modified form of carbon, offers versatile potential for use in coating machine components and in the field of electronic switches. An international team of researchers led by physicists at the University of Basel have been studying the lubricity of this material on the nanometer scale. Since it produces almost no friction at all, it could drastically reduce energy loss in machines when used as a coating, as the researchers report in the journal "Science".

University of Basel, 08.01.2016. Clean Energy From Water
Fuel cells generate electrical energy through a chemical reaction of hydrogen and oxygen. To obtain clean energy, the splitting of water into its components of hydrogen and oxygen is critical. Researchers at the University of Basel study how sunlight can be used for this purpose. The scientific journal "Chemical Communications" published their latest results.

All media releases can be found at: www.nanoscience.ch/nccr/media/recent_press_releases

Please provide feedback

Please send feedback and information for SNI update to: c.moeller@unibas.ch.