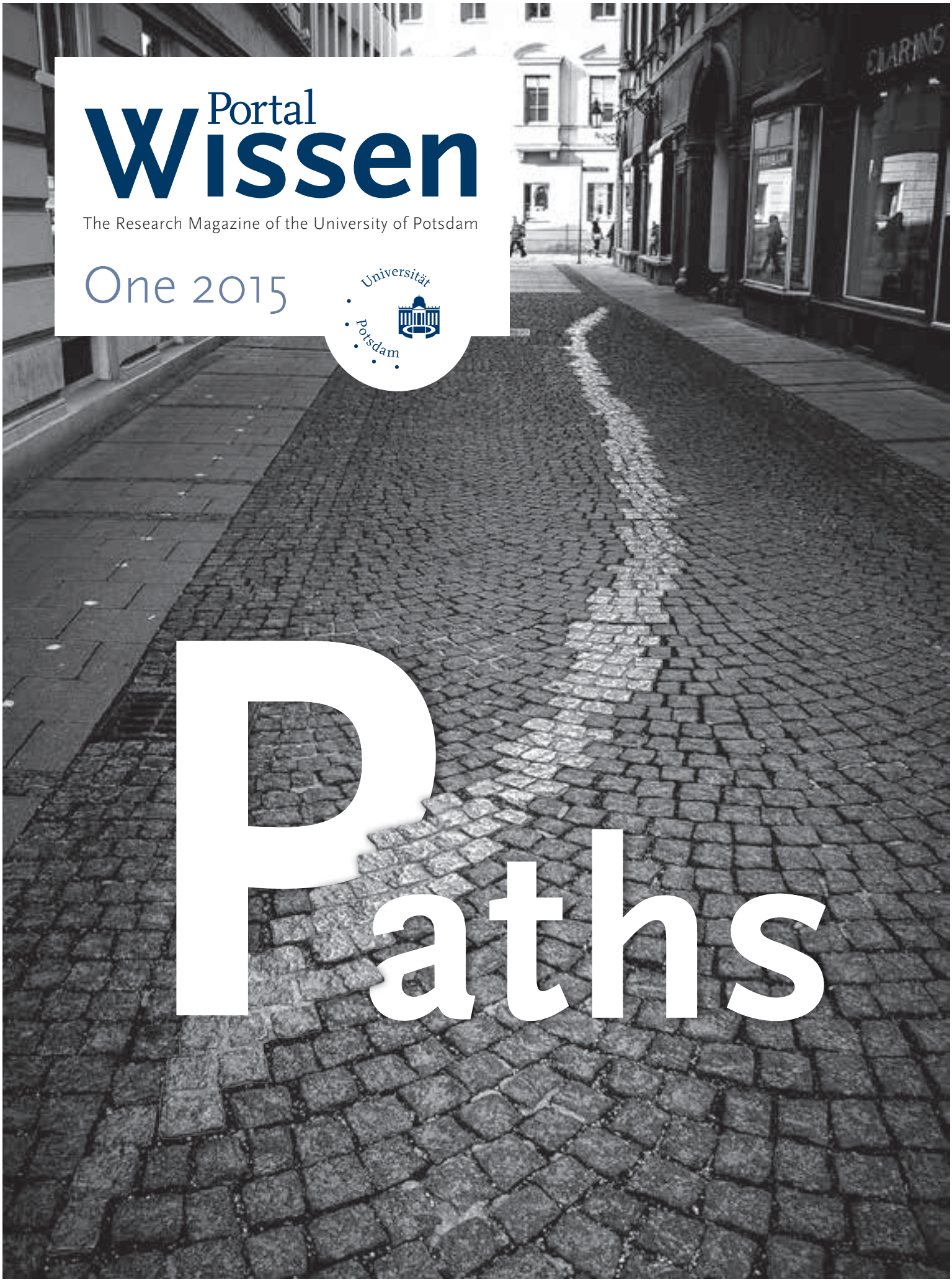
Portal Wissen

The Research Magazine of the University of Potsdam

One 2015

Universität Potsdam



Paths

The Photographer of "Paths"

Dr. Aldo Dall'Aglio took the cover photo and the pictures introducing the five themed sections of the magazine.

When talking about "paths" the famous lines of Robert Frost's poem *The Road Not Taken* come to mind: "Two roads diverged in a wood and I – / I took the one less traveled by, / And that has made all the difference." This motto has influenced many of my decisions on which path through life to take.

Many people look back on their lives and wish they had chosen another path at a certain point. I look back and am proud that I often took "the less-traveled" path rather than the easy way out. I have always done what I considered to be right, despite the resistance of others. Our decisions and experiences make us who we are.

In the mountains, where I took some of these photos, you sometimes have to decide between two paths: one that might save your life and another that might lead to calamity. Unfortunately, as often happens in life, you cannot foresee which path is right.

THE PHOTOGRAPHER

Dr. Aldo Dall'Aglio is an astrophysicist. Since 2011 he has been working as a software engineer and architect at T-Systems International GmbH. During his scientific career he researched the distribution of extragalactic hydrogen between very distant galaxies. Since the available software programs for evaluating the recorded data were not sufficient for his purposes, he began developing his own software. He enjoyed it so much that becoming a full-time software engineer was self-evident.

Contact
Dr. Aldo Dall'Aglio
http://theant.photography
aldo@daglio.org

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).

Photo: Dall'Aglio, Aldo

Dear Readers,

How traits are inherited from one generation to the next, how mutations change genetic information and consequently contribute to the development of new characteristics and emergence of new species – all these are exciting biological questions. Over millions of years, genetic differentiation has brought about an incredible diversity of species. Evolution has followed many different paths. It has led to an awesome natural biodiversity – to organisms that have adapted to very different environments and are sometimes oddly shaped or behave strangely. Human-made biodiversity is stunning, too. Just think of the 10,000 rose varieties whose beauty delights, or the myriad wheat, barley, and corn variations; plants that had all once been plain grasses feed us today. We humans create our own biodiversity unknown to nature. And it is serving us well.
Thanks to genome research we are now able to read the complete genetic information of organisms within a few hours or days. It takes much longer, however, to functionally map the many genomic sequences. Researchers achieve this through various methods: Activating or deactivating genes systematically, modifying their code, and exchanging genetic information between organisms have become standard procedures worldwide. The path to knowledge is often intricate, though. Elaborate experimental approaches are often necessary to gain insight into biological processes.
Methods of genomic research enable us to investigate not only what is "out there" in nature, but also to ask, "How does a living organism, like a moss, react when sent to the International Space Station (ISS)? Can we gain knowledge about the adaptation strategies of living beings in harsh environmental conditions or even for colonizing the Moon or Mars?" Can we use synthetic biology to precisely alter microorganisms, planned on a drawing board so to speak, to create new options for treating diseases or for making innovative biology-based products? The answer to both questions is a resounding Yes! (Although moving to other planets is not on our present agenda.)
Human land use determines biodiversity. On the other hand, organisms influence the formation of landscapes and, sooner or later, the composition of our atmosphere. This also leads to exciting scientific questions. Researchers have to strike new paths to reach new conclusions. Paths often cross other paths. A few years ago it was still unforeseeable that ecological research would substantially benefit from fast DNA sequencing methods. Genome researchers could hardly assume that the same techniques would lead to new possibilities for examining the highly complex cellular regulation and optimizing biotechnological processes.
You will find examples of the multi-faceted research in biology as well as other very interesting articles in the latest edition of *Portal Wissen*. I wish you an enjoyable read!

PROF. DR. BERND
MÜLLER-RÖBER
PROFESSOR OF
MOLECULAR BIOLOGY

Photo: privat

Pathbreaking

Wegweisend

Path through Life

Lebensweg

Pathfinders

Wegbereiter

Pathless

Unwegsam

36

A Path Out

Ausweg

48

Impressum

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: Antje Horn-Conrad (ViSdP), Matthias Zimmermann
Contributions: Dr. Barbara Eckardt, Petra Görlich
Translation: Susanne Voigt, On Tour in Afghanistan: Pearl Wallace

Address of the 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:
Cywinska, Magda/Stefanie, Krüger 12; Dall'Aglio, Aldo 1, 2, 6/7, 16/17, 24/25, 36/37, 48/49, 56; ESA 38; Fotolia.com/a40757se 10 bottom; Fotolia.com/Hugh O'Neill 10 top; Fotolia.com/iko-noklast_hh 20 right; Fotolia.com/Ingo Bartussek 20 left; Fotolia.com/MasterLu 10 center; Fotolia.com/oatography 18; Fotolia.com/photophonie 50; Fotolia.com/Stripped Pixel 8; Fritze, Karla 9 (2), 11 (2), 13 top, 14, 15 (2), 19, 40, 53, 33 right 2nd from the top, 33 right bottom, 33 right top, 39 (2), 41 (2), 45 (2), 47 top, 51 bottom, 54 center, 54 top, 55 (2); Fuhr, Prof. Dr. Harald 16, 29 (2), 31 top, 33 left top, 34/35 background, 35; Jantz, Julka 27, 34, 28/29 background, 28 (2), 30/31 background, 32 bottom, 32/33 background, 32 (2), 33 left bottom, 33 right 3rd from the top; Keuning, Annet 47 center; Klaer, Andreas 21, 22, 23 (2); Krüger, Stefanie 13 center; Krüger, Stefanie/Günter, Dr. Christina 13 bottom (2); private 3; Sadeqar, Mr. 30; Schildgen, Taylor 42/43, 44 (2), 36, 47 bottom; Spijkerman, Dr. Elly 54 bottom; Warschburger, Prof. Dr. Petra 51 top

Layout/Design:
unicom-berlin.de

Editorial deadline for next issue:
31 April 2015

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

Print: Brandenburgische Universitätsdruckerei und Verlagsgesellschaft Potsdam mbh
Circulation: 1,500 copies

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

Photo: Dall'Aglio, Aldo


Path
breaking

Smog over Hong Kong.

Post-carbon Futures

Making the City of Tomorrow

Photo: Fotolia.com, Stripped Pixel

About two thirds of all Europeans and over three quarters of Germans now live in cities...and their number is continuously increasing. Urbanization is a worldwide trend. It is estimated that over 60% of Chinese people will be living in cities by 2030. In Europe, the share of primary energy consumption in cities is about 70% with about the same proportion of CO_2 emissions. Cities are not only areas where problems arise but also where solutions can and must be found. Cities like Copenhagen, Barcelona, and Munich have long been best-practice examples and cooperate with other cities worldwide. This is not only a matter of climate policies but also of environmental issues like smog in rapidly growing Asian metropolitan areas, e.g. Beijing or Hong Kong. Prof. Kristine Kern and Dr. Ross Beveridge from the Leibniz Institute for Regional Development and Structural Planning (IRS) and 12 European partners are researching the future of urban development – and the ideal "Post Carbon City of Tomorrow".

The percentage of the world's population living in cities first eclipsed 50% in 2008. The biggest of these cities, inexorably growing into "megacities", confront urban planners and local administrations with enormous challenges: Energy supply, traffic infrastructure, waste and sewage disposal, housing, and public transportation have to meet the needs of current and future inhabitants and be environmentally sustainable. "Climate change, however, has become the most pressing and manifest problem in many places," explains Kern, who has been dealing with sustainable urban development for 15 years and holds the chair "Governance of Urban Infrastructure and Global Change". The research project "European Post Carbon Cities of Tomorrow", in short POCACITO, owes its name to this key concern as a least common denominator. Its goal is nothing less than the model city of tomorrow. The metaphor of a "carbon-free city" is not meant literally, and its vision is not limited to climate policy. "'Post carbon city' does not mean a city entirely without carbon," says Beveridge, who, along with Kern, represents the IRS in the project. "The underlying idea is to break with negative dependencies that manifest themselves in CO_2 pollution. The project explores possibilities for change and presents ways to implement them – for various cities on various pathways," Beveridge says.

The project's partners demonstrate the breadth of POCACITO's approach. Thirteen European institutions have joined forces under the auspices of the Ecologic Institute in Berlin, among them researchers of analytical and theoretical disciplines, like those from the IRS, as well as representatives of consultancies and applied research organizations. So, it is hardly surprising that in the first phase in early 2014 they defined the project's common framework – which was hotly debated, as Beveridge admits. "We asked if we would deal only with concrete political practices related to climate or if we would develop a holistic vision of a city of tomorrow." In the end the partners agreed on a broad approach including climatic as well as social, economic, and other environmental aspects. "Such a broad definition makes sense because of the close relationship between climate policy and a broader sustainability policy," Kern adds. "This is why the German energy transition should be seen as a comprehensive social, economic, and political transformation process."

"We want to develop a holistic vision of a city of tomorrow."

During the next phase of the project, funded by the European Framework Program 7, they have to compile facts about the status quo of urban development in Europe, for which the researchers of the IRS will primarily be responsible. They are preparing three working papers – so-called "deliverables" – about measures that cities, states, and transnational city networks use to address the challenges they face and what they have achieved. The first working paper is a survey of the "100 Leading Cities" in sustainable development in Europe. Even though POCACITO is supposed to develop the model of a "post carbon city", many European cities have already been pursuing their own way towards that goal for some time now, as Kern explains. "Many European cities, like Stockholm, Amsterdam, Freiburg, and Munich, began facing these challenges years or even decades ago and are therefore ahead of the others."

"Many European cities have already been pursuing their own way towards that goal for some time now."

THE RESEARCHERS

Prof. Dr. Kristine Kern studied public administration in Stuttgart and economics and political science in Tübingen and Berlin. Since 2012 she has been Professor of Governance of Urban Infrastructure and Global Change at the University of Potsdam and the Leibniz Institute for Regional Development and Structural Planning (IRS).

Contact
Leibniz-Institut für Regionalentwicklung
und Strukturplanung
Flakenstraße 28–31
15537 Erkner
✉ kristine.kern@uni-potsdam.de

Dr. Ross Beveridge studied history in Manchester and International Studies in Newcastle where he earned his doctoral degree in 2010. Since 2010 he has been a research fellow at the IRS.

Contact
✉ Beveridge@irs-net.de

Photos: Fritze, Karla (2)

Cities with future plans: Copenhagen, ...

... Barcelona ...

... and Stockholm.

Beveridge gathered material from available sources, interviewed experts and central research institutions, and analyzed various concrete measures in order to compile an inventory of the leading cities. Pursuing the selected focus while keeping an eye on seemingly peripheral areas was both exciting and challenging. "We wanted to make the investigation as versatile and interesting as possible and thus looked at many urban contexts – climate, traffic, and housing," Beveridge says. "We had to simultaneously consider the problems of small cities and their specific resources to cope with them compared to those of big cities. Our goal is to enable all cities to address their individual challenges according to their means."

The second and third "deliverables" present examples of "good practices" at city, national, and European levels. "For this we looked at cities across Europe and asked what they have done and if their measures are 'good practices'," Beveridge explains. There are many examples: Copenhagen, for example, considered the secret bike capital of the world, provides free bikes throughout the city. Munich has had a program for efficient buildings for some time now, and Stockholm is trying to develop closed reutilization cycles by incinerating its waste and converting it into district heating. Malmö counts on comprehensive sustainability strategies. "We are also interested in socially sustainable initiatives. How do cities handle social problems?" Kern asks. "As part of their housing program, Malmö built new and highly energy-efficient apartments in the long-abandoned harbor district that are also affordable for low-income households."

Transnational city networks, on the other hand, address other topics. Local municipalities with similar concerns join forces in such networks because they can act more effectively together. "The Covenant of Mayors, for example, represents more than 6,000 European cities with about 190 million inhabitants," Kern says. The initiative which started in 2008 brings together municipalities who want to exceed the EU reduction target for CO_2 emissions of 20% for 2020. "Such networks provide opportunities to proceed from local measures

THE PROJECT

Post-Carbon Cities of Tomorrow – foresight for sustainable pathways towards liveable, affordable and prospering cities in a world context (POCACITO)

Participating: 13 European project partners, led/ directed by the Ecologic Institute;
at the IRS: Prof. Dr. Kristine Kern, Dr. Ross Beveridge
Duration: 2014–2016
Funded by: European Framework Program 7

http://pocacito.eu/

to a more general and comprehensive plan." One of the 13 POCACITO partners is the network Energy Cities, whose 200 members from 30 countries are engaged in sustainable energy policies in their communities.

The goal of the analysis is to develop a typology of cities and trajectories that will help to adapt successful strategies and measures to other cities worldwide. The inventory is not only supposed to present the diversity of initiatives but also inspire others to follow suit. "Such a typology can help less advanced cities. It would give them a road map for activities without having to become a Malmö or a Stockholm," says Beveridge. "It is important to communicate that a city can always do something, no matter how minor, to indicate that they have recognized problem areas and are taking them seriously. Even first steps are 'good practice'."

Although POCACITO's approach is rather broad in the first phase, its approach is more specific and detailed when it comes to the local cases, i.e. the city. Case studies are being prepared on eight European cities, among them metropolitan areas like Barcelona and Istanbul but also smaller communities like Litoměřice in the Czech Republic and Rostock in Germany. This is being done in a direct exchange with the citizens. The first step is to take stock of implemented projects within the relevant fields – from infrastructure projects to climate policy to housing. In the next step decision makers and citizens, under the guidance of POCACITO project partners, will develop joint visions of what they want to implement in concrete steps by 2050. "At the end we want to have a road map that shows exactly what has to be done when in order to reach the goal," Kern explains.

"Even first steps are 'good practice'."

While the IRS "deliverables" are being used as working papers for the workshops in the selected cities, Kern and Beveridge deal with other phases of the project and ensure the academic publication of the results, which will also be made available to those cities that want to pursue the path towards becoming a "Post Carbon City of Tomorrow" at the end of the project.

There is a lot of interest in this European initiative, Kern adds. "Europe and European cities are, to some extent, pioneers in this field." This is why POCACITO is expected to lead to a "marketplace of ideas", in which all cities worldwide can draw inspiration.

MATTHIAS ZIMMERMANN

Photos: Fritze, Karla (2)

Prof. Kristine Kern and Dr. Ross Beveridge

SpiderMAEN – Spinning Out Ideas

Prof. Andreas Taubert and his team of chemists "spin the silk" from gene to material

AFM topography of spider silk.

Photo: Cywinska, Magda/ Krüger, Stefanie

SpiderMAEN is the current project of Prof. Andreas Taubert – alluding to the well-known comic superhero. The professor and his research group are not only fascinated by spiders but particularly by spider silk, which plays an important role in their latest research. The natural product has many positive properties. Relative to its weight, silk's mechanical load capacity is four times that of steel. Silk can be stretched to up to three times its initial length without tearing.

When you ask Andreas Taubert, Professor of Supramolecular Chemistry and Materials Chemistry, about the background of the DFG-funded project "Recombinant Spider Silk-based Hybrid Materials for Advanced Energy Technology", he compares his approach to that of children. "We go through the world and look for something exciting." This is how he came across spider silk while looking for biological materials. Spider silk is extremely robust, flexible, biodegradable, lightweight, and water-resistant but has a high water absorption capacity. It has a diameter of only 0.0005-0.005 millimeters and is 20 times thinner than a human hair yet three times stronger than polymers. With only 200 grams of spider silk you could span the Earth. A spider silk rope with only a one-millimeter diameter could carry an 80-kilogram human.

"We go through the world and look for something exciting."

Previous DFG-projects sought to produce recombinant hybrid and functional materials from synthetic molecules under controlled crystallization conditions. The researchers used synthetic polymers and tried to produce hybrid materials with calcium carbonate, calcium phosphate, and ferrite.

THE RESEARCHERS

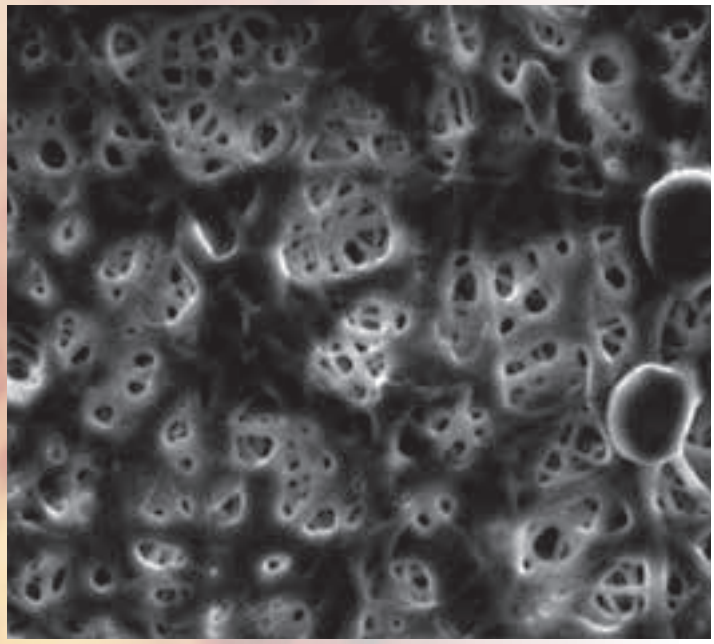
Prof. Andreas Taubert studied chemistry in Basel. He completed his PhD in Mainz in 2000 on the subject "Polymer-controlled Mineralization of Zinc Oxide". After a three-year postdoc at the University of Pennsylvania, he was a group leader at the University of Basel and subsequently Junior Professor at the University of Potsdam and the Max-Planck Institute of Colloids and Interfaces in 2006. Since 2011 he has been Professor of Supramolecular and Materials Chemistry at the University of Potsdam.

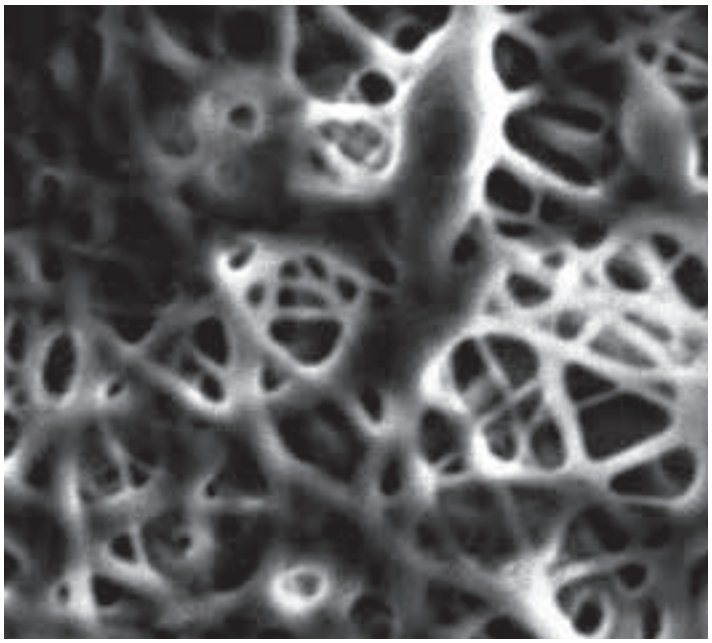
Contact
Universität Potsdam, Institut für Chemie
Karl-Liebknecht-Str. 24–25
14476 Potsdam
✉ ataubert@uni-potsdam.de

Stefanie Krüger studied chemistry at the University of Potsdam. Since March 2014 she has been a PhD student in Taubert's research group and is dealing with "Spider Silk-based Multifunctional Inorganic Materials".

Contact
✉ stefano6@uni-potsdam.de

Photos: Krüger, Stefanie (center); Krüger, Stefanie/Günter, Dr. Christina (bottom); Fritze, Karla (top)





SEM image of spider silk.

By combining the properties of inorganic minerals and organic polymer components, these hybrid materials took on interesting characteristics, which can be used in artificial biomaterials.

The new priority program "Generation of Multifunctional Inorganic Materials by Molecular Bionics", which includes Prof. Taubert's subproject, takes different approach, one that focuses on material technology. The researchers want to apply this biotechnological method for new materials, to follow the path from bacterium to superconductor, so to speak. "First the bacterium is 'forced' to produce unnatural organic proteins or carbohydrates, something that normally does not happen," Taubert explains. Next the molecules interact with inorganic substances not mineralized by biological organisms. The researchers then have to manipulate genes of these organisms to be able to realize material technologies, i.e. to produce new proteins. They strike the path from gene to material. There are different ways to do so, but all require a non-biological inorganic material.

"It has become possible to spin fibers as well as film, gels, and capsules from spider silk."

The Potsdam chemists use spider silk from Thomas Scheibel's research group at the University of Bayreuth. The silk construct that Taubert and his team use for the mineralization experiments resembles a piece of paper or felt.

The scientists are initially focusing on the development of reliable synthesis protocols that are supposed to ultimately yield a photocatalytically active spider-silk inorganic hybrid material. The main problem is that spider silk is insoluble. The challenge for the researchers is to create a processable material because they have little use for an "insoluble lump". The researchers need a material in a condition that facilitates useful processing. It has become possible to spin fibers as well as film, gels, and capsules from spider silk.

The chemists want to enter a new "world of properties", and they are convinced that they are on the right path. "If we keep an eye on the technology transfer vision, it will be possible to submit a follow-up application in 2016, when the current project ends," Taubert says. He finds preparing applications very useful because you are forced to intensively deal with the subject and to stay caught up with the current state of knowledge in order to find a niche that allows you to distinguish your research from others'. It differs from academic publishing. The chemists also developed the current project in this way, which presents an exotic combination of spider silk and inorganic material and is important for basic research.

DR. BARBARA ECKARDT

Krüger and Taubert in the lab.

Photo: Fritze, Karla

Guest Commentary

TERESA SANTOS-SILVA
UNIVERSIDADE NOVA DE LISBOA

Lecker

It was one of the first words we learned, after "bitte" and "danke".

With three kids under the age of 6 and none of us speaking German, food was either "lecker" or "biack".

It was a big challenge to adapt to a new country, house and kindergarten. At first you were alert, with all your sensors quite sharp, trying not to get lost in the train station and not to miss the bus stop. Because you don't know the way, the supermarket seemed to be miles away, the park was comparable to a wild forest and the tram always left one minute before you arrived at the stop.

Finally, when your dinner actually corresponded to your expectations, because you managed to decipher most of the ingredients in the supermarket, or when you dared to ask for directions and almost understood the answer, you felt a heroine.

As always, there were some occasional drawbacks accompanied with the typical question: Why didn't I stay at home? What was I thinking? Who said it would be a good idea to come all the way to Germany, dragging ascendants and descendants? And that is when neighbors became your new family. Sharing your glories and miseries was compulsive. It is what helped you laugh in those two minutes before crashing out.

My four months stay in Potsdam had all of that and a bit more. Going to the park early in the afternoon, having barbeques with a broad variety of "Wurst" and running for the tram every morning were part of the routine. I was surprised with how edible my cooking was and how dispensable items like microwaves or dishwashers are. I was captivated by the pleasant time spent with the kids and, even though it was much more exhausting than working an entire day in the lab, it was always deeply rewarding.

Back to cruising speed in Lisbon, some small details are still maintained from this lively adventure. Almost everyday, either Kiko, Rodi or Tiago (the nick names for the hangers at the kita) will count the numbers in Spanish (thank you Álvaro, Jerónimo, Mateo, Íñigo and Javi); "Spätzle" is part of our regular diet; the true meaning of "*austi costa raban*" (an adapted version of "Achtung, Ausstieg auf der Fahrbahn") is, in fact: "Watch out when you leave the tram so that you don't pinch your *raban*". And during dinner, Tiago repeatedly and enthusiastically yells: "Lecker, lecker, lecker!"

Photos: Fritze, Karla (2)

Photo: Dall'Aglio, Aldo

Women Earn with Beauty, **Men with Strength**

Prof. Marco Caliendo has researched the relationship between career and bodyweight

Photo: Fotolia.com/oatography

With a wasp waist like Heidi Klum's you can boast in the office – and also earn more. Women with supermodel measurements have higher incomes than their more full-figured colleagues. This is the result of a study by the economist Prof. Marco Caliendo from the University of Potsdam and his colleague Markus Gehrsitz from the City University of New York.

The labor market researchers were above all surprised that it is not only overweight women who are paid less by their bosses but also those with a normal bodyweight. Both groups earned up to 12% less than the super-slim ones. The study indicates that earnings decrease steadily with increasing bodyweight. The researchers were able to rule out health as a primary cause of bodyweight as an impact on earnings, because their analysis also considered the health status of respondents.

A Body Mass Index (BMI) of 21.5 seems to meet the beauty standards employers consider worthy of promotion. The researchers examined the relationship between BMI – a criterion for determining if someone is overweight, underweight, or normal – and the subjects' incomes and jobs. Their model indicates that women's incomes peak at a BMI of 21.5. The ideal value corresponds to a body height of 1.70 m and a weight of about 62.5 kg, well below the clinical threshold for obesity. Is the office a catwalk where pounds decide your career prospects?

Photo: Fritze, Karla

Marco Caliendo, Professor of Empirical Economics at the University of Potsdam since October 2011, confirms this but admits at the same time that a follow-up study is needed to more closely examine companies and the working environment. The "slimness premium" prevails at workplaces with customer contact, for example in gastronomy, sales, and service, i.e. in all branches where interaction with customers and coworkers plays a considerable role.

The present study of the Institute for the Study of Labor (IZA), which the two researchers have submitted for publication, evaluates data of 18,000 individuals. They used data from the German Socio-Economic Panel (SOEP). The SOEP, located at the German Institute for Economic Research, (DIW Berlin), is a representative panel survey already running for 30 years. Each year about 22,000 individuals from 12,000 households across Germany are sampled by the fieldwork organization TNS Infratest Sozialforschung, which collects data about earnings, employment, education, and health. Long-term social and societal trends can be observed because follow-up interviews are done with the same individuals. Data from the health survey, underway since 2002, is collected every other year. This allows conclusions to be drawn about discrimination due to age, gender, or skin color. This is a major subject, especially for labor market researchers like Caliendo. The present study, which consists of the 2002, 2004, 2006, and 2008 waves of the survey, does not touch on such serious discrimination that has to be sanctioned by lawmakers. To examine the relationship between career and weight the researchers focused on personality traits for better or worse employment performance. "Pay depends on various characteristics like education, work experience, or residential area. We also know that very open and extroverted people have better job chances than introverts. The BMI, on which we have concentrated, is only a minor factor." It is nevertheless very interesting because research has rarely focused on the influence of bodyweight on one's career.

> *"Is the office a catwalk where pounds decide your career prospects?"*

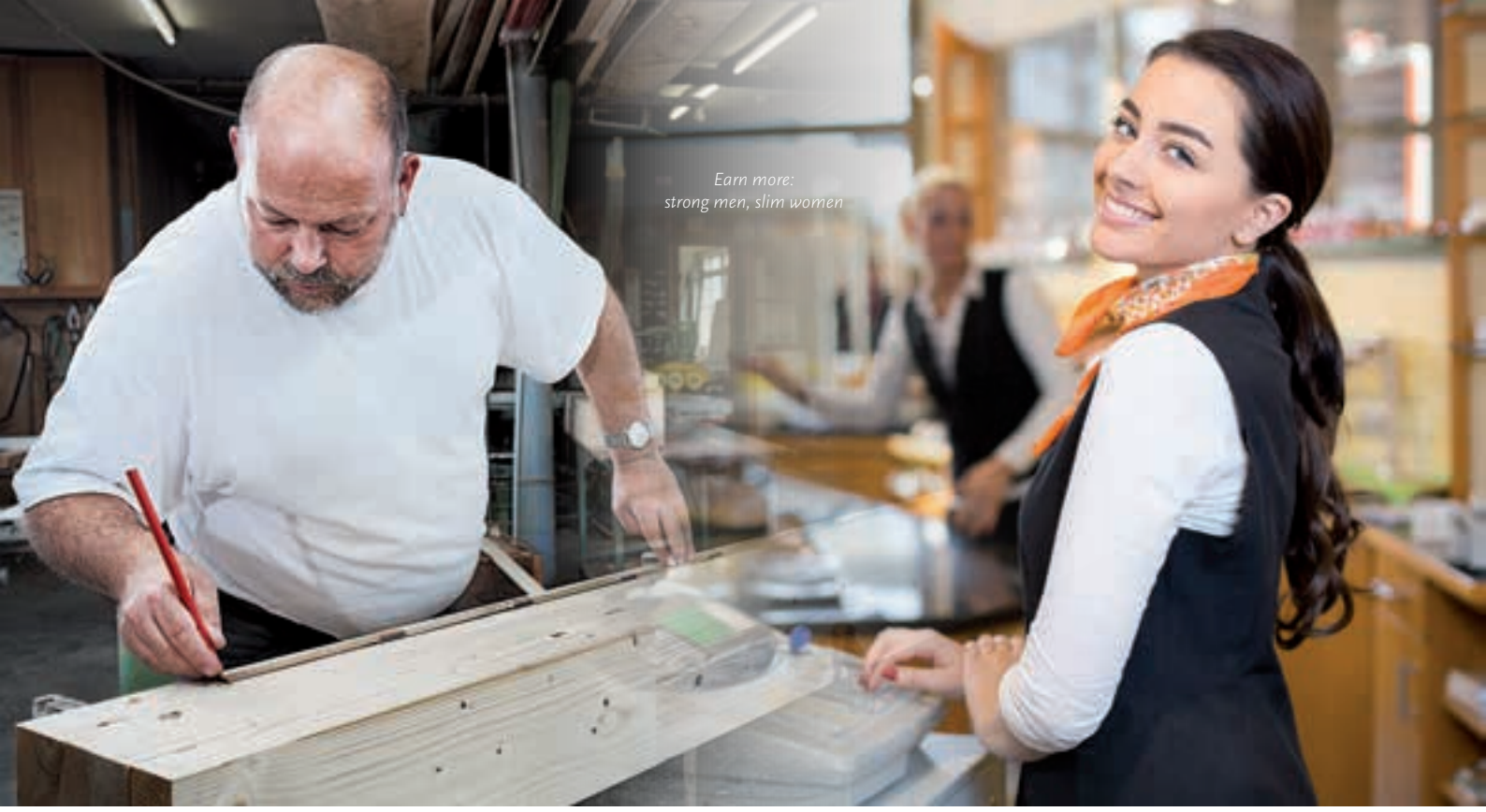
How did Caliendo come across this aspect? "Articles in US-American literature point out that beauty leads to success on the labor market and overweight people are disadvantaged." The 40-year old researcher wanted to get a clearer picture. After meticulously evaluating all data he can present explicit facts in his IZA discussion paper "Obesity and the Labor Market: A Fresh Look at the Weight Penalty". One of the most convincing charts

THE RESEARCHER

Prof. Marco Caliendo studied economics at the Goethe University in Frankfurt/Main and the University of Manchester. Since 2011 he has been Professor of Empirical Economics at the University of Potsdam and Program Director for the research area "Evaluation of Labor Market Programs" at the Institute for the Study of Labor (IZA) in Bonn.

Contact

Universität Potsdam
Wirtschafts- und Sozialwissenschaftliche Fakultät
August-Bebel-Str. 89
14482 Potsdam
✉ caliendo@uni-potsdam.de



Earn more: strong men, slim women

shows a steep income curve for women: up to a BMI of 21.5, a value that is considered attractive according to social standards. After this peak the curve falls immediately. The difference between the earnings of normal and obese people is not as significant as expected. Although obesity is generally considered a career killer, the relationship between body weight and earning opportunities requires a more differentiated analysis as proven by the IZA paper. What really counts is slimness. Even people of normal weight remain financially behind, at least in service jobs.

The study also evaluates data of men based on height, weight, and earnings. A newspaper summarized the results under the headline "Fat Belly, Fat Income". Caliendo, himself athletic and slim, is smiling behind his desk. "This is not exactly the case," says the father of two who keeps fit with football and jogging. More weight would not benefit him in his job although overweight men are more socially accepted and often associated with a certain status in academic literature. Ultimately, however, there is no proof of a relationship between weight and earnings in men, at least not in office jobs. His study shows that overweight men have better chances in physically demanding jobs. "Men with less muscular strength earn lower wages in blue-collar jobs. We have discovered that underweight men earn up to 8% less than normal or overweight ones," the researcher says. This, however, applies only to blue-collar workers. It is probably muscle mass that is important for physical work. "SOEP measured this, too." Caliendo describes mechanical devices you just have to squeeze: "Physical strength is measured through the pressure." This makes it easy for companies to identify men with muscular strength. Those with a BMI of 23 spanning far into the obese range have the highest income, while underweight men can expect lower wages.

"Strong men earn more in production, slim women in the service sector."

The overall result shows that men have a strength premium and women a slimness premium. "For women we expected an explicit overweight penalty but this was not fully confirmed. There is only this slimness premium", so Caliendo. Although physical attractiveness clearly influences earnings, whether someone gets a job is not based on his or her body measurements.

Could the study lead to additional uncertainty among overweight women? "In these results I see no discrimination of overweight women, but in a previous study on unemployed men and women we did establish that overweight women have a lower self-esteem. They ask for a lower income during job interviews, while there are no significant differences in men." However: Even though the researchers were able to determine a "slimness premium" in their data, they cannot say why this is so. How does this premium come about? "We need additional evidence, particularly reliable information from the working environment. The Socio-Economic Panel data do not suffice for that," he explains. Much more will have to be investigated to get further relevant evidence. Only two things have been proven so far: Strong men earn more in production, slim women in the service sector. Klum's physique, however, would not really pay off. With a BMI of 18 she falls below the desired measurements.

HEIDI JÄGