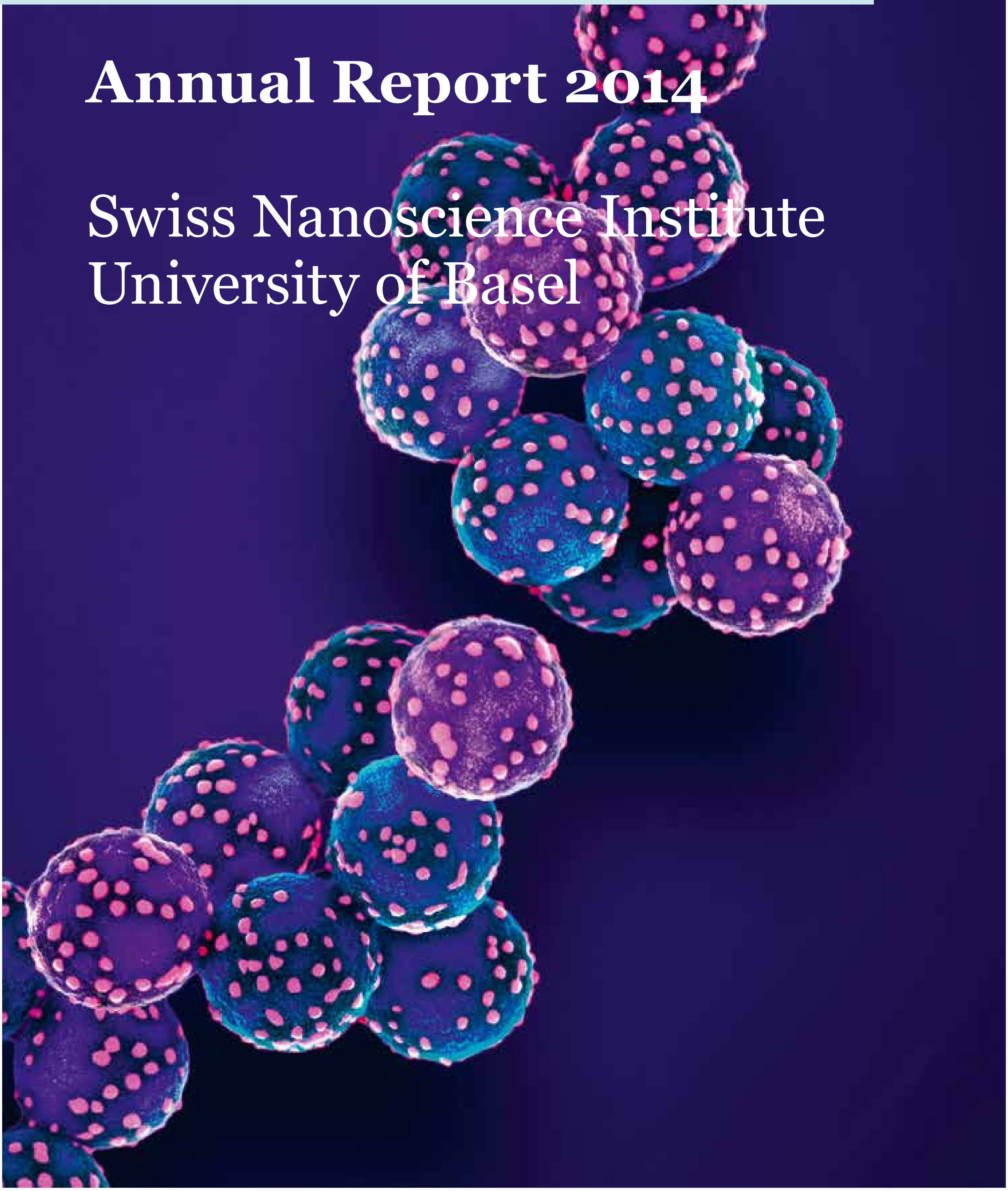
Universität Basel

Swiss Nanoscience Institute

SNI
SWISS NANOSCIENCE INSTITUTE
EINE INITIATIVE DER UNIVERSITÄT BASEL UND DES KANTONS AARGAU

Annual Report 2014

Swiss Nanoscience Institute
University of Basel



The Swiss Nanoscience Institute (SNI) is a research initiative of the Canton of Aargau and the University of Basel.

This report summarizes work conducted at the Swiss Nanoscience Institute (SNI) during 2014.

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In memoriam Professor Hans-Joachim Güntherodt

Content

Foreword

2014 was a special year for the SNI. We had to bid farewell to our treasured founding father, Professor Hans-Joachim Güntherodt, who passed away unexpectedly in July. He played a substantial role in shaping the SNI and his dedication and outstanding ability to build bridges contributed significantly to making the SNI the nationally and internationally recognized research platform it is today. We would therefore like to dedicate this year's annual report to Hans-Joachim Güntherodt. While compiling this annual report, we spoke with some of his close companions. What repeatedly became clear in all these discussions was Hans Güntherodt's great understanding of how to motivate people and implement new ideas across the boundaries of institutions and disciplines.

New events well received

2014 was also special for us because it was the first full year in which the SNI stood on its own two feet because the predecessor organization, NCCR Nanoscale Science, was phased out in 2013 as planned. In September 2014, we therefore held our first SNI Annual Event. It was a great success and clearly showed the high level of interdisciplinary research being performed in the SNI. The first SNI lecture also took place in 2014. As part of this event, SNI members invite renowned international scientists to the University of Basel. Professor Jan Liphardt of Stanford University started the ball rolling in November 2014.

Network benefits SNI members

Another new feature in 2014 was the introduction of an SNI membership for researchers from the various departments at the University of Basel and the partner institutions. All Principal Investigators (PIs) and Co-PIs of SNI projects and doctoral students in the SNI PhD School automatically become members of the SNI. Other interested partners from the network who want to become actively involved in SNI research are warmly welcome. SNI members are invited to our events and therefore benefit from the interdisciplinary SNI network.

New constellation of management team

Changes were also made to the SNI management team in 2014. In February, Dr. Tibor Gyalog, who had been responsible for communications and events, left the SNI to take up a professorship at the University of Applied Sciences Northwestern Switzerland. His duties have been taken over by his colleagues Meret Hornstein and Dr. Christel Möller. In July, Audrey Fischer, who for many years was responsible for finances and HR, moved to the newly founded NCCR Molecular Systems Engineering. Her successor, Claudia Wirth, has already familiarized herself with the work very well and she is open to all enquiries from SNI members and all other interested people.

Use of new media

Throughout 2014, we also produced three short videos with which we aim to inform viewers briefly and concisely about the SNI. In the three videos, researchers, doctoral students and students have their say and explain what the SNI stands for in an entertaining manner. All those involved, both in front of and behind the camera, showed great commitment to this enjoyable task and learned a great deal during the production process. The videos are available on the SNI website and on YouTube and are also ideal for use in presentations and exhibitions.

Successful research at the SNI

As you will read in this report, 2014 was also a successful year from an academic perspective. The various research groups involved in the SNI have published countless notable papers in renowned journals and were invited to a number of conferences. The SNI PhD School has become firmly established and the doctoral students are making good progress. The 2014 application phase showed just how strongly doctoral positions at the SNI are sought after. A total of 437 young scientists from around the world applied for the eight places available.

The year's events and successes are explained in more detail in this report. As we did last year, we have divided it into two parts – a more general section in which we present the highlights from the various areas of the SNI, and an academic section containing summaries of all SNI PhD and Argovia projects. I hope you enjoy reading it. I would like to thank you for your excellent collaboration in 2014 and I look forward to many exciting events in 2015.

Kind regards,

Christian Schönenberger

Christian Schönenberger, March 2015

Swiss Nanoscience Institute

Who Are We?

The Swiss Nanoscience Institute (SNI) at the University of Basel is a center of excellence for nanosciences and nanotechnology. In the SNI network, interdisciplinary teams of scientists conduct basic and applied research and actively support knowledge and technology transfer to industry. Within the study of nanoscience and the PhD School, the SNI trains young nanoscientists and prepares them for careers in industry and academia.

Commitment of the Canton of Aargau

The SNI was founded in 2006 by the Canton of Aargau and the University of Basel to promote research and training in nanosciences and nanotechnology in Northwestern Switzerland. Since then, numerous research projects have been successfully initiated in which researchers from various disciplines and institutions work together in one network. The SNI has a total budget of 7.3 million Swiss francs, of which 5 million come from the Canton of Aargau and 2.3 million from the University of Basel. In addition to research and training, the SNI is also involved in public relations and provides targeted support for various initiatives, particularly those aiming to interest children and young people in the natural sciences.

A diverse network

The success of the SNI is based on the interdisciplinary network that has been built up and consolidated over the years. This network includes various departments at the University of Basel, the University of Applied Sciences Northwestern Switzerland (FHNW), the Paul Scherrer Institute (PSI), the Department for Biosystems Science and Engineering at the Federal Institute of Technology (ETH) Zurich in Basel (D-BSSE), the CSEM (Centre Suisse d'Electronique et de Microtechnique) in Muttenz as well as the Hightech Zentrum Aargau and i-net Nano. Membership of the SNI, which is earned by participating in SNI projects, and regular academic conferences involving its members constantly stimulate and encourage the exchange of information within the network.

Excellent education for students

In 2002, the University of Basel – under the leadership of the SNI's predecessor institution – launched the bachelor's and master's degree programs in nanosciences. Today, this demanding degree program is firmly established. Around 40 students who begin the bachelor's program each year receive a solid basic education in biology, chemistry, physics and mathematics and can subsequently choose from a wide range of courses that allow them to focus on specific topics. Early on in their education, the students have the opportunity to participate in various research groups, an activity that always proves particularly motivating.

A variety of topics at the PhD School

To promote the further training of young scientists and a wide spectrum of basic scientific research, the SNI initiated a PhD School in 2013. At the end of 2014, 24 doctoral students were enrolled. Within the SNI PhD School, doctoral students are each supervised by two members of the SNI network. They also become involved in internal events such as the Winter School and the annual meeting and take part in various courses to gain insights into areas such as intellectual property, communication and rhetoric.

Leaders in their field

Basic sciences form the foundation of research work at the SNI. In addition to the various projects funded as part of the PhD School, the SNI also supports the basic scientific research performed by Argovia professors Roderick Lim and Martino Poggio. Both were promoted to associate professor in 2014 and their research successes in nanobiology and nanotechnology have contributed to the SNI's outstanding international reputation. The SNI also supports titular professors Thomas Jung, who works in the Department of Physics at the University of Basel and at the Paul Scherrer Institute (PSI) and Frithjof Nolting from the PSI. From the end of 2014, Michel Kenzelmann from the PSI became the third titular professor, who is supported by the SNI.

Strong connections to practical application

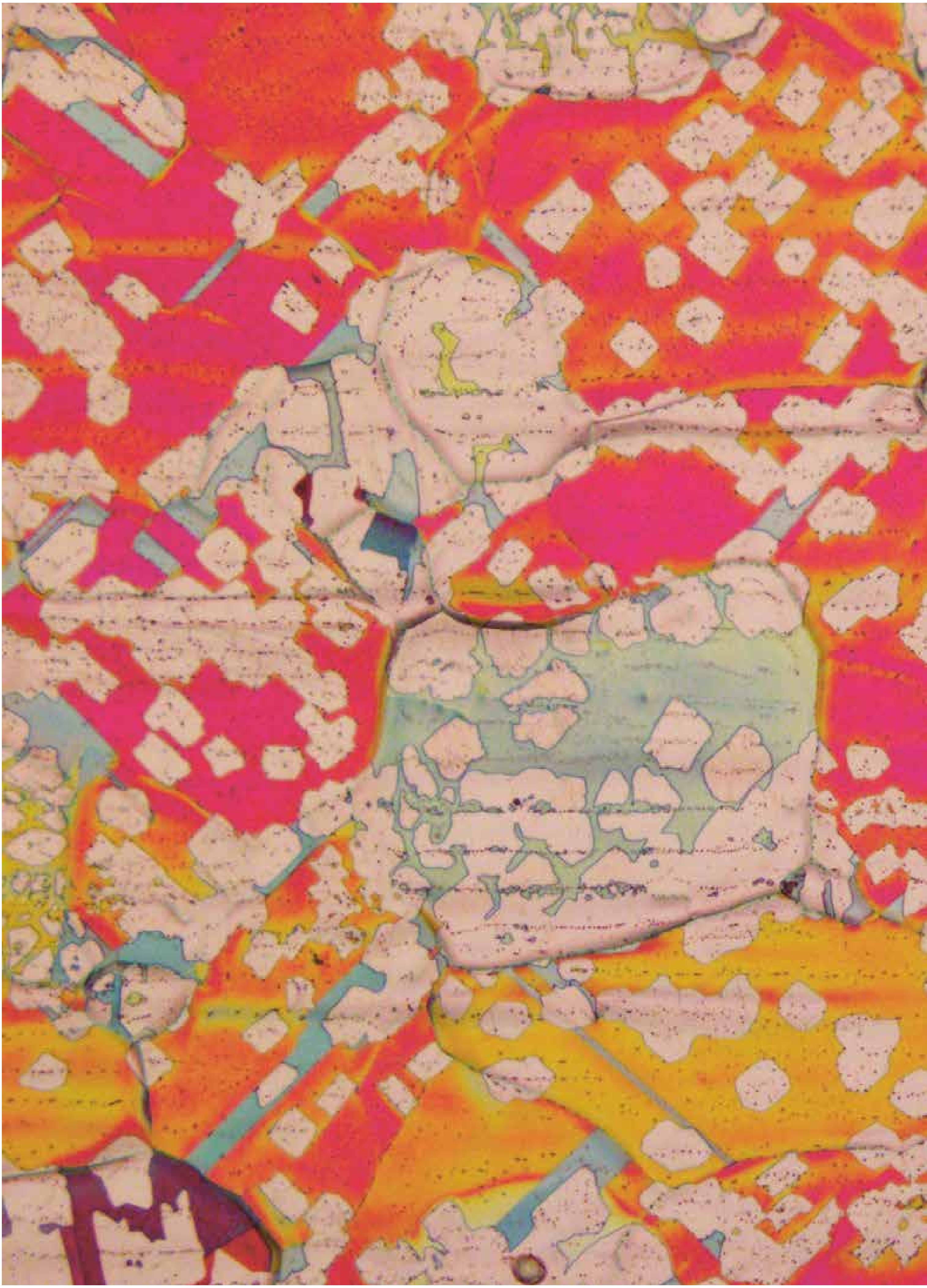
Since it was founded, the SNI has placed great value on the transfer of academic findings to industry. To optimize this process, the SNI started an annual call for applied research projects. This program entitled *Nano Argovia* supports about ten projects each year from a wide range of nanotechnology research topics in close collaboration with industrial companies in Northwestern Switzerland and has a total budget of around 1.5 million Swiss francs. With the Nano Argovia program, the SNI is building an important bridge between research and application. In several cases, this collaboration has led to Commission for Technology and Innovation (CTI) and other follow-on projects.

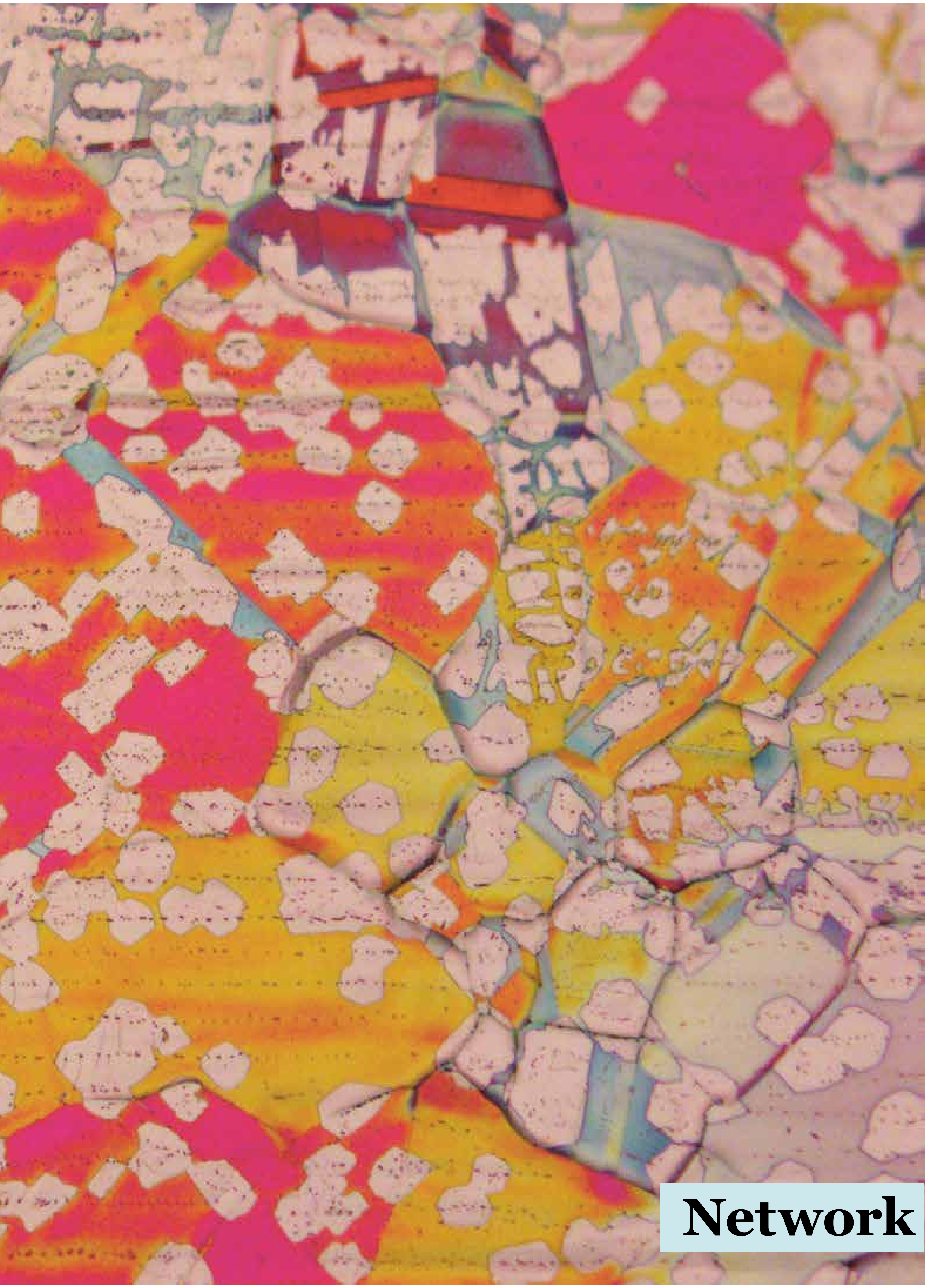
Services in demand

The SNI views itself not only as a pure research institution, but also provides various services to industrial companies. In excellently equipped workshops for technology, mechanics and electronics, industrial companies can harness the in-depth knowledge of the staff and the outstanding technical resources of the SNI and the affiliated departments.

Sharing the fascination with others

The SNI wishes to involve the public in its fascination with the natural sciences through active communication and participation in various events. For example, the SNI team is actively involved in science festivals and fairs both at home and abroad, provides schools and groups of interested visitors with an insight into everyday laboratory life, and strives to make scientific achievements accessible to a wide audience.





Network

The SNI Network

Enriching Teaching and Research

The Swiss Nanoscience Institute (SNI) offers important funding instruments for research institutions in Northwestern Switzerland that focus on nanoscience. The University of Applied Sciences Northwestern Switzerland (FHNW) has always been one of the most active partners in the SNI network and has already initiated numerous successful applied research projects. In addition to many Argovia projects and activities in nanoscience studies, PhD theses are supported by the SNI and carried out at the School of Life Sciences FHNW (HLS FHNW). We speak to Professor Gerda Huber, Director of the HLS FHNW, to find out more about the long-standing partnership between the FHNW and the SNI.

Importance of nanosciences for FHNW

When the SNI was founded in 2006, Professor Gerda Huber – then the new Director of the School of Life Sciences FHNW – came into direct contact with the nanosciences for the first time. Professor Hans-Joachim Güntherodt had already contacted her when she was nominated for the post and passionately explained about the National Center of Competence in Research Nanoscale Sciences and the existing cooperation between the FHNW and the University. In the ensuing nine years, Gerda Huber has seen for herself the role of the SNI network for her institution: "Nano was and remains an important part of the FHNW, particularly in the life sciences. The SNI provides us with a key platform that we can use to finance applied nanoscience research projects and that offers us opportunities to collaborate in the education of students."

