Portal Wissen

The Research Magazine of the University of Potsdam

One 2013

Universität Potsdam

LAYERS

The Photographer of “Layers”

The cover photo and the pictures introducing the five themed sections of the magazine were taken by Professor Bernd Walz.

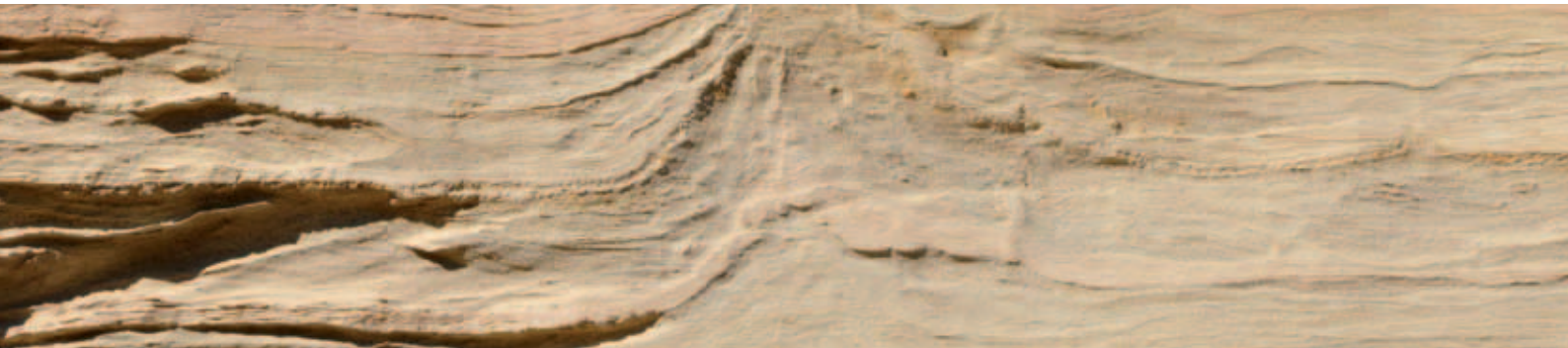
Layers give structure and repetition. They are based on each other, reflect chronological sequences and historical epochs, show hierarchies, periods of growth and much more. A photo depicting layers allows for various associations about the most different topics. My photographic works mainly focus on landscape photography, macro and micro photography. When composing a picture, layers create repetitive picture elements that contribute to the aesthetics of a photo.

THE SCIENTIST

Professor Bernd Walz studied biology at the universities of Gießen and Heidelberg. He received his PhD at Heidelberg University. After this, he was a scientific assistant and Heisenberg Research Fellow at Ulm University. In 1986 he was offered a chair of zoology at the University of Regensburg. In 1994 he was appointed professor of animal physiology at the University of Potsdam. His research focuses on cellular physiology and on cellular signal processing in particular. In Potsdam, Professor Walz was also spokesperson of the PhD research group “Functional Insect Science,” and he was Prorector and Vice President for Research and Young Academics for six years. In his leisure time, Professor Walz takes photographs and is an active member of the Photo Club Potsdam. Most of the photos in this edition are from his photo project “Crystalline Landscapes”. Walz says, “Photography decelerates my everyday life. It is the chance for me to experience nature in a way that I have lost as a laboratory biologist.”

Contact
Universität Potsdam
Institut für Biochemie und Biologie
Karl-Liebknecht-Str. 24–25, 14476 Potsdam
✉ walz@uni-potsdam.de

Our service for you. Scan further links directly with your smartphone or tablet and a free app for QR-Codes (e.g. ZBar, QR Code Scanner, QR Droid).



Dear Readers,

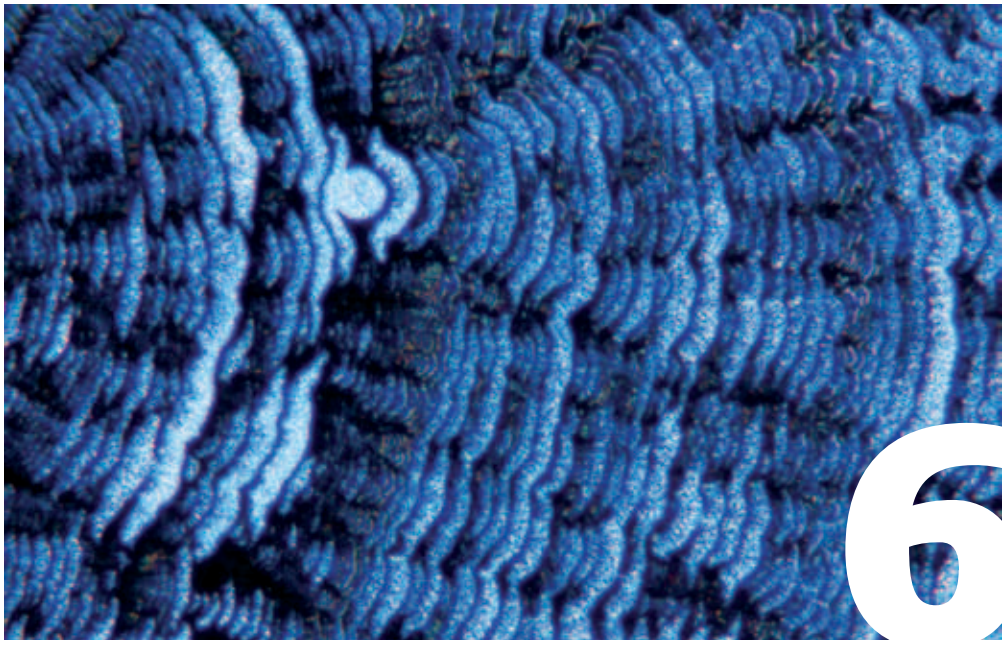
The latest edition of our Potsdam Research Magazine "Portal Wissen" addresses the topic "Layers" in many different ways. Geoscientists often deal with layers: layers of soil, sediment, or rock are the evidence of repeated and long-lasting processes of erosion and sedimentation that took place in the early history of the earth. For instance, mountains are eroded by water, ice and wind. The sand that results from that erosion might eventually form a new layer on the ocean floor known as a sediment horizon. After tens of millions of years, tectonic plate movements can deform the ocean floor, pushing it upwards as mountains are created, bringing the layers of sand from former mountain chains together with fossilized sea dwellers into the realm of climbers and mountaineers – a fundamental cycle within the Earth system that was succinctly described by Ibn Sina nearly 1000 years ago, and later by Charles Darwin when he was crossing the Andes.

The landscape around us overlays the products of recent processes with those from the past. Slow processes or extreme events that happen very rarely – like floods, earthquakes or rockslides – wipe out certain characteristics, while others remain on the surface. In this sense, the landscape is like a palimpsest – a piece of parchment that monks in the Middle Ages scraped clean again and again to write something new. Analysing rock layers and soil is similar to the work of a detective. Geophysical deep sounding with sound and radar waves, precise measurements of motions related to earthquakes, and deep boreholes each provide a glimpse of the characteristics of what lies beneath us, giving us a better understanding of spatial distribution of the various layers. Fossils can tell us the age of a layer of sediment, while radiometric isotopes in minerals reveal how quickly a rock moved from deep within the Earth up to the surface, perhaps during the process of mountain building. Thin layers of ash tell us when there was a devastating volcanic eruption that influenced environmental conditions. The shape, gradation, and surface conditions of sand grains reflect whether wind or water was responsible for their transport. We know, for instance, that northern Germany was a desert landscape more than 260 million years ago. At that time, the wind made huge dunes migrate across the region. Over time, climate and vegetation slowly alter the physical and chemical characteristics of sand and rock at the surface, turning them into soil, the epidermis of our planet. Mineralogical analyses of layers of the soil layer tell us whether the climate was dry or wet. These kinds of observations allow us to reconstruct links between our climate system and processes that have taken place on the Earth's surface, as well as those processes that originate at much deeper levels. The clues we use might be hidden under the surface of the earth or clearly visible on the surface, like in the mountains, or even in freshly cut rock alongside roads.

On the following pages, we invite you to accompany scientists from Potsdam into their world of research. They track hidden traces of long-gone earthquakes in the Tien Shan Mountains; they discover ancient forms of life in deep-sea sediments. They even examine layers in outer space that can tell us something about the formation of planets. "Portal Wissen" not only presents scientists of the University of Potsdam who deal with the sequence of layers formed by solid rock, but also those scientists who deal with levels of education or social strata. Research scientists explain how to implement the social mission of inclusion in teaching, and how pupils from the Berlin district Kreuzberg examine language in urban neighbourhoods together with students from the University of Potsdam.

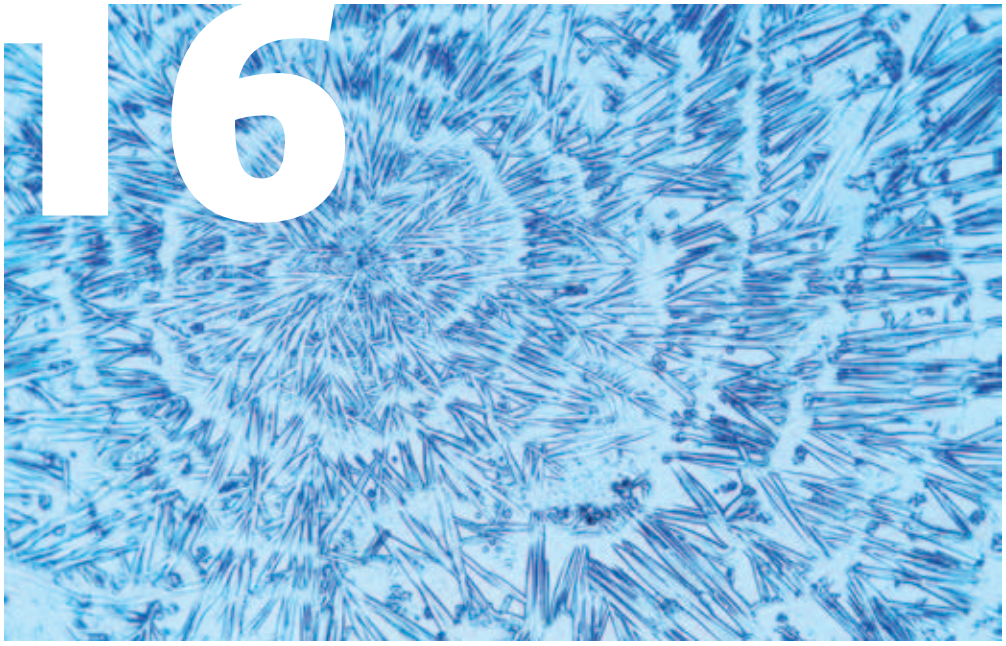
Although these types of "layers" are very different, they all have something in common. Their structure and profile are evidence of continuously changing conditions. The present will leave traces and layers that future geoscientists will measure and examine. We already speak of the Anthropocene, a geological era dominated by humans, which is characterized by far-reaching changes in erosion and sedimentation rates, and the displacement of natural habitats. I hope that you will discover exciting and inspiring stories in this edition. And remember – it is always worth having a look beneath the surface.

PROFESSOR MANFRED STRECKER, PHD
PROFESSOR OF GEOLOGY



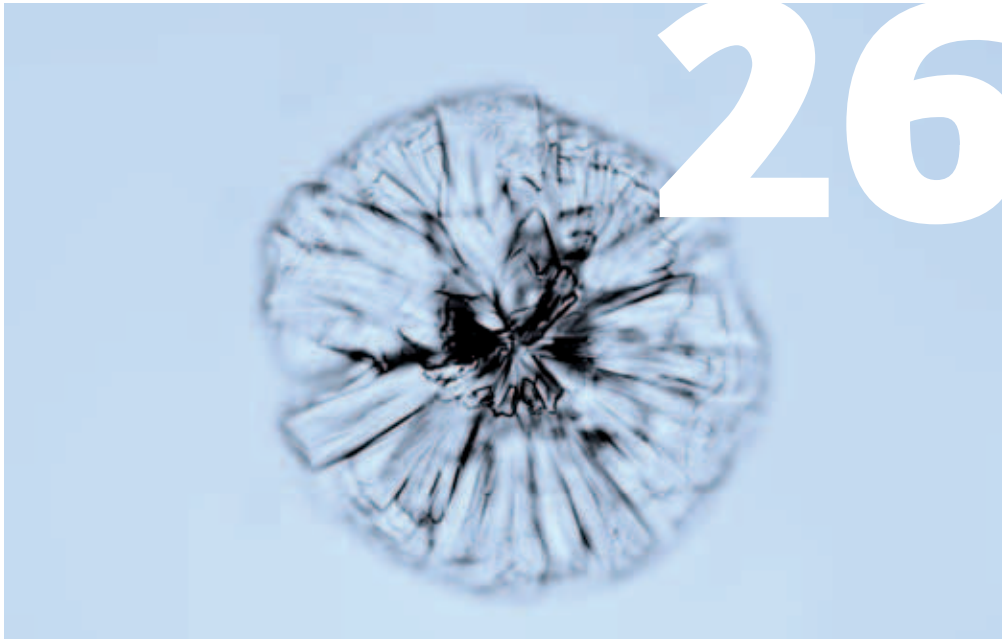
Deep Layers

Tiefenschichten



Educational Backgrounds

Bildungsschichten

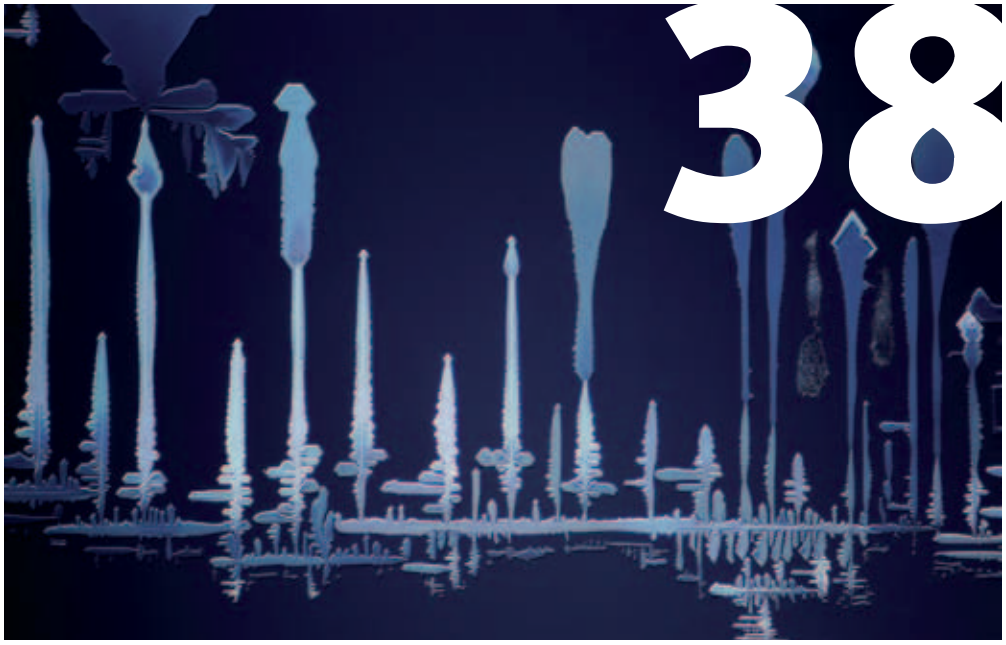


Extra Shifts

Sonderschichten

Social Stratums

Gesellschaftsschichten



Science Stories

Geschichten

Imprint

Portal Wissen
The Research Magazine of the University of Potsdam
ISSN 2194-4237

Publisher:
Press and Public Relations Department on behalf of the President of the University

Editors: Birgit Mangelsdorf (ViSdP), Matthias Zimmermann
Contributions: Dr. Barbara Eckardt, Petra Görlich, Antje Horn-Conrad
Translation: Susanne Voigt

Address of Editorial Office:
Am Neuen Palais 10 · 14469 Potsdam
Tel.: (0331) 977-1675, -1474, -1496
Fax: (0331) 977-1130
E-Mail: presse@uni-potsdam.de

Photos/Figures:
AVZ/UP: 52/53 u. (4); Colibri Photonics: 28, 29, 30 l.; fotolia.de/bloomua: 42; fotolia.de/More Images: 40/41; Fritze, Karla: 2 o., 15 u., 22 u., 24 u., 30 r. (2), 32 o., 32 u., 45, 50 u. (3); Gornitzka, Lydia: 23; Graduiertenkolleg „Intrapersonale Entwicklungsrisiken des Kindes- und Jugendalters in längsschnittlicher Sicht": 18/19, 20/21 (3), 22 (3); Halle, Prof. Dr. H.: 34; Herzschuh, Prof. Dr. Ulrike: 25; Hocher, Prof. Dr. Berthold: 35 u.; Klaer, Andreas: 36, 37 (2); Landgraf, Angela: 2/3 u., 8/9, 11 (2); NASA/JPL/Space Science Institute: 14 o., 14 u., 15 o.; NASA/JPL/University of Colorado: 12/13; pixelio.de/Alexandra H.: 31; pixelio.de/Der Arzt: 35 o.; pixelio.de/Gabi Schoenemann: 43; pixelio.de/IchSelbst!: 33; pixelio.de/Rainer Sturm: 44; Rakhmatullina, Dr. Ekaterina (Universitaet Bern): 32 M. (3); Rosenwinkel, Swenja: 10, 11 M.; Stache, Sören: 51, 53 o.; Stieglitz, S. & Dang-Xuan, L. (2012): Social Media and Political Communication – A Social Media Analytics Framework. Social Network Analysis and Mining (SNAM): 48; Strecker, Prof. Dr. Manfred: 3 o.; twitter.com: 50 o.; Walz, Prof. Dr. Bernd: 1, 6/7, 16/17, 26/27, 38/39, 46/47; Wiese, Prof. Dr. Heike: 42 o.

Layout/Design:
Stephen Ruebsam, unicom-berlin.de

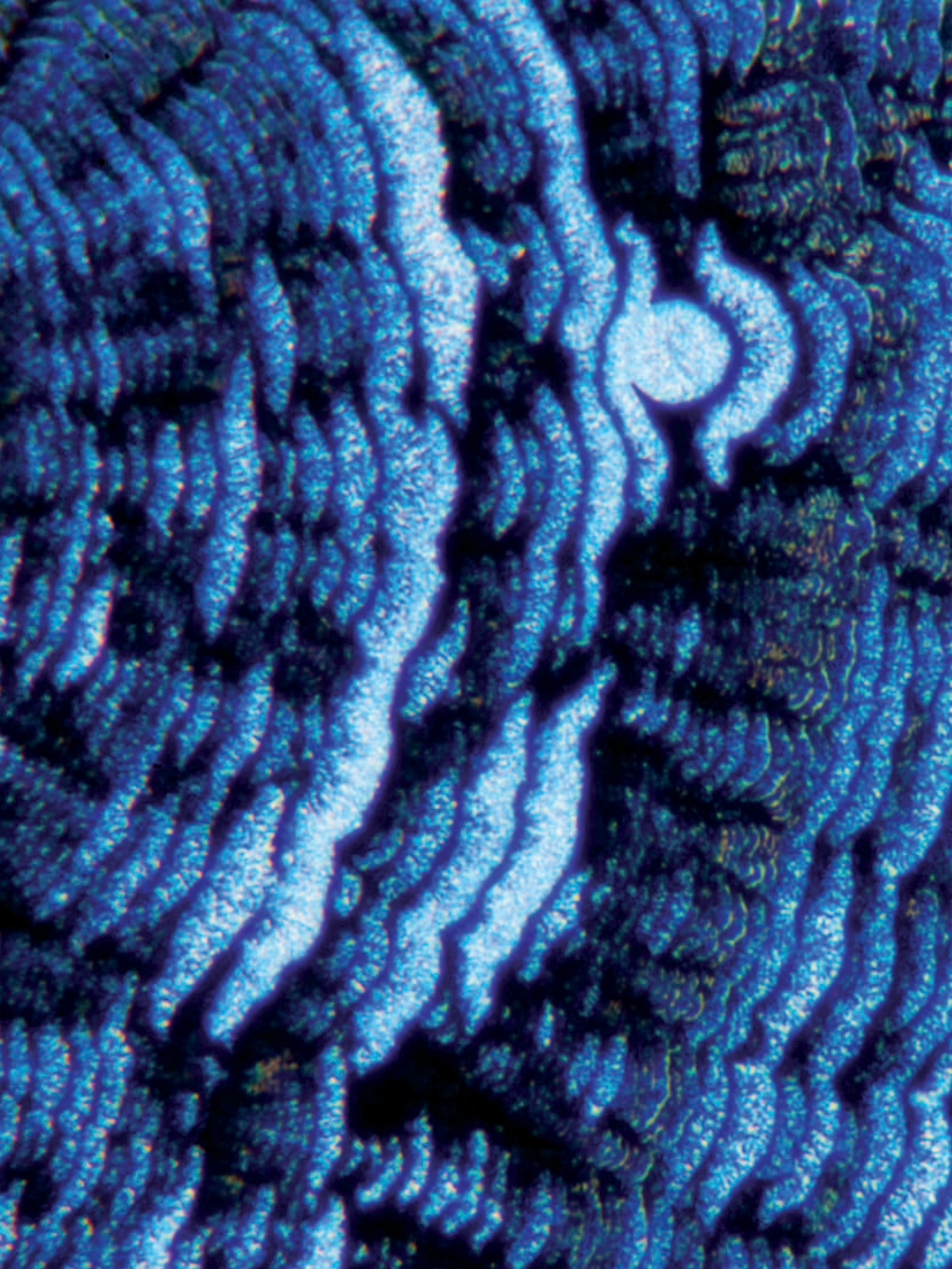
Editorial deadline for next issue:
31. März 2013

Advertisements: unicom MediaService
Tel.: (030) 509 69 89 -15, Fax: -20
Valid price list for advertisements: No. 1
www.hochschulmedia.de

Print: Brandenburgische Universitätsdruckerei und Verlagsgesellschaft Potsdam mbh
Circulation: 2,000 copies

The editorial office reserves the right to shorten submitted articles or letters without changing their meaning.