Synergies in teaching and research

SNI research projects involving the FHNW are mainly conducted within the Nano Argovia program, in which two academic partners work on an applied research topic with a company from Northwestern Switzerland. Gerda Huber emphasizes here that this collaboration has often initiated follow-on projects, as well. It sometimes results in CTI projects or further collaborations with the companies involved, leading to long-lasting partnerships. Synergies between network partners also exist within teaching at the SNI. FHNW professors offer block courses for nanoscience students and some nanoscience students at the University of Basel complete their master's theses at the FHNW. "We have had very good experiences with the nanoscience students coming to us and are impressed by their commitment and quality," says Gerda Huber on this aspect of the collaboration. For some time now, three FHNW professors – Veronica Butterweck, Uwe Pieles and Patrick Shahgaldian – have also been able to play a leading role in supervising PhD theses at the University of Basel. Patrick Shahgaldian and Uwe Pieles have both successfully applied to supervise SNI doctoral students as part of the SNI PhD School. "This also allows us to monitor practice-oriented elements in the education of young scientists to an even better extent," comments Gerda Huber.

Open communication from the outset

In terms of this collaboration with the SNI, Gerda Huber also values personal, open and transparent communication. In the early years, she met with Professor Güntherodt on various boards; today, she has regular personal contact with Professor Christian Schönenberger and Professor Wolfgang Meier, the mutual esteem is clear for all to see. Gerda Huber hopes that this positive collaboration will continue in the future. On the academic side, she and her colleagues wish to focus primarily on materials science topics in medical technology, nanostructured surfaces, functional biomaterials and printed electronics.

Northwestern Switzerland linked with nanotechnology

Gerda Huber believes that the SNI is to be credited for Northwestern Switzerland's indisputable link with high-quality nanotechnology. The establishment of a functioning network and the provision of funding have led to the development of an excellent nano center. "However, investment in this network must continue at the same level or even higher; it cannot survive alone," she explains. "Ten years ago, the people responsible in SMEs were not yet aware of the benefits to be gained from working with higher education institutions and universities. This awareness is changing, but we need to keep working on it."

Professor Hans-Joachim Güntherodt, to whom this annual report is dedicated, played a significant role in setting up the SNI network. Gerda Huber stayed in contact with him after beginning her work as Director at the School of Life Sciences FHNW. She considered him to be a wonderful, direct person who loved the region and wanted to produce something useful. "He always encouraged and supported the FHNW and played a considerable role in bringing together the University of Applied Sciences and the University of Basel," Gerda Huber concludes.

SNI Network in Brief

The SNI network includes various departments at the University of Basel, the University of Applied Sciences Northwestern Switzerland (FHNW), the Paul Scherrer Institut (PSI), the Department for Biosystems Science and Engineering at the Federal Institute of Technology (ETH) Zurich in Basel (D-BSSE), the CSEM (Centre Suisse d'Electronique et de Microtechnique) in Muttenz as well as the Hightech Zentrum Aargau and i-net Nano.

The exchange of information and ideas within the network is encouraged and supported through regular scientific conferences and SNI membership, which is acquired by participating in SNI projects. SNI members contribute to nanoscience studies, the PhD School and the Argovia program.

Observing Nature's Tiny Factories

The New National Center of Competence in Research Molecular Systems Engineering

The National Center of Competence in Research Molecular Systems Engineering (NCCR MSE) was founded in 2014 by Professor Wolfgang Meier of the University of Basel and Professor Daniel Müller of the Federal Institute of Technology (ETH) Zurich. Over the next 12 years, they will cooperate with other universities and institutions on the construction of artificial molecular factories.

Minuscule little factories

Is it possible to artificially recreate a biological reaction that is driven by energy? This is the question that scientists at the University of Basel and the Federal Institute of Technology (ETH) Zurich will tackle within the NCCR MSE. To do so, the researchers will build tiny containers that will each house a chemical reaction. For example, molecule A will be transformed into molecule B. Then a second nanocontainer, in which molecule B becomes molecule C, is placed next to this and a reaction chain is created. And if the researchers attach a third and fourth container, which enable further reaction steps to take place, a tiny factory will be established.

Road already paved

Several years before the conclusion of the National Center of Competence in Research Nanoscience (NCCR Nano) in early 2013, the idea emerged to pursue a subsequent Center of Competence in Research in nanochemistry. In the Department of Chemistry at the University of Basel, Professor Wolfgang Meier was already thinking about the future of the department and had begun to run through various ideas. When Professor Daniel Müller returned to Basel in 2010, the idea became a concrete plan. “We met and infected each other with our ideas,” Meier says, “until we thought: OK, let's set up an NCCR!”

Experience from the NCCR Nano

Meier gained plenty of experience in the NCCR Nano that proved useful for the NCCR MSE. If a problem occurs, he often reflects on how it was solved in the NCCR Nano. Meier benefits from his experience not only in terms of administration, but also in the research performed in the NCCR MSE, for example the interdisciplinary nature of the NCCR. In each so called work package of the NCCR MSE, researchers from different subject areas work together. “It is important that people do not just work together with others from the same discipline,” Meier emphasizes. For example, biologists are included in the research group focusing on supplying energy to the factories. They know what to consider when constructing factories in cells. This enables a smooth transition to the next work step.

Supported by Professor Güntherodt

To strengthen the chemistry side of the NCCR Nano, Professor Hans-Joachim Güntherodt strongly advocated appointing Professor Meier to the University of Basel. Of the many offers open to him in 2003, Meier did not hesitate to choose Basel because, quite simply, everything fell into place here. The NCCR Nano was always important for Meier. He is still active in the current SNI as Vice Director, is responsible for the nano study program and supervises an SNI PhD student.

In the run-up to the NCCR MSE, Wolfgang Meier often discussed his ideas and plans with Hans-Joachim Güntherodt who shared his numerous contacts and provided tips and feedback. So it is no surprise that upon receiving unofficial approval for the NCCR on the morning of the official announcement, the first thing Meier did was to call Hans Güntherodt.

NCCR Molecular Systems Engineering in Brief

The National Center of Competence in Research (NCCR) Molecular Systems Engineering was launched in 2014 by the Swiss National Science Foundation. As Director of the NCCR, Professor Wolfgang Meier from the Department of Chemistry represents the University of Basel (the leading house), while Co-Director Professor Daniel Müller from the Department for Biosystems Science and Engineering represents the Federal Institute of Technology (ETH) Zurich in Basel, the co-leading house.

The NCCR Molecular Systems Engineering brings together scientists from the fields of biology, chemistry, physics, bioinformatics and engineering. The aim of the various research groups is to combine and produce molecular modules in order to develop minuscule “molecular factories”. These nanometer-sized factories will then be used to produce specific chemical compounds for industry or to control cellular systems that play a role in the development of diseases or whose function is essential in sustaining health.

Planning for the Future

Continuing Proximity to Physics

Christoph Tschumi, Administrative Director of the University of Basel, regards the Swiss Nanoscience Institute (SNI) as a model for success that in many respects reflects the objectives of the University of Basel. This means that the SNI also plays a role in the University's long-term site planning. If all goes well, the SNI could be moving into new premises, together with the Department of Physics, in just nine years.

The aim: consolidation

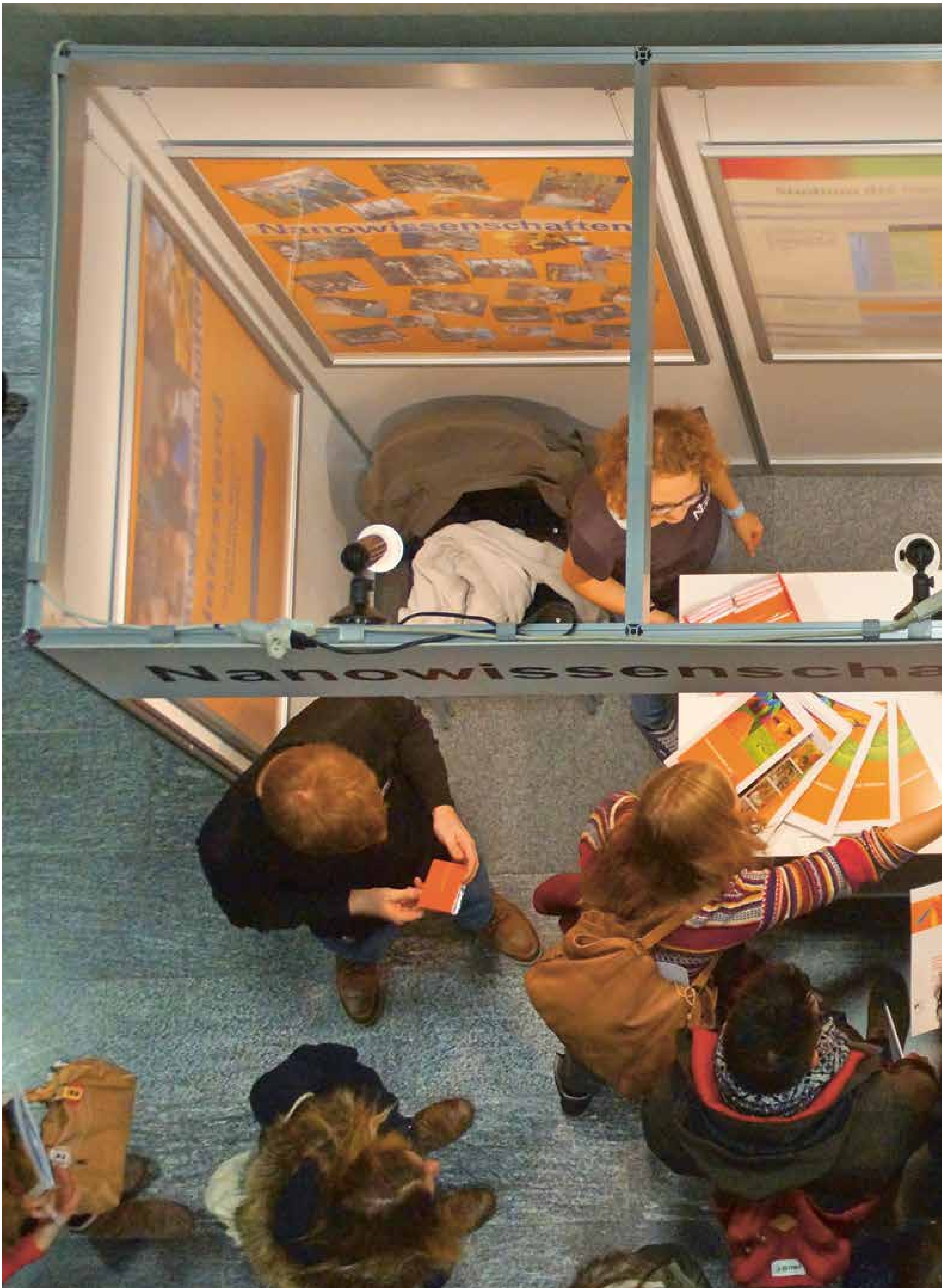
To harness synergies effectively and ensure positive collaboration, the University of Basel plans to bundle its research activities – currently spread throughout the city – in three campus areas. The Schällemättli campus has been earmarked for the life sciences. The implementation and planning of the new buildings for the Biozentrum and the Department of Biosystems Science and Engineering at the Federal Institute of Technology (ETH) Zurich in Basel are right on track. The University also has concrete plans for the Departments of Chemistry and Physics and the SNI. The intention is to rebuild the entire area between Klingelbergstrasse, Pestalozzistrasse, Spitalstrasse and St. Johanns-Ring – already home to the Departments of Physics and Chemistry – for the two departments and the SNI. To create space for the first new building, Chemistry would first need to relocate to the Rosenthal campus. Physics and the SNI would then move into the new building. The switch would be completed in around 2027, when Chemistry would return and move into its new building on Klingelbergstrasse. In addition to making cooperation between researchers more effective, an attractive campus will also benefit students. Classes and practical courses would be close together and an attractive campus layout with a modern learning environment and catering facilities would provide a stimulating atmosphere.

Renovation is not an option

"However, there are still some obstacles to overcome before this can be put into practice," notes Christoph Tschumi, who as Administrative Director for the University of Basel is responsible for construction planning. "The Cantonal Department of Heritage Preservation has applied for protected status for the Chemistry building." Potential legal proceedings could last up to two years. In addition, the area houses buildings belonging to other partners such as the Institute of Forensic Medicine, a department of the Canton of Basel-Stadt. An agreement must be reached with these partners, too. "But for the University, renovating the existing buildings is not an option," says Tschumi, answering the obvious question. "Renovating would not create the additional spaces that are urgently required; instead, various new safety requirements would actually reduce valuable space. We need more room and would therefore have to move to an alternative area outside the city if the Schällemättli plan does not work out."

SNI is a model of success

Tschumi is, however, confident that the current plans will be successful. "If everything runs smoothly, the SNI and the Department of Physics could move into the new building in 2024," he comments. This means that the SNI will remain close to the Department of Physics in the future, too. However, the SNI will not need to wait until 2024 for its name to appear on the outside of the building. As part of the new corporate design project at the University of Basel, signs on buildings will also be replaced and the SNI will be mentioned explicitly. "At the moment, the fact that we do not highlight an institution as important as the SNI shows how modest we are," Tschumi laughs. For him, the SNI is clearly a model of success. "The SNI fulfills many of the University's objectives," he explains. Here he is thinking particularly of interdisciplinarity, the transfer of basic scientific findings to applied research, collaboration with industry, and the involvement of the Canton of Aargau. Furthermore, the nanosciences are one of the University of Basel's focal areas, and by educating young nanoscientists and performing research, the SNI is making a real contribution to its success.


Nanowissenschaften

Nano Study Program

A Vision Becomes Reality

A Look Back at the Development of the Nano Study Program

The SNI's founding father, Professor Hans-Joachim Güntherodt, stood for many aspects of research. One of these was interdisciplinarity: Collaboration between the various disciplines across the boundaries of institutions. He was not the only one in Basel who wanted to firmly anchor interdisciplinary research at the University. Professor emeritus Andreas Engel, structural biologist in the Biozentrum for more than 25 years, had a vision of implementing interdisciplinarity in teaching, too. In 2002, with support from his colleagues at the National Center of Competence in Research Nanoscience, he established the degree program in nanosciences. Today, this challenging program is optimally integrated at the University of Basel and continues to enjoy immense popularity among committed young people with a general interest in the natural sciences.

A good time for something new

The founding of the National Center of Competence in Research Nanoscience (NCCR Nano) gave Professor Andreas Engel the idea not only to conduct interdisciplinary research, but also to provide young scientists with an interdisciplinary education. On the one hand since there are many young people whose broad interest in the natural sciences makes it difficult for them to choose a subject after leaving school. And on the other hand because an interdisciplinary education is the ideal route into the world of nanoscience, where the boundaries between the different disciplines dissolve. "So I thought it seemed ideal to create a degree program in which we would begin by training students in biology, chemistry, physics and mathematics and specialize later," Engel recalls. Also, 2002 seemed like the ideal time to start something new: "The NCCR Nano had just started and the University was transitioning to the Bologna system," adds Andreas Engel.

Constructive collaboration

His colleagues Professor Ueli Aebi (Biozentrum) and Professor Hans-Joachim Güntherodt (Department of Physics) were immediately receptive. Other professors in the Departments of Physics and Chemistry were also convinced and became supporters and advocates for the nano study program. After green light was given by the Faculty and Professor Gian-Reto Plattner, then Vice Rector for Research at the University of Basel, the work began. The newly founded committee for nanoscience studies compiled the relevant courses from the existing programs for biology, chemistry and physics. Together with the mathematicians, they considered what format a lecture could take that was developed specially for nanoscience studies. Although the nanoscience students were to receive less instruction in mathematics than physics students, they should still be able to specialize in physics topics at a later point. "We worked very constructively with our colleagues and found a good solution," comments Andreas Engel.

Joint events to ensure solidarity

For Andreas Engel, it was important from the outset to create a feeling of solidarity between the nanoscience students and to offer events especially for their degree program. From the very first semester, he organized visits to companies in Northwestern Switzerland that tackle nanoscience questions. These field trips continue to this day. The list of companies is constantly extended to give students the broadest possible insight into industrial research. In addition, the students on the bachelor's program particularly value the block courses in which they spend entire days working in various research groups in the SNI network. "We did not have these block courses back in the first semester," Engel recalls. "It was an idea that came from the Biozentrum and was not initially compatible with the timetables for chemistry and physics." However, the block courses soon became a key component in the bachelor's nano degree program.

Working in research groups

From the outset, working in various research groups was also to play an important role in the master's degree program. At the beginning, it was established that students on the master's program would have to complete two project and one master's theses. To ensure a broad, interdisciplinary education, the students had to choose two different disciplines for their project theses.

First Swiss university with a nano program

Once the framework was defined for nanoscience studies, Andreas Engel and his team really had to get down to work. "We travelled through Switzerland, from school to school, advertising the new study program." And with success! In Fall semester 2002, the first nano students began their course, making the University of Basel the first university in Switzerland to offer bachelor's and master's degree programs in nanosciences.

Ongoing expansion

At the moment, around 40 students enroll in the nanosciences course in Basel each year. This comparatively small group is full of highly motivated and dedicated young people. Most of them know that they have chosen a demanding degree program. An excellent atmosphere of solidarity helps them to overcome the challenges of a degree program in which they study three disciplines at the same time. The program is constantly being expanded to improve what is on offer. In 2014, for example, a seminar was held for the first time on the subject of media competence and the students used what they learned to produce a radio program.

More than a decade of nanoscience studies in Basel has shown that graduates receive an outstanding education and will therefore be welcome additions to the workforce at a range of laboratories and companies. Dr. Mohammed Ibn-Elhaj, Head of New Technologies at Rolic, confirms: «Since several years, Rolic Technologies is in contact with nano students from the University of Basel as they regularly visit the labs at Rolic. The education during the nanocurriculum in Basel is excellent and offers insights into different aspects and applications of nanomaterials. Rolic is happy to welcome young nano scientists from Basel as new members in our teams.»

Nano Study Program in Brief

The University of Basel was the first Swiss university to establish a nanoscience program back in 2002. Students receive an interdisciplinary and practice-oriented education and can graduate with both bachelor's and master's degrees. In 2014, 91 students were enrolled in the bachelor's degree program and 23 students took master's courses. Seven students finished their bachelor's degree and six completed their master's degree with a pleasing overall average score of 5.72. In 2014, the University of Basel welcomed five Erasmus students from Spain to the nanoscience program. Students from Basel also completed their project work or master's theses abroad (Tennessee, Massachusetts and Dublin). By participating in various research groups, they broadened the experiences gained in their studies.

Students on the bachelor's degree program particularly value the block courses and company visits. The range on offer is constantly being extended. At the moment, students can choose from 30 block courses held in the Departments of Physics and Chemistry, the Biozentrum, the Department for Biosystems Science and Engineering at the Federal Institute of Technology (ETH) Zurich in Basel, the University of Applied Sciences Northwestern Switzerland, the Paul Scherrer Institut and the Adolphe Merkle Institute.

Eight companies from Northwestern Switzerland opened their doors to nanoscience students, allowing them to gain an insight into applied research early in their education. The nanoscience curriculum is regularly optimized by those responsible. In 2014, nanoscience students attended the Nanoscience Media Competence lecture for the first time. During this event, students learned a great deal from the media professionals in attendance and subsequently produced their own radio show.

Graduate Glory in Nanoscience Studies

SNI Presents First Award for Best Master's Thesis

In 2014, the Swiss Nanoscience Institute began honoring outstanding achievements by young nanoscientists with an award for the best master's thesis in nanoscience at the University of Basel. In March 2014, Professor Christian Schönenberger presented the award (including prize money of 2,000 Swiss francs) to Heidi Potts. In her winning thesis, the young researcher looked at novel ultra-thin silicon solar cells, which are cheaper to produce than conventional products.

The combination counts

With her master's thesis, Heidi Potts wanted to contribute to research into renewable energies and therefore decided to work on solar cells. She concentrated on silicon cells. Although these have long been used in photovoltaic systems, they can still be optimized. For example, costs can be reduced by producing very thin solar cells. To achieve high efficiency, however, more emphasis must be placed on surface effects because these play a greater role in ultra-thin cells than in cells of a conventional thickness. For example, surface losses may occur because the charge carriers produced recombine on the surface and are no longer useful. In her master's thesis, Heidi Potts investigated how to produce thin silicon solar cells in which recombination problems can be largely avoided through passivation. To do this, she combined a very thin silicon oxide layer with a somewhat thicker layer of silicon nitride and characterized these new "protected" thin silicon substrates through various optical and electrical methods. To optimize the manufacturing process, she built a chamber in which the growth of the required layer of silicon oxide can be controlled under the influence of ozone and temperatures of up to 450°C. The results of her investigations showed that by combining the two layers and improving the manufacturing process, Heidi Potts has demonstrated a potential way of optimizing silicon cells.

Using initiative to achieve her goal

It was not only the quality of Heidi Potts' work, but also her commitment and single-mindedness that proved impressive. She wanted to work with solar cells and also wanted to spend some time in Canada. So she took the initiative and began looking for a suitable research group. Her search led her to Professor Nazir Kherani at the University of Toronto, who had just started a new project with silicon cells for which Heidi applied. Supported by a travel grant from the SNI, she began the experimental research for her master's thesis in Toronto in September 2012 with the best possible support from Dr. Thilo Glatzel and Dr. Katrein Spieler from the SNI in Basel. During her six-month stay in Toronto, Heidi Potts not only reaped the academic benefits, but also enjoyed the flair of a Canadian university campus and came to know the merits and drawbacks of a city with over a million inhabitants.

Nanoscience studies: ideal preparation

After completing her master's thesis in May 2013, Heidi Potts returned to Switzerland and successfully completed her final examinations. She then left the University of Basel to start her doctoral dissertation at the EPFL in Lausanne. Here too, she approaches her work with a positive attitude and dedication. Supervised by Professor Anna Fontcuberta i Morral, she produces and investigates nanowires with new physical properties. Thanks to her nanoscience studies in Basel, she feels perfectly equipped to tackle this highly topical subject.

As with so many of her fellow students, Heidi Potts chose her degree program because she had a broad interest in the natural sciences and did not want to restrict herself to one discipline right away. She has never regretted moving into nanoscience and coming to Basel, recalling fondly: "I always really enjoyed Basel as a city and the familiar atmosphere at the university. And studying nanoscience was just great. We received a very good basic education in the natural sciences and gained an insight into current research topics and applications at an early stage. We always worked well together, learned a lot, and had fun." Heidi Potts enjoyed positive experiences throughout her studies at the University of Basel. And her award for the best master's thesis is the crowning glory.

PhD School

An Ideal Framework for PhD Students

The SNI PhD School

In 2012, the Swiss Nanoscience Institute founded a PhD School with the aim of training excellent young scientists in the interdisciplinary nanosciences. The SNI management places great value here on the outstanding support provided to the doctoral students by two supervisors. In addition to working intensively in their respective research fields, the doctoral students receive insights into areas such as communication, rhetoric, intellectual property and patents through specially developed SNI courses. In winter and summer schools, all SNI doctoral students get to know their colleagues from other disciplines and from the SNI partner institutions and make use of this ideal opportunity to talk about their work and experiences.

Diversity in the snow

By the end of December 2014, 24 doctoral students were enrolled in the SNI PhD School. They take the opportunity to participate in various activities offered by the SNI PhD School and to benefit from the diversity of the SNI. For example, the year began with the SNI's now established Winter School, *Nanoscience in the Snow*. More than 30 interested participants, including guests and speakers from other departements, met in Kandersteg in the Bernese Oberland. In addition to discussions about nanoscience in a relaxed atmosphere, the program also included four tutorials, six specialist presentations, and a poster session. As in previous years, the presenters covered a wide range of topics – from optoelectronic applications for colloidal nanocrystals through to new biomedical tools for investigating neurodegeneration. All those involved really enjoyed combining technical discussions with fun in the snow in the beautiful Swiss Alps.

Across the boundaries of subject areas

A similarly diverse range of topics was offered at the SNI's first annual event, the SNI doctoral students playing a significant role in its success. The two-day meeting, which took place in Lenzerheide in September 2014, proved to be an excellent opportunity for the doctoral students to present and discuss their research findings in the form of a presentation or poster. SNI Director Professor Christian Schönenberger was impressed by the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quality of the talks and posters: "Most of the young people are already working at a very high level and have an excellent understanding of how to clearly explain their research topics to academics from other subject areas as well."

Who owns an idea?

Patent attorneys and professionals dealing with intellectual property also require a solid understanding of a wide range of topics. The SNI doctoral students learned this – and much more – at a workshop in November 2014 that was specially developed and organized for the PhD School. The 20 participants came together for an afternoon and received an insight into the very specialist world of intellectual property through presentations by Dr. Wolfgang Henggeler (Unitectra), Dr. Tomas Brenner (Hightech Zentrum Aargau) and Dr. Robert Sum (Nanosurf). Using a few examples, the students were also shown how to research the patentability of inventions. In this way, they learned the procedure used by technology transfer experts, which ultimately leads to a decision on whether a patent will be filed. "The IP workshop used an easily accessible and understandable approach to teach us a great deal about patents, trademarks and copyright," commented Nadia Linda Opara, PhD student at the SNI.

Good starting point

The events mentioned above offered the doctoral students excellent opportunities to find out more about topics outside their specialist areas and, in this way, to develop their skills and interdisciplinary thinking. The range of special workshops for SNI doctoral students will be expanded in the coming years to cover as many areas as possible. The SNI team is currently working on a concept for rhetoric and communication courses for 2015. The SNI's doctoral students very much appreciate this offering and expressed their gratitude during the production of the SNI videos, for example. There, Nora Sauter and Davide Cadeddu, two of the PhD students, summarized the advantages of the SNI PhD School: "The SNI PhD School offers an excellent framework in which to study for a doctorate and is the ideal platform for starting your career."

SNI PhD School in Brief

In 2012, the Swiss Nanoscience Institute founded a PhD School to promote the education of early career researchers in the nanosciences. The first doctoral students began their research activities in 2013. Up to the end of 2014, 24 doctoral students from 13 different countries were enrolled in the SNI PhD School. The eight new projects advertised in 2014 (to start in 2015) received 437 applications from young scientists all over the world – clear evidence of the SNI's excellent reputation.

All doctoral students at the SNI are supervised by two scientists from the SNI network. Currently, six departments at the University of Basel and the partner institutions (University of Applied Sciences Northwestern Switzerland, Paul Scherrer Institut and the Department for Biosystems Science and Engineering at the Federal Institute of Technology (ETH) Zurich in Basel) are involved in the SNI PhD School. All doctoral students in the SNI PhD School participate in the various SNI conferences with the opportunity to present their work in an interdisciplinary environment. In addition, the SNI offers various courses and meetings that are specially developed for the doctoral students. In 2014, the focus was on intellectual property and academic exchange during the annual Winter School *Nanoscience in the Snow*.

Trapped in Indentations

A PhD Thesis in the SNI PhD School Makes Promising Progress

In the SNI PhD School, which was launched in 2012, 24 doctoral students are currently conducting research in the various disciplines of the nanosciences. One of these students is Michael Gerspach. He began his project in 2013 as one of the first students in the SNI PhD School.

Initial impetus from Professor Güntherodt

Already in his schooldays, Michael Gerspach was extremely interested in the natural sciences. He attended a school specializing in biotechnology in Lörrach, Germany. At an introductory event at the University of Basel, he listened to a presentation by Professor Hans-Joachim Güntherodt. The presentation and the topics were so interesting that he found out more and decided to study nanosciences in Basel. In the meantime, Gerspach has become a doctoral student in the SNI PhD School. He is completing his doctoral dissertation partly at the PSI in Villigen in the group of Dr. Yasin Ekinci and partly in Professor Thomas Pfohl's group at the University of Basel. His aim is to develop a nanosystem that will allow individual biomolecules to be examined in solution in the future. "There are many people who are interested in trapping individual nanoparticles so that they can examine them," explains Michael Gerspach the background to his work. To do this, Gerspach produces chips into which he etches a network of micrometer-wide channels that are just nanometers in depth. These channels contain even smaller indentations, so-called traps, at regular intervals.

Trapping gold nanoparticles

At the moment, Gerspach is trapping gold nanoparticles with a diameter of 60 nanometers in his traps. To do so, he takes advantage of their negative charge. The surfaces of the indentations and channels in the microchip also have a negative charge. When Gerspach adds a solution with nanoparticles to the system, the particles seek out the place with the smallest repulsion from the walls: In one of the many indentations on the microchip. The particles then dwell there for up to several minutes. With the aid of interference scattering microscopy (iSCAT), the gold nanoparticles are optically imaged in their traps.

In further experiments, Gerspach has also managed to capture particles with a diameter of 40 nanometers. In the future, however, he wants to use this method to immobilize and map even smaller particles and, in a subsequent step, biomolecules.

Better images using glass microchip

If smaller particles are to be examined in the future, it is very important to take high-contrast images so that the particles can actually be detected. Since silicon, the material used for current chips, strongly reflects the incident laser beam used for the imaging, it is difficult to spot the particles on the pictures. For this reason, Gerspach no longer uses silicon wafers for his chips, but glass instead. Thanks to this change, even smaller particles can now be identified on the images with a high contrast.

Stronger traps

Stronger traps are required if, for example, smaller particles with less charge are to be trapped. Up to a certain limit, the researchers can reduce the height of the channels. This increases the repulsion from the walls and compensates for the lower charge of the particles. The general rule is that the smaller the channel heights, the stronger the hold on the particles.

In addition, the carrier solution weakens the functionality of the system. The gold nanoparticles and (in the future) biomolecules are inserted into the chip's channels in a salt solution, since biomolecules occur in an isotonic salt solution in their natural environment to remain stable. However, salt shields the negative charges. This reduces the repulsion between the particle and the wall of the channel and consequently weakens the traps. To use the developed system for immobilizing individual biomolecules, the channels and traps must be made even smaller to compensate for the effect of the salt solution.

Clear advantages

Gerspach sees some clear advantages to the chip he has developed: "What's really cool about this technology is that it works without any external force." A chip of this type could be used by anyone anywhere. No major set-up is required as it is the case with optical tweezers, for example.


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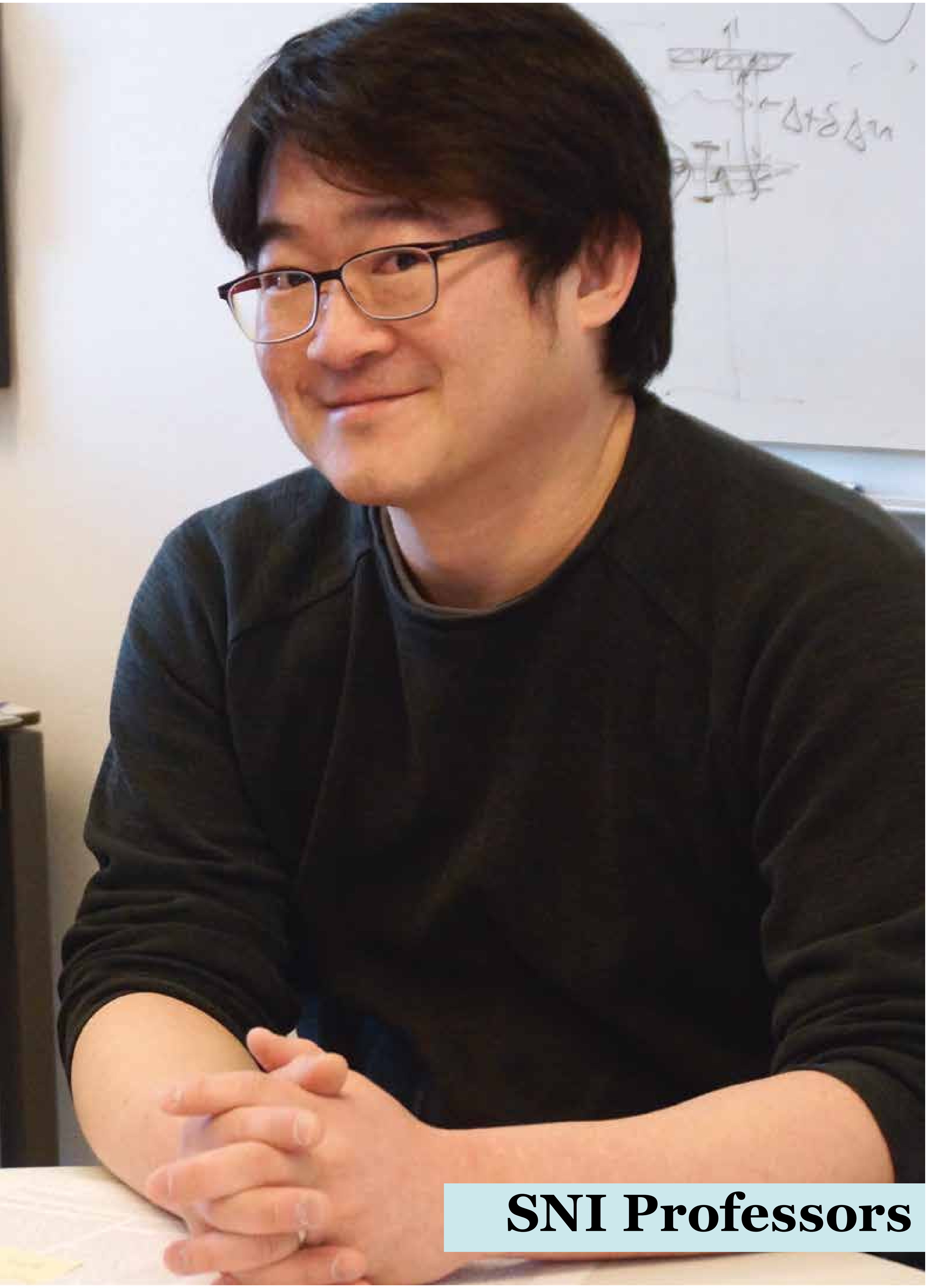
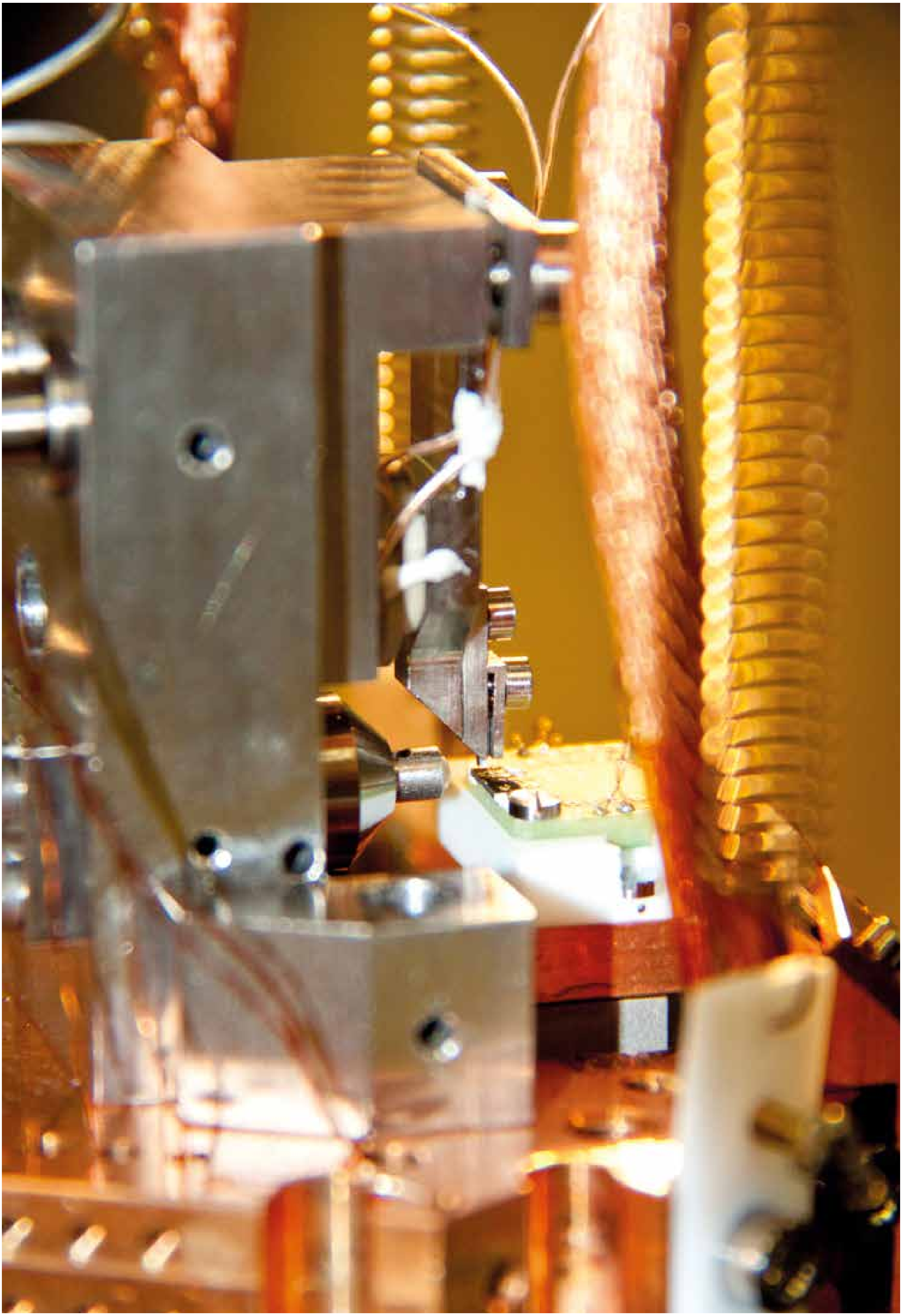


SNI Professors



For Microscopes and the Control of Quantum Systems

Argovia Professor Martino Poggio Studies Nanowires

For the last six years, the SNI has supported the two Argovia professors Roderick Lim and Martino Poggio. They both started in 2009 as assistant professors at the University of Basel. In the meantime, they have built up their research groups and due to their excellent academic achievements were promoted to associate professors in 2014. While Roderick Lim is located at the Biozentrum and focuses on Nanobiology, Martino Poggio has established his laboratory at the Department of Physics. He is working on the development of a nano-Magnetic Resonance Force Microscope and focuses his research on nanowires that can be applied in this microscope and additionally can be used as multifunctional sensors.

Improvements with nanowires

In the past, Martino Poggio has published several internationally recognized papers on the development of a nanometer-scale magnetic resonance imaging microscope (nano-MRI). This new type of microscope is characterized by its high sensitivity, which comes mostly from its use of ultra-sensitive mechanical cantilevers in the signal detection. While MRIs that are currently used in medical diagnostics need at least 10^{16} atoms to map structures in detail, the nano-MRI can already work with just 1000 atoms. This means that where conventional MRIs make images with resolutions in the millimeter or, at best, micrometer-scale, a nano-MRI can image nanometer-scale objects. However, according to Poggio, a further improvement of the nano-MRI with the currently used cantilevers is not possible. Therefore, he is now studying nanowires, promising new mechanical transducers that may be used in nano-MRI and additionally as highly sensitive, multifunctional sensors.

Grown from the bottom up

In contrast to cantilevers, these nanowires are not etched or milled out of a larger block (top-down), but self-assemble from molecular components (bottom-up). Since they are nanometer-scale crystals, they grow almost perfectly under controlled conditions and thus are not only smaller than traditional cantilevers, but also have nearly perfect electronic and mechanical properties. The scientists can also use different materials during growth producing so-called “core-shell” structures, which further increases the range of potential applications.

Tiny defects show positive effects

The Poggio team works closely together with the group of Professor Anna Fontcuberta i Morral from the EPF Lausanne and Professor Richard Warburton from the Department of Physics at the University of Basel. Some time ago, the scientists from Lausanne discovered that upon optical excitation, the nanowires which they had produced emit a bright red light at several locations. Further studies proved that, during the self-assembly of the nanowires, tiny defects appear at these locations close to the surface. These imperfections were a stroke of luck for the scientists as they act as traps for single electrons and therefore can emit single photons. Today, the scientists let the nanowires grow under specifically defined conditions so that several of these defects, called quantum dots, are formed close to the surface. Without functionalization or an external electric field, these quantum dots efficiently emit single photons of similar wavelength.

Close exchange leads to new ideas

When this phenomenon was discussed during a seminar in Basel, PhD student Michele Montinaro from Poggio’s group got the idea to investigate whether the energy level of the emitted light is coupled with the movement of the nanowire. He launched a series of experiments, in which he mechanically vibrated nanowires that were glued to a substrate and examined the emission energy of the light as a function of the nanowire movement. It turned out that the two parameters – position of the nanowire and the measured photon energy – are strongly coupled. “When the nanowire is bent, a strain appears mainly on the surface of the nanowire. Since the quantum dots are close to the surface, this strain influences the quantum dots and affects the energy level of the emitted light, “ Poggio explains the observed phenomenon.

Mechanics control the quantum state

For him, these results are so fascinating because the position of the nanowire determines the energy level of the quantum dot. The strength of the coupling between the quantum dots and the nanowire motion is among the largest ever measured in systems where a quantum device is coupled to mechanical motion. Furthermore, the researchers can reversibly tune and control the optical frequency of the quantum dot without influencing the intensity of the photoluminescence by the mechanical motion of the nanowire. Vice versa, it is also possible to draw conclusions about the location of the nanowire or even of the quantum dots based on the measured energy levels.

The Poggio team published these results together with their colleagues in July 2014 in Nano Letters[1]. Michele Montinaro, first author of the paper, successfully completed his PhD in September 2014 and started a job at Sensirion in Stäfa in January 2015. Martino Poggio will further investigate the coupling of the quantum dots and also advance the use of nanowires in his nano-MRI and its application in the study of quantum dots. As quantum dots are also suitable to detect electric fields, the team will also test their use as scanning sensors of electric fields.

[1] M. Montinaro, G. Wüst, M. Munsch, Y. Fontana, E. Russo-Averchi, M. Heiss, A. Fontcuberta i Morral, R.J. Warburton & M. Poggio. Quantum dot opto-mechanics in a fully self-assembled nanowire. Nano Lett. 14, 4454 (2014)

SNI Professors in Brief

The Swiss Nanoscience Institute has supported Argovia professors Roderick Lim and Martino Poggio since they began working as assistant professors at the University of Basel in 2009. Both were promoted to associate professor in 2014 thanks to their outstanding academic achievements. Roderick Lim has made a name for himself through his research in nanobiology with a focus on nuclear pore complexes. Martino Poggio focuses on nanomagnetism and nanomechanics and has developed a highly sensitive nano-MRI that has gained worldwide recognition.

In 2014, Lim and Poggio presented their findings in eight papers in peer-reviewed scientific journals and nineteen lectures at various international conferences. In addition to the funding they received from the SNI, Lim and Poggio have together raised external funding of CHF 1.5 million for their research.

In addition to the Argovia professors, the SNI supports the titular professors Thomas Jung, who works in the Department of Physics at the University of Basel and the Paul Scherrer Institut (PSI), and Frithjof Nolting, who has his research group at the PSI. At the end of 2014, Michel Kenzelmann, who also researches at the PSI, became the third SNI supported titular professor.

Nano-Velcro for Transport

Argovia Professor Roderick Lim Develops New Concept

In 2009, Professor Roderick Lim joined the Swiss Nanoscience Institute as an assistant professor in Nanobiology. Since then, he has made major breakthroughs in his science and technology receiving tenure in 2014. In the last Annual Report, we presented ARTIDIS, a device for the diagnosis of malignant tumors developed by his team. This project has now been advanced so that co-workers have founded a spin-off and are currently commercializing a prototype for clinical applications. In 2014, Lim also made major progress in his basic research projects. His studies on the transport of molecules into and out of the cell nucleus through the so-called nuclear pore complexes have led to a paper in Nature Nanotechnology[2].

Selective transport through the nuclear membrane

The nucleus of animal and plant cells is separated from the cell plasma by a biomembrane. Despite this barrier, an intensive exchange of substances takes place between the nucleus and the cytoplasm. For example, numerous proteins are formed in organelles in the cytoplasma but are required for the synthesis of DNA in the nucleus. The blueprint for proteins, however, is produced in the nucleus and has to be transported to the protein production sites in the cytoplasm. Tiny pores in the nuclear membrane enable this massive transfer into and out of the nucleus.

For years, Roderick Lim has studied the biophysical basics of this transport process. Together with colleagues from Lausanne and Cambridge, he has created an artificial bio-synthetic system based on the nuclear pore complex to better understand this ingenious system that enables selective transport of specific molecules.

Strength of the bond is crucial

The driving force behind the transport of substances into and out of the cell nucleus is diffusion. However, the substances, which are partially large molecules, do not passively diffuse through the nuclear pore complex. Instead, they bind to specific import proteins. Only when a substance is marked with such an import protein, it can pass the pore. For this purpose, the import complex binds to proteins that coat the inner surface of the pore and that are similar in their function to a Velcro strip. The research team now postulated that the transport through the nuclear pores depends on the strength of binding to the Velcro-like proteins. If the binding is loose enough, the molecule can still diffuse through the pore. If the bond is too strong, the molecule stays in place and cannot move.

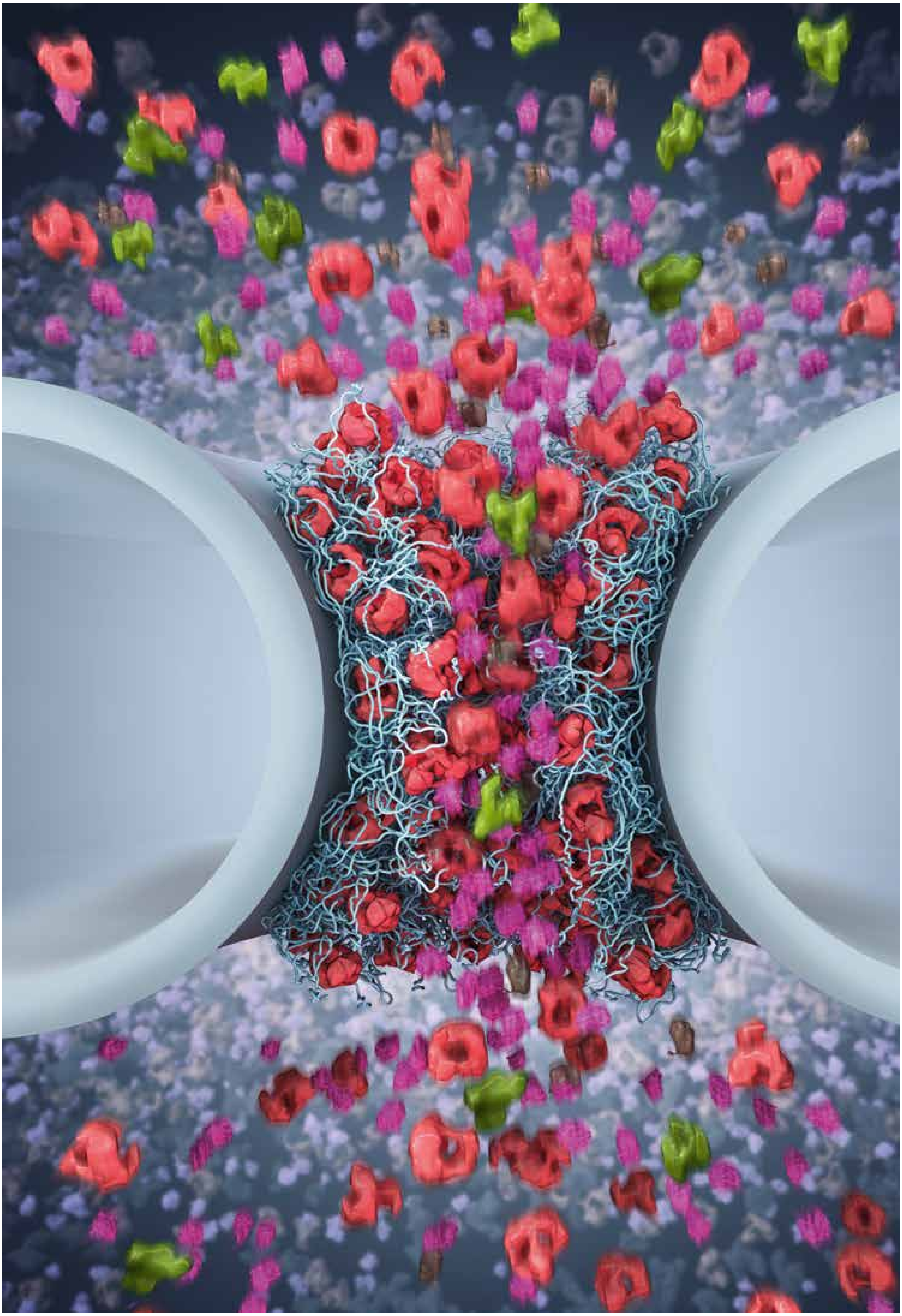
An artificial system confirms hypothesis

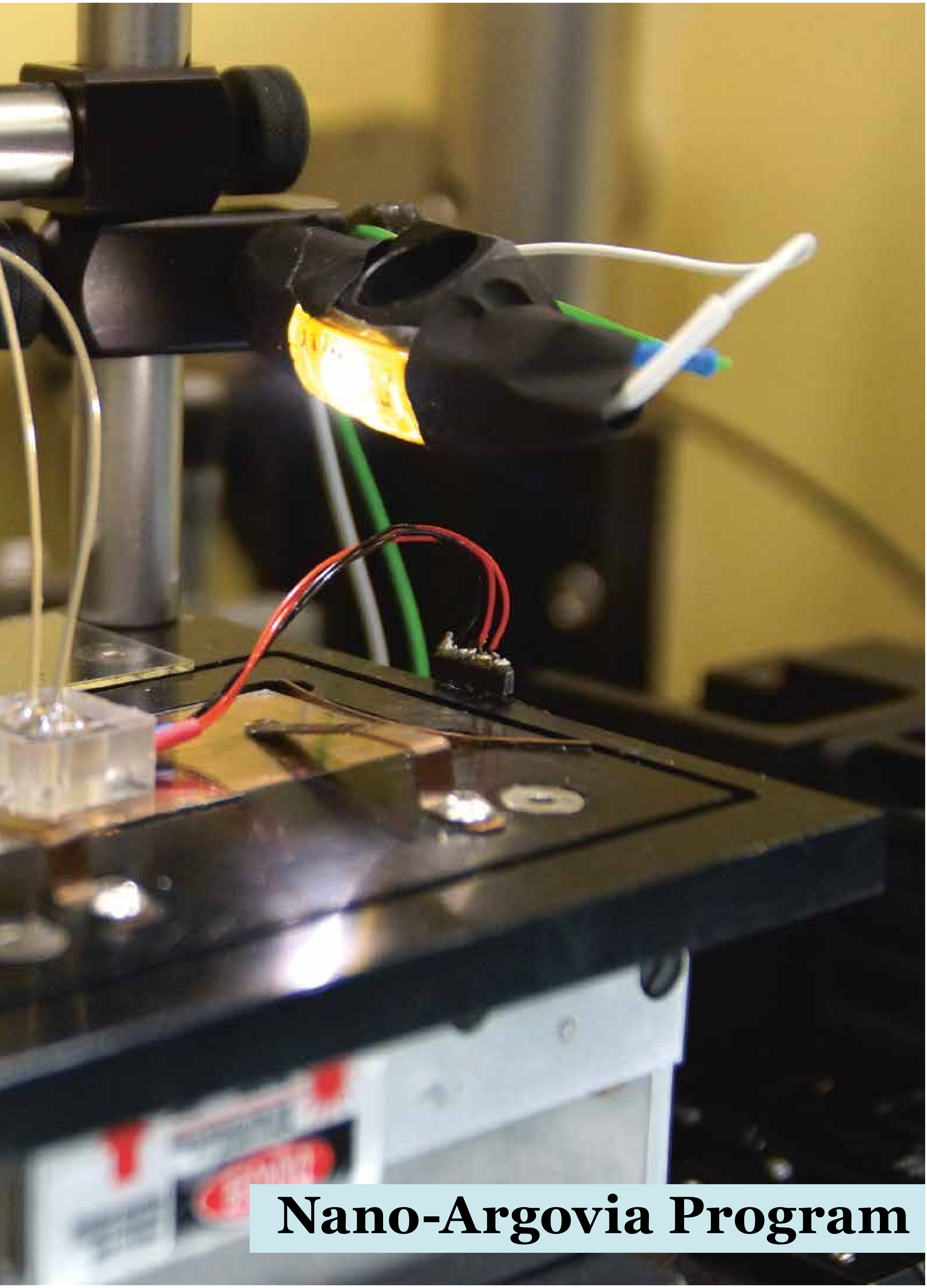
To test their hypothesis, the scientists coated particles with import proteins and studied their behavior on the molecular Velcro. When the Velcro was "clean", the particles stuck immediately and were not transported. However, when the Velcro was "dirty" (i.e. occupied with other import proteins), adhesion was significantly reduced and the particles slid over the surface just by diffusion. Everyone knows this phenomenon. If a Velcro strip is contaminated with lint, the counterpart no longer adheres well. This is undesirable for a jacket pocket, but resembles a perfect system for the transport of molecules into and out of the cell nucleus.

Applications may follow

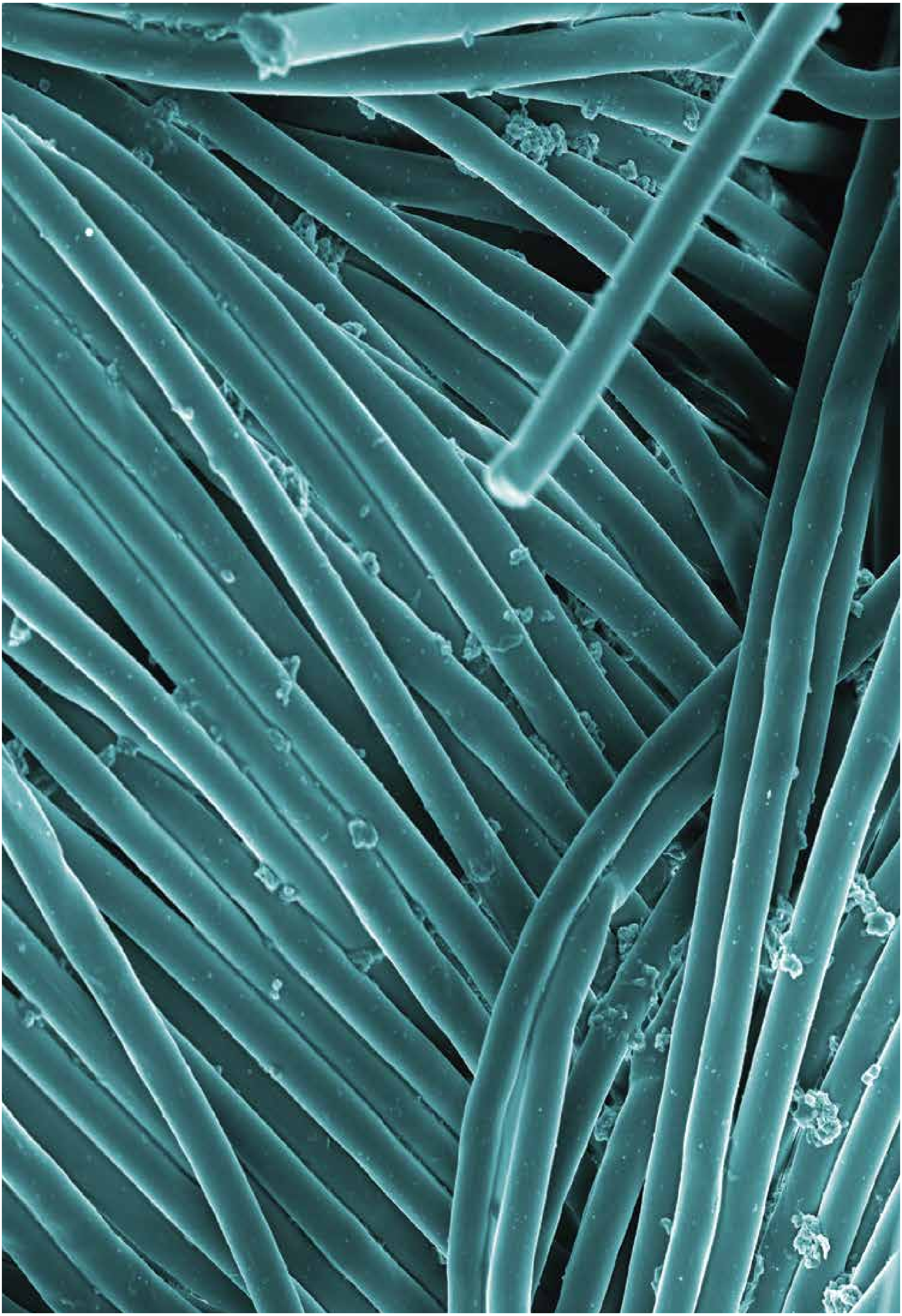
For Lim, these results, which help his team to understand the principles of nuclear pore complexes, are only the beginning and he is now working towards possible applications. "Using the dirty Velcro effect, we should be able to define the path for selected particles and speed up their transport without requiring external energy," he explains. "This principle could find very practical applications, such as nanoscale conveyor belts, escalators or tracks," says Lim. The findings could also potentially be applied to further miniaturize lab-on-chip technology, since the newly discovered transportation method would make today's complex pump and valve systems obsolete.

[2] K.D. Schleicher, S.L. Dettmer, L.E. Kapinos, S. Pagliara, U.F. Keyser, S. Jeney & R.Y.H. Lim. Selective transport control on molecular velcro made from intrinsically disordered proteins. Nature Nanotech. 9, 525 (2014)





Nano-Argovia Program



Nanofacts Finds Facts

A Successful Argovia Project with a Cooling Effect

With the Nano-Argovia program, the Swiss Nanoscience Institute has created an important funding instrument that can be used to exploit the potential application of basic scientific findings in close collaboration with industrial companies. The projects, which are always conducted by two academic research institutions from Northwestern Switzerland and one industry partner, are designed to last for one to two years. Argovia projects can therefore help new research findings to be transferred to industry but are also suited to respond to needs from industrial companies.

Innovative clothing with a cooling effect

The successful Argovia Nanofacts project was completed in March 2014. Its aim was to help develop novel textiles with an active cooling function. Functional clothing of this type could be used not only for leisure purposes, but could also (for example) be worn by firefighters underneath their protective clothing. Cooling clothes would bring immense relief during their work and thus help to keep the emergency responders safe.

Cooling by dissolving

The cooling function is to be achieved using special materials adhered to the surface of the textile. To do so, the researchers packed active substances into nanocapsules surrounded by a membrane. When the capsules come into contact with water or sweat, the active substance dissolves inside the capsule, consuming energy. This reduces the temperature in the capsule environment. The person wearing the clothes feels this cooling effect. The active substance is then regenerated when the clothing is dried, meaning that the desired effect can be achieved again the next time it is worn.

Not too big and not too small

Seemingly simple in theory, in practice this must first be researched and tested. Many different factors play a role. The size of the capsules, for example, is a decisive factor with significant influence on the permanent use of the textiles. The capsules must be small enough that they adhere permanently to the surface and do not wear away too quickly. On the other hand, the capsules should contain enough active material to ensure a good level of effectiveness. A certain minimum size is therefore required. Tests have shown that the optimum capsule size is between 100 and 10,000 nanometers. However, there was previously no suitable method of packing materials into capsules of this size.

Polyurethane and sugar – the ideal combination

As part of the Nanofacts project, scientists from the University of Applied Sciences Northwestern Switzerland (FHNW), the University of Basel and the company HeiQ Materials have now investigated two methods of creating the desired capsules. Existing emulsion technologies were further developed and novel techniques were applied to build larger units from tiny vesicles. Capsules with an outer shell made of polyurethane – a chemically inert material which is therefore supposed to have no health risks – proved particularly promising. Inside, a sugar functions as the active substance that causes the cooling effect by dissolving in water. The Nanofacts team examined various sugars and characterized the different compositions of the polyurethane and sugar capsules.

Promising approach

The results now available appear very promising. With the aid of calorimetric tests, the researchers were able to determine the crystalline sugar content in the capsules and investigate the cooling effects through microcalorimetry. Most of the capsules produced displayed the desired cooling. The reactions of the best examples used up to 100 joules per gram of capsule at 37°C. The researchers at the FHNW produced a large batch of the ideal combination for the partner company HeiQ Materials, where they were adhered to textile surfaces and tested. Here too, the selected approach appears promising because the capsules used achieved significant cooling. Only their durability in the repeated washing test leaves a little to be desired and requires further stability improvements. Overall, the Nanofacts project was clearly heading in the right direction and, according to project leader Professor Uwe Pieles, should definitely be pursued further. An application has already been submitted for a CTI project.

The Nano-Argovia Program in Brief

The Nano-Argovia program bridges the gap between the basic scientific research conducted at the SNI and industrial applications. Each Argovia project pairs two academic partners from the SNI network with an industrial company from Northwestern Switzerland. The team normally spends one year examining the feasibility of various nanotechnology approaches that originated from the research conducted at the SNI. In 2014, 13 Argovia projects received total funding of more than CHF 1.5 million. As a survey of the industrial companies involved shows, these collaborations with scientists from the SNI network is highly valued. All the companies surveyed confirmed that they would participate in another Argovia project. The collaborations from 2014 have so far resulted in a total of 21 publications and one patent application.

Measuring Density and Viscosity with Vibrations

Doctoral Dissertation on an Argovia Project Completed Successfully

SNI applied research projects in the Nano-Argovia program are initially approved for one year. If the prospects of success are good, they can also be extended. The Argovia project NoViDeMo, which focused on the development of a device to measure viscosity and density, was started in 2012 and successfully concluded in November 2014 with the completion of Benjamin Bircher's doctoral dissertation. In this project, a team of scientists – including experts from the University of Basel, the University of Applied Sciences Northwestern Switzerland, the University Hospital Basel and the company Endress & Hauser Flowtec – clearly demonstrated just how successful interdisciplinary collaboration between science and industry can be.

Faster and smaller

The aim of the NoViDeMo project was to develop a measurement device for the real-time analysis of viscosity and density in liquids that is suitable for use in chemical, biological and biomedical research, and for industrial applications. To this end, the research team led by project manager Dr. Thomas Braun applied cantilever technology. Therefore, doctoral student Benjamin Bircher for the most part spent the last three years developing a sophisticated and optimized system based on the prototype of an existing cantilever platform that works now significantly faster and uses smaller sample volumes.

Microcantilevers vibrate in liquid

In this prototype, based on developments of Professor Christoph Gerber's team, microcantilevers are placed in a tiny plastic channel. To take measurements, these cantilevers are stimulated to vibrate. If liquid flows through the channel, the resonance frequency and vibrational amplitude of the cantilevers change. These changes can be precisely measured using a laser. To adapt the system to smaller sample volumes, Bircher first altered the method of actuating vibration. In the previous test platform, the cantilevers were stimulated using an acoustic signal. This also influences the channel itself and leads to a feedback to the cantilever, which interferes with the measurement and prevents the further miniaturization of the system. Instead of acoustics, Bircher opted for photothermal excitation of the cantilevers using a second laser with a different wavelength. This excitation does not influence the channel itself. The researchers were then able to reduce its size so that rather than a sample volume of one milliliter (as in traditional viscosity measurements), only one microliter is required. Subsequent tests showed that further miniaturization to under 100 nanoliters is problematic because the vibrational amplitude decreases drastically when the volume is reduced further and accurate measurements are no longer possible.

No influence if the setup is right

Bircher also conducted numerous tests to examine the influence of photothermal excitation on the liquid to be tested. This showed that if the setup is designed correctly, the influence on the liquid can be minimized because there is no danger of the liquid warming up and therefore changing its viscosity. "The development of photothermal excitation is particularly interesting because these findings are not only suitable for developing a viscometer, but can also be applied very well to atomic force microscopy," says Benjamin Bircher, explaining this innovation.

Quicker with oil

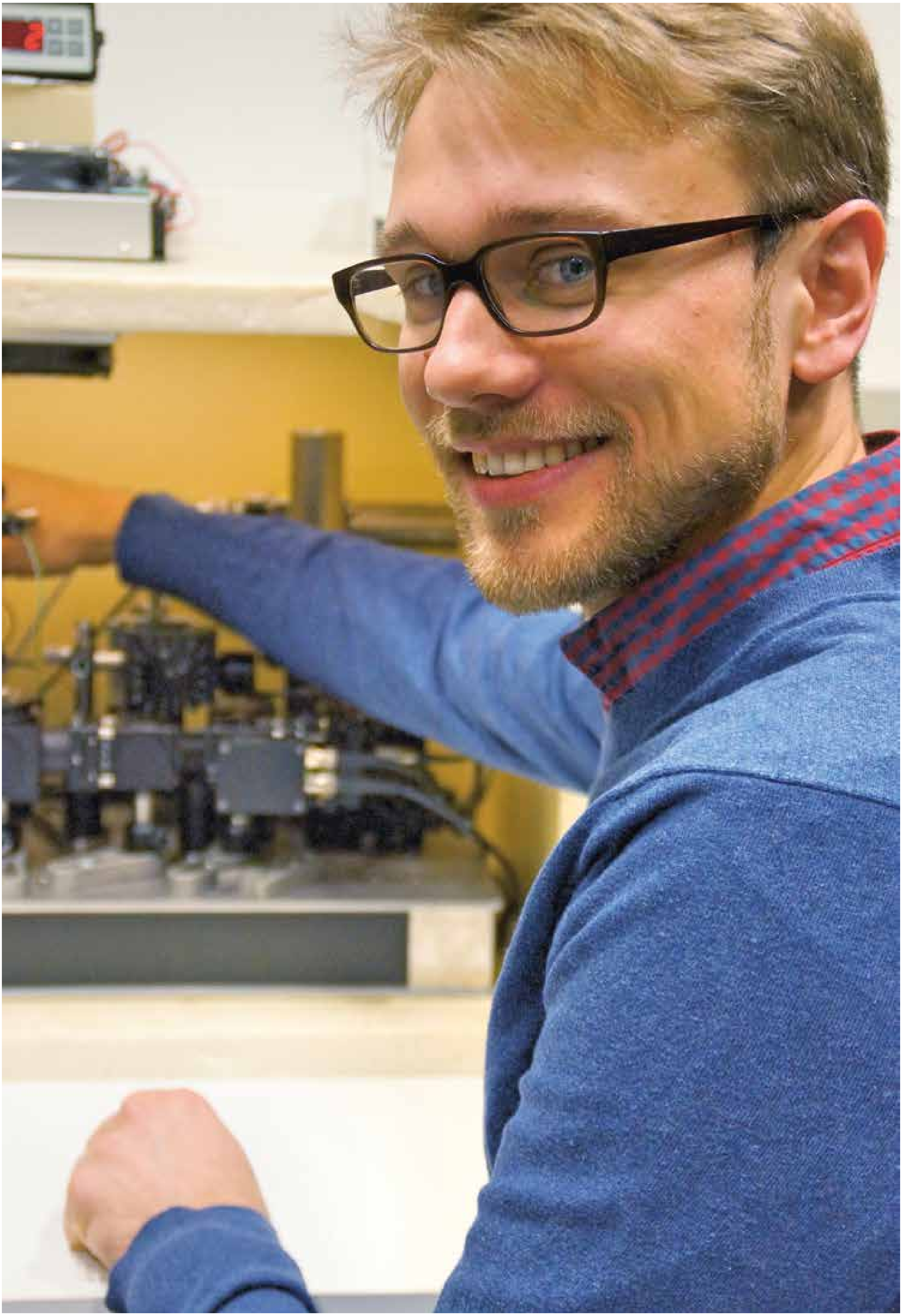
After improving the channels and therefore reducing the volume required, the scientists addressed the speed of the analysis. Conventional, commercial viscometers take around one minute per measurement. However, Benjamin Bircher wanted a microliter drop to be analyzed within one second. This short time span increases throughput and avoids problems that occur through unspecific adsorption due to long exposure. He solved this problem by separating the water-soluble samples not with water, but with oil. The oil pushes the sample in and out of the channel without the mixing that occurs with water. The samples can therefore be transported into and analyzed in the liquid channel fully automatically and in quick succession.

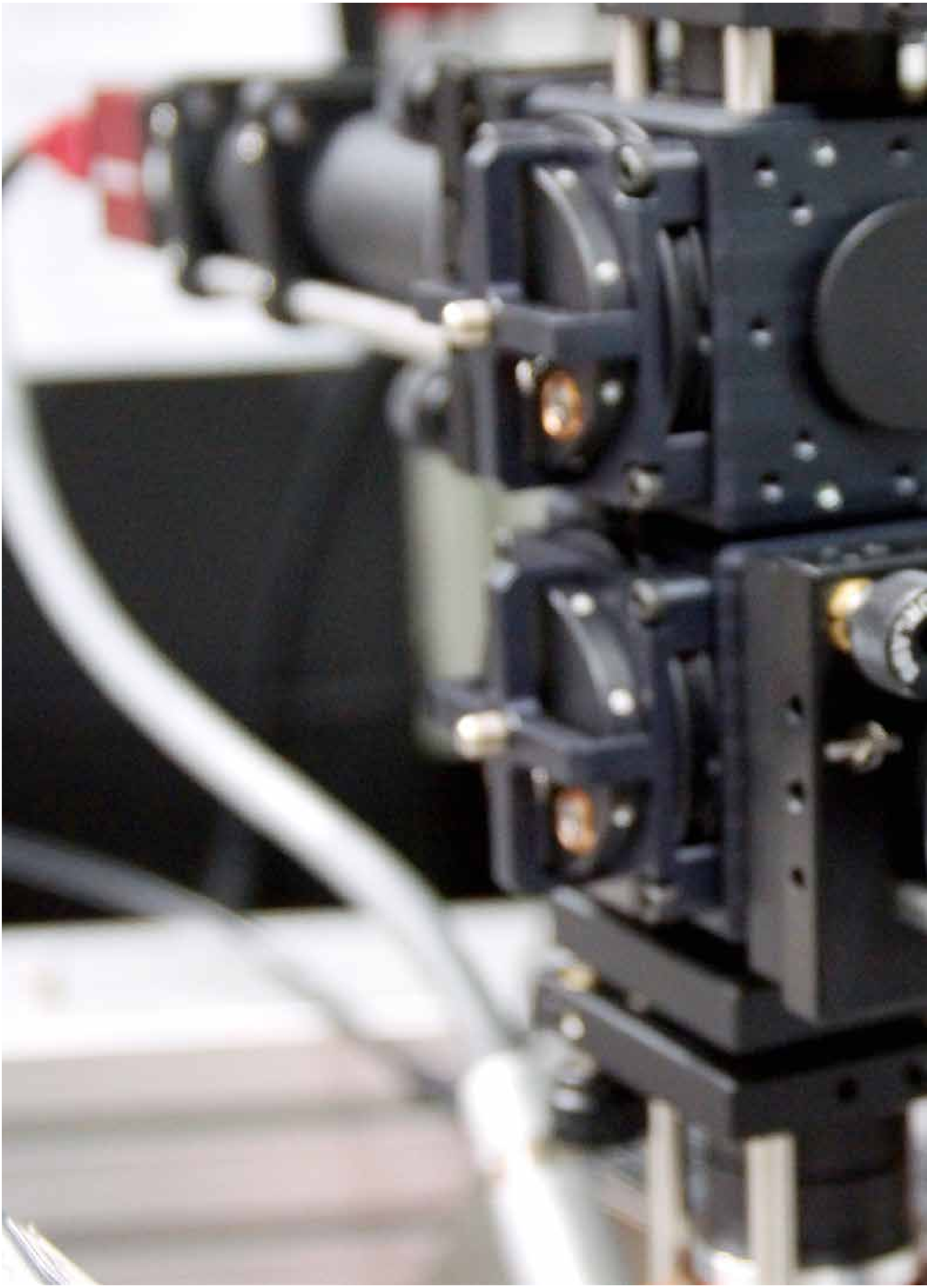
Numerous applications tested

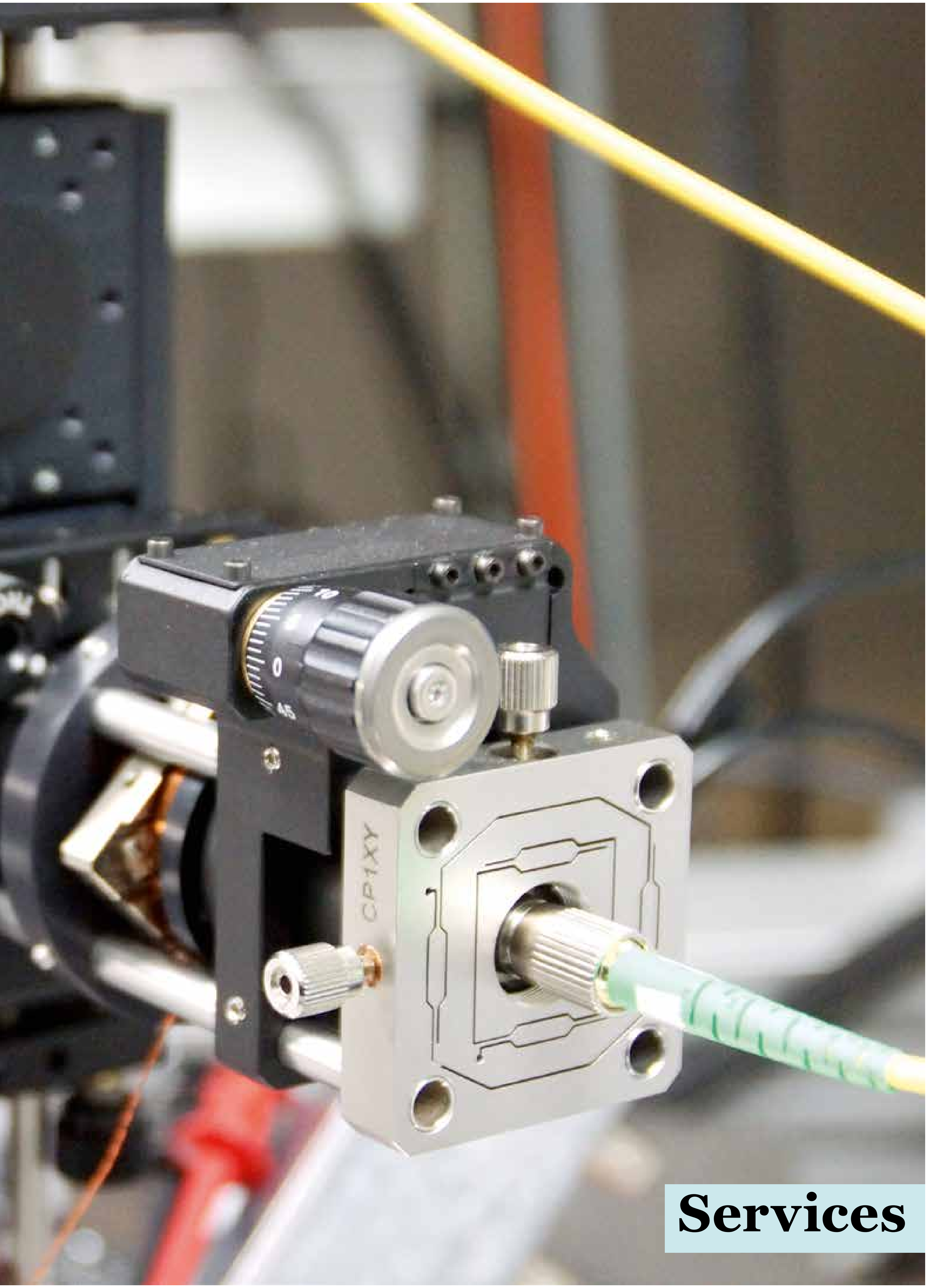
The team has now performed measurements with various substances to test the device's suitability. For example, the system has been successfully used to analyze the glucose content of a liquid. This occurs using functionalized polymers that cross-link when glucose is added. Such a change in viscosity can be measured depending on the glucose concentration in the environment. The device can also be used to determine protein folding. The scientists were able to demonstrate this using lysozyme. This small, water-soluble protein unfolds when urea is present. As the urea concentration increases, the relative viscosity changes.

Work to continue

The various tests have clearly shown that the device developed is ideally suited to measuring minor changes in viscosity and density in the smallest amounts of liquid and without using labels. Various applications are conceivable. The device is ideally suited for quality control for a wide range of liquids as well as for the real-time monitoring of chemical and molecular reactions. "The NoViDeMo Argovia project may be finished," comments Thomas Braun. "But we will definitely continue to research in this field and develop the device further."







Services

New Design Solves the Problem

Nanotech Service Lab Offers Support for Very Specific Issues

The Swiss Nanoscience Institute views itself not only as a research platform and educational establishment, but also as a service partner for internal research groups and external industry partners. Experienced colleagues in the excellently equipped technology, mechanics and electronics workshops in the Department of Physics (which are supported by the SNI) tackle complex technical matters to the customer's complete satisfaction. By operating the Nanotech Service Lab (NSL), the SNI also offers its own service for analyzing different surfaces. Run by Dr. Monica Schönenberger, the NSL mainly offers microscopy analyses but also advises internal contacts and external companies on a wide range of issues. For example, a collaboration with the Frick-based company Jakob Müller AG in 2014 led to a mechanical part being changed and, therefore, to a solution for a long-standing problem.

Overloaded material is the most probable cause

Since 1887, Jakob Müller AG has been developing innovative technologies for the ribbon and narrow fabric industry. Today, the company from the Frick Valley is the world's leading provider of machines for producing items such as seat belts. For some years, Jakob Müller AG repeatedly experienced problems with particular leaf springs in a drive that moved the vertical threads up and down when weaving ribbons. The Nanotech Service Lab was contacted to investigate this problem more closely. Dr. Monica Schönenberger and Dr. Peter Reimann, head of the Technology group in the Department of Physics, began by precisely analyzing the steel springs and at the same time requested support in the research study from

Hightech Zentrum Aargau and the SNI, which was quickly approved.

The results were surprising because the various microscopic studies showed no material differences between the broken and intact springs. Physicochemical tests commissioned also confirmed that the breaks had nothing to do with material flaws or differences. However, it was clear that the curves of the springs were subject to enormously high tensile stress that reached its maximum at the points of breakage. Based on these results, the team concluded that the breaks were most likely caused by a general overload to the material.

The solution: a larger radius

The NSL team therefore suggested changing the form of the springs. "A modified design reduced the stress ratios on the spring curves, meaning that the material no longer reached its tolerance thresholds," explains Monica Schönenberger. Various new spring forms were tested. One spring with just one curve of a larger radius proved particularly suitable. Initial tests with 50 prototypes showed that this alteration to the design really did reduce the vulnerability of the springs considerably. During an internal endurance test with around 100 million load changes, there was not a single failure. By contrast, the old form had a failure rate of 3–60% per 10 million load changes. And so, in summer 2014, Federtechnik AG in Kaltbrunn produced the first 500 new springs in series.

Successful cooperation

Bernhard Engesser, Head of Research and Development at Jakob Müller AG, was extremely pleased with the successful collaboration with the SNI. In a thank-you letter, he highlighted the fact that the team had not only supported Jakob Müller with pure laboratory tests and analyses, but had also supplied concrete design proposals to put the project on a promising track. Monica Schönenberger and Peter Reimann continue to follow the progress of the new springs because they are now being used around the world in production conditions, where they are proving their suitability.

SNI Services in Brief

The SNI offers various technology services for internal and external partners from science and industry. In particular, the technology department and the electronics and mechanics workshops in the Department of Physics and the Nanotech Service Lab (NSL), which is run by the SNI itself, consistently develop innovative solutions to a wide range of problems and tasks with their excellent equipment and highly qualified employees.

In 2014, the NSL worked on projects for the companies Jakob Müller AG, Micro Crystal AG, Endress & Hauser, Ziegler Papier AG in Grellingen and the University of Applied Sciences Northwestern Switzerland (FHNW), and supported numerous internal research groups. The NSL's services include analyses and consulting based on various microscopic tests (scanning probe microscopy, light microscopy, confocal laser color scanning microscopy, scanning electron microscopy, photoelectron spectroscopy, electron spectroscopy, X-ray structure analysis and Raman spectroscopy).

A Sketch Is All It Takes

The Mechanics Workshop Implements Ideas and Supports Teams in Their Research

The excellent workshops by the Department of Physics, which are also supported by the SNI, continually contribute to the academic success of the SNI researchers at the University of Basel. The mechanics workshop – and above all its manager, Sascha Martin – are the first port of call when it comes to modifying and developing specialist microscopes. Professor Richard Warburton, for example, recently came to Sascha Martin and requested assistance with a few ideas. He and his team required a special confocal resonance fluorescence microscope for analyzing quantum dots. His postdoc, Dr. Andreas Kuhlmann, then worked with Sascha Martin to develop a prototype that contributed significantly to the production of a paper published in Nature[3].

Quantum dots as a research topic
Quantum dots are a popular research topic at the SNI. They fulfil important requirements for implementing quantum bits and, therefore, lay the groundwork for a possible quantum computer. Specialist methods and devices are required to examine self-organized quantum dots in semiconductors. Quantum dots are just a few nanometers in size and the experiments require extremely low temperatures of -270°C. Professor Richard Warburton researches quantum dots of this type and so required a universal tool to investigate them. He envisioned a confocal resonance fluorescence microscope that would provide him with new insights into the world of quantum dots. Since no commercially available microscope met his requirements, he contacted Sascha Martin to arrange for such a microscope to be produced.

Polarization should solve the problem
In a fluorescence microscope, the sample to be examined is stimulated by a laser, whereupon light is emitted with a

longer wavelength. The difference in wavelength means that the stimulating laser beam can be easily distinguished from the fluorescence light emitted. For experiments with semiconductor quantum dots, however, the scientists required a resonance fluorescence microscope in which the laser and fluorescence have exactly the same wavelength. This makes it difficult to distinguish between the two. To solve this problem, Richard Warburton and Andreas Kuhlmann had the idea to incorporate polarizing filters into the system. These are intended to linearly polarize the light so that the polarization of the stimulating laser beam and the emitted light are orthogonal to one another. It would then be possible to clearly distinguish between the stimulating and emitted light, allowing initialization, manipulation and reading of the status of the quantum dot.

Certain requirements must be fulfilled

As is usual when working with Sascha Martin, the scientists began by briefly sketching the idea on a piece of paper. Martin immediately started putting the plan into action. There were certain framework conditions he had to fulfill. All materials had to be able to withstand very low temperatures approaching absolute zero and be suitable for vacuums. In addition, the cryostat into which the microscope was to be transferred for analysis has a strong magnetic field, so the materials could not be magnetic. There were also requirements regarding size, electrical conductivity, thermal conductivity and stability. The mechanical material properties and production options for each component also played an important role to ensure that once the planning was complete, parts could be produced precisely and free from distortion with CNC processing machines.

Martin incorporated the various pieces of information into the parts planning via CAD and discussed the designs at length with Andreas Kuhlmann, who also considered it important, for instance, to keep the helium consumption in the system as low as possible. One trick to achieve this is to polish all metal surfaces facing upward. The heat radiation from outside is then reflected back by the mirror-like surfaces and the system requires less cooling.

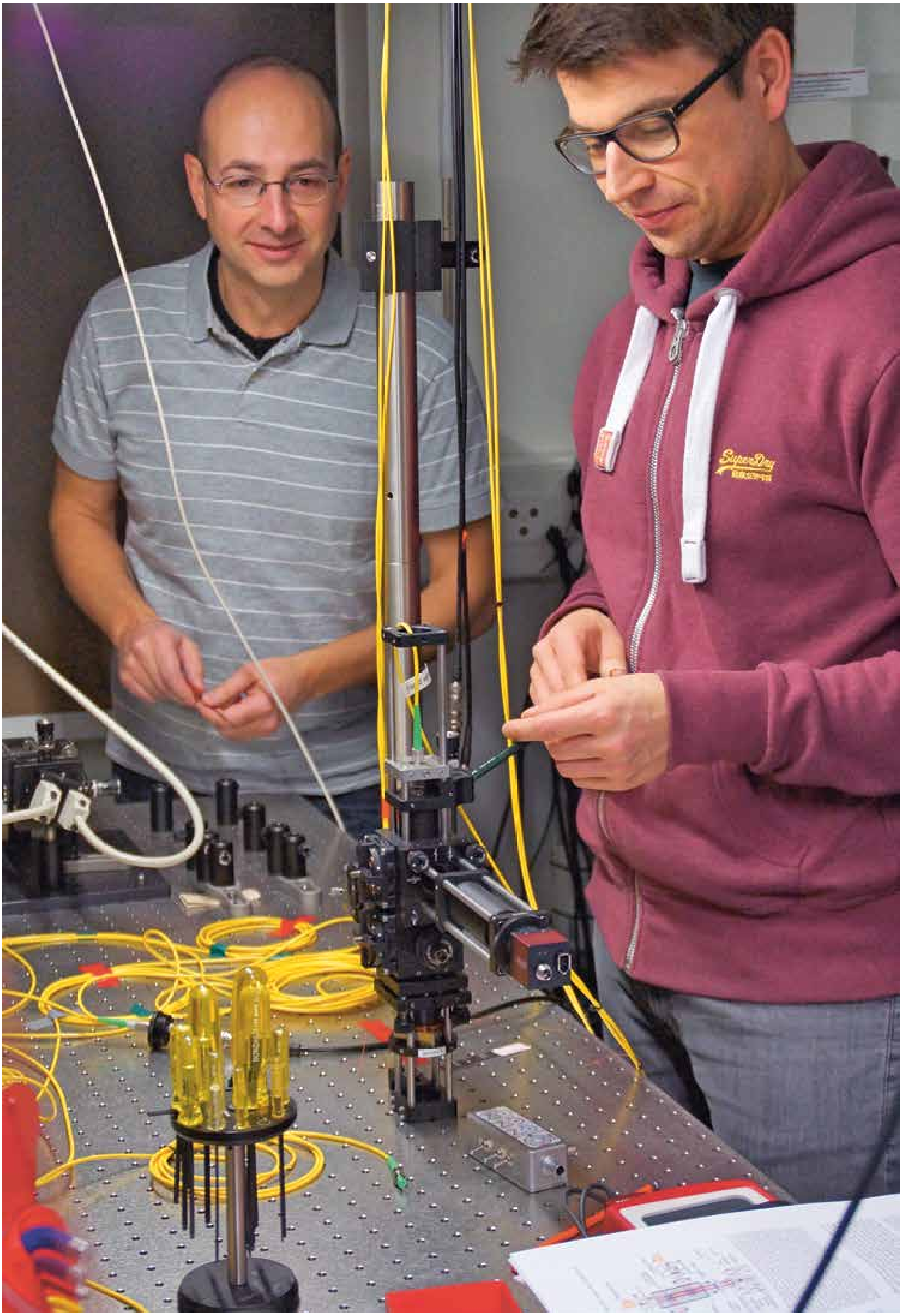
Successful implementation

The microscope envisioned by Warburton and Kuhlmann is now complete and in use. It is the only one of its kind worldwide and provides new insights into the world of quantum dots. "The new microscope is absolutely fantastic and was pivotal in the production of our *Nature* paper," comments Warburton. "It is really brilliant to have such outstanding workshops here in the building. They are excellent and fast, giving us a real advantage over other universities," Kuhlmann adds.

Other groups also benefit from the experience

The experience gained by Sascha Martin and his team with every project also benefits the other groups in the SNI and the Department of Physics. The different research groups often have similar requests and have to deal with comparable problems. Sascha Martin considers himself lucky to have such good conditions in the Department of Physics: "We are a small, flexible team with highly qualified colleagues and fantastic equipment and we work very well with the other workshops. This allows us to provide an optimal service and to make important contributions to research."

[3] M. Munsch, G. Wüst, A. Kuhlmann, F. Xue, A. Ludwig, D. Reuter, A.D. Wieck, M. Poggio & R.J. Warburton. Manipulation of the nuclear spin ensemble in a quantum dot with chirped magnetic resonance pulses. Nat. Nanotech. 9, 671 (2014)


Superdry

Communication & Outreach

Interdisciplinary and on a High Level

The First Annual Event of the SNI

From September 11th to 12th, the first Annual Event of the Swiss Nanoscience Institute was held at Lenzerheide. During seventeen scientific presentations and the poster session, the 75 participants had a good insight into the diverse and highly topical research at the SNI. Furthermore, the meeting offered an excellent occasion to exchange ideas and thoughts with colleagues from various disciplines and different SNI network partners.

For the first time under the sole leadership of the SNI

Professor Christian Schönenberger opened the meeting with a brief review of the history of the SNI that emerged from the NCCR Nanoscale Science and was founded in 2006. In 2013, the NCCR Nanoscale Science came to a close and since then, the SNI has been standing on its own two feet. Therefore, this year's meeting was the first under the sole sponsorship of the Swiss Nanoscience Institute.

Interdisciplinarity – a challenge for all

In his introduction, Christian Schönenberger emphasized how important and challenging interdisciplinary meetings are. All participants have to adapt the level of information and detail for talks and posters so that colleagues from other disciplines can benefit as well as colleagues coming from a related field.

This was achieved to a great extent by all speakers. Many attendees particularly liked the presentation of Benjamin Bircher, who won the *Best Talk Award*. Benjamin Bircher is working on his PhD in the Argovia project NoViDeMo. During his talk, he managed to convince everybody in the audience that fluidity measurements are suitable for the determination of various chemical and biological properties of liquids.

Diverse topics

Other doctoral students who are enrolled in the SNI PhD school also nicely presented their plans and first results. Arne Barfuss, for example, taught everybody in the audience that diamonds are perfectly suited for cutting ice and, in his research, also can be used as sensitive sensors. Sensors were also the keyword in the lecture of Ralph Stoop. The PhD student investigates silicon nanowires for biochemical analyses. Proteins of individual cells are the target of Stefan Arnold's research. He develops new methods that only need minimal amounts of material to investigate and compare the protein composition of individual cells. With these analyses, the researchers hope to gain a better understanding of various diseases. Michael Gerspach presented other new methods for the study of tiny objects. The SNI PhD student demonstrated in short films how he is able to capture individual nanoparticles for further analyses using electrostatic forces. New materials are in the focus of Dr. Peter Makk. He works with graphene that was first produced in 2004. In his presentation, he descriptively showed how the thin graphene layers can be suspended above metallic gates and how their examination lays the foundation for the use of their unique electrical properties.

Exciting presentations – everyone takes something home

Not only PhD students provided fascinating insights into their research. Two invited speakers, Professor Marcel Mayor and Professor Roderick Lim, also shared their success stories. Marcel Mayor showed in his presentation how chemists produce molecules with specific properties using synthetic chemistry. Inspired by colleagues from other disciplines who look for molecules with specific characteristics, chemists can produce molecules that fulfill certain tasks. The Argovia Professor Roderick Lim introduced the audience to his latest results in respect to the transport of macromolecules into and out of the nucleus through the so-called nuclear pore complexes.

The two days of the meeting were also enriched by the presentations of project leaders from the various SNI network partners. Professor Per Magnus Kristiansen (FHNW) presented his Argovia project PATCELL that aims to improve implants. Professor Patrick Shahgaldian talked about the Argovia project NANOzyme that investigates the combination of artificial and natural enzymes. Additionally, researchers from the groups of the SNI titular professors Thomas Jung and Frithjof Nolting from the Paul Scherrer Institute in Villigen as well as representatives of other Argovia projects were among the speakers.

Poster session – a successful combination of discussions and apéro

Some deeper discussions were possible during the poster session. This was combined with an apéro and took place on the first day after the presentations. Here, everyone was able to obtain a good overview of the various projects as participants were asked to vote for the best poster. Hans-Peter Lang scored the best and won this award with his poster on the electronic nose. The electronic nose is one of the projects from the first days of the SNI. It is based on a cantilever test system that analyzes tiny traces of different substances in the human breath. These results give indications of different diseases.

This first Annual Event of the SNI was a success as many participants confirmed. Due to the consistently positive echoes, the Annual Event 2015 will be organized at Lenzerheide again shortly before the new semester starts.

Communication and Outreach in Brief

In 2014, the small SNI team took part in various science festivals such as the tunBasel special exhibition at MUBA, the Science Days in Europa-Park Rust and the Beijing Science Festival. As in previous years, the SNI was also represented at the TechDays. To inform people throughout Switzerland of its activities, the SNI publishes an electronic newsletter entitled *SNI update* four times a year. The SNI also helps the press office at the University of Basel to compile media releases about outstanding publications by SNI members and organizes laboratory tours for groups of visitors.

New target groups are also to be addressed in three videos that were produced in 2014 and are now available on the SNI website and YouTube. The SNI team also organized internal events for the SNI PhD School, the first SNI annual conference and the newly launched SNI Lecture, for which Professor Jan Liphardt of Stanford University was invited to Basel.

Concentrated and Enthusiastic Participants

The SNI is Committed to Engage Children in Science

The founding father of the SNI, Professor Hans-Joachim Güntherodt, was a driving force behind informing a broad audience about nanoscience and related technologies. Since its foundation, the SNI has engaged in a wide variety of events to bring science closer to children and young people. In 2014, the SNI team offered the module *Nanomedicine* at different TechDays in Switzerland, presented hands-on experiments during a special exhibition at the MUBA Basel and participated again in the Science Days at Europa-Park in Germany. Several national and international groups of visitors got an insight into the life of a researcher during their visits of the SNI's laboratories. Two highlights of the SNI's outreach activities of 2014 were the Science Festival in Beijing and the participation in the Future Day of the University of Basel.

Nanoscale science for Chinese children

Meret Hornstein and Florian Dettwiler represented the Swiss Nanoscience Institute at this year's Bejing Science Festival in September. During one week, the two nano scientists were up and about in order to share the fascination of nanoscale science with Chinese children. As at previous science festivals, the SNI booth was crowed all the time because Meret Hornstein and Florian Dettwiler were not simply offering information but also invited the kids to engage actively in nanoscience. They could give free reign to their imagination and build nano cars out of small vibration motors and toothbrushes. Additionally, the children were fascinated by the amazing shapes that can be created with ferrofluids and by the computer simulation of a scanning probe microscope that allows a playful discovery of the nanoworld.

After arriving back in Basel, Meret Hornstein commented: "It is important for the SNI to participate in events like this because there we can raise the interest in natural sciences among children. Additionally, it is an excellent opportunity to further expand the SNI network and to make the SNI visible outside Northwestern Switzerland." In the Basel area, many readers of the Basler Zeitung could indirectly participate in this event as the newspaper reported in detail on the SNI activities at the Bejing Science Festival.

Exciting Future Day

The University of Basel had asked various departments to actively participate in the *Zukunftstag 2014* and to provide a program for young children of university colleagues. The SNI and the Physics Department jointly offered a mix of activities. These were made public over the website of the Ressort Chancengleichheit and fully booked within a few days.

The girls and boys who had been fast enough to register, came together on the 13th of November to experience physics and nanoscience during exciting experiments. The program started with a vivid talk by Professor Christian Schönenberger on light and colors. Through various experiments, the kids could learn for example that light consists of waves, how colors are mixed and why the light at sunset turns red. The kids continued with a course about floating that was constructed by Dr. Peter Reimann and his team. There, the kids made a ball float only through their muscular strength, or balanced Ping-Pong balls with a hair dryer. They had to invest just the right amount of strength to move a specially purpose-built air cushion boat over the finish line. Next on the schedule was a workshop held by Michael Steinacher and his team. The 10 to 13 year old kids could prove a steady hand by soldering their own game of skill. Additionally, the girls and boys could have an insight into the micro- and nanoworld at various microscopes. Dr. Monica Schönenberger and Dr. Christel Möller instructed the kids to examine samples from flora and fauna. The kids left the Physics Department in an excited mood, with lots to talk about at home.

Interested visitors from all over the world

The SNI welcomed various groups of visitors throughout 2014, and the spectrum of interested people was very diverse: from Swiss school classes to Chinese managers from the biotech industry. All visitors received basic information about the SNI and nanoscale science during an introductory lecture that was always adapted to the respective target group and then visited selected laboratories, where graduate students and post-docs gave insight into their research.


Ciel

SNI Uses Modern Media

Three Films about the SNI on YouTube

In 2014, the SNI produced three short videos to provide general information and boost interest. On seven shooting days spread throughout the year, the team interviewed 13 scientists, students and doctoral students to illustrate different aspects of the SNI's activities. These videos are now available on YouTube and the SNI website. To appeal to an international audience, versions are available both in German and with English subtitles.

Let's see what's on YouTube
Communication has changed greatly over the past few years. Many young people hardly ever send emails, preferring to use Twitter, Skype and WhatsApp instead. To access information, they do not read, but first see what is available on YouTube. It therefore makes sense for the Swiss Nanoscience Institute to use this channel, too, and develop a presence on the site.

Three short ones are better than one long film
At the start of 2014, the SNI communication team therefore began to plan a video. Project manager Dr. Christel Möller soon found a suitable partner in Voltafilm, Lucerne. All those involved quickly realized that, rather than one long image video presenting all the various aspects of the SNI, it would be better to produce three shorter videos. Shorter films also appeal to people who want something quick to watch, and different videos can be better tailored to specific target groups.

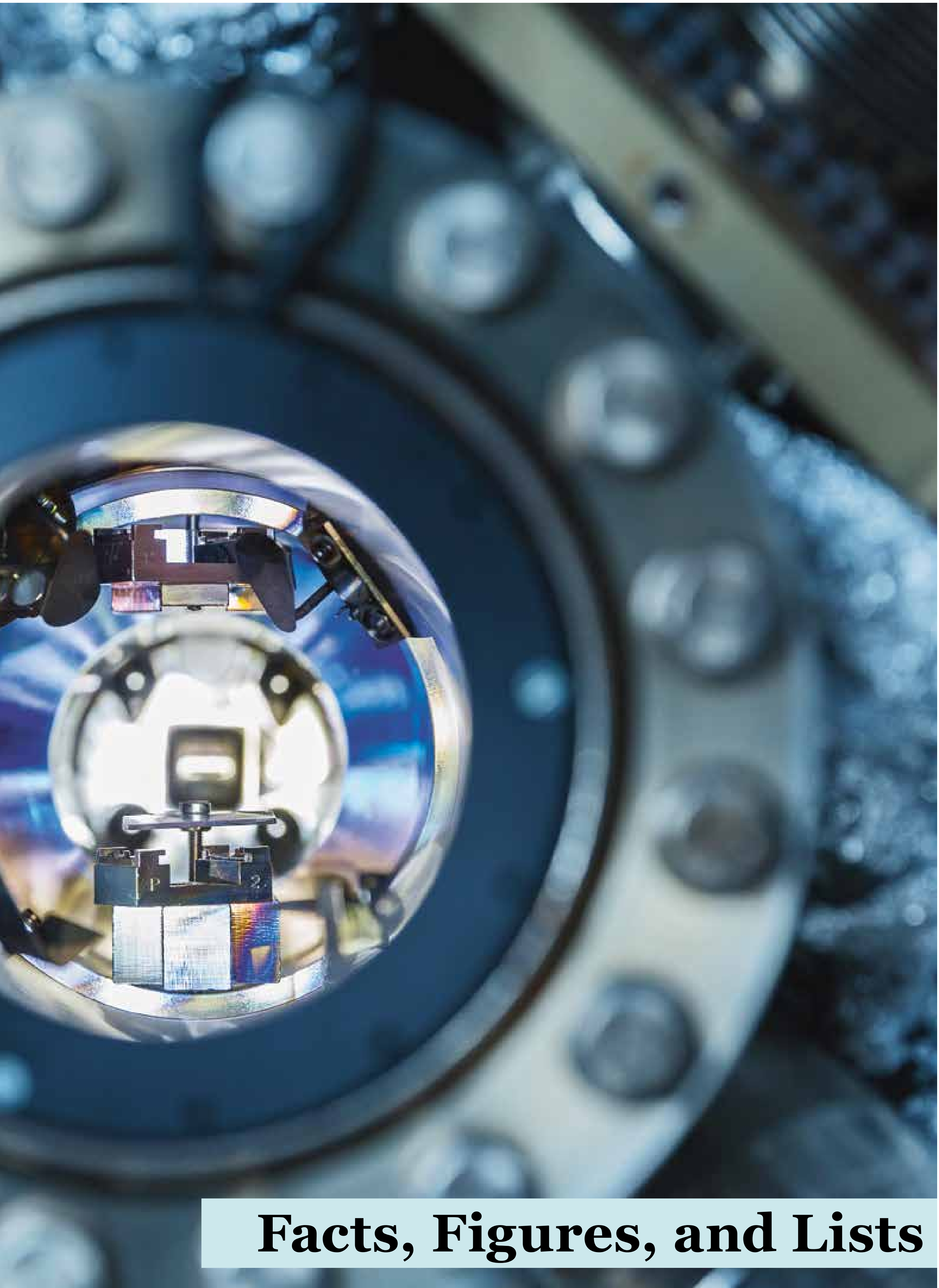
The aim of the first film was to provide a brief overview of the SNI, briefly touching on its commitment to basic scientific research and the applied Nano-Argovia program, educating young researchers in the nanosciences and the PhD School, and the inspirational communication of scientific content to children and young people. The second film was to focus on research and clearly demonstrate the interdisciplinary and diverse nature of the SNI's research based on four research topics from the areas of physics, chemistry and biology. The third film aimed to show the study of nanosciences and the PhD School in a little more detail. Four young nanoscientists were to put forward their experiences of studying at the SNI and show what makes the nanosciences and the SNI PhD School so special.

Hours of material cut to just a few minutes
Around 13 minutes of film material can now be viewed, featuring motivated researchers, students in discussions, and plenty of smiling faces. The film team has done a great job of capturing the pleasant and relaxed atmosphere at the SNI. All three films show how fun it is to study, teach and research at the SNI.

Watching the finished films, it is impossible to imagine the time invested. Many hours of preparation were required before writing the script, finding suitable protagonists, and planning and conducting the shoot. In the end, the team had several hours of material at their disposal. Romana Lanfranconi of Voltafilm spent almost 100 hours reducing this to just 13 minutes in consultation with Christel Möller. After the experts spent three days incorporating the titles and effects, a sound engineer worked on the music and sound for a further three days. In the end, around 1,400 megabytes remained from almost 550 gigabytes of raw material.

The first two films were released back in May 2014 and have been viewed by more than 1,400 people on YouTube alone. The third video – about studying at the SNI – needed to capture the flair of Basel too, so the relevant scenes were not filmed until late summer. This third film has been available on the Internet since early December, successfully concluding the video project.

You can watch the videos at *www.nanoscience.ch/nccr/media/video* or on YouTube at *www.youtube.com/channel/UCbR9khNxj-XbhcSu7_cCOVw.*



Facts, Figures, and Lists

Financial Report

The SNI is a center for excellence in nanoscale sciences and nanotechnology that was initiated by the Canton of Aargau. It is generously financed by the Canton of Aargau with 5 million and the University of Basel with 2.3 million Swiss francs per year. The mandate of the SNI is to educate and support young talents, to gain new insights and knowledge through scientific research as well as to support and enhance know-how and technology transfer for the benefit of industries in Northwestern Switzerland. With the Nano-Argovia program, the SNI has created a vehicle that matches the requirements of local companies. The broad spectrum ranging from teaching in the bachelor and master program, over the PhD School for the stimulation of basic research to applied Argovia projects is also reflected in the financial report.

The budget positions of the SNI are:
Management & Overhead
Infrastructure (investment in building and equipment)
KTT & PR (knowledge and technology transfer)
Outreach (events and print materials)
Support (support of young principal investigators at the professor level)
Nanostudy (bachelor and master program)
PhD School

The SNI PhD School that supports PhD students accounts for the largest position in the planning budget with 2 million Swiss francs per year. KTT & PR with 1.6 million Swiss francs per year is the second largest position. It includes all activities related to knowledge and technology transfer including the very successful Argovia projects that are supported with approximately 1.5 million Swiss francs per year. Another major position are the support measures with a nominal sum of 1.4 million Swiss francs for the two Argovia professors Roderick Lim and Martino Poggio and the two PSI titular professors Thomas Jung and Frithjof Nolting. The nominal costs for the bachelor and master program in nanoscience that is carried out in close collaboration with the network partners in Northwestern Switzerland add up to around 0.6 million Swiss francs per year.

On overview of the expenses in 2014 in these different budget categories as well as the overall financial balance is given in the two following tables:

SNI Expenditure 2014 in SFr.

		Univ. BS	Canton AG	Total
Management	Personnel and operational costs	300‘338	166‘162	466‘500
	Overhead		650‘000	650‘000
Infrastructure	Infrastructure building	-	-	-
	Infrastructure equipment	509‘129	236‘207	745‘336
KTT & PR	Personnel and operational costs	43‘197	120‘298	163‘496
	Argovia projects		1‘535‘724	1‘535‘724
Outreach	Personnel and operational costs	110‘409	69‘409	179‘818
Support	Argovia professors	488‘591	809‘326	1‘297‘916
	PSI professors		179‘510	179‘510
Nanostudy	Bachelor and master program	302‘067	203‘555	505‘622
PHD School	Research projects	522‘772	839‘393	1‘362‘165
Total Expenditure 2014 in SFr.		**2‘276‘503**	**4‘809‘584**	**7‘086‘087**

In addition to the financial support from the Canton of Aargau, the project partners have contributed 2.0 million Swiss francs through public funding instruments or their own means solely for applied projects (Argovia projects). The industrial partners have added 0.95 million Swiss francs. This sums up to 2.95 million Swiss francs third-party support, which is considerably more than the contribution of 1.6 million by the Canton of Aargau in this category. This large third-party funding for the Argovia projects is an excellent achievement.

In 2014, 13 Argovia projects were supported. Six of these (46%) included an industrial partner from the Canton of Aargau. The Canon of Aargau requires that we achieve a participation rate of 50%. We slightly missed this target in 2014. The percentage of participating companies from Aargau is always fluctuating. In 2013, a rate of 73% was reached and the average over the last four years was 59%.

The SNI assets on 31th December 2014 are 7.6 million Swiss francs. Obligations of 1.3 million Swiss francs from 2014 that are already awarded and will only become operative in 2015 and reserves of 2.0 million for the PhD School need to be subtracted. These reserves are necessary as we currently support more PhD students – to enable a fast start of the PhD School – than will be possible on a long-term basis.

SNI Balance 2014 in SFr.

	Univ. BS	Canton AG	Total
Income	2'299'808	5'013'404	7'313'212
Revenues		247'332	247'332
Income	**2'299'808**	**5'260'736**	**7'560'544**
Expenditure	**2'276'503**	**4'809'584**	**7'086'087**
Balance year 2014	**23'305**	**451'152**	**474'456**
SNI Assets per 01.01.2014	**1'205'080**	**5'902'341**	**7'107'420**
Annual balance	23'305	451'152	474'456
SNI Assets per 31.12.2014 in SFr.	**1'228'385**	**6'353'492**	**7'581'877**

SNI Members

SNI Board

Prof. C. Schönenberger, Director
Prof. E. Constable, Vice-Director (Rectorate)
Prof. C. Gerber, Vice-Director (Scientific Outreach)
Prof. J. Gobrecht, Vice-Director (Network)
Prof. D. Loss, Vice-Director (Physics)
Prof. W. Meier, Vice-Director (Chemistry & Nanocurriculum)
Prof. E. Nigg, Vice-Director (Biozentrum)
Prof. E. Meyer, Vice-Director (Physics)

Argovia Board

Regierungsrat A. Hürzeler, Head Departement Bildung, Kultur und Sport Aargau
Prof. C. Bergamaschi, Director FHNW
Prof. J. Mesot, Director PSI
Prof. E. Constable, Vice-Rector Research University of Basel
Prof. C. Schönenberger, Director SNI

SNI Management

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A. Fischer (until 07/2014), HR & Finance
C. Wirth, M.A. (since 09/2014), HR & Finance
M. Hornstein, MSc, Communication & Events
S. Hüni, Communication & Events
Dr. C. Möller, Communication & Events
Dr. K. Spieler, Coordination Nanocurriculum

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PSI Prof. M. Kenzelmann, Laboratory for Developments and Methods, PSI
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Dr. J. Köser, School of Life Sciences, FHNW
Prof. P. Kristiansen, School of Engineering, FHNW
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M. Waser, School of Life Sciences, FHNW
Prof. S. Willitsch, Chemistry Department, University of Basel
Prof. T. Wintgens, School of Life Sciences, FHNW
Prof. D. Zumbühl, Physics Department, University of Basel

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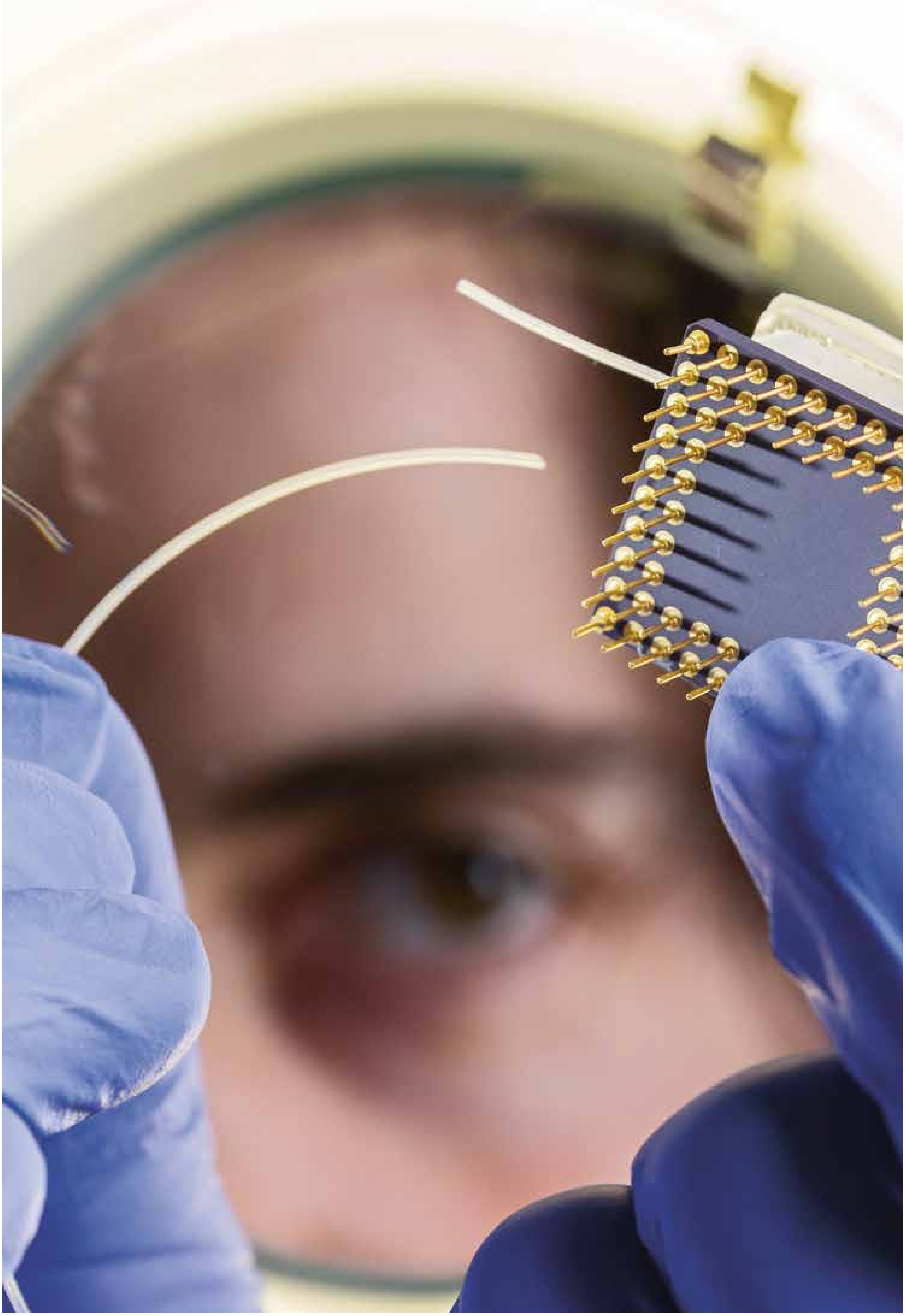
MSc Y. Aeschi, Chemistry Department, University of Basel
MSc S. Arnold, Biozentrum, University of Basel
MSc A. Barfuss, Physics Department, University of Basel
MSc D. Cadeddu, Physics Department, University of Basel
Mpharm T. Einfalt, Chemistry Department, University of Basel
MSc M. Gerspach, Chemistry Department, University of Basel
MSc R. Goers, Chemistry Department, University of Basel
MSc D. Gonçalves, Intensive Care, University Hospital Basel
MSc C. Handschin, Physics Department, University of Basel
Dipl. chem. S. Keller, Chemistry Department, University of Basel
MSc M. Moradi, School of Life Sciences, FHNW
MSc T. Nijs, Chemistry Department, University of Basel
MSc J. Nowakowski, Laboratory for Micro- and Nanotechnology, PSI
MSc N. Opara, Laboratory for Micro- and Nanotechnology, PSI
MSc J. Overbeck, Physics Department, University of Basel
MSc M. Palma, Physics Department, University of Basel
MSc D. Riedel, Physics Department, University of Basel
MSc P. Rios Flores, Biozentrum, University of Basel
MSc I. Rouse, Chemistry Department, University of Basel
MSc Y. Sakiyama, Biozentrum, University of Basel
MSc N. Sauter, Chemistry Department, University of Basel
MSc M. Schulzendorf, Physics Department, University of Basel
MSc D. Sharma, Laboratory for Micro- and Nanotechnology, PSI
MSc D. Yildiz, Physics Department, University of Basel



Projects of the SNI PhD School

Started in 2013

Project	Principal Investigator (PI) and Co-PI	PhD Student
P1201 Microfluidics to study nano-crystallization of proteins.	T. Braun (C-CINA), H. Stahlberg (C-CINA)	S. Arnold
P1202 Nanofluidic devices for biomolecules (Electrostatic nanotrapping)	Y. Ekinci (PSI), T. Pfohl (Univ. Basel)	M. Gerspach
P1203 On-surface covalent assembly of coordination polymers with integrated read and write functions	C. Housecroft (Univ. Basel), T. Jung (PSI)	T. Nijs
P1204 Site-specific magnetic studies and control of large self-assembled spin systems	T. Jung (PSI), A. Kleibert (PSI)	J. Nowakowski
P1205 Watching the nanomachinery of the nuclear pore complex at work by high speed-AFM	R. Lim (Univ. Basel), C. Gerber (NanoMotion)	Y. Sakiyama
P1206 Nanomechanical oscillators for diamond spin-optomechanics	P. Maletinsky (Univ. Basel), R. Warburton (Univ. Basel)	A. Barfuss
P1207 Design of a polymer membrane-based molecular "hoover"	W. Meier (Univ. Basel), D. Müller (D-BSSE)	R. Goers
P1208 Ultra-sensitive force detection and molecular manipulation	E. Meyer (Univ. Basel), M. Poggio (Univ. Basel)	M. Schulzendorf
P1209 Design of polymer nanoreactors with triggered activity	C. Palivan (Univ. Basel), J. Huwyler (Univ. Basel)	T. Einfalt
P1210 Bottom-up nanowires as ultra-sensitive force transducers	M. Poggio (Univ. Basel), R. Warburton (Univ. Basel)	D. Cadeddu
P1211 Ultraclean Suspended Graphene	C. Schönenberger (Univ. Basel), D. Zumbühl (Univ. Basel)	C. Handschin
P1212 Nano-photonics with diamond	R. Warburton (Univ. Basel), P. Maletinsky (Univ. Basel)	D. Riedel
P1213 Artificial Metalloenzymes for Molecular Nanofactories	T. Ward (Univ. Basel), S. Panke (D-BSSE)	S. Keller
P1214 An ion-atom hybrid trap on a chip: synthesis and control of nanosystems on the single-molecule level	S. Willitsch (Univ. Basel), P. Treutlein (Univ. Basel)	I. Rouse
P1215 Nanostructure Quantum Transport at Microkelvin Temperatures	D. Zumbühl (Univ. Basel), D. Loss (Univ. B)	M. Palma

Started in 2014

Project	Principal Investigator (PI) and Co-PI	PhD Student
P1301 Energy dissipation over structural and electronic phase transitions	E. Meyer (Univ. Basel), M. Poggio (Univ. Basel)	D. Yildiz
P1302 Probing the initial steps of bacterial biofilm formation: dynamic and molecular principles of surface-based cell motility and mechanosensation	T. Pfohl (Univ. Basel), U. Jenal (Univ. Basel)	N. Sauter
P1303 Assembly and investigation of electrochemically triggered molecular muscles	M. Mayor (Univ. Basel), M. Calame (Univ. Basel)	Y. Aeschi
P1304 Folding mechanisms of beta-barrel outer membrane proteins and their catalysis by natural holdases and foldases	S. Hiller (Univ. Basel), D. Müller (D-BSSE)	P. Rios Flores
P1305 Towards X-FEL based dynamic studies on 2D and 3D nanocrystals of membrane proteins on solid supports	C. Padeste (PSI), H. Stahlberg (C-CINA)	N. Opara
P1306 Slow-release nano-pills for mosquitoes for interrupting malaria transmission	P. Hunziker (Univ.-Spital Basel), R. Brun (Tropeninstitut, Univ. Basel)	D. Gonçalves
P1307 Optoelectronic nanojunctions	M. Calame (Univ. Basel), M. Mayor (Univ. Basel)	J. Overbeck
P1308 Supramolecular charge and spin architectures produced by chemical clipping	P. Shahgaldian (FHNW), T. Jung (PSI)	M. Moradi
P1310 Plasmonic Sensing in Biomimetic Nanopores	Y. Ekinci (PSI), R. Lim (Univ. Basel)	D. Sharma

Argovia Projects

Prolonged Projects

(with and without financial support)

Project	Project leader	Project partner
A7.4 Nano-LTB: Low-Temperature Bonding (LTB) of Multichip Modules by Nano-Size Silver Sintering	H. Van Swygen-hoven-Moens (PSI)	A. Wahlen (FHNW), N. Hofmann (FHNW Windisch), Ch. Liu (ABB Switzerland Ltd. Baden-Dättwil; AG)
A7.5 NanoFACTs: nano Functional Active Component Capsules for Textiles	U. Pieles (FHNW)	W. Meier (Univ. of Basel), Ch. Bradbury (HeiQ Materials AG, Bad Zurzach; AG)
A7.6 NanoMorph: Nanostructured surfaces for the control of polymorphism of active pharmaceuical ingredients	P. Shahgaldian (FHNW)	Th. Jung (PSI), B. Schneider (RPD TOOL AG, Birsfelden; BL)
A7.7 NoViDeMo: Novel viscosity- and density-meters for process monitoring and biomedical sensing applications	Th. Braun (C-CINA)	J. Köser (FHNW Muttenz), O. Glaied (FHNW), J. Hench (Univ. Hospital Basel), M. Touzin (Endress+Hauser Flowtec AG, Reinach; BL)
A7.9 WGB-NPA: Wide Band Gap Power Semiconductors Improved by Nanoscale Probe Analytics (until 31st March without report)	E. Meyer (Univ. of Basel)	Th. Jung (PSI), H. Bartolf (ABB, Baden-Dättwil; AG)
A8.1 Bio-DURACLEAN: Bio-DURABLE self-cleaning painting: development of dirt repellency coatings for large surface	O. Glaied (FHNW)	U. Pieles (FHNW Muttenz), W. Meier (Univ. of Basel), G. Siragna (Walter MÄDER AG, Kilwangen; AG)
A8.3 EL-ENA: Electrophoretic active hybrid core shell silica nanoparticles decorated with dendritic structures for colored electronic ink (e-ink) and e-paper applications	U. Pieles (FHNW)	G. Grundler (FHNW), G. Nisato (CSEM Muttenz), R. Öhrlein (BASF Research Center Basel, BS), A. Hafner (BASF Research Center Basel; BS)
A8.7 NANOX: Mixed mode nanocomposite catalyst for the effective decomposition of hydrogenperoxide vapour used in sterilization processes of pharmaceutical GMP clean room production facilities and isolator systems	U. Pieles (FHNW)	P. Shahgaldian (FHNW), C. E. Housecroft (Univ. of Basel), O. Scheuber (SKAN AG, Allschwil; BL)
A8.8 NAPOHIC: Nano carbon based semiconductive polymers for high-voltage cables (until 31st March without report)	J. Gobrecht (PSI)	J. de Pietro (FHNW), M. Kristiansen (FHNW Windisch), L. Xie (ABB Corporate Research, Baden-Dättwil; AG)
A8.9 TIGHTSEAL: Gastight thin films to minimize emissions of graphite sealings (until 31st March without report)	M. Waser (FHNW)	U. Pieles (FHNW), J. Gobrecht (PSI), U. Wegmann (Klinger AG, Egliswil; AG)

Projects Started in 2014

Project	Project leader	Project partner
A9.2 em-Select: Polymer-Emulsion-Segmented Electroconductive Nano Fibres for antistatic textile finishing	U. Pieles (FHNW)	J. Gobrecht (PSI), C. Denier (FHNW Windisch), M. Height (HeiQ Materials AG, Bad Zurzach; AG
A9.6 NANOFIL: Functionalized nanofiber-enhanced filter media for fine particle and heavy metal removal in flue gas and sewage water	C. Ludwig (PSI)	T. Griffin (FHNW), U. Pieles (FHNW), I.-V. Thanou (Alstom AG, Birr; AG)
A9.7 NanoSiCTrenchFet: Physical Studies of SiC Nano-Trench-MOSFETs	M. Schnieper (CSEM Muttenz)	N. Marjanovic (CSEM Muttenz), J. Gobrecht (PSI), E. Meyer (Univ. of Basel), R. Minamisawa (ABB Switzerland Ltd. Baden-Dättwil; AG), H. Bartolf (ABB Switzerland)
A9.9 NANOzyme: Novel Nanobiocatalysts based on confined and concerted artificial and natural enzymes	P. Shahgaldian (FHNW)	P. Corvini (FHNW), T. Ward (Univ. of Basel), A. Cumbo (INOFEA GmBH, Basel; BS)
A9.10 PATCELL: Surface-patterning of PLGA for Improved Cell Interaction and Tissue Integration of Resorbable Fixation Implants	P. M. Kristiansen (FHNW)	V. Guzenko (PSI), J. Lungershausen (FHNW), J. Köser (FHNW), S. Beck (Synthes, Oberdorf; BL)
A9.12 SCeNA: Single cell nanoanalytics	Th. Braun (C-CINA)	H.P. Lang (Univ. of Basel), G. Schlotterbeck (FHNW), G. Dernick (Roche, Basel; BS)
A9.15 SINAPIS: Niederdruckwasserstrahl-injizierte Nanopartikel zur Verbesserung von Implantaten	R. Schumacher (FHNW)	M. de Wild (FHNW), O. Braissant (Univ. of Basel), M. Straubhaar (WATERjet Robotics AG, Oftringen; AG)

SNI Impact

Peer-reviewed Articles

M. N. Alberti, S. Nowakowska, M.D. Tzirakis, J. Nowakowski, P. Fesser, W.B. Schweizer, A. Shchyrba, C. Thilgen, T.A. Jung & F. Diederich, Synthesis of trans-A2B2- and trans-A2BC-porphyrins with polar 4′-(dimethylamino) tolan-4-yl substituents, and a screening protocol for vapor-phase deposition on metal surfaces, Eur. J. Org. Chem. 2014, 5705 (2014)

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A. Balan, P.M. Derlet, A. Fraile Rodríguez, J. Bansmann, R. Yanes, U. Nowak, A. Kleibert & F. Nolting, Direct observation of magnetic metastability in individual iron nanoparticles, Phys. Rev. Lett. 112, 107201 (2014)

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F.R. Braakman, D. Cadeddu, G. Tütüncüoglu, F. Matteini, D. Rüffer, A. Fontcuberta i Morral & M. Poggio, Nonlinear motion and mechanical mixing in as-grown GaAs nanowires, Appl. Phys. Lett. 105, 173111 (2014)

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S. Widmer, M. Dorrestijn, A. Camerlo, Š.K. Urek, A. Lobnik, C.E. Housecroft & E.C. Constable , Coumarin meets fluorescein: A Förster resonance energy transfer-enhanced optical ammonia gas sensor, Analyst 139, 4335 (2014)

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G. Zhang, G. Proni, S. Zhao, E.C. Constable, C.E. Housecroft, M. Neuburger & J.A. Zampese ,Chiral tetranuclear and dinuclear copper(II) complexes for TEMPO-mediated aerobic oxidation of alcohols: are four metal centres better than two?, Dalton Trans. 43, 12313 (2014)

J. Zhang, A. Shchyrba, S. Nowakowska, E. Meyer, T.A. Jung & Matthias Muntwiler, Probing the spatial and momentum distribution of confined surface states in a metal coordination network, Chem. Commun. 50, 12289 (2014)

M. Zimmermann, R. Cal, E. Janett, V. Hoffmann, C.G. Bochet, E. Constable, F. Beaufils & M.P. Wymann, Cell-permeant and photocleavable chemical inducer of dimerization, Angew. Chem., Int. Ed. 53, 4717 (2014)

Invited Talks

A. Barfuss, Strain-coupling of a nitrogen vacancy center spin to a diamond mechanical oscillator, QSIT Lunch Seminar, ETHZ, Zurich (Switzerland), July 3, 2014

T. Braun, New tools to study neurodegenerative diseases, Nanoscience in the snow, Kandersteg (Switzerland), January 29-31, 2014

T. Braun, Single cell visual proteomics, Gordon Research Conference, Barcelona (Spain), June 22-27, 2014

R. Brun, Neglected diseases, current status and future needs, European Summit for Clinical Nanomedicine and Targeted Medicine, Basel (Switzerland), June 23-25, 2014

M. Calame, Silicon nanowire bio-chemical sensors, International Conference on Ultimate Integration on Silicon, 15th ed. (ULIS 2014), Stockholm-Sigtuna (Sweden), April 7-9, 2014

M. Calame, Emerging functionality in nanoparticles arrays, E-MRS Spring Meeting, Lille (France), May 26-30, 2014

M. Calame, Mechanical and electronic structure of molecular junctions and alternative contacting strategies, Walter-Schottky-Institut (WSI), TU München, München (Germany), June 24, 2014

M. Calame, Formation and transport mechanisms in individual and self-assembled networks of molecular junctions, 2nd Self-Assembly and Molecular Electronics conference, Aalborg (Denmark), August 27-29, 2014

M. Calame, Electromechanical structure of molecular junctions & alternative contacting strategies, International Workshop «Controlled charge and heat transport at the molecular scale», University of Konstanz (Germany), September 29-October 1, 2014

W. Fu, Sensing with radio-frequency(RF)-operated graphene field-effect transistors, GrapChina 2014, Ningbo (China), September 1-3, 2014

Ch. Gerber, AFM Technology in life sciences, Kolloquium, University of Regensburg, Regensburg (Germany), May 5, 2014

Ch. Gerber, AFM Technology in life sciences, 5th European Nanomanipulation Workshop, Mulhouse (France), June 18, 2014

Ch. Gerber, AFM technologies in personalized medical diagnostics, Fuerzas y Túnel 2014, San Sebastian (Spain), August 27-29, 2014

Ch. Gerber, AFM Technology in life sciences, European Conference in Surface Science (ECOSS-30), Antalya (Turkey), August 31-September 5, 2014

Ch. Gerber, AFM technologies for non-invasive diagnostics, Bristol Nanoscience Symposium, Bristol (UK), September 15-16, 2014

Ch. Gerber, Pushing the boundaries in personalized medical diagnostics with AFM technologies, Functionality of Organized Nanostructures 2014 (FON›14), Tokyo (Japan), November 26-28, 2014

Th. Glatzel, Scanning probe microscopy and spectroscopy of nanodiamonds, Seminar at Tel Aviv University, Tel Aviv (Israel), February 11th, 2014

Th. Glatzel, Manipulation and imaging of single molecules by atomic force microscopy, NGC2014 Nano and Giga Challenges in Electronics, Photonics and Renewable Energy, Phoenix (USA), March 10-14, 2014

Th. Glatzel, Manipulation and imaging of single molecules by atomic force microscopy, SA-Swiss Nano-Workshop, iThemba Labs, Western Cape (South Africa), April 14-15, 2014

Th. Glatzel, Manipulation and imaging of single molecules by atomic force microscopy, Seminar at IBM, Rüschlikon (Switzerland), May 15th, 2014

Th. Glatzel, Advanced scanning probe force microscopy for nanoscale analysis, Swiss NanoConvention, Brugg/ Windisch (Switzerland), May 21-22, 2014

Th. Glatzel, Force microscopy & applications, International Day of Engineering: Advanced Materials, DHBW Lörrach (Germany), October 14th, 2014

B.E. Herzog, Boundary between the thermal and statistical polarization regimes in a nanometer-scale spin ensemble, QSIT Lunch Seminar, ETHZ, Zurich (Switzerland), June 5, 2014

S. Hiller, Molecular mechanisms in outer membrane protein biogenesis, Biochemistry lecture series, University of Tübingen, Tübingen (Germany), July 10, 2014

C.E. Housecroft, From Waden clusters to functional materials, Prof. Ken Wade Celebration: One-Day Inorganic Chemistry Symposium, Durham (UK), December 15, 2014

A. Jöckel, Sympathetic cooling of a membrane by optomechanical coupling to ultracold atoms, Condensed Matter in Paris 2014 (JMC 14, CMD 25), Paris (France), August 24-29, 2014

T. Jung, Supra-molecular architectures at surfaces probing structure, electron and spin states, Indiana State University, Bloomington (USA), March 13, 2014

T. Jung, Supra-molecular architectures at surfaces probing structure, electron and spin states, Argonne National Laboratory, Chicago (USA), March 12, 2014

T. Jung, On-surface chemistry and supramolecular chemistry: Engineering with molecules at interfaces, American Chemical Society (ACS) Meeting, Dallas (USA), March 19, 2014

T. Jung, Supramolecular architectures at surfaces for probing structure, electron and spin states, Swiss NanoConvention, Brugg/Windisch (Switzerland), May 21-22, 2014

T. Jung, Supramolecular architectures at surfaces for probing structure, electron and spin states, 8th International Workshop on Nanoscale Spectroscopy and Nanotechnology (NSS8), Chicago (USA), July 28-31, 2014

T. Jung, Fracture investigations on the nanometer scale: The scanning force microscope providing the hands and eyes for deeper insight, 7th International Colloquium Micro-Tribology, Osieck-Warsaw (Poland), September 7-11, 2014

T. Jung, Switching molecules: Imagine there is a device only 1nm in size, University of Heidelberg, Heidelberg (Germany), November 24, 2014

T. Kampschulte, Sympathetic cooling of a membrane by optomechanical coupling to ultracold atoms, ESF Conference on Quantum Technologies Based on Hybrid Emitter-Solid State Systems, Strasbourg (France), September 21-25, 2014

A. Kleibert, Magneto-chemical interactions at molecule-substrate interfaces investigated by means of X-ray photo-emission electron microscopy, 575. WE-Heraeus-Seminar on «Functional metalorganics and hybrids», Bad Honnef (Germany), November 17-19, 2014

P.M. Kristiansen, Realizing functional surface topographies for industrial applications, Polymer Replication on Nanoscale, Copenhagen (Denmark), May 12-14, 2014

P.M. Kristiansen, Targeting selective cell response through topographical surface structuring of resorbable polymer implants, SNI Annual Meeting, Lenzerheide (Switzerland), September 11-12, 2014

A. Kuhlmann, Charge and spin noise in a semiconductor quantum dot, 44th «Jaszowiec» International School and Conference on the Physics of Semiconductors, Wisła (Poland), June 7-12, 2014

R.Y.H. Lim, The nanomechanical signature of breast cancer, 11th Annual International Workshop on Nanomechanical Sensing (NMC), Madrid (Spain), April 30-May 2, 2014

R.Y.H. Lim, Nanomechanical cancer diagnostics, Swiss-Korean Life Science Symposium, Seoul (Korea), May 6-9, 2014

R.Y.H. Lim, Selective transport control outside the nuclear pore complex, From Solid State to Biophysics VII, Cavtat-Dubrovnik (Croatia), June 7-14, 2014

R.Y.H. Lim, The molecular basis of selective transport control by the nuclear pore complex, World Congress on Biomechanics, Boston (USA), July 5-10, 2014

R.Y.H. Lim, The nanomechanical signature of breast cancer, World Congress on Biomechanics, Boston (USA), July 5-10, 2014

R.Y.H. Lim, Nanobiology of the nuclear pore complex, SNI Annual Meeting, Lenzerheide (Switzerland), September 11-12, 2014

R.Y.H. Lim, Nanobiology of the nuclear pore complex, EPSRC Summer School on Molecular-Scale Engineering, Buxton (UK), September 24-25, 2014

R.Y.H. Lim, Nanobiophysics and the nuclear pore complex, Nanofluidics in Physics and Biology, Lausanne (Switzerland), October 30-31, 2014

R.Y.H. Lim, Nanobiophysics and the nuclear pore complex, Zernike Colloquium, University of Groningen, Groningen (Netherlands), November 6-7, 2014

R.Y.H. Lim, Karyopherin-centric control of nuclear pores based on multivalent binding with FG nucleoporins, American Society for Cell Biology, Philadelphia (USA), December 6-10, 2014

P. Maletinsky, Nanomechanics and two-level systems, Gordon Research Conference: Mechanical Systems in the Quantum Regime, Ventura (CA) (USA), March 9-14, 2014

P. Maletinsky, Quantum sensing using single spins in diamond, Quantum Technologies for Metrology and Sensing Workshop, Lancaster (UK), June 30-July 1, 2014

P. Maletinsky, Strain-coupling of single spins to nanomechanical oscillators, Cavity optomechanics – from the micro- to the macroscale, Innsbruck (Austria), November 4-6, 2013

M. Mayor, Nano-scale functional architectures assembled by synthetic chemistry, SNI Annual Meeting, Lenzerheide (Switzerland), September 11-12, 2014

E. Meyer, Nanoscale dissipation of layered materials, International Nanotribology Forum: Kerala 2014, Kochi (India), January 6-10, 2014

E. Meyer, Friction on the nanometer scale, Nanoscience in the snow, Kandersteg (Switzerland), January 29-31, 2014

E. Meyer, Nanomechanical investigations of graphene by force microscopy, 2nd Sino-European Graphene Research Cooperation Workshop, Madrid (Spain), May 12-13, 2014

E. Meyer, Dissipation on the nanometer scale, First European Workshop on Understanding and Controlling Nano and Mesoscale Friction, Can Picafort (Spain), May 26-29, 2014

E. Meyer, AFM Experiments with single molecules, XXI International Summer School "Nicolás Cabrera", New Frontiers in Scanning Force Microscopy: From Ultrahigh-Vacuum to Biological Material, Madrid (Spain), July 14-18, 2014

E. Meyer, Mechanism of energy dissipation on the nanometer scale, Swiss-Japanese Tribology Meeting: Energy Savings through Tribology, Zurich (Switzerland), September 8-10, 2014

E. Meyer, Pushing and pulling of single molecules, CECAM and COST workshop : Friction and Interface Dynamics at the Nano- and Mesoscales, Tel Aviv (Israel), October 27-31, 2014

M. Montinaro, Quantum dot opto-mechanics in a fully self-assembled nanowire, NCCR QSIT General Meeting, Arosa (Switzerland), February 5-7, 2014

A. Mokhberi, Sympathetic cooling of molecular ions in a surface-electrode trap, COST Action MP1001 Final Meeting, Marseille (France), October 6-7, 2014

D. Müller, Forced unfolding, refolding and misfolding of single beta-barrel proteins into lipid membranes, Gordon Research Conference (GRC) on Protein Folding Dynamics, Galveston (TX) (USA), January 5-10, 2014

D. Müller, Directly observing the unfolding, folding and working of single native membrane proteins at subnanometer resolution, Bi-Annual Meeting of the Spanish Society for Chemical Biology, Bilbao (Spain), February 4-6, 2014

D. Müller, Deciphering molecular mechanisms guiding cell shape in mitotisisn, International meeting of the German Society for Cell Biology, Regensburg (Germany), March 18-21, 2014

D. Müller, Directing the folding of proteins into membranes, Gordon Research Conference (GRC) on Single Molecule Approaches to Biology, Lucca (Italy), July 13-18, 2014

D. Müller, Directing the folding pathways of proteins into membranes, 110th Titisee Conference on Structure, Forces and Dynamics of Macromolecular Complexes, Titisee (Germany), October 8-12, 2014

M. Munsch, Manipulation of the nuclear spin ensemble in a quantum dot with chirped magnetic resonance pulses, 22nd International Symposium Nanostructures: Physics and Technology, St. Petersburg (Russia), June 23-27, 2014

F. Nolting, Nanomagnets and artificial multiferroics studied with X-ray photoemission electron microscopy, German Physical Society spring meeting, Dresden (Germany), March 30 - April 4, 2014

F. Nolting, A close look at magnetic multilayers and nanomagnets with X-ray microscopy, Moscow International Symposium on Magnetism, MSIM-2014, Moscow (Russia), June 29 - July 3, 2014

F. Nolting, Anisotropy control in artificial multiferroics and nanomagnets studied with photoemission electron microscopy, First International Workshop Novel Trends in Physics of Ferroics 2014, St. Petersburg (Russia), July 4-5, 2014

C.G. Palivan, Polymer membranes decorated with proteins: Towards functional bio-nanosystems, NanosMat International Conference, Dublin (Ireland), September 8-11, 2014

S. Panke, Towards an orthogonal metabolism – cellular import of xenobiotics and de complexation of metabolism, Xenobiology 1.0, Genoa (Italy), May 6-8, 2014

M. Plodinec, Resolving the mechanobiology of epithelium on native basement membranes, World Congress on Biomechanics, Boston (USA), July 5-10, 2014

M. Poggio, Nano- and opto-mechanics of fully self-assembled nanowires, Institute for Terahertz Science and Technology Seminar, UCSB, Santa Barbara (USA), April 24, 2014

M. Poggio, Cantilever magnetometry of individual ferromagnetic nanotubes, International Seminar on Nanomechanics Systems (NEMS 2014), Paris (France), June 30-July 2, 2014

M. Poggio, Quantum dot opto-mechanics in a fully self-assembled nanowire, ESF Conference on Quantum Technologies Based on Hybrid Emitter-Solid State Systems, Strasbourg (France), September 21-25, 2014

M. Poggio, Coupling nanomechanics to solid-state spin, PhD School on Nano-optomechanics, Strasbourg (France), September 25-26, 2014

M. Poggio, Nanometer-scale magnetometry, Nanoscale Science Department Seminar, MPI Stuttgart, Stuttgart (Germany), December 17, 2014

C. Scheller, Evidence for helical nuclear spin order in GaAs quantum wires, NCCR QSIT Winter School & General Meeting, Arosa (Switzerland), February 3-7, 2014

C. Schönenberger, Optics with ballistic electrons in suspended monolayer graphene, 9th Advanced Research Workshop NanoPeter 2014 Fundamentals of Electronic Nanosystems, St. Petersburg (Russia), June 21-27, 2014

C. Schönenberger, Graphen - Entdeckung eines Supermaterials, Graphen - Material der Zukunft, Volkshochschule Zürich, Zurich (Switzerland), September 4, 2014

C. Schönenberger, Electron optics in suspended graphene, Institute of Condensed Matter, EPFL, Lausanne (Switzerland), November 21, 2014

P. Shahgaldian, Protein supramolecular engineering: Development of novel catalytic and molecular recognition nanomaterials, 49th Midwest Regional Meeting of the American Chemical Society, Columbia (MO) (USA), November 12-15, 2014

P. Treutlein, Hybrid atom-optomechanics, NORDITA Conference on Quantum Engineering, Stockholm (Sweden), August 18-23, 2014

P. Treutlein, Hybrid optimechanics, PhD School on Nano-optomechanics, Strasbourg (France), September 25-26, 2014

R.J. Warburton, Quantum dot optics, 18th International Winterschool on New Developments in Solid State Physics, Mauterndorf (Austria), February 23-28, 2014

R.J. Warburton, Charge noise and spin noise from a semiconductor quantum dot, APS March Meeting, Denver (USA), March 3-7, 2014

R.J. Warburton, Quantum dots: single photons, single spins, Quantum Technologies for Metrology and Sensing Workshop, Lancaster (UK), June 30-July 1, 2014

R.J. Warburton, Electron, hole and nuclear spins in an InGaAs quantum dot, Spin-based Quantum Information Processing (Spin Qubit 2), Konstanz (Germany), August 18-21, 2014

S. Willitsch, New developments in collisional and spectroscopic studies with cold molecular ions in traps, European Conference on Trapped Ions (ECTI), Mainz (Germany), September 15-19, 2014

D.M. Zumbühl, Controlling spins in semiconductor nanostructures, Swiss NanoConvention, Brugg/Windisch (Switzerland), May 21-22, 2014

In the Media

Printed media

Programmheft „Die Physiker" Februar 2014: Zwei Inserate SNI

Aargauer Zeitung 18/02/2014: tunBasel soll Jugendliche für Technik und Naturwissenschaft begeistern

BZ 18/02/2014: Der Krimi beginnt mit einer Solar-Loki

Uni Nova März 2014: Webtipp von Meret Hornstein, SNI

The Sunday Telegraph März 2014: Inserat SNI

The Sunday Telegraph Juni 2014: Heidi shows how determination can pay off

Le Temps 26/06/2014: Nano-velcro de la cellule

Basellandschaftliche Zeitung 27/06/2014: Diamanten als winzige Sensoren

Thurgauer Zeitung 28/06/2014: Diamanten als winzige Sensoren

St. Galler Tagblatt 28/06/2014: Diamanten als winzige Sensoren

Media Planet 30/06/2014: Jung, enthusiastisch und erfolgreich

Basellandschaftliche Zeitung 10/07/2014: Professor Hans-Joachim Güntherodt ist gestorben

Basler Zeitung 11/07/2014: Sein Credo: „Alles ist Nano"

Basler Zeitung 15/09/2014: Nachbarkantone lehnen dankend ab

Basler Zeitung 25/09/2014: Eine gut geplante Reise ins Ungewisse

i-Net Dezember 2014: White Paper Cleantech – Printed and Organic Electronics

Schweizer Illustrierte 29/12/2014: Nanopartikel blockieren Erreger

Online media

www.nature.com 07/11/2013: Thoughts on an education

www.unibas.ch 28/01/2014: Neues Wirkprinzip für Kaliumkanäle entdeckt

www.unibas.ch 10/02/2014: Die Universität Basel an der Muba 2014

www.unibas.ch 11/02/2014: Spiralförmig geordnete Elektronen- und Kernspins in Quantendrähten

www.physicsworld.com 21/02/2014: Ordering electrons and nuclear spins in quantum wires

www.unibas.ch 06/03/2014: Bert Müller wird Fellow der International Society for Optics and Photonics

www.unibas.ch 17/03/2014: Neue Erkenntnisse über die Bindung von Molekülketten an Oberflächen

www.uni-online.de 23/05/2014: Erfassung von Arterienverkalkungen: Kombiniertes Verfahren entwickelt

www.news.doccheck.com 26/05/2014: Blutgefässe: Verkalkungen besser charakterisieren

www.schattenblick.de 27/05/2014: Erfassung von Arterienverkalkungen – Kombiniertes Verfahren entwickelt

www.medizin-und-technik.de 27/05/2014: Weich- neben Hartgewebe sichtbar machen

www.medizin-aspekte.de 25/06/2014: Ausschreibung Hamburger Wissenschaftspreis 2015: Nanowissenschaften

www.brightsurf.com 25/06/2014: Nanoscale velcro used for molecule transport

www.myscience.ch 25/06/2014: Uni-Basel beteiligt an Entdeckung eines Nano-Klettbands

www.sciencenewsline.com 25/06/2014: Nanoscale Velcro Used for Molecule Transport

www.sda.ch 25/06/2014: Du nano-velcro pour transporter des substances

www.sda.ch 25/06/2014: Nano-Klettband kann Substanzen transportieren

www.unibas.ch 25/06/2014: Nano-Klettband als Transportmittel für Moleküle

www.aargauerzeitung.ch 26/06/2014: Diamanten als winzige Sensoren verwenden – dank Basler Forschern

www.basellandschaftlichezeitung.ch 26/06/2014: Diamanten als winzige Sensoren verwenden – dank Basler Forschern

www.oltnertagblatt.ch 26/06/2014: Diamanten als winzige Sensoren verwenden – dank Basler Forschern

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www.unibas.ch 26/06/2014: Hochsensible Nanosensoren: Physiker realisieren zehn Jahre alten theoretischen Ansatz

www.bionity.com 26/06/2014: Nano-Klettband als Transportmittel für Moleküle

www.thermalplant.com 26/06/2014: Nanoscale velcro used for molecule transport

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