Portal Wissen online at
www.uni-potsdam.de/portal




Deep
LAYERS
Tiefenschichten

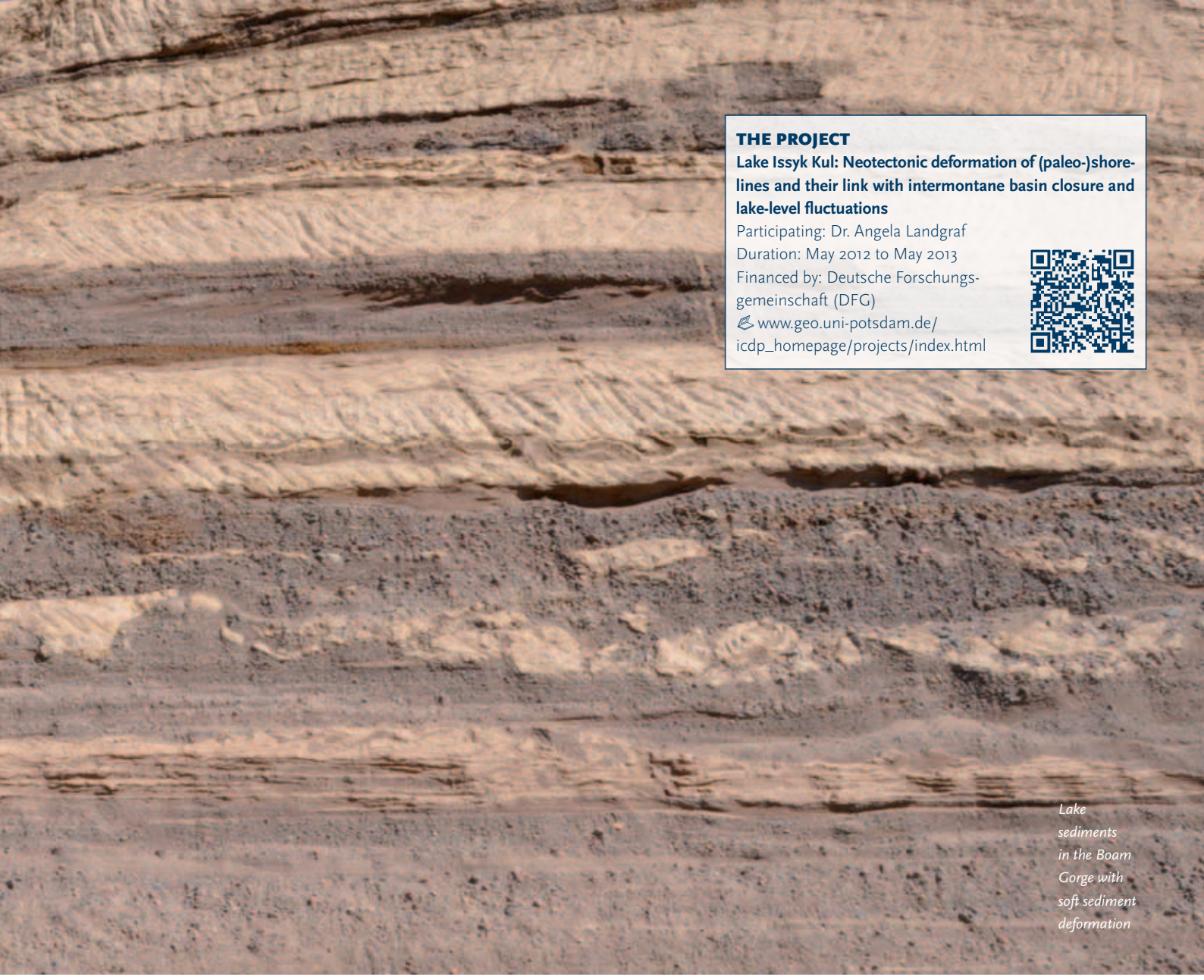
Traces in the Sand

Geologists from Potsdam measure the shorelines of Lake Issyk Kul

Volcano eruptions, earthquakes, floods, landslides – these forces of nature form new patterns of our landscape again and again. Today we can still find traces of events long gone although they might be hidden by many layers of sediment. With enthusiasm and flair, geologists from Potsdam explore the reasons for significant changes in the water level of Lake Issyk Kul in Kyrgyzstan.

The computer monitor shows a barren, treeless landscape. The sandy ground is covered by dried grass. There are also a few big pieces of rock scattered on the ground. Somewhere in the background you can see the snow-covered peaks of the Tien Shan Mountains. There are small sand slopes near a huge fresh-water lake that an untrained eye can hardly recognize. Other places are marked by cliffs that are several metres high and form steps in the landscape. The geologist Angela Landgraf took photos of this prominent landscape during a six-week expedition last autumn. For her, these slope breaks are witness of a time long gone because they are shorelines marking the areas where the banks of the lake were in the past. The scientist from Potsdam was looking for evidence of the geological past of Lake Issyk Kul on her expedition to the north of Kyrgyzstan. Being the second largest mountain lake in the world, Lake Issyk Kul reaches 670 metres in depth.

"We know that about 25,000 years ago and again about 500 years ago the water level of Issyk Kul was much higher than today," Angela Landgraf explains. The scientist wants to investigate the reasons for this. On one hand, climatic changes can lead to water-level fluctuations in big lakes. On the other hand, they can be the result of tectonic events, like repeated earthquakes. Cli-



THE PROJECT

Lake Issyk Kul: Neotectonic deformation of (paleo-)shorelines and their link with intermontane basin closure and lake-level fluctuations

Participating: Dr. Angela Landgraf
Duration: May 2012 to May 2013
Financed by: Deutsche Forschungsgemeinschaft (DFG)
www.geo.uni-potsdam.de/icdp_homepage/projects/index.html

Lake sediments in the Boam Gorge with soft sediment deformation

matologists intend to use the lake as a climate archive in the near future and to obtain drilling cores from lake sediment. The sediment layers of the lake provide valuable information about the former climate conditions in the region. However, earthquakes can significantly influence the composition of sediments and the water level of a lake. This may happen when complete hillsides or rock masses slide into the water and block the outlet of a lake. To gain reliable information about the climate of the past millennia, scientists have to be able to distinguish between tectonic and climatic causes for sedimentation pulses. The investigations of Angela Landgraf should provide clarity.

Many geological events took place in the area around Issyk Kul that presumably influenced the lake. "The area is seismically very active," Angela Landgraf explains. About 100 years ago the region was hit by a series of strong earthquakes. Historical documents prove that there were also severe earthquakes before. Such earthquakes may have left traces in the former shorelines, which the scientist reconstructed with the help of satellite pictures before her expedition. These shorelines are unique reference horizons for geoscientists, which they use to decipher the uplift and subsidence of the surface. Indicators for earthquakes also exist in the outcrops that reveal lake sediments that are thousands of years old. In some places, the fine layers in the sand and the light and dark layers of clay, silt, and gravel are deformed, folded or bent. Using scraper and brush the scientists uncover and analyse such structures, also called seismites.

"Climatologists intend to use the lake as a climate archive in the near future."

Scientists measure a boulder that was possibly part of a natural dam that closed the Boam Gorge.

"If such soft sediment deformation repeatedly occurs within a larger area, it is an indicator for an earthquake," Angela Landgraf says. It is not easy to identify these places: "We spent a lot of time travelling through the countryside in a Russian minibus," she admits.

It is also quite difficult to find the former shorelines in this rough terrain. The geologist measures with a differential GPS unit to gather high-resolution data. "On the aerial photographs you can identify the shorelines much better than in the field," she comments. The relief erodes quickly in the soft sediments. However, slope breaks, lagoons, bays, and cliffs provide evidence for the former location of the shoreline.

"Outcrops reveal layers of sediment that are thousands of years old."

Geoscientists assume that a geological event was responsible for an approximately 50 metres higher lake level of Issyk Kul about 25,000 years ago. Angela Landgraf looked for indicators in the Boam Gorge at the western end of the lake. A landslide might have closed the narrow gorge and created a natural dam. There is nothing left of it today, but in the plain behind the gorge there are huge boulders. They might be remnants of a natural dam, outburst by the dammed-up water mass. Then a disastrous flood would have devastated the area.

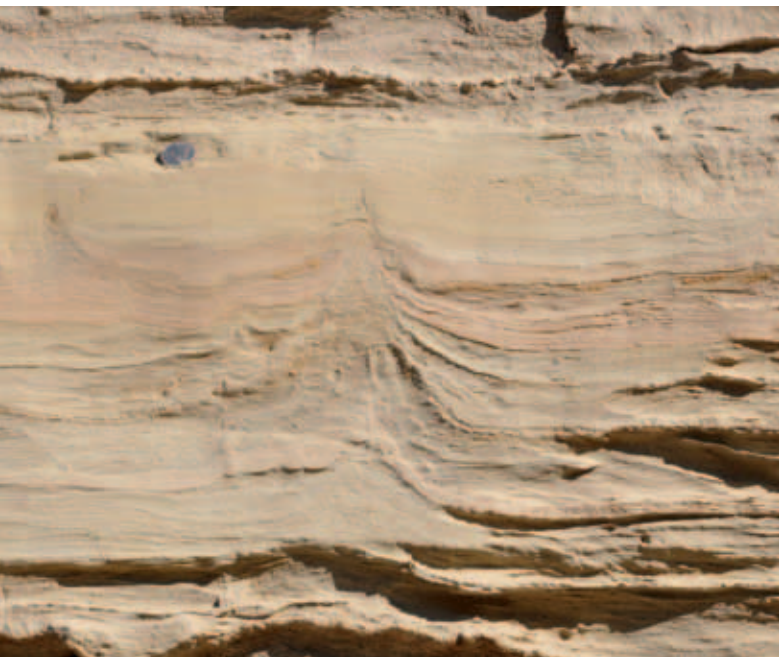
Angela Landgraf analyses size and age of these boulders to determine whether they really have their origin in the gorge. Using a mathematical model, she can calculate which transport capacity the water needs to move the boulders. Thus she can draw conclusions regarding the flood event that was possibly triggered by the breaking of the natural dam. The amount of nuclides built by the

INTERNATIONAL CONTINENTAL SCIENTIFIC DRILLING PROGRAM (ICDP)

The "International Continental Scientific Drilling Program" (ICDP) gives multidisciplinary teams of scientists from all over the world the chance to work on drilling cores and to answer global questions. The programme intends to provide exact, fundamental and globally significant knowledge about composition, structure, and dynamic processes in the Earth's crust using unique means of scientific deep drilling. The programme deals with various questions: development of the climate, volcanic activities, geothermal energy, large fault zones or origin of earthquakes. Deep drilling is complex and expensive. Such projects are only possible by international cooperation and co-financing. In addition to the international programme, there is a scientific structural programme of the DFG (German Research Foundation) in Germany. Coordinator of this programme is Professor Roland Oberhänsli from the University of Potsdam. When scientists prepare for deep drilling they have to do preliminary explorations. This will make sure that drilling is done at the right place. After the drilling, core samples have to be scientifically analysed. For this the scientists can use the national programme.

The University of Potsdam is participating in the ICDP with several projects. In addition to Lake Issyk Kul, which is regarded as a promising climate archive due to its age, geologists also explore reefs in Japan, the migration of hominids from Africa, the development of magma in the caldera of Pozzuoli or plate movements in New Zealand. With her work, Angela Landgraf prepares and supports the planned future deep drilling project at Lake Issyk Kul.

✎ www.geo.uni-potsdam.de/icdp_homepage/index.html



Zoom into a soft sediment deformation structure. The seismites may indicate shaking caused by an earthquake.

interaction with secondary cosmogenic radiation on the surface of the rock shows her when these boulders were deposited. If this time matches with the occurrence of the lake's highstand, a landslide dam is probably the reason for the accumulation of lake water.

More than 250 kilogrammes of rock samples wait for Angela Landgraf after her return from Kyrgyzstan. They all have to be analysed in the laboratory. Despite the exertion she has enjoyed the expedition to Lake Issyk Kul. "It is really an amazing landscape – the crystal-clear blue lake, the snow-covered mountains," these are places as they were described in the books of Chingiz Aitmatov. And she says, "You can really look forward to every new working day". And of course, you should also have a certain thirst for adventure.

HEIKE KAMPE

THE SCIENTIST

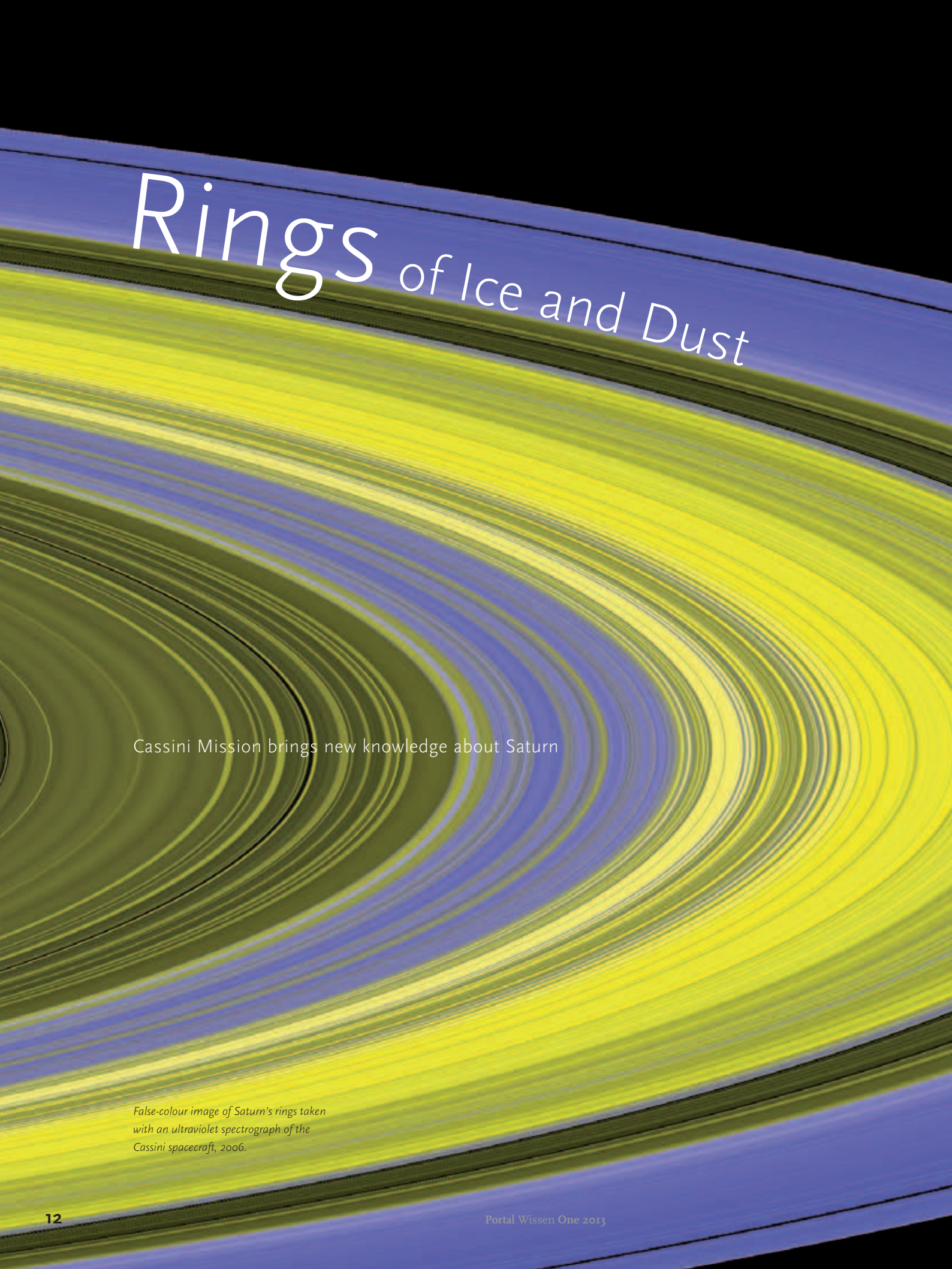
Dr. Angela Landgraf studied geology at the University of Potsdam. After finishing her doctorate, she is now working as a Postdoc at the Institute for Earth and Environmental Science.

Contact
Universität Potsdam
Institut für Erd- und Umweltwissenschaften
Karl-Liebknecht-Str. 24–25, 14476 Potsdam OT Golm
landgraf@geo.uni-potsdam.de

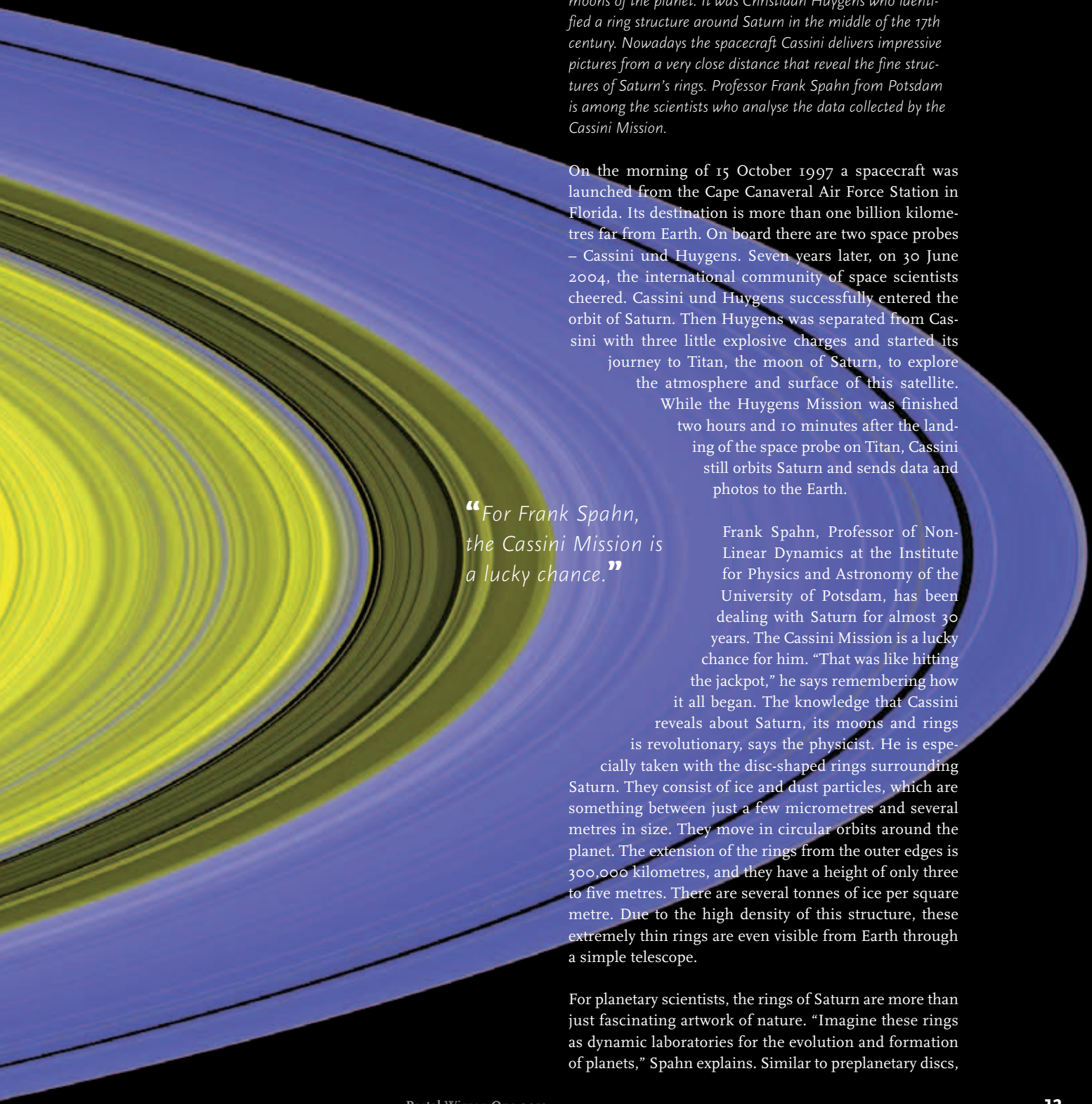
Blick auf die ehemaligen Strandlinien des Issyk Kul. Im vorderen Bereich zeigen die Böschungen an, wo sich das Ufer vor etwa 500 Jahren befand. Die hinteren Böschungen wurden etwa vor 25.000 Jahren abgelagert, als der Wasserstand des Issyk Kul etwa 50 Meter über dem heutigen Niveau lag.

Rings of Ice and Dust

Cassini Mission brings new knowledge about Saturn



False-colour image of Saturn's rings taken with an ultraviolet spectrograph of the Cassini spacecraft, 2006.



Galileo Galilei was the first to see them. In 1610 he observed Saturn's rings through a simple telescope. However, he did not recognise them as such because he thought that they were moons of the planet. It was Christiaan Huygens who identified a ring structure around Saturn in the middle of the 17th century. Nowadays the spacecraft Cassini delivers impressive pictures from a very close distance that reveal the fine structures of Saturn's rings. Professor Frank Spahn from Potsdam is among the scientists who analyse the data collected by the Cassini Mission.

On the morning of 15 October 1997 a spacecraft was launched from the Cape Canaveral Air Force Station in Florida. Its destination is more than one billion kilometres far from Earth. On board there are two space probes – Cassini und Huygens. Seven years later, on 30 June 2004, the international community of space scientists cheered. Cassini und Huygens successfully entered the orbit of Saturn. Then Huygens was separated from Cassini with three little explosive charges and started its journey to Titan, the moon of Saturn, to explore the atmosphere and surface of this satellite. While the Huygens Mission was finished two hours and 10 minutes after the landing of the space probe on Titan, Cassini still orbits Saturn and sends data and photos to the Earth.

"For Frank Spahn, the Cassini Mission is a lucky chance."

Frank Spahn, Professor of Non-Linear Dynamics at the Institute for Physics and Astronomy of the University of Potsdam, has been dealing with Saturn for almost 30 years. The Cassini Mission is a lucky chance for him. "That was like hitting the jackpot," he says remembering how it all began. The knowledge that Cassini reveals about Saturn, its moons and rings is revolutionary, says the physicist. He is especially taken with the disc-shaped rings surrounding Saturn. They consist of ice and dust particles, which are something between just a few micrometres and several metres in size. They move in circular orbits around the planet. The extension of the rings from the outer edges is 300,000 kilometres, and they have a height of only three to five metres. There are several tonnes of ice per square metre. Due to the high density of this structure, these extremely thin rings are even visible from Earth through a simple telescope.

For planetary scientists, the rings of Saturn are more than just fascinating artwork of nature. "Imagine these rings as dynamic laboratories for the evolution and formation of planets," Spahn explains. Similar to preplanetary discs,

which are the stellar nurseries of planets, there is a lot of material in these rings in a confined space. The particles constantly bump against each other and move around a centre of mass. Astronomers assume that bigger bodies, so-called planetesimals, can form under such conditions. They are the basic components of planets. The areas where such formation of stars and planets takes place are far beyond our solar system – out of reach for humans today. But Spahn is convinced, "One day we will have telescopes with such a high resolution that we will be able to watch the planets grow." But before this happens, scientists need to make do with models. They can check the validity of these models with the help of the planetary rings. "To these places we can fly," the scientist says.

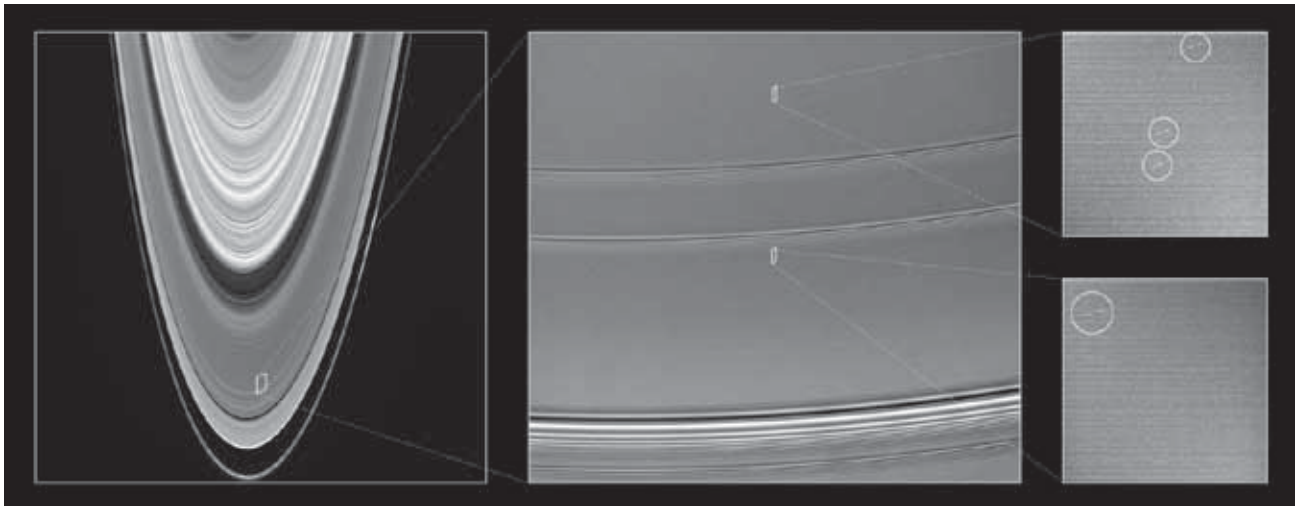
"You have to imagine these rings as a dynamic laboratory for the evolution and formation of planets."

SATURN

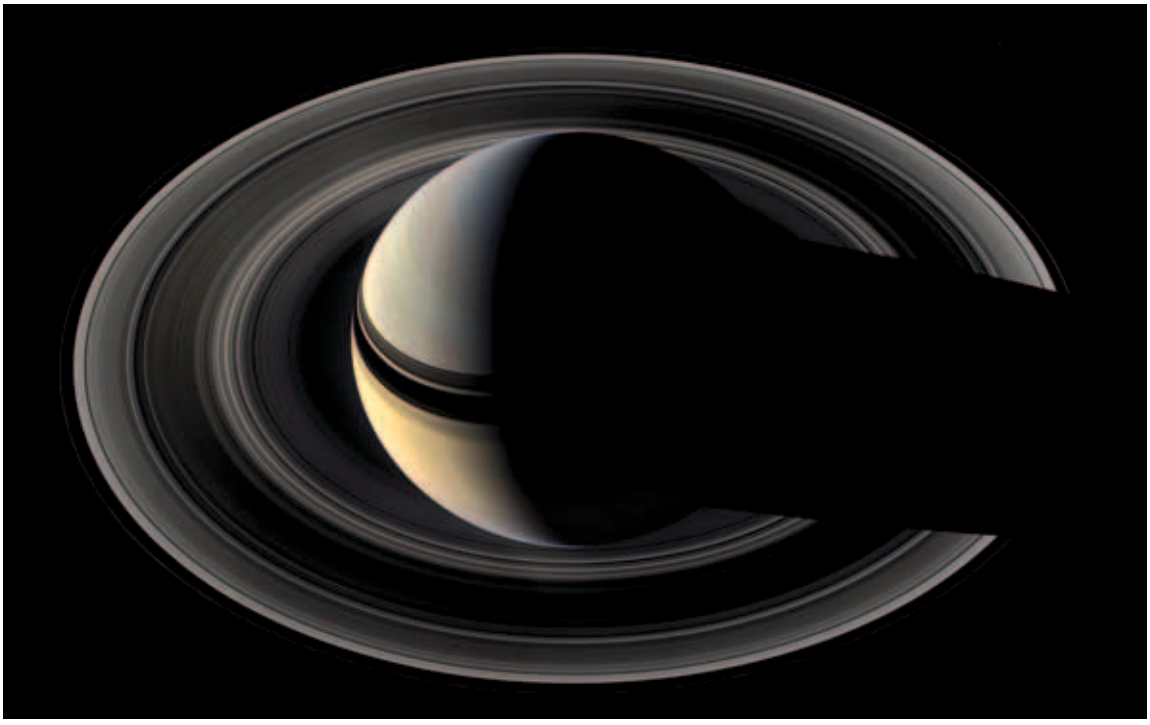
The second biggest planet in our solar system has a diameter of 120,500 kilometres. Being a gas planet, it consists of 96 per cent hydrogen and is approximately 1.4 billion kilometres from the Sun. The temperatures in the Saturn system are between -150 and -200 degrees Celsius. Several icy moons orbit the planet. Saturn has a prominent ring system consisting of water ice. It takes Saturn about 30 years to make one revolution around the Sun.

Nevertheless, there is a big difference between the processes in preplanetary discs and Saturn's rings. The latter are subject to the tidal power of Saturn. Since the rings are very close to the planet, enormous, disruptive forces act on the particles. They prevent the formation of objects that are bigger than 30 metres. If they exceed this size, they are torn apart by tidal power. Nevertheless, planetary scientists can learn a lot from this due to fortunate circumstances. Saturn is surrounded by numerous moons that orbit the planet beyond the rings. For a long time scientists have assumed that small natural satellites are hidden within the ring system. The so-called moonlets can have diameters of several kilometres. If they consist of solid ice, the tidal powers cannot do them any harm. Already in the 1980s Frank Spahn wondered what effect moonlets might have on the ring structures of Saturn. He ran computer simulations with bodies in a viscous disc and calculated the structures that such moons of Saturn might leave in the ring due to the effect of gravitational forces. In theory there was the hope that these traces would tell where the moons were hidden.

The calculations showed: Moonlets with a diameter of more than one kilometre should produce gaps with bow waves. Later the scientists found out that smaller moonlets can be identified by propeller-shaped features in the rings. They themselves are too small to be directly pictured. In fact, with the help of these hypotheses, they were able to identify moonlets in the rings of Saturn, first with pictures taken by the space probe Voyager 2 and later



The four first discovered propeller moons



Saturn and its rings

with pictures from Cassini. "So far we have discovered more than 300 bigger objects in Saturn's rings," Spahn explains. "The most beautiful are the huge-scale propellers that almost create a gap," he says with a smile. "They have all the qualities we predicted." New estimates by astronomers say that the number of moonlets and bigger chunks of ice in the rings is enormous. There are perhaps more than a million. "Pan," with a diameter of 30 kilometres, is the biggest moon that has been discovered so far.

"The moons in Saturn's rings bear implications for the formation and evolution of the rings."

For the scientists, the moons in Saturn's rings not only bear strong implications for the pattern that forming planets leave in gas and dust clouds. They also provide information about the formation and history of the rings around the gas planet. So far there have been two theories. One theory says that the rings are remnants from the time when Saturn was formed five billion years ago. However, in that case there should not be any objects that have a diameter of more than 30 metres. In the meantime, it was possible to provide evidence of many such moonlets with diameters of between 100 metres and several kilometres. This indicates that the ring around Saturn is younger than the planet itself. It probably formed at the time of the Late Heavy Bombardment about four billion years ago when numerous asteroids crashed into the planets of our solar system and their satellites. One or more icy moons of Saturn were destroyed by impacts, perhaps. The remnants evenly distributed around the planet and finally formed the impressive rings.

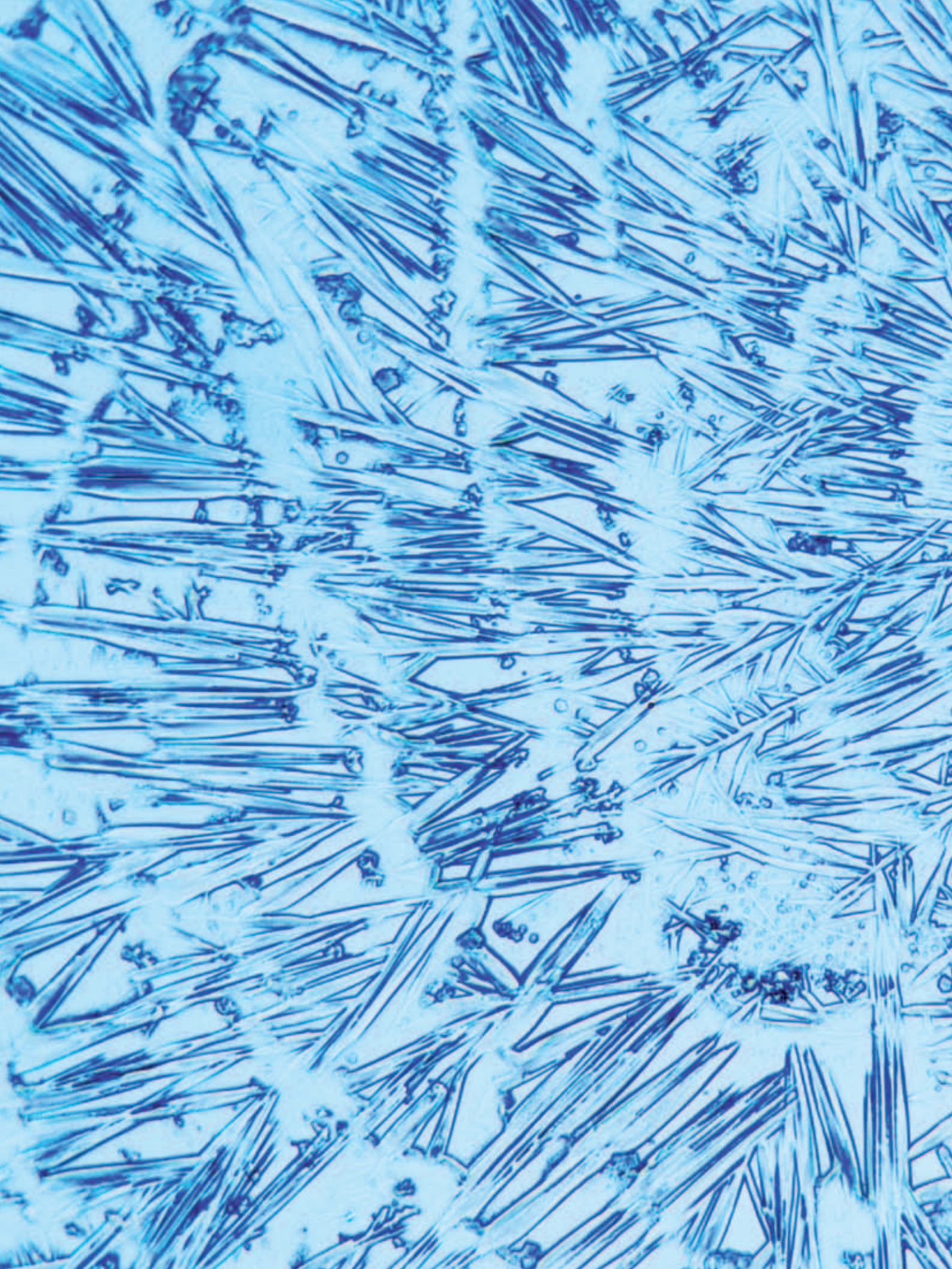
The Cassini Mission will come to an end in 2017. Then the spacecraft will fly through the rings to Saturn and eventually hit the planet. "I am really looking forward to this moment," says Professor Spahn. "Then we will see the particles of the rings directly for the first time."

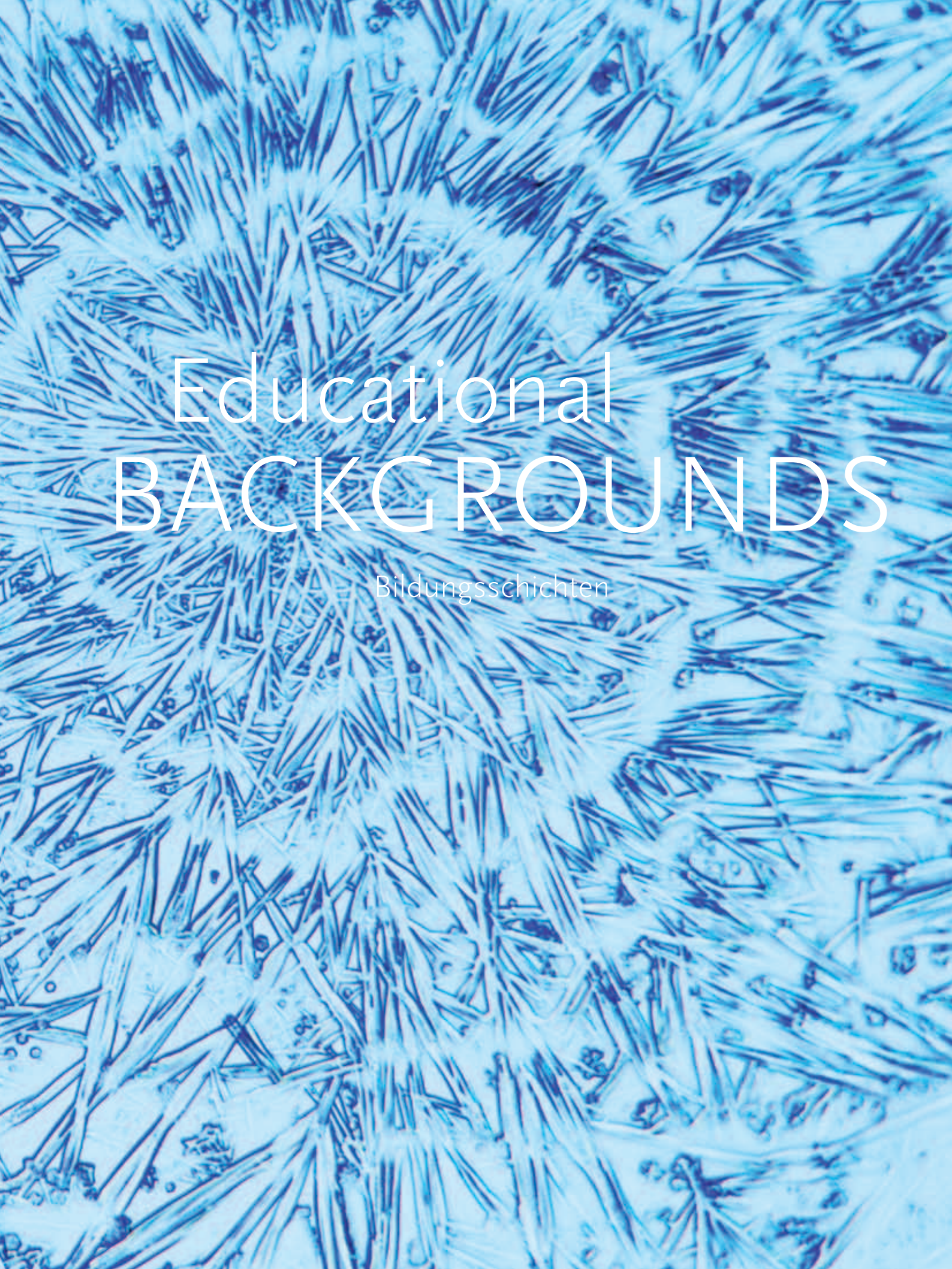
HEIKE KAMPE

THE SCIENTIST

Professor Frank Spahn is a theoretical physicist. Since 2006 he has been an associate professor at the Institute of Physics and Astronomy at the University of Potsdam. He is a member of the Cosmic Dust Analyzer Team of the Cassini Mission.

Contact
Universität Potsdam
Institut für Physik und Astronomie
Karl-Liebknecht-Str. 24–25, 14476 Potsdam OT Golm
✉ frank@agnld.uni-potsdam.de




Educational
BACKGROUNDS
Bildungsschichten

Children help in research: More than 3,000 children take part in the PIER Study, which is the basis for psychologists from Potsdam to examine developmental risks.

Stumbling Blocks

Psychologists at the University of Potsdam study childhood development risks

Learning disabilities, aggressive behaviour, depressive moods – developmental disorders occur quite frequently in children and adolescents. Which personal qualities contribute to the development of such disorders and which ones protect against them? How do they actually take effect? How do they influence each other? These are questions raised by doctoral students in a research training group that was initiated by psychologists of the University of Potsdam in 2011. In order to get to the bottom of these kinds of questions, the doctoral students collect data in the context of a project called the PIER Study (Potsdamer Intrapersonale Entwicklungsrisiken). More than 3,000 children from schools in Brandenburg have already participated in the study. First results are now available.

Why does a child become anorexic when he or she reaches puberty while many others overcome the turbulence of hormones without any bigger problems on their way towards adulthood? Why can one child read fluently three years after starting school while others still have problems in understanding the content of a text? The

research training group "Intrapersonal Developmental Risks in Childhood and Adolescence – A Longitudinal Perspective" is striving to answer these questions.

The scientific programme behind this title is ambitious. The research programme enables doctoral students of psychology at the University of Potsdam to deal with a wide range of questions in a still understudied field of research. "We already know many of the factors that can lead a child astray or may result in detours in his or her development," says Birgit Elsner, spokesperson of the research training group, "but we do not know much about how these factors actually take effect and how they influence each other." Elsner says that a PhD research programme is most suitable for examining these complex interactions. This way, the twelve doctoral students can investigate their research questions and assess a large variety of measures in one large sample of children: "Individual projects wouldn't be able to achieve this."

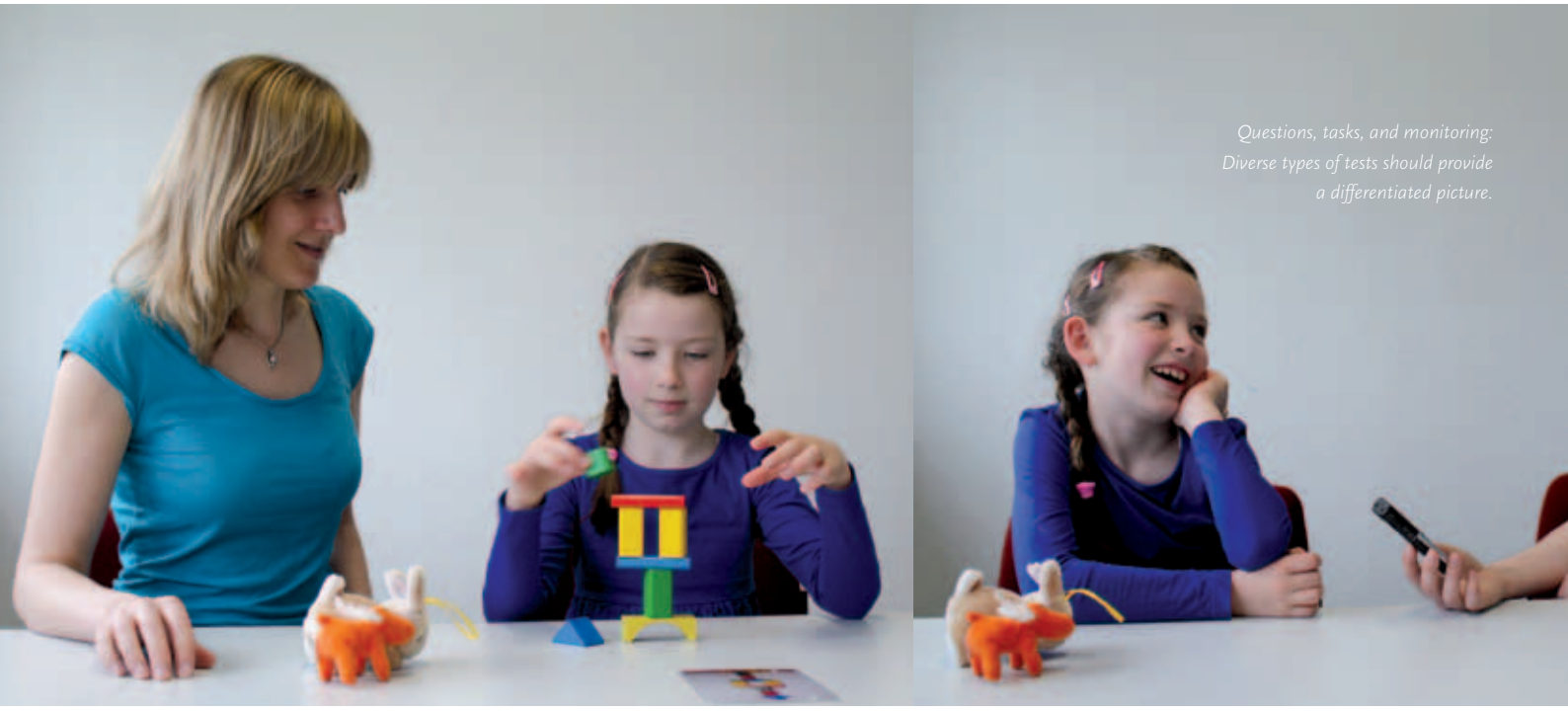
"Why do some people have more problems on the long and winding road of growing up?"

Thirteen scientists of the Department of Psychology teamed up for this project. They all work in different psychological areas. Some have specialized in aggressive behaviour or in emotional processing; others concentrate on reading motivations or eating and weight disorders. In their joint research project they want to investigate why some people have more problems than others on the long and winding road of growing up.

The research training group does not focus on inherited dispositions or competencies, or external stumbling blocks, such as difficulties in the family or at school. Rather, the researchers concentrate on intrapersonal development risks such as cognitive and emotional information processing, or on individual ways of reaction to external events. External and internal factors interact in complex ways when it comes to developmental disorders. However, the project is based on the assumption that personal qualities like self-perception or a sense for injustice, which are formed during childhood, mediate between innate features and environmental factors. So far, there is not enough consolidated knowledge about the characteristics that make children prone to developmental disorders and about characteristics that protect them. Such disorders are quite common among children and adolescents. To know more about them might improve prevention and treatment.

The research training group focuses on three problem areas that are particularly important for everyday life at schools and in the family. The first field deals with learning disorders. The second group of problem behaviour includes both externalizing problems, like aggressive behaviour, and internalizing problems, like anxiety and depression. Eating and weight-related disorders are examined in the third field.

The research project will only provide useful results if the scientists are able to obtain data from a large number of children and adolescents. In order to record changes and



Questions, tasks, and monitoring: Diverse types of tests should provide a differentiated picture.

gain a longitudinal perspective, these examinations have to be repeated several times over the course of several years. This requires a considerable amount of time and effort. As a first step, the research training group was able to draw on a sample that was first investigated in 2005. This preceding study on children, who are between 11 and 19 years today, was financed by the University of Potsdam as part of a programme for doctoral candidates. As of today, this first group includes about 1,500 participants. A second sample with more than 1,600 children from first to third grade became part of the project in 2012. In order to compile and examine such a group, it was necessary to obtain the consent of the schools and parents first. Afterwards, about 40 student research assistants were recruited and thoroughly trained in a three-day instruction course. During individual two-hour sessions with the children, the experimenters, who are either doctoral students or student assistants, ask each child about his or her attitudes, ideas and feelings, and they record some of these procedures on tape. Additionally, they ask the children to solve some computer tasks that are presented in a playful way and are geared toward the children's age. Parents and teachers fill in questionnaires about each child.

All this is worth the effort. "The collected data form the basis for the work in the research groups," explains Juliane Felber, who is one of the two coordinators of the project. "However, the researchers always also pay attention to the overall picture. The final result is more than just the sum of the different individual projects."

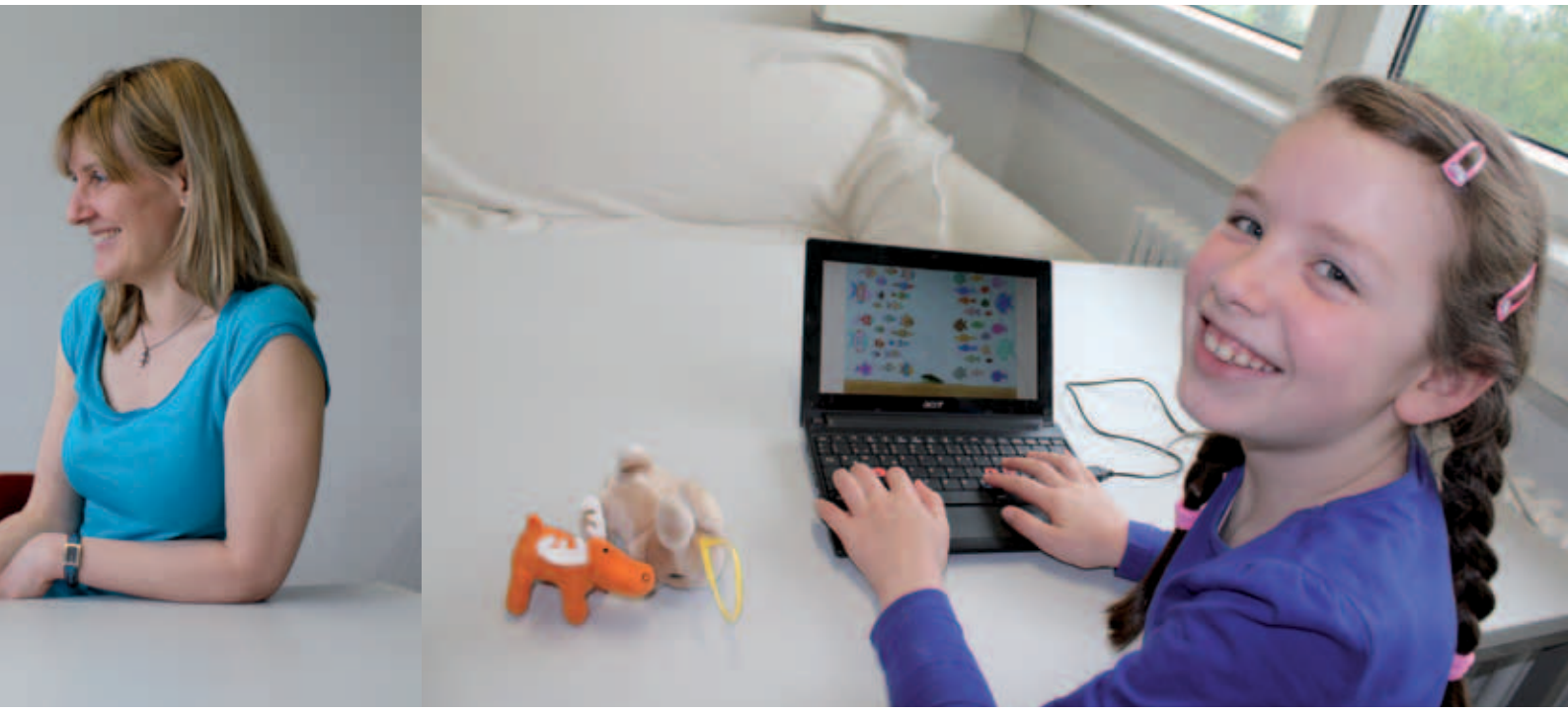
Juliane Felber and Rebecca Bondü are the ones who coordinate the logistics and organisational details. The shelves of Felber's office are filled with rows of neatly labelled stacks of documents. People often knock at the door to pick up documents, to discuss questions or to arrange appointments.

THE PROJECT

Research Training Group "Intrapersonal Developmental Risks in Childhood and Adolescence – A Longitudinal Perspective" ("Intrapersonale Entwicklungsrisiken des Kindes- und Jugendalters in längsschnittlicher Sicht")

The research training group is funded by the German Research Foundation. The group was initiated by thirteen psychologists of the University of Potsdam in 2011. Twelve young scientists are preparing their doctoral theses in this group. The empirical data are collected in the PIER Study affiliated to the research group. The word PIER stands for "Potsdamer intrapersonale Entwicklungsrisiken" (www.uni-potsdam.de/pier-studie). It is a large-scale study with more than 3,000 pupils from Potsdam and the surrounding areas. A wide-ranging accompanying programme with seminars, workshops, and a summer school provides the doctoral candidates with methodological tools and methods and gives them an overall perspective of project and research fields.

✎ www.psych.uni-potsdam.de/graduiertenkolleg/grk1668/index-d.html



A great challenge: finding your own way – to the solution of the task and to growing up.

The first doctoral candidates started their research work in spring 2011. By now, a dozen junior scientists are working on their own projects. Fidan Sahyazici-Knaak, for instance, examines the connection between certain attitudes – like an excessive striving for perfection or a continuous feeling of helplessness – and the development of depressions after crucial life events. Therefore, she looks into the findings of those children who show typical signs of inner withdrawal, like lethargy and sadness, and contrasts them with the information children gave about their perceptions and feelings. "For a long time it was thought that children and adolescents hardly ever suffer from depressions. This is why the research on this topic has only been done for about 20 years and is comparably young," Sahyazici-Knaak says. The suspected connection could already be deduced from the data of the first survey. Only the longitudinal perspective, however, will show whether unfavourable attitudes promote the withdrawal into an inner world or whether they are formed as a consequence of depressive moods.

"The pleasure of reading is more important for reading competence than external incentives."

In her dissertation, Franziska Stutz wants to empirically analyse the assumption that reading motivation in its different forms is closely linked to reading competence. "How often do you read?" is one of the standard questions of the survey. The children can answer this question by pointing to circles of various sizes. Furthermore, interviewers will ask them, why they read: Do they read for fun? Or because they hope to be appreciated for it? Do they want to keep up with others? We know from older children that the joy of reading is more important for their reading competence than external incentives because it makes them pick up a book more often. It is assumed that frequent reading in early emergent readers automatizes the reading process. Automatization in reading is a prerequisite for freeing capacities in our brain which, in turn, allow for a deeper processing and complex understanding of the text. The first results of Franziska Stutz's research suggest that reading motivation enhances later reading competence already among first to third graders.
The research work of Anja Sperlich takes place in the "EyeLab" of the university. While the children read age-appropriate sentences, a special camera takes pictures of the eye movement every millisecond. A computer programme analyses the movement of the pupils, records how long the gaze remains on one position or whether it just skips a word. Data analyses give some information about how many words per minute the participants read and how many letters they were able to process simultaneously. Anja Sperlich relates her lab findings to reading skills that Franziska Stutz assesses as well.

When the research training group finishes their work in September 2015, all present doctoral students will have completed their work and the next cohort will have started their task. If the research programme will be prolonged by another four and a half years as intended, a data record over a period of nine years will be available. This would cover the entire period of children's development from the start of school to the end of puberty. "These data are definitely interesting for other scientists and field workers," spokesperson Birgit Elsner says. In any case, the joint programme of the psychologists from Potsdam will contribute to our knowledge in this field. Birgit Elsner underlines, "Childhood and adolescence are significant phases of human development. Our research will help to identify problems at an early stage and, what is even better, to prevent their occurrence. Thus, the research training group is an important investment into the future of our society."

SABINE SÜTTERLIN

THE SCIENTIST

Professor Birgit Elsner has lectured and done research at the Department of Psychology of the University of Potsdam since 2007. Since 2008 she has been chair of the Division Developmental Psychology. Her research interests focus on cognitive processes in early infancy. With her work in the research training group, whose spokesperson she is, she has extended her field of research into the age group of school children and adolescents.

Contact
Universität Potsdam
Department Psychologie
Karl-Liebknecht Str. 24–25, 14476 Potsdam OT Golm
✉ birgit.elsner@uni-potsdam.de

Urban Talks

Getting Involved in Linguistics

Big cities are as diverse in their languages as they are in their people. Dialects, accents, slang, and youth language – they open up most interesting fields of research for linguists. Heike Wiese and Christoph Schroeder, linguists at the University of Potsdam, bring together students and young people from the Berlin district Kreuzberg to investigate language in urban neighbourhoods.

It has 25 pages and includes 88 words. When you open this booklet, you read "dissen," "chillen," and "messern," "Opfer," "Digga" and "yallah". The entry for "Azzlack" reads: "compound word from 'azzl-' for 'asozial' ('scum') and '-ack' for 'Kanacke' ('wog'), originally used in rap". You find these words in the Kiezdeutsch Dictionary that explains the origin and meaning of terms used in youth language. Pupils from Berlin-Kreuzberg and the Hessian town of Hattersheim compiled this dictionary together with students of the University of Potsdam during their research project "Let's do Language – Hood goes Uni". Over a period of two semesters, 26 pupils and 46 Masters students of German studies, educational studies, foreign language linguistics, communication, and general linguistics investigated the language in their urban neighbourhoods using linguistic methods.

"The idea for this project was born when I saw a call for proposals of the Robert Bosch Foundation for their programme *Denkwerk*," says Heike Wiese, Professor for Contemporary German Language at the University of Potsdam. The aim of the *Denkwerk* programme is to encourage young people to study humanities, she adds. With the idea to win pupils from schools in Berlin-Kreuzberg for this programme, she launched the project "Let's do Language" together with Christoph Schroeder, Professor for German as a Second or Foreign Language. They initiated the project under the umbrella of the Centre for Language, Variation, and Migration. After getting the grant of about 45,000 Euros, the two professors from the German Department were able to start their project in autumn 2011. Its duration is three years. Each year new groups of pupils and students will come together.

"Azzlack comes from the rap scene: The part 'azzl' stands for 'asozial' ('scum') and '-ack' for the 'Kanacke' ('wog')."

Three schools in Kreuzberg took part in the experiment "Hood goes Uni". The pupils are in the tenth to twelfth grade. They are between 15 and 18 years old, and most of them have a multilingual background. In addition to German, they speak Turkish, Russian, Arabic, or Kurdish. At Hector Peterson School, for instance, 97 per cent of the students have a heritage language other than German, at Carl von Ossietzky School, 84 per cent, and at Robert Koch School, 96 per cent.

A new dialect has emerged in the urban environment of these pupils over the past years – and this is Kiezdeutsch. "Kietzdeutsch is a youth language spoken in multi-ethnic urban neighbourhoods in Germany", Wiese explains. The lexicon of this dialect is complex. Speakers often use loan words and neologisms from a number of different languages as well as grammatical innovations – an exciting topic for linguists.

In November 2011, pupils and students met at the University of Potsdam for the first time. The pupils attended a lecture and got a first glimpse of the campus. After that, they discussed with their mentor students which topics might

Pupils and students analyse urban youth language together.

THE PROJECT

"Let's do Language – Hood goes Uni"
(„Lassma Sprache erforschen – Kiez goes Uni")

Participants: Professor Heike Wiese, Professor Christoph Schroeder, Centre „Sprache, Variation und Migration", Carl-von-Ossietzky-Oberschule Berlin, Hector-Peterson-Schule Berlin, Robert-Koch-Schule Berlin, Heinrich-Böll-Schule Hattersheim

Duration: 2011 to 2014

Financed by: Denkwerk Programme of Robert-Bosch-Stiftung

✍ www.kiezdeutsch.de and www.uni-potsdam.de/sprachforscher

be exciting for them. In eight different groups, the young people worked on research questions such as how Turkish-German families experience their multilingualism; or how one's own language affects the person one is talking to.

Abdullah, Furkan, Naciye, and Seyma of Hector Peterson School decided to record the language of their neighbourhood in a dictionary. On the schoolyard, on underground trains or in the streets of Berlin-Kreuzberg, the 15 and 16-year-old pupils looked out for words that were characteristic of Kiezdeutsch. "We observed how pupils communicated with each other, wrote down the words, and discussed them," Naciye describes their approach. The young people analysed each word linguistically, establishing its origin, meaning, and grammar. Their mentors, the students Dominika Hrubcová, Anda Kruklina, and Larissa Friesen, supported them during the research process. In order to find out who recognises and uses typical Kiezdeutsch words, the pupils prepared a questionnaire and conducted interviews with parents, acquaintances, and friends. "It was exciting to find out what is actually the difference between Kiezdeutsch and conventional German," Abdullah says. For the pupils, Kiezdeutsch is their everyday language. "This is just how we talk to each other," Naciye says.

"For the pupils, Kiezdeutsch is their everyday language."

For the university students it was different. "I did not know many of these words," Anna Kruklina admits. The same was true for the pupils of the partner school in Hattersheim. On the other hand, there were many words that the Hattersheim pupils collected, which the Berlin pupils heard for the first time. Kiezdeutsch is shaped locally. "Typically Kiezdeutsch," Kruklina says. Her new favourite word is "baba". According to the dictionary, the word "baba" means outstanding, top notch, or excellent. The Kiezdeutsch Dictionary exists as a prototype in ring binding at present, but work on a print version is in progress. Heike Wiese and Christoph Schroeder have been working with schools in Kreuzberg for years analysing grammar and youth language. Heike Wiese knows, "In public perception, there is often an association of 'migration background' – 'in need of language support'. We have an entirely different experience." She also points out that *Denkwerk* is a programme to support highly talented pupils. This is why they mainly ask pupils with good school performances to take part. Hrubcová, who is a student of communication linguistics, has been surprised by the high linguistic competence of the pupils. "They are very aware of their language and can analyse it," she says.

Participation in this project aims to reduce apprehensions about university, and to open the perspective of university studies. Because: "A big problem at German universities is the fact that we are much too homogenous," Heike Wiese says. There are not enough students whose parents are not college or university graduates and there are not enough with a migration background. "This is not good," Wiese says. "At schools in Kreuzberg there are those groups who are underrepresented at our universities," the linguist continues. It therefore makes sense to involve pupils from these places in scientific research. "If the pupils study German language and literature and teach German at school later on, we will kill two birds with one stone because we have the same problem at our schools: not enough teachers with a migration background," Wiese says.

15-year-old Naciye has already decided to study at university. It looks like she will not become a linguist, though: "I will study medicine."

HEIKE KAMPE

THE SCIENTISTS

Professor Heike Wiese studied German language and literature and philosophy in Göttingen. Since 2006 she is Professor for Contemporary German Language at the University of Potsdam and speaker of the Centre for Language, Variation, and Migration at the University of Potsdam. She is the author of the book "Kiezdeutsch. Ein neuer Dialekt entsteht" published in 2012.

Contact
Universität Potsdam · Institut für Germanistik
Am Neuen Palais 10, 14469 Potsdam
✉ heike.wiese@uni-potsdam.de

Professor Christoph Schroeder studied English language and literature, German as a foreign language, linguistics, and educational sciences at the University of Bremen. Since 2007 he is Professor of German as a Second and Foreign Language at the University of Potsdam.

Contact
Universität Potsdam · Institut für Germanistik
Am Neuen Palais 10, 14469 Potsdam
✉schroedc@uni-potsdam.de

Thousand Years – Half a Metre Deep

Ulrike Herzschuh looks back into the past to be able to look into the future

She measures trees on the northern edge of Siberian forests. She drills in lake sediments on the Tibetan Plateau and sometimes goes by helicopter to get a better overview. The palaeoclimatologist Ulrike Herzschuh is not an adventurer but a down-to-earth biologist and mother of two. She was the first to get the Young Investigator Award of the State of Brandenburg and was awarded the Albert Maucher Prize of the German Research Foundation. Her research interest is climate in prehistoric times. She looks way back into the past to be able to make predictions for future developments.

Since 2005 the scientist from the Alfred Wegener Institute for Polar and Marine Research has had close ties to the University of Potsdam. First she was junior professor and now has been professor of palaeoecology and palaeoclimatology at the Institute of Earth and Environmental Sciences for a year. She appreciates close contact to students. She knows how to fill them with enthusiasm for her projects and can often win them as like-minded collaborators. Two women, students at the university, who Ulrike Herzschuh employed as scientific assistants with the Maucher prize money, are among the group of doctoral students who accompany her on expeditions to the Alpine and Arctic regions of Asia. At Qinghai Lake on the Tibetan Plateau, one of the largest salt lakes in the world, the palaeoclimatologist is investigating the effect of global warming on the monsoon system. The semi-arid landscape is considered a sensitive area. Even minor changes in humidity may have serious consequences like heavy rainfall in India or huge dust storms over China. Professor Ulrike Herzschuh investigates what climatic conditions led to the development of certain types of vegetation in the past and she looks for comparable types and situations in our present vegetation. Fossil finds like pollen or chironomid midges in lake sediments are sources of information for her.

A core of half a metre is sometimes enough to look 1,000 years back into climate history, as is the case in northern Siberia. There she analyses the connection between forest development and the chemical composition of lakes. When she and her colleagues pitch their tents in the wilderness in summer to measure trees and explore vegetation, they always do this together with researchers from Yakutsk University. Ulrike Herzschuh would hate to miss this longstanding cooperation: A Russian biologist, for instance, is investigating the well-preserved diatoms in lake sediments. They are typical indicators of the environmental conditions in different periods and offer valuable clues. Ulrike Herzschuh wants to find out how the Siberian timber line moves further to the north in the course of climate warming. If more trees grow there, more sunlight will be absorbed, thus increasing the warming. Since the forest "migrates" very slowly, this effect will only start in 100 years or later. This is an effect with a delay that is difficult to calculate in present climate models. Such long-term processes have consequences that are not easy to predict, for Herzschuh an appealing challenge that raises theoretical demands. After all, the permafrost regions of Siberia are considered key regions for global climate change. Ulrike Herzschuh has found important partners for her work in the Potsdam Research Network. At the university, she cooperates not only with geoscientists but also with biologists like the vegetation ecologist Professor Florian Jeltsch and the evolution scientist Professor Ralph Tiedemann. With Professor Tiedemann she established a palaeogenetic laboratory. A second one is being established at the Alfred Wegener Institute and will be open to scientists of the university, too.

ANTJE HORN-CONRAD

PEARLS OF SCIENCE

Each of these research institutes is unique. Together they want to make better use of their potential. Eighteen leading scientific institutes in Brandenburg followed the University of Potsdam's initiative in 2009 and joined forces within "pearls · Potsdam Research Network". They want to use synergies dovetailing research and education even more closely. Furthermore, they want to raise third-party funds more successfully and develop fields of research geared to the future.

www.pearlsofscience.de

Extra SHIFTS

Sonderschichten

Business Model Research

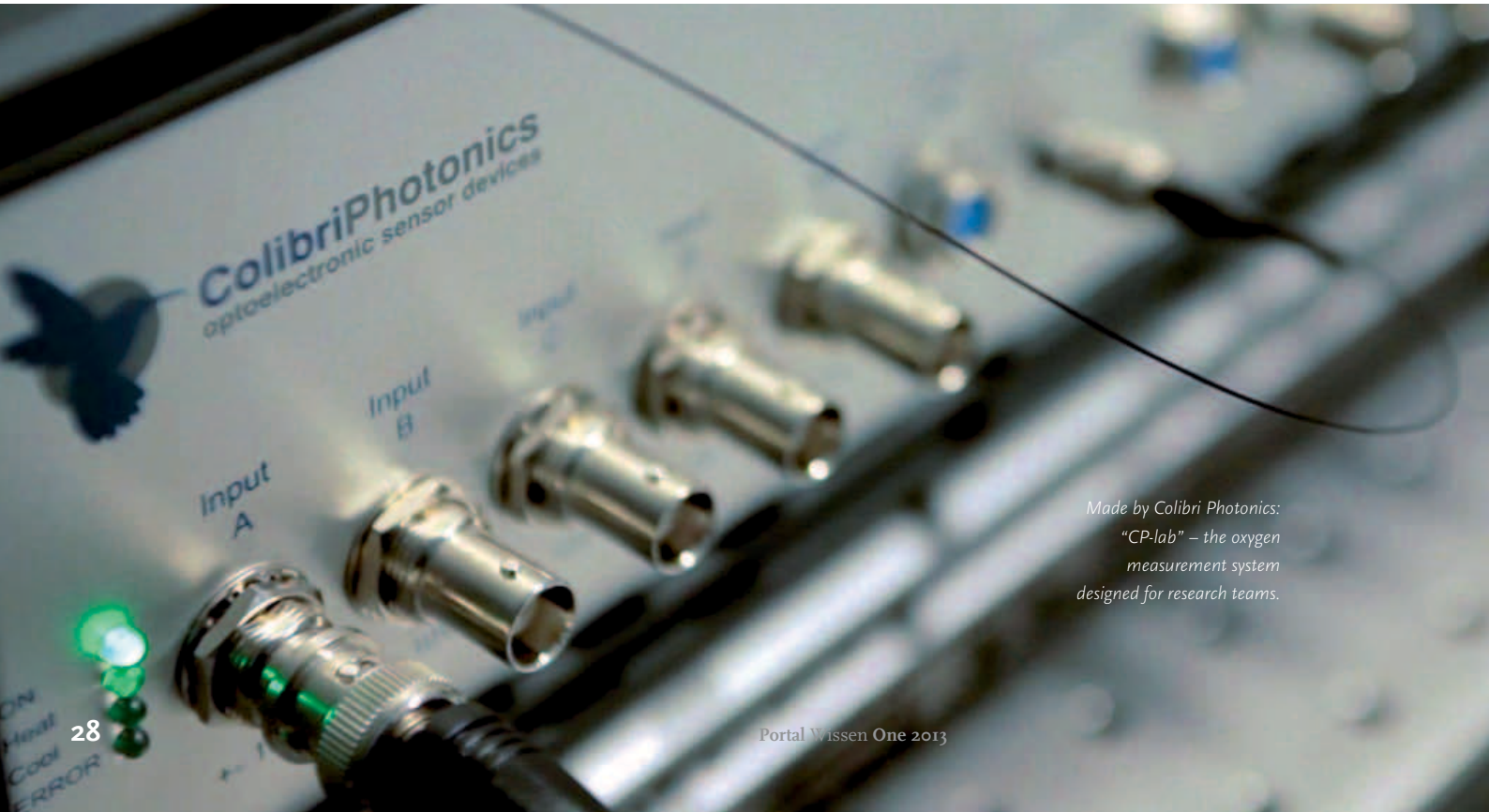
The Entrepreneurial Scientist

"Colibri Photonics" has existed since 2010. The company produces tiny sensors that scientists or medical doctors use for non-contact measurement of the oxygen content in very small tissue samples. The technology is based on dyes that phosphoresce more or less intensively when exposed to laser light depending on the concentration of oxygen.

Even to those who are not very experienced in business it will make sense that founding a high-tech company like Colibri Photonics needs three things: First you need technical expertise, second business know-how and third entrepreneurial spirit. The founding team of Colibri meets these prerequisites perfectly. Physicochemist Elmar Schmälzlin is mainly in charge of the technical aspects. He took his doctoral degree in nonlinear optics and worked as a sales engineer for optical communication technologies. In 2003 he started work at the University of Potsdam. Marvin Stolz, who graduated in business administration, has the logical, organisational, and strategic expertise.

Both of them have entrepreneurial spirit, clearly proven by the fact that they dared to set up a company. The University of Potsdam gave both the impulse and comprehensive support for their undertaking. Schmälzlin and Stolz did not meet by chance, but as a result of the university's long-term strategy to promote start-ups consistently and to distinguish itself as an entrepreneurial university.

Dieter Wagner, who was professor of business studies from 1993 to 2012 with the key areas organisation and HR management as well as Vice President of the University of Potsdam for many years, explains what this means. "From its very beginning, the University supported spin-offs of students and alumni. In the course of time this became more and more systematic. We were able to develop an integrated concept that links science and technology transfer with setting up companies. It is our vision that we can anchor the idea of using scientific findings in an entrepreneurial way throughout the university."



Made by Colibri Photonics: "CP-lab" – the oxygen measurement system designed for research teams.

THE COMPANY

Colibri Photonics specializes in minimally invasive, laser-based measurements of oxygen. The phosphorescent sensor material is either embedded in thin glass fibre or optical probes or extremely small polymer beads. Physicochemist Dr. Elmar Schmälzlin developed these sensors to application maturity, starting in 2003 as a Postdoc in the working groups of Professor Hans-Gerd Löhmannsröben at the Institute of Chemistry of the University of Potsdam. From 2011 to 2012 he was group leader at the Fraunhofer Institute of Applied Polymer Research IAP in Potsdam-Golm. Dipl. Kfm. Marvin Stolz, M. Sc. joined the working group in 2008 in the course of the project "InnoLaserSensor" of the ForMaT programme funded by the Federal Ministry of Education and Research at the Chair of Physical Chemistry. In 2010 Schmälzlin and Stolz founded their company and since 2012 they have both worked as entrepreneurs.

Contact

Colibri Photonics GmbH
Am Mühlenberg 11
14476 Potsdam OT Golm
marvin.stolz@colibri-photonics.com
schmaelzlin@colibri-photonics.com
www.colibri-photonics.com

The founders of Colibri – Dr. Elmar Schmälzlin (left) and Marvin Stolz.

Dieter Wagner is also Director of "Potsdam Transfer," the central scientific institution for start-ups, innovation, knowledge and technology transfer, which the university established in 2011 to streamline all activities that had existed so far. Patent services are among the traditional tasks of technology transfer. The location managers of the centre provide assistance to prospective founders and support them when they prepare their business plans. They also give them access to know-how and support programmes or establish contacts with a "Senior Coach," who helps them and shares his or her experience with them.
"Scouting" is another field of activity for Potsdam Transfer: collaborators who are familiar with the university and the markets look for applicable research results. They do this not only at the university but also at extramural institutions in Potsdam. If they have identified an interesting project, they will contact the scientists to explore any potential marketing opportunities and analyse the demand. It happens quite often that research scientists have to be convinced that their interesting results do not automatically mean climbing the next step on the academic career ladder.

This can change if you already encourage and practise entrepreneurship during the early stages of university career. Katharina Hölzle and her chair "Innovation Management and Entrepreneurship" work in this particular field. They offer courses for Master and Bachelor students in which the students can learn the basics of setting up a business. If they are interested, they can continue with technology and investment management as well as entrepreneurship, i.e. finding and implementing business ideas. These offers are not only for future graduates in business administration but also for those in other study courses and departments.

"Entrepreneurial personalities need self-confidence and role models for guidance."

"Entrepreneurial personalities need a good deal of self-confidence and some role models for orientation," Katharina Hölzle says, "the rest is skills that you can learn." Topics of these courses are market analyses, marketing, cost-benefit analysis and legal questions. However, as Hölzle says, in the course of their school time young people have often lost the courage to even consider setting up a business. "They often have the idea that thinking in an entrepreneurial way just means being eager for big money although it primarily means undertaking something." This is why the chair offers plenty of methods and formats to arouse interest among students to take their first steps towards self-employment while weighing the chances and risks objectively. The offers range from seminars and workshops for small groups to summer schools and business plan competitions. The participants practise by using fictitious firms, their own projects and case studies from the real world. Knowledge and experience of the consultants and scouts of Potsdam Transfer are often an integrated element. "We adjust the curriculum flexibly to the existing needs," Katharina Hölzle says.

Not only teaching but also research helps to introduce entrepreneurship at universities – and to make the entrepreneurial university the model for academia. Scientists of Potsdam Transfer, for instance, examine how to improve knowledge transfer, how careers of women in research develop and how small and medium-sized enterprises can employ their staff more flexibly.

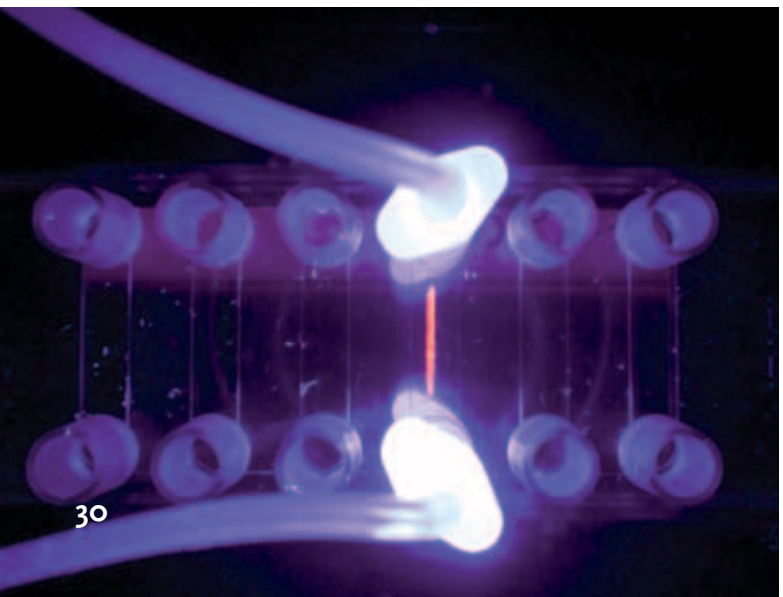
The results of their efforts speak for themselves. The number of spin-offs has increased from about 17 to more than 30 annually in the last four years. In 2011 there were even 37 start-ups, which came into being due to the support of scouts and consultants. For eight years in a row the teams from Potsdam have been awarded the top position of the "Ideenschmiede," a prize of the Berlin-Brandenburg Business Plan Competition for People Starting up in Business. In 2009 the University of Potsdam was among the ten universities that were chosen for the support programme "EXIST-IV" of the Federal Ministry of Economics and Technology (BMWi).

"Teaching and research will always remain an irreplaceable asset of our university," Dieter Wagner, who is meanwhile emeritus professor, says, "but universities are being made increasingly responsible for bringing something back to the region from the investment for progress in knowledge." Potsdam's starting point is ideal. It is in an economically weak region that has an enormous potential for innovation because the university is well networked with other scientific institutions in Potsdam, such as the Max Planck, Fraunhofer, Helmholtz, and Leibniz Institutes. Start-up companies find appropriate locations and contacts at the "GO:IN" Innovation Centre in Potsdam-Golm as well as in the start-up rooms of Potsdam Transfer. There is still a lot of space in the vicinity of Golm where high-tech companies could set up their businesses close to the research institutes.

The newly established companies work predominantly in the fields of services and consultancy. The percentage of technology-based start-ups is to be increased in the future. At the same time, it is important to spread entrepreneurship throughout the university. "Entrepreneurship culture, as it is sometimes called today, is to be established in all departments, from natural sciences to humanities, among professors and students, in management and administration. "As experts of start-ups we are the innovative core," says Enrico Sass, who is in charge of all services at Potsdam Transfer and head of the EXIST project, "but we continue to ensure that everybody identifies with the idea of an entrepreneurial university."

Back to Colibri Photonics. Elmar Schmälzlin and Marvin Stolz met during the project "Research for the Market in Teams" (ForMaT) of the Federal Ministry of Education and Research. Interdisciplinary teams of scientists and economists had to analyse the marketing potential of selected technologies during the first phase of the project. This was how Stolz, graduate in business administration, came to the Institute of Chemistry in 2008 where Schmälzlin was doing some research on the miniaturisation of molecular oxygen probes.

Microchannels prepared with oxygen sensors of Colibri Photonics



It did not take long until the two had joined forces and started to find out what niches there are for these instruments. "We spent the first three years talking to biologists, medical staff, and biotechnologists," Schmälzlin says. Stolz prepared a business plan with the assistance of the GO:IN Innovation Centre. It took three months until the finances were in place after the funding by ForMaT had expired. And in summer 2012 Colibri sold the first instruments to university labs. If things go well, the company will pass the break-even point for the first time in 2014. And the location Potsdam-Golm has another innovative company.

SABINE SÜTTERLIN

THE SCIENTISTS

Professor Katharina Hölzle has held the Chair of Innovation Management and Entrepreneurship since May 2011. She advises companies on questions of strategic technology and innovation management.

Contact
Universität Potsdam
Wirtschafts- und Sozialwissenschaftliche Fakultät
August-Bebel-Straße 89, 14482 Potsdam
✉ katharina.hoelzle@uni-potsdam.de

Professor Dieter Wagner held the Chair of Organisation and HR Management from 1993 until his retirement at the end of September 2012. His research interest focused on start-up management. Wagner was founding director of the Brandenburg Institute for Entrepreneurship and Small and Medium-Sized Enterprises (BiEM), that was established in 2001. In 2005 he set up the Centre for Entrepreneurship and Innovation of the University of Potsdam (BIEM-CEIP) together with his deceased colleague Professor Guido Reger. It was merged with Technology Transfer of the University of Potsdam (UP Transfer) in 2011. This is how Potsdam Transfer was established with Dieter Wagner as its director. Scientific assistant and head of Transfer Services is **Dr. Enrico Sass**. He is in charge of the EXIST-IV project at Potsdam Transfer.

Contact
Potsdam Transfer
Dortustraße 46, 14467 Potsdam
✉ kontakt@potsdam-transfer.de
✍ www.potsdam-transfer.de

Giving Teeth to Tooth Protection

Vulnerable protective layers, slippery polymers and enamel that repairs itself

We all know – sweet and sour things are not good for our teeth. A short aqueous citric acid bath is enough to affect the hard dental enamel. A look through the microscope shows a scene of destruction. The first signs are visible after only 30 seconds. A few minutes later, fissures are formed. It does not even take half an hour until so much calcium phosphate has been dissolved out that the shining surface of the tooth looks like a miniaturized cratered landscape. Caries-causing bacteria have an easy time now. They can now settle in and continue their destructive work, with the well-known, often painful and always irreversible consequences.

"A tooth is not bone," Andreas Taubert says raising his hands: "If something gets broken here, nothing will grow again." The chemist sees this fact as a big challenge. Taubert is professor of supramolecular chemistry and inorganic hybrid materials. For almost ten years he has examined how to produce inorganic materials in a controlled way. He and his research group look for chemical solutions to better protect enamel and to repair damage with minimally invasive methods. This means without drill and filling material.

Will it be possible to create the surface of a tooth in such a way that new calcium phosphate can be precipitated from saliva and the tooth can virtually repair itself? Although Taubert does time-consuming basic research, he considers this a concrete application: an additive to toothpaste or mouthwash, for instance, which prevents the withdrawal of calcium phosphate from enamel and initiates a process of remineralisation. The scientist estimates realistically that this will take another five to ten years.

First you have to find out what exactly happens on the tooth surface. Taubert is not a medical doctor but he has close contacts to the School of Dental Medicine at the University of Berne. They prepared the microscopic images of the acid attack on the enamel for him. They also raise the medical questions and provide him with the biological background knowledge. "A thin film from the proteins of saliva form on teeth soon after cleaning. This is called pellicle. It prevents abrasion caused by chewing and protects the enamel against the dangerous acid attack," the chemist explains and adds what the decisive problem is: "If you do not brush your teeth regularly, the protective film becomes the perfect culture medium for various bacteria – the basis for plaque."

"If anything gets broken here, nothing will grow again."

Thorough analyses of the pellicle have shown that a first generation of bacteria grows at the beginning, and later the harmful caries bacteria are deposited. To avoid this danger from the outset, Taubert's group is trying to produce polymers that interact with the protective film and should ensure that the first generation of bacteria cannot settle.

THE PROJECT
Bioinspired Calcium Phosphate Mineralization
www.chem.uni-potsdam.de/atb/index.htm

PhD candidate Tobias Mai (left) and Professor Andreas Taubert in the lab.

The destructive work: Under aqueous citric acid, smooth dental enamel shows cracks and deep cavities after a short time (from left to right).

So far the research scientists have experimented with two different types of polymers and analysed their interaction with the pellicle. PhD student Tobias Mai tested polyethylene glycol, a well-known industrial polymer to which bacteria cannot stick very well. He proved that the slippery effect of the polymer in the natural protective film of the tooth gets even stronger. "There seem to be synergies," Taubert says. "This is a very good start, but now we want to know how the effect comes about."

Each answer raises ten new questions. "I know that I am sometimes quite impatient," Taubert laughs and he tells us that he had to learn as a young scientist that research processes need time. He did not lose his contagious thirst for knowledge though. More than ten up-and-coming scientists are in his team. Like Tobias Mai there are some who "have sunk their teeth" into the dental topic. They very much appreciate the open and uncomplicated atmosphere in which each unexpected event becomes a source of new ideas. "We can also learn from intended strategies that did not work out. Nothing can go wrong actually," Tobias Mai says.

"Actually, nothing can go wrong."

Taubert encourages the young people to persevere, to overcome obstacles and not to be frustrated by failures. There are still lots of uncertainties when it comes to the crystallization of calcium phosphate that should grow on the damaged surface of the tooth and repair it. Only two of the over 20 calcium phosphates we know seem to fit at all: hydroxylapatite and fluorapatite. The scientists experimented with a gold surface first on which they let a brush-like polymer layer grow. It turned out to be a suitable "soil" for the crystallization of calcium phosphate. "Such model systems help us to better understand the very complex process of mineralization," Taubert says. The scientists do not know yet how the polymer layer will react to tooth surface or saliva. It is also unclear how calcium phosphate should find the correct spot in the mouth. "If it mineralizes in the wrong place, scale will form," Taubert explains the unwanted effect and shrugs.

The multitude of open questions does not distract the chemist. He sees himself at the intersection of basic and applied research. For him, specific technological problems in medical engineering are as spurring as biomimetics inspired by nature. Only when we understand how the body forms bones and teeth out of mineral crystals and organic macromolecules will we be able to artificially "replicate" similar composite material. And, Taubert says, the demand for this is increasing.

ANTJE HORN-CONRAD

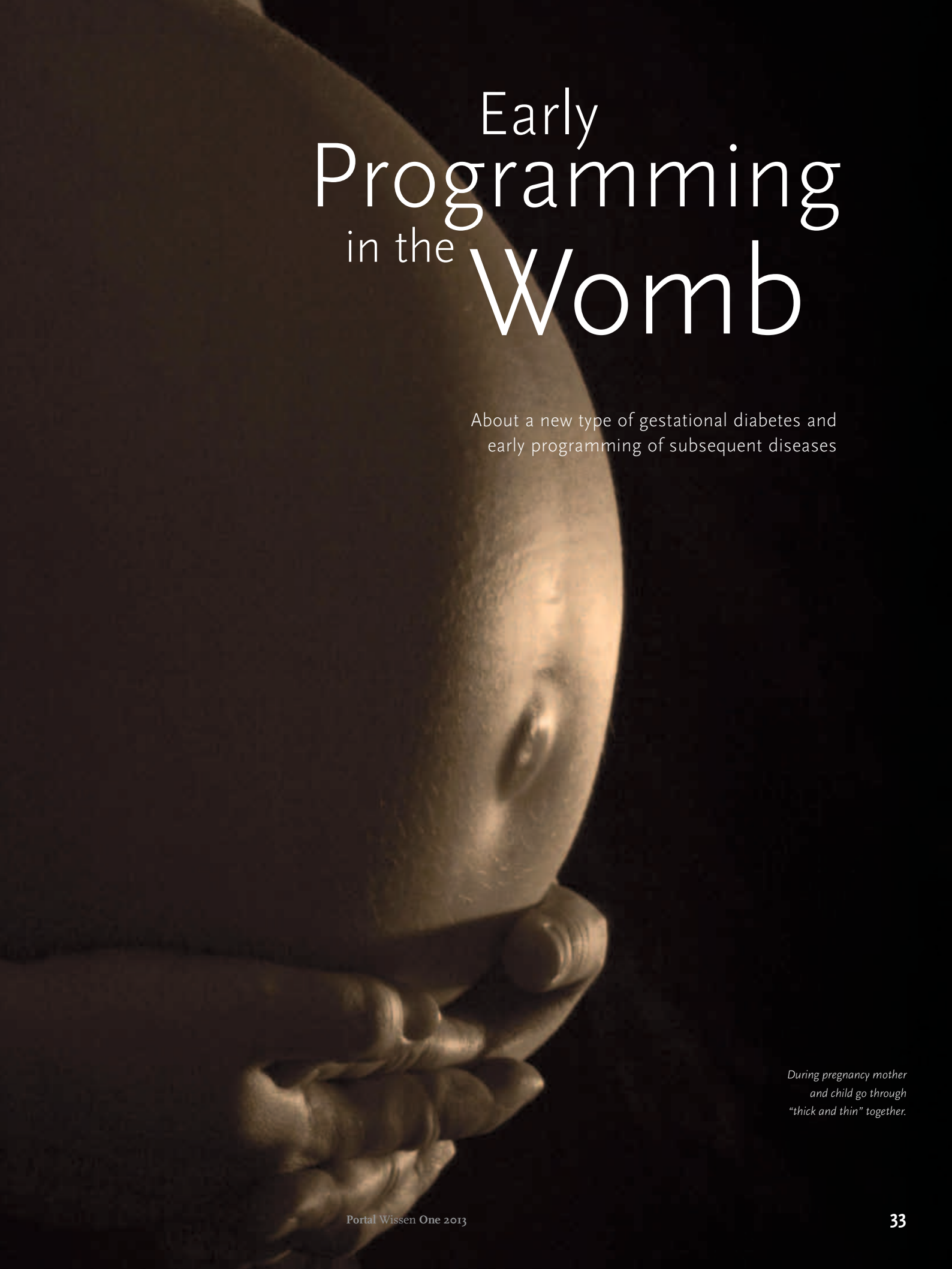
THE SCIENTIST

Professor Andreas Taubert studied chemistry in Basel. He took his PhD degree in Mainz in 2000. He became assistant professor at the University of Potsdam and at the Max Planck Institute of Colloids and Interfaces in 2006. Since 2011 he has been Associate Professor of Supramolecular Chemistry and Anorganic Hybrid Materials.

Contact
Universität Potsdam
Institut für Chemie
Karl-Liebknecht-Straße 24–25, 14476 Potsdam OT Golm
✉ ataubert@uni-potsdam.de

Early Programming in the Womb

About a new type of gestational diabetes and early programming of subsequent diseases



During pregnancy mother and child go through "thick and thin" together.

The publication in the scientific serial PNAS caused quite a stir. Together with scientists from the Netherlands, Germany, and Switzerland, nutritional scientists from the University of Potsdam succeeded in finding a cause of gestational diabetes that had been unknown so far. Berthold Hocher, medical expert and professor of experimental nutritional medicine, examined the mechanisms of insulin resistance caused by a mutation in the kidneys with his research group. In cases of magnesium deficiency, this insulin resistance can cause diabetes mellitus during pregnancy.

"In cases of gestational diabetes, the risks for the child are not insignificant," Berthold Hocher explains. "Due to the increased carbohydrate supply through the blood, the foetus gains weight which can lead to problems during childbirth." At the same time it causes dysmaturity of internal organs. When the maternal supply of sugar stops after birth, it causes hypoglycaemia. The implications might be visible only after many years because the child is at a higher risk of developing diabetes later in life.

"Are diseases already founded in the foetus that manifest in adulthood?"

For Berthold Hocher this early imprinting of the unborn child during pregnancy has become an important research field. Being a specialist in internal medicine and a nephrologist at the Berlin university hospital Charité, he has very often been consulted when women had health problems during pregnancy. There has always been the question about the influence of a mother's illness on the development of a child. Are diseases established in the foetus during this early stage of development that manifest themselves in adulthood?

"Foetal programming" is the name of this relatively new field of research, which is gaining in significance. "Twenty years ago one started to understand that there is a connection between pregnancy and later diseases of the offspring," Hocher says. The British epidemiologist David Barker was the first to put forward this hypothesis. He evaluated statistics which suggested that the mortality rate of newborns was particularly high in the disadvantaged coal-mining regions of England around 1900. About 60

NEW TYPE OF GESTATIONAL DIABETES

Until now, hypomagnesemia during pregnancy was seen as one of the main reasons for hypertension. Now a connection to the development of gestational diabetes has been confirmed for the first time. Pregnant women without previously diagnosed diabetes suddenly exhibit high blood glucose levels. There is a mutation in two to three per cent of all women, which inhibits the transportation of magnesium from the primary urine back to the body in tubules of the kidneys. The considerable loss of magnesium during pregnancy gets even higher. Magnesium is a significant factor contributing to insulin resistance. The risk of developing diabetes increases.

Foetal development adjusts to the environment – for good or worse.

years later there was a high fatality rate from cardiovascular diseases in the same region. Barker assumed that the bad living conditions of pregnant women caused the high infant mortality as well as the cardiovascular diseases later. He found more proof in the records of midwife Ethel Margaret Burnside from 1917. The British Ministry of Defence had commissioned her to give health care advice to young mothers and to look after them because the ministry was concerned about the "children of the country". Midwives noted weight, food, and growth of the infants meticulously. David Barker was able to use this "database" fifty years later to show the interrelation between low birth weight and the risk of fatal cardiovascular diseases later in life. Another study from the Netherlands shows that high numbers of children born during the "Hunger Winter" of 1944 suffered from type-2 diabetes later in life. Their mothers ingested only 400 to 800 kilocalories per day during their pregnancies.

Meanwhile, nutritional physiologists and medical experts like Berthold Hocher can prove the possible effects of such critical events during the early phase of life on a molecular level, not only for malnutrition but also supernutrition of mothers. Animal experiments suggest that male offspring of pregnant rats on high protein diet suffer from hypertension, whereas female offspring tend to deposit a lot of fat. In the nine months when the human foetus matures, there are short periods during which certain functions of metabolism are established and then remain the same for the whole life. Hocher demands more awareness of, and sensitivity for, such risks in antenatal care. "It is a well-known fact that nicotine is harmful for the unborn child. Nevertheless, a lot of pregnant women smoke," he remarks and then explains that such negative environmental influences could lead to structural modifications in genes. "Epigenetic modifications of the DNA causing diseases in later life can occur upon environmental stimuli like under-nutrition, over-neutrino or smoking of the pregnant mothers very easily during the early phase of life. Adjustment to the environment happens relatively quickly." Hocher includes excessive stress of the mother in the critical events that can lead to foetal programming. The placenta usually protects the foetus from the stress hormone cortisol. If the unborn is affected, however, there is an increased risk of suffering from arteriosclerosis as an adult. A high cortisol level in pregnant women also reduces the brain volume of the child. "The related cognitive deficits and language disorders often only become apparent when the child starts to go to school," Hocher says.

The scientist sees the share of foetal programming in relation to hereditary transmission at 30 per cent. When we understand the processes of early programming in the womb exactly, we have to ask ourselves whether it is possible to "reprogramme" them. "There are first clues but we are still at the very beginning," Hocher says. "However, it would be a step forward to have routine diabetes check-ups for all pregnant women and to start treatment in time if necessary." The earlier we take countermeasures, the lower the risk that children are born with an insulin resistance and become diabetics themselves in the course of their lives.

"Hocher sees excessive maternal stress among the critical events."

ANTJE HORN-CONRAD

THE SCIENTIST

Professor Berthold Hocher, specialist in internal medicine and nephrologist at the university hospital Charité, is now Professor of Experimental Nutritional Medicine (Solvay Personal Chair) at the Institute for Nutritional Science at the Faculty of Science of the University of Potsdam.

Contact
Universität Potsdam
Institut für Ernährungswissenschaften
Arthur-Scheunert-Allee 114–116
14558 Nuthetal OT Bergholz-Rehbrücke
✉ hocher@uni-potsdam.de

Surviving through Recall

How Plants Learn

Drought, heat, caterpillars, hail – plants cannot run away from dangerous situations. They have to cope with stress in a different way. Biologists are presently on the track of a phenomenon that they call „molecular plant memory". Molecular biologist Isabel Bäurle examines the role played by the genome packaging of a plant.

Two small green seed leaves on a tiny stipe – the delicate little plants are six days old. They grow on a light, gel-like culture medium in a closed petri dish. In "their" culture cabinet at the Institute of Biochemistry and Biology on the Campus Golm they feel very well. 16 hours a day the light shines, the temperature is at 23 degrees Celsius. These are ideal conditions for growth. What the young seedlings of Arabidopsis will have to endure in a few hours not all of them will survive. For an hour they will be exposed to a temperature of 44 degrees Celsius in the lab – heat stress that only well-adapted plants can bear.

"We are interested in the stress memory of plants."

Isabel Bäurle takes a close look at the petri dish in her hand. The bottom of the dish is divided into six different sectors that are marked by black lines. In each sector the growing plants have a slightly different genotype that was changed by mutation. The molecular biologist wants to find out why some plants survive the heat and others die. "We are interested in the stress memory of the plants," the scientist explains. She got the renowned Sofja Kovalevskaja Award and is doing research as a visiting professor at the University of Potsdam in the next five years. With the prize money of 1.65 million Euros granted by the Alexander von Humboldt Foundation, she is setting up her own research group. In addition, she was appointed to the junior professorship Epigenetics of Plants at the University of Potsdam just recently.

Before the heat begins – test plants in the lab.

The plantlets in the petri dish will not experience heat for the first time in their young lives. They have already survived a temperature of 37 degrees Celsius to which they were exposed once without any problems. The scientists know by now: Through such a "heat training" plants can survive a second, potentially fatal, heat event. However, without such adaptation they will not live on. The plants also react with adaptation to other stressors like drought or traumas due to animals. Little research has been done to date about how this adaptation is maintained or how the information of an experienced stress reaction is stored. Biologists assume that plants have a kind of

molecular memory that enables them to react to stress they have experienced before faster and more efficiently when it occurs a second time.

The key to plant memory lies in the DNA. "We think that certain genes are responsible, which are switched on by stress," Isabel Bäurle explains. Genes activated in this way contain the code for specific proteins that protect the plant – for instance by modifying the cell membranes. "Our central hypothesis says that genes switched on as a result of stress will be active much faster in the next stress event," Bäurle says. First results indicate that the reasons for this lie in a modified structure of the proteins that wrap the DNA.

In the laboratory, the biologist works with mutants of the Arabidopsis that have a modified stress memory. The scientists bred more than 5,000 mutations by treating the plant seed with chemical mutagens. Randomly distributed mutations developed in the genetic material of the plants in this way. Then the researchers tested which of these plants had the ability to establish a heat memory. Some of them lost their molecular stress memory and became "forgetful". Some others had longer lasting "powers of recall" for stress situations. If the researchers identify those genes in them that were modified by mutations, this will indicate the genes that are responsible for the heat stress memory in wild types.

"It is our goal to provide our knowledge for breeding better adapted agricultural crop," Isabel Bäurle explains. Stress-resistant crop will play an increasingly important role in agriculture in view of climate change with its anticipated growing number of heat and drought periods. "Plants cannot run away from stress. They have to cope with it at the location of their habitat," the biologist states.

Before Isabel Bäurle came to Potsdam, she had done research at the John Innes Centre in Norwich, England for five years. There she already focused on the memory of plants in her work. She investigated vernalization. This is how biologists call the phenomenon that certain plants only flower after exposure to a prolonged cold period. She can resort to the methods she learnt in England to investigate the molecular memory of plants in her present research work.

Isabel Bäurle is group leader and supervises five doctoral candidates and several staff members and students. Establishing a new team is an exciting challenge for her. You can achieve more with a team than alone. "You also have to be a bit of a manager," she points out. But the 38-years old biologist has already gained experience with this in her private life. She is the mother of two young children. She returned from her parental leave just a few months ago. "Organisation, self-discipline, and support of the family" helped her to manage the balance between family and scientific career.

"Plants cannot run away from stress."

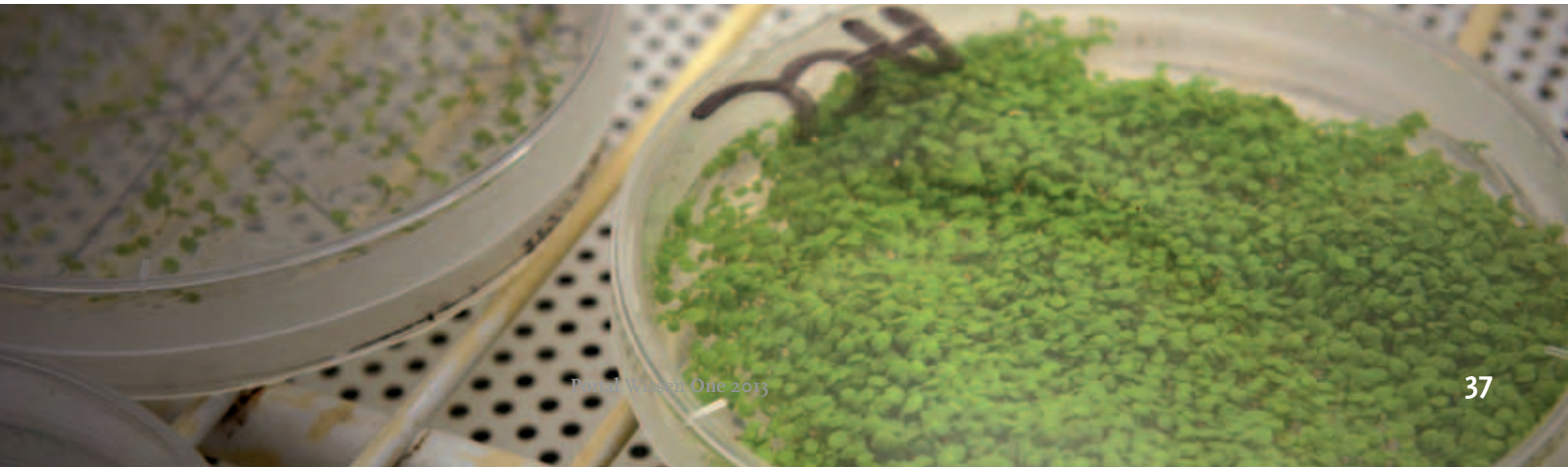
She puts the petri dish with the Arabidopsis seedlings back into the lit-up culture cabinet. Some of these plants will be just dry and faded rests the next day. The others will grow on.

HEIKE KAMPE

THE SCIENTIST

Dr. Isabel Bäurle studied biology in Freiburg. At present she is visiting professor in the group on the molecular memory of plants of Professor Bernd Müller-Röber. She was recently appointed to the junior professorship of Epigenetics of Plants at the University of Potsdam.

Contact
Universität Potsdam
Institut für Biochemie und Biologie
Karl-Liebknecht-Str. 24–25, 14476 Potsdam OT Golm
✉ isabel.baeurle@uni-potsdam.de



Social STRATUMS

Gesellschaftsschichten

"Wicked Problems"

Young academics investigate "Contested Public Administration"

Science rarely seems to be simple because it tries to explore the unexplored and to understand what has not been understood so far. The questions and problems it deals with are often complicated, tricky or complex. Or they are even "wicked". The Research Training Group that was started at the Faculty of Economics and Social Sciences of the University of Potsdam in October 2012, as its name suggests, has taken up the cause of such "wicked problems".

There are problems that are as simple as the solutions to overcome them: "If you want to make sure that only those can enter a car park who are allowed to do so, you just put a barrier in front of it," Professor Klaus H. Goetz says. The Professor of Politics and Governance in Germany and Europe was the first spokesperson of the new DFG-funded research training group "Wicked Problems, Contested Administrations" in Potsdam. In October 2012 young researchers started to examine how modern public administration responds to pressing political problems that cannot be easily solved. "Wicked problems," a term that has been used in English-speaking management sciences for quite a while, have a particular quality compared to others," Goetz explains. There are actually three distinct features. First, wicked problems are complex and often involve several levels. Administrational institutions from local to international levels and of different sizes may be affected by the same problem. Perhaps they have to implement an international protocol on climate change, for instance. Secondly, wicked problems are bound up with a lot of uncertainty regarding the means that are used and the purpose they should achieve. It is often very unclear whether the aims of an action can be implemented with the envisaged measures at all. While a car park barrier keeps out unwanted cars, it is not clear whether the reduction of CO_2 emissions will delay climate change. And thirdly, wicked problems are ambiguous. The involved parties often do not agree what the actual problem is. Even experts do not reach a consensus when formulating the problem because of insufficient or contradictory information. When natural scientists have to "translate" findings into political or administrative actions, for instance regarding environmental questions, we can observe ambiguity.

The young scientists of the training group do not primarily deal with the wicked problems in their doctoral theses. "We do not investigate the problems as such, but rather how administrative bodies handle them," Bertolt Wenzel, one of the eight PhD candidates, says. He wants to find out in his project what are the means used by political actors in Europe to stop or reduce marine pollution. The interesting aspect is that European institutions like the European Commission and regional bodies have to work together for this aim. "I want to analyse whether this form of cooperation will lead to a juxtaposition of institutions disturbing each other or to a more effective solution to the problems," Wenzel says. The PhD candidates focus on investigating how public administration at all levels tries to meet the varied challenges they are confronted with. In their individual projects they also examine questions like: From where does an administration department get the information that is the basis of its decision-making? How does it handle it? What does it decide and how does it act afterwards? The aim is to get a comprehensive insight into how administrative units collect and coordinate knowledge and prepare it for political decision-makers to have it available when it is needed. Goetz says, "Just a few experts were interested in swine flu and what you can do against it before it spread. Administrative bodies have to hold available an inventory of knowledge so that it can be used at the right time to take political decisions on a broad basis."

"There is often no consensus about the actual problem."

WICKED PROBLEMS

"Wicked Problems" stand out through a high degree of complexity, uncertainty, and ambiguity. This is why they are a fundamental challenge for institutions of public administration – at local, national, and international level. The term "wicked problems" has been used in English-speaking social sciences since the 1960s. For the Research Training Group "Wicked Problems, Contested Administrations: Knowledge, Coordination, Strategy" it has been translated into German.

The research scientists are interested in the question: who will find which solutions?

The theoretical and methodological approaches of the individual research projects are different. After all, the research training group is an interdisciplinary team. Twelve professors of the Faculty of Economics and Social Sciences are involved, i.e. scientists in public management and governance, but also sociologists and business economists. They all have a common interest in "wicked problems" and the strategies used by public administration to handle them.

Correspondingly, the topics of the eight individual projects are manifold. How does tax administration of international financial flows work in the 21st century? How does the administration of secret services work after the end of the Cold War? Four PhD candidates are working on the attempts being made by administrative bodies ranging from the municipal to the international level to translate climate protection into administrative activities.

"Showing trends and patterns when confronted with wicked problems."

Proceeding from the specific nature of these problems, the obvious thing is to include a wide range of them. "Many wicked problems are unique in their specific form," Goetz says, "as are the approaches of administration to solve them. We want to reflect some of the experimental processes with our thematic variety of projects. We want to show how administrative solutions are tested and how they are rejected." A young scientist is examining, for instance, what is the potential significance of Design Thinking for public administration. However, it is not the primary goal of the research training group to prepare a manual of wicked problems: "A manual 'Ten ways how to deal with wicked problems' will not evolve from the project," Klaus H. Goetz says. "But we hope to show trends and patterns when confronted with wicked problems and also solution strategies that are more appropriate than others."

Like the problems they are dealing with, the PhD candidates should cross borders and network internationally. The official language of the research training group is English. Part of the financial means is scheduled for inviting international visiting professors on a regular basis. Meetings, conferences, and an annual international workshop for PhD candidates with their partners in the Norwegian town of Bergen and in Stockholm will ensure that the research work of the young scientists and also the relevant projects of the participating professors complement and enhance each other.

However, the vision of the pioneers in this research training group goes further. According to Goetz, the DFG-funded project can form the basis of a structured training of doctoral students at the entire faculty later on. As many doctoral students as possible should benefit from the proposals that are developed by the scientists of the research training group. These proposals range from tailor-made qualification programmes via the equal opportunities programme, which is considered a model university-wide, to international cooperation. "In this way, a contour-forming research programme will initiate, at the same time, sustainable promotion of young researchers," Klaus H. Goetz underlines. And this is not a problem, but a solution.

MATTHIAS ZIMMERMANN

THE PROJECT

Research Training Group on "Wicked Problems, Contested Administrations: Knowledge, Coordination, Strategy" (Graduiertenkolleg „Von vertrackten Problemen und herausgeforderten Verwaltungen: Wissen, Koordination, Strategie")

Speaker: Professor Klaus H. Goetz (Politik und Regieren in Deutschland und Europa)
Financed by: Deutsche Forschungsgemeinschaft (DFG)
Duration: October 2012 to March 2017
www.wipcad-potsdam.de

Cross over

Political scientists from Potsdam are dealing with the challenges of climate change

Climate change is among those topics that are discussed the most intensively all over the world. Even if it is not evident at first glance, these are often complex political problems by now. This is why natural and political scientists at the University of Potsdam work closely together – in the project PROGRESS.

Rising sea level or storm surges: The Baltic Sea also bears climate risks.

THE PROJECT

Potsdam Research Cluster for Georisk Analysis, Environmental Change and Sustainability

Participating: Universität Potsdam, Deutsches GeoForschungsZentrum (GFZ), Potsdam-Institut für Klimafolgenforschung (PIK), Hasso-Plattner-Institut für Softwaresystemtechnik (HPI), Alfred-Wegener-Institut (AWI), Hochschule für Film und Fernsehen „Konrad Wolf“ (HFF), Leibniz-Institut für Regionalentwicklung und Strukturplanung e.V. (IRS)

Financed by: Bundesministerium für Bildung und Forschung (BMBF)

Duration: 2009 to 2013

www.earth-in-progress.de

"If we want to react to current problems like climate change better and more sustainably, we do not only depend on natural scientific findings but, above all, on the way that political administrative systems recognize this knowledge and process it accordingly," Werner Jann, Professor of Political Science, Administration, and Organisation, is certain. "And this is exactly our special field." The question is how governments, administrative bodies as well as the interaction between different levels of public administration, civil society, and science have to be organised to identify problems and to react to them. It is important to the researcher that natural scientific findings can be realized quickly and correctly by administration departments. These findings have to "match" internal administrative structures and processes but also enable administration to articulate its need with regard to natural scientific findings.

"I highly appreciate the readiness of geoscientists to cooperate with us."

According to Werner Jann this joint project is "a great chance for the University of Potsdam". PROGRESS stands for Potsdam Research Cluster for Georisk Analysis, Environmental Change and Sustainability. A part of PROGRESS is the research project Governance Structures – Institutions and Policy-Making. From a perspective of political science and public administration the project analyses how different actors in the Baltic Sea Region deal with the problem of climate change. This provides new opportunities for cooperation of two focus areas at the University of Potsdam: Public Policy and Management as well as Earth Sciences and Integrated Earth System Analysis. "I highly appreciate the readiness of geoscientists to cooperate with us," Werner Jann says. Such kind of cooperation is certainly not a standard. Among the partners of the political scientists are also the Potsdam Institute for Climate Impact Research, the German Research Centre for Geosciences and the Alfred Wegener Institute.

Climate change is a political phenomenon with many layers. It affects the international, national as well as regional and local levels of public policy. Within the PROGRESS

Political scientists investigate how policy and administration deal with climate risks.

project, the political scientists examine which institutional arrangements, organisational structures, and coordination processes are developed as a consequence of increasing climate risks, like for instance an increasing sea level and more storm surges in the Baltic Sea Region. The central question is: Which solutions can they provide and how do they influence formulating concrete strategies in policy making? On a national level, for instance, the project focuses on the interplay between political, administrative, social, and scientific actors. The scientists investigate to what extent international administrative bodies learn from best practices in other countries, on other political levels and also from their own past. They compare Western and Central Eastern European countries in the Baltic Sea Region, focusing on Sweden, Finland, Denmark, Germany, Poland, and Estonia. Furthermore, they analyse how regional organisation like the Union of the Baltic Cities, the Council of the Baltic Sea States or the Helsinki Commission respond to climate change. The project also looks into climate policy making and the respective governance structures of the European Commission "The project aims at", Werner Jann explains, "describing and understanding how specific governance structures affect the capacity of actors at national, regional, and European levels." Only if we know which institutional arrangements facilitate long-term and coordinated solutions and which ones are more likely to be an obstacle, it will be possible to develop best practices and recommendations for certain organisational structures and concrete policy making.

"To what extent does international public administration learn from best practices in other countries, other political levels and also from their own past?"

"We conducted a lot of interviews and organised computer-assisted surveys in the ministries of the Baltic States and at the EU Commission," Jann says. Problems occur both in generating and disseminating the knowledge and in coordination. What is more, there are a lot of conflicts because the ministry of agriculture looks at a situation from a different angle than the ministry of energy or transport. The different perspectives raise the question: How do we achieve coordinated and sustainable political strategies? This is where the scientists of Potsdam come in. "We are dealing with conflict resolution, coordination, planning processes, and general decisions from positions of uncertainty," Werner Jann says. The scientists do not only contact scientific colleagues but also representatives of practical policy making, a field where the political scientists of Potsdam have a lot of experience. The professors of Werner Jann's focus area work as consultants for governments, the OECD, and the United Nations. Jann says that you have to engage in a productive dialogue with those working in the field convincing them to reconsider their views and thus to bring about change. Continuous communication with practitioners and presence at meetings and conferences help to maintain contacts. "Political advisory work is a continuous process of education." You cannot act on the assumption that preparing an expert opinion will change the world overnight.

Not all strategies can be used to the same extent at every place. "When we have understood how reasonable coordination, long-term planning and sustainable political programmes work in the Baltic Sea region, we will be able to apply our experience in Indonesia or Bangladesh, for instance." First you have to establish what works in an advanced system. If a master plan does not work out in the Baltic region, it is highly unlikely that it will be useful in Bangladesh.

"Political advisory work is a continuous process of education."

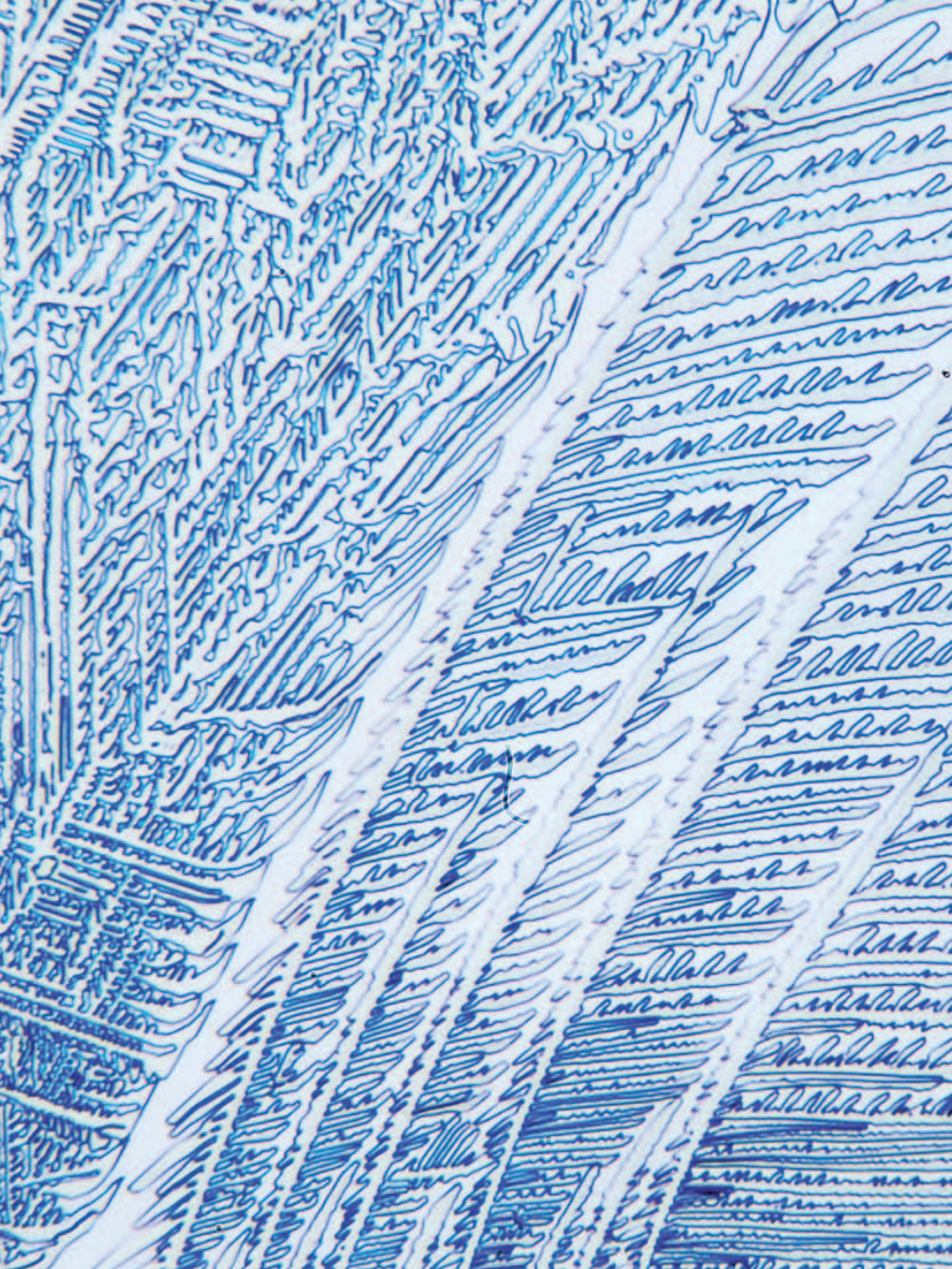
Natural and political scientists approach their research topics in very different ways. Natural scientists develop models that are as reliable as possible. Political scientists rather proceed from uncertainty and ignorance. "We think that we will not have full knowledge regarding georisks in the foreseeable future and perhaps we never will," Werner Jann thinks. Nevertheless, administrative bodies have to react to them and research has to be involved – and this is exactly why natural and social scientists should work together.

DR. BARBARA ECKARDT

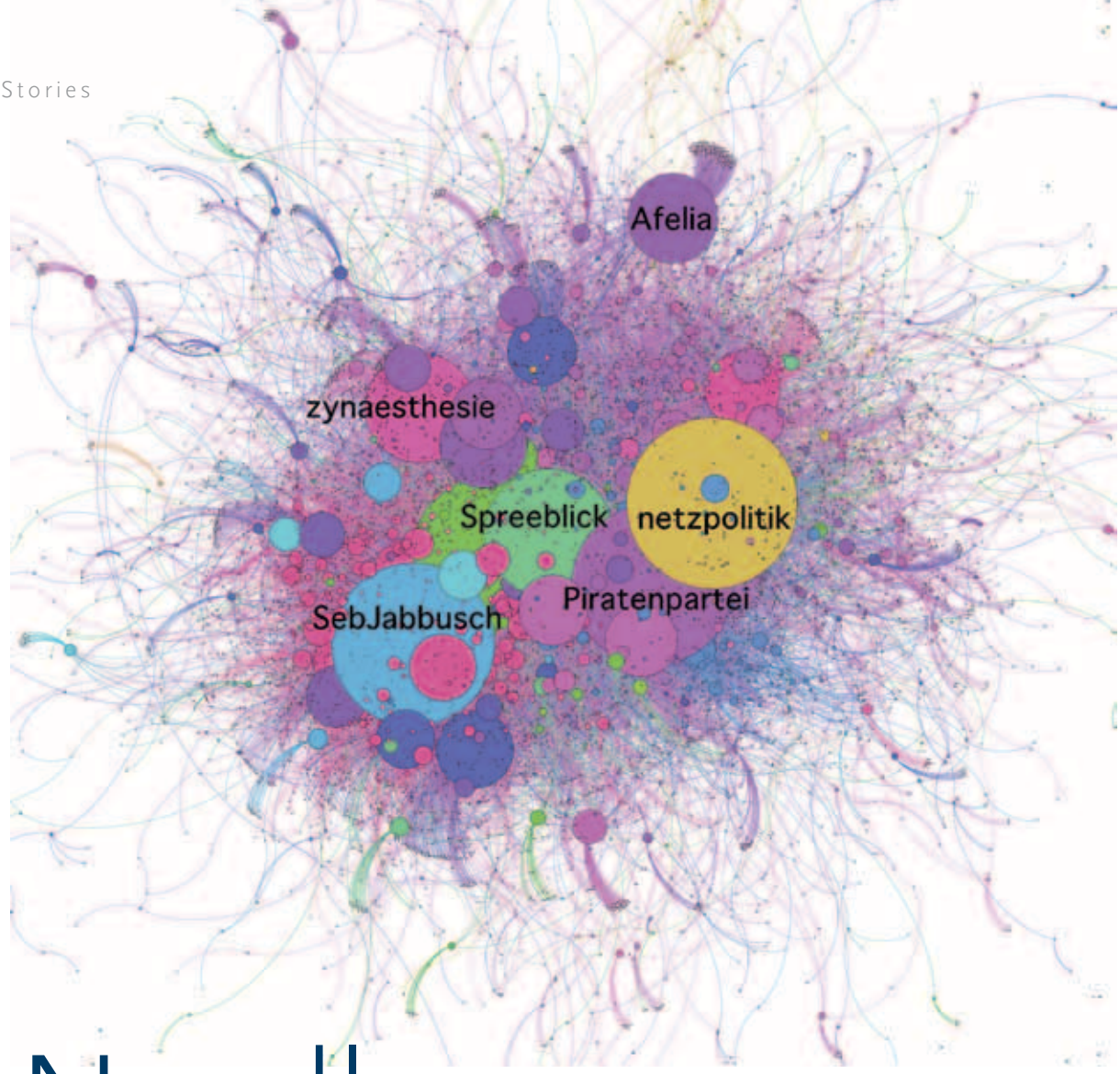
THE SCIENTIST

Professor Werner Jann studied political sciences, mathematics, and economics in Berlin and Edinburgh, Scotland. Since 1993 he has been Professor for Political Science, Administration and Organisation at the Faculty of Economics and Social Sciences at the University of Potsdam. He is also spokesperson of the Focus Area Public Policy and Management.

Contact
Universität Potsdam
Wirtschafts- und Sozialwissenschaftliche Fakultät
August-Bebel-Straße 89, 14482 Potsdam
✉ jann@uni-potsdam.de




Science
STORIES
Geschichten



Who speaks about what – and where? Analysing social media communication is Sisyphus work.

Needles in a Haystack

Project Group: Analysis of Opinion-Forming on the Internet

Social media have changed the world of public communication. Through applications such as Twitter, Facebook, and blogs, the opportunities for public communication have expanded, and individual and collective actors of all types participate as speakers in public discourses. Journalistic "gatekeepers" on the Internet are no longer mediators of topics and opinions. This development has an impact: Processes and structures of current discourses are changing. Topic arcs and opinions take other routes than in traditional media. Scientists from Potsdam take part in a project group that will examine this phenomenon. They want to develop and evaluate automated procedures that can be used to analyse large amounts of digital texts from online discourses. This might answer important questions in communication science.

THE PROJECT
Analysis of Opinion-Forming on the Internet ("Analyse von Diskursen in Social Media")
Project coordinator: Professor Stefan Stieglitz (Westfälische Wilhelms-Universität Münster)
Duration: 2012 to 2015
Financed by: Bundesministerium für Bildung und Forschung (BMBF)
www.social-media-analytics.org./de

According to which patterns do topics spread on the Internet? How does opinion-forming take place? Science has not answered these questions yet. This is why scientists at the universities of Potsdam, Münster, Munich, and Stuttgart-Hohenheim examine the course of political communication on the Internet. The Federal Ministry of Education and Research (BMBF) funds the project with a total of 800,000 Euros until summer 2015.

Facebook, Twitter, and blogs will be examined in more detail. The participating teams are confronted with a lot of questions: Do citizens really gain influence in the democratic process with these media? Or does the power over public opinion remain in the hands of a few? How does the media environment influence the quality of the discussions? They want to find the answers to these questions with the help of new interdisciplinary methods.

The research group "Analysis of Discourses in Social Media" wants to develop exactly these methods. The prospects of success are very good. The conditions are certainly excellent. After all, scientists of various disciplines are collaborating in the project: leading experts for information systems from Münster, computational linguists from Potsdam and communication scientists from Munich and Stuttgart-Hohenheim. Once the methods have been developed, it will be possible to analyse and evaluate large amounts of text from the Internet semi-automatically. The idea is also to record the networks between postings, i.e. the connections resulting from hyperlinks or sending short text messages, so-called tweets. The latter would help considerably to get a much better understanding of channels for spreading information and the influence of individual nodes.

"We want to analyse the different types of social media with the help of prototypical software."

"We want to analyse the different types of social media texts with prototypic software and structure them on the macro level. To do this, we first have to analyse the sentiments and attitudes, as well as the quality of a discourse. This will provide us with an insight into the type of the respective utterance and the existing dynamics on the micro level of individual tweets. The analysis will be extended to entire discourses through combining automated and manual procedures," Professor Manfred Stede explains the approach. The computational linguist has taken over the management of Potsdam's part in the project. The project may provide new insights and ideas for scholars in the humanities and social sciences in particular.

Much will depend on how well Stede's team can do their job: the customized application of computational methods to Internet texts. Only if this works out, they will lift the "secret" of emerging networks of contributions about a specific topic. Stede and two of his PhD students are looking for the proverbial needle in the haystack. It is their aim to create a set of instruments that will signal whether social media texts are assessments of events or persons. This tool has to recognize that the sentence "I watched the news on BBC." does not contain any assessment. On the other hand, it has to detect the doubly negative assessment in the sentence "Gauck is even worse than Wulff". This presents a real challenge to the scientists. They intend to classify these expressions of subjectivity in a way that makes it possible to quantify open or just encoded attitudes and possibly the reference to other postings. Furthermore, they want to prepare methods to determine the quality of social media statements and comments. Both these methods serve to support the human analyst with automated means.

"Stede and two PhD candidates are looking for the proverbial needle in the haystack."

Manfred Stede is aware of the great expectations, but the pressure does not put him on edge. On the contrary, the project work fascinates him. It is exciting to adapt the existing tools, i.e. the systems for language identification, for determining parts of speech or syntax, to the new types of texts, he says. The computer scientist is looking forward to contributing to fully automatic identification of irony and sarcasm. In computational linguistics, there are already preliminary approaches for different languages to an automatic identification of irony in Internet communication. "They draw on features like certain emoticons and abbreviations, the excessive use of punctuation marks and lexical exaggerations. It seems that articles also play a role in some languages," Stede explains. Now it is important to find out to what extent these and other features exist in German tweets. "Here we will break new ground, at least when it comes to the automatic analysis."

Stede's group is running a kind of test prior to the actual analysis. The group received a large set of data about the "case" of the former Federal President Christian Wulff, which they use to test the suitability of the existing tools. These are all Twitter data: 253,172 tweets comprising almost four million words. However, the number of contributions to be analysed will be smaller. Foreign-language texts and tweets referring to other people with the name Wulff can be omitted, as well as URLs and duplicates. More than one million words will remain.

"We have made good progress in our research," Stede states. "First we have classified certain linguistic phenomena to be able to use our tools and to modify them if necessary." This was inevitable because Twitter texts have specific characteristics. In the meantime, a whole catalogue of "interference factors" has been accumulated. It includes morphological, lexical, syntactical and semantic problems but also typical spelling mistakes,

SELECTION OF TWITTER-SPECIFIC PROBLEMS

Hashtags
Hashtags are words led by a #-sign. The tags mark specifically interesting and recurring Twitter topics. The computer programmes that have been developed for analyses do not comprehend that "#Wulff" and "Wulff" refer to the same word and person.

Colloquial language and slang words
They often appear on Twitter because people often have everyday conversations and exchange their opinions. German example: „#Wulff soll im Amt bleiben und wuppen für die Kohle!" (#Wulff should stay in office and bust his back for the dough.)

Intersentential irony
This occurs when two or more statements result in an ironic connotation. German example: „Ich lese immer Frau Merkel stellt sich hinter #Wulff ... Er steht am Abgrund, da ist dahinter besser ☺)). (I often read that Mrs Merkel backs Wulff ... He is standing on the brink of disaster so in his back is safer.)

Research material: Twitter messages

smileys, and emoticons. Uladzimir Sidorenko, PhD student, mainly took care of these phenomena. He has to arrange for the normalization of text data and explore possible "pitfalls" for conventional computer programmes. The Belorussian shares his work on the tools with the PhD student Andreas Peldszus, who is dealing with coreference resolution at the moment. For computational linguists this is the automatic identification of pronouns and names that pick out the same person or entity. The next task after processing Twitter will be the analysis of Facebook. "This will be less time-consuming", Stede hypothesises. „The texts are better structured." It is still completely open which political scandal will be in the focus of the corpus data. "We are actually waiting for new disclosures," team member Sidorenko says. This will be true all the more during the hot phase of analyses. The scientists in Münster will record online datasets for 14 days and send them to Potsdam for evaluation. They will start in 2013.

PETRA GÖRLICH

THE SCIENTISTS

Professor Manfred Stede studied computer science and linguistics at the Technische Universität Berlin; in 1996 PhD degree in computer science at the University of Toronto. Since 2001 he has been Professor of Applied Computational Linguistics at the University of Potsdam.

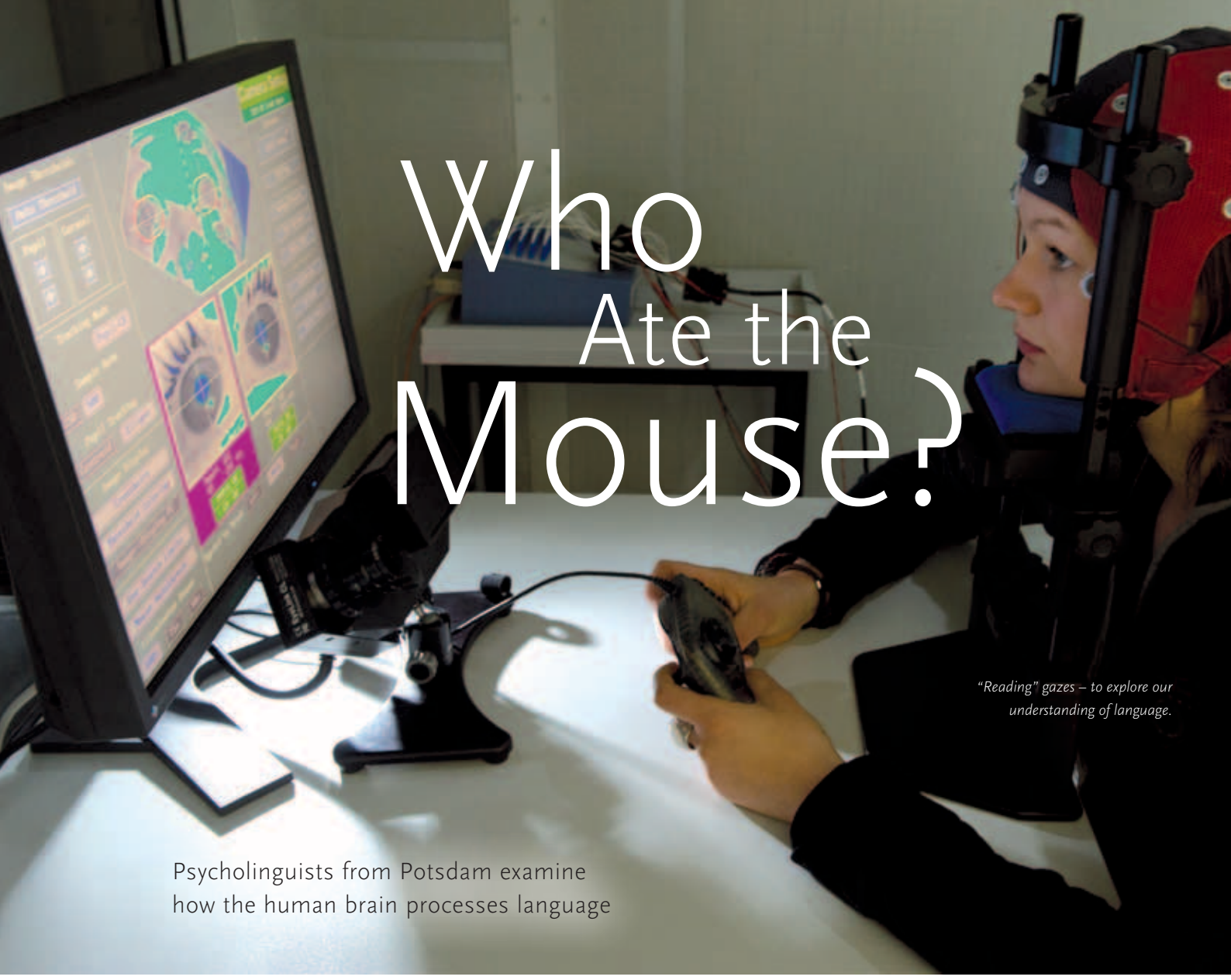
Contact
Universität Potsdam
Department Linguistik
Karl-Liebknecht-Straße 24–25, 14476 Potsdam OT Golm
✉ stede@ling.uni-potsdam.de

Uladzimir Sidorenko studied German language and literature at the Minsk State Linguistic University and graduated with a Master's degree in computational linguistics in 2007.

Contact
✉ Uladzimir.Sidarenka@uni-potsdam.de

Andreas Peldszus studied computational linguistics and philosophy at the University of Potsdam and graduated with a Master's degree in 2011.

Contact
✉ peldszus@uni-potsdam.de



Who Ate the Mouse?

"Reading" gazes – to explore our understanding of language.

Psycholinguists from Potsdam examine how the human brain processes language

We can understand what we read and hear without any difficulty. We do this without ever really thinking about the high performance of our brain. It is the aim of psycholinguistics to examine the unconscious processes that form the basis of our understanding of language. Shravan Vasishth's group develops computational models of parsing based on data that were collected in experiments and compares the results of computer simulations with the results of experiments.

Let us start with a little experiment. Please, read the following sentence: "The cat ate the mouse." You can understand the content of the sentence without being aware of the principles that our brain relies on to assemble the words to construct a sentence. Now consider: "The cat that the dog chased ate the mouse." You can understand this sentence, too, without much difficulty. But what about the following example: "The cat that the dog that the boy called out to chased ate the mouse." Most English speakers have considerable difficulty to comprehend who did what to whom. Some may even consider it ungrammatical. The last sentence is grammatically correct, but our brain does not manage at once to find the respective subject for each verb. What happens is that we are unable to keep track of who called out to whom, who chased whom, and who ate what. One might think that the sentence is difficult to understand compared to the other two because it is much longer. However, rephrasing the sentence shows that the problem does not lie in its length. "The boy called out to the dog that chased the cat that ate the mouse." This sentence has exactly the same meaning as the difficult sentence above, it is as long as the one before but much easier to understand. A theory of human language processing should explain this and many other phenomena.

> *"The cat that the dog that the boy called out to chased ate the mouse."*

Psycholinguist Shravan Vasishth and his group work on these phenomena. In experiments, the scientists try to understand the mechanisms that our brain uses to unlock the meaning of words and sentences. They simulate these

processes in computer models and then test them on people to find out whether they respond the way the model predicted it according to the theory.

The research scientists do not restrict their work to the German language but analyse comparable phenomena in many other languages. Potsdam's proximity to multicultural Berlin turns out to be an advantage. Vasishth's postdoctoral researcher Titus von der Malsburg found Spanish-speaking participants there, and Rukshin Shaher could work with native English speakers.

"You cannot directly observe the processes taking place in our brain."

The research group is almost a bit like the Tower of Babel: The PhD students and postdocs have come to Potsdam from various parts of the world and they also speak plenty of foreign languages themselves. Thus it is much easier for them to collect their data in their language area. They do this in cooperation with university institutions around the globe. Pavel Logačev has worked together with Hindi-speaking participants in Allahabad, India. Lena Jäger has worked on Mandarin Chinese in Beijing and Taipei. Lena Benz is doing her research in Great Britain and Bruno Nicenboim in Argentina.

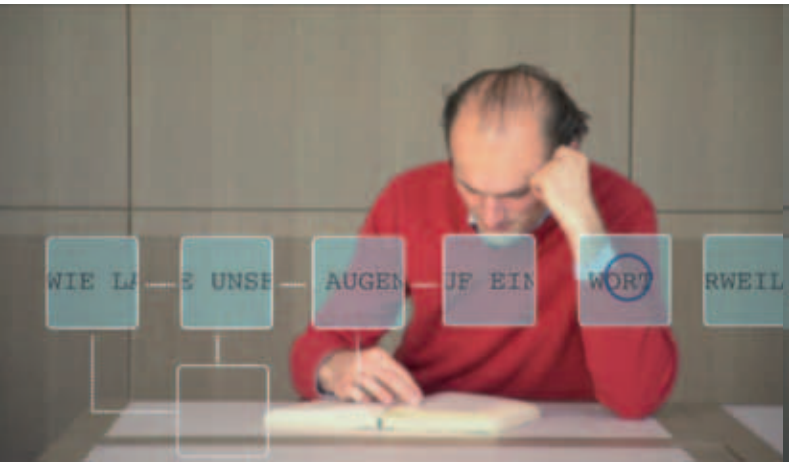
We cannot directly observe the processes that take place in our brain. On top of it, these processes happen at an extreme speed. For recording them in real time, the scientists have to use experimental methods with a significantly high time resolution. One of these methods is "eye-tracking," i.e. measuring the movement of gaze direction. Another is electroencephalography (EEG), which is the recording of the brain's electrical activity.

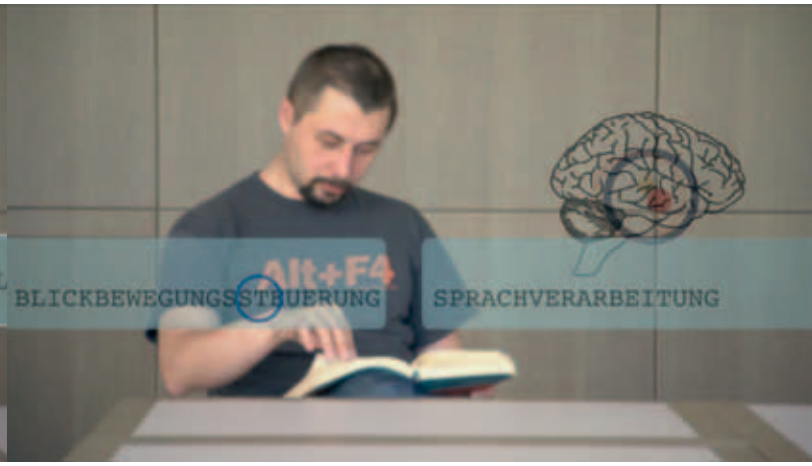
Eyetracking experiments are based on the assumption that eye movements while reading reflect cognitive processes of language processing. If the eyes stay longer on a certain word, it suggests that there are difficulties in integrating this word into the sentence structure.

During the EEG experiment, the participant wears a cap with many electrodes, which register the brain waves while reading. A classical experiment would use a pair of sentences like this: "Peter drinks his coffee with milk." and "Peter drinks his coffee with salt". As soon as the participant reads the inappropriate word "salt" with regard to the context, he or she will stop short. When comparing the EEG signals of the two sentences, the amplitude for the startling at "salt" is bigger than at the word "milk" that had to be expected in this context.

Pairs of sentences like these that differ in just one detail are the material for the experiments in the language processing laboratory. The effects of this tiny manipulation are measured here. The results of each test contribute new pieces to the puzzle: giving an answer to the big question how the brain understands language.

Another important tool of Shravan Vasishth and his group is a computational model that the professor developed together with his PhD supervisor Richard Lewis. At that time the prevailing approach of linguistics was influenced by the research on artificial intelligence. Mechanisms that we use to understand language were described mathematically and simulated on the computer. The Lewis and Vasishth model makes it possible to simulate how we analyse sentence structures during language processing.





The researchers use their experimental data to work out a theory. On this basis, the model then predicts, for instance, at which point of the sentence "The cat that the dog that the boy called out to ..." a virtual participant would start to hesitate. Such predictions are verified with measurements from participants and other examples. If the results are contradictory, the researchers will have to revise their theory. They will also refine the model itself. PhD student Felix Engelmann for instance works on connecting the theories on eye movement control with the language processing model. This will allow for more precise predictions.

"What's it good for? This typical question of non-professionals makes each basic researcher sigh."

What is it good for? Such a typical question of a non-professional makes each basic researcher sigh more or less deeply. "For me there are two answers to this question," says Shravan Vasishth with composure. The first one focuses on the practical aspect of theoretical science: You can integrate disorders of speech processing into the computer models as they happen to people with cerebral damage, for instance due to a stroke. Umesh Patil, a member of Vasishth's team, simulates such disorders called aphasia to find the causes of these symptoms. He uses experimental data that his colleague Sandra Hanne collects in her work with aphasia patients. Research projects of that kind may help to develop therapies for such speech disorders.

The second answer, the actual motivating one for the research scientist is: "I cannot do otherwise. It is the urge to find this profound truth about nature."

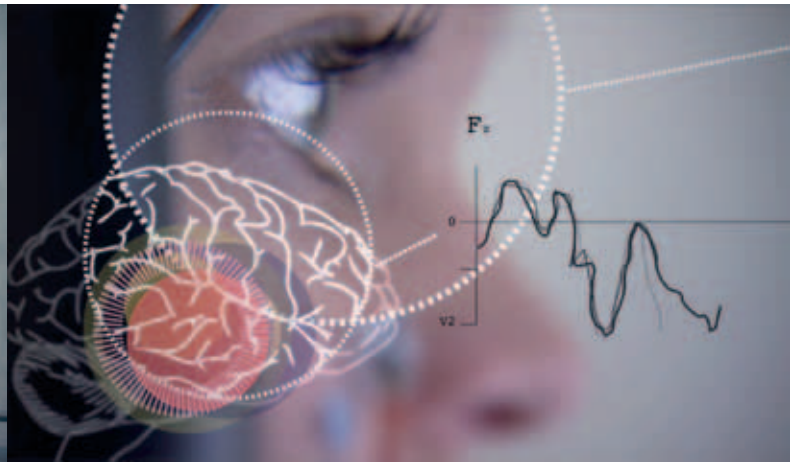
One day the computational models for the research in speech processing might lead to the development of thinking machines or perhaps to something completely different. For the time being, the psycholinguists have the aim to contribute to a comprehensive understanding of information processing in the human brain that enables thinking, learning, and knowledge.

SABINE SÜTTERLIN

THE SCIENTIST

Professor Shravan Vasishth studied Japanese in New Delhi and Osaka, did a PhD in linguistics and a Master's degree in computer and information sciences at Ohio State University in the USA. Since 2004 he has been professor at the University of Potsdam, since 2008 he has been Chair of Psycholinguistics and Neurolinguistics. His central research interest is human sentence comprehension processes.

Contact
Universität Potsdam
Department für Linguistik
Karl-Liebknecht-Str. 24–25, 14476 Potsdam OT Golm
✉ vasishth@rz.uni-potsdam.de



A THOUSAND QUESTIONS – ONE CITY

Does sugar cause diabetes?

What does Frederick II have to do with potatoes?

How does language enter our heads?

Blinded by rage?

Where does the alphabet come from?

Why is it getting warmer and warmer?

Can soil disappear?

Information about science in Potsdam: www.prowissen-potsdam.de

WISSENSCHAFT SCIENCE
FÜR DIE ZUKUNFT
FOR THE FUTURE POTSDAM

PROWI
proWissen Potsdam e.V.

POTSDAM

Free Telescope

This page, when rolled into a tube, makes a telescope with 1:1 magnification.


Where Knowledge grows
www.uni-potsdam.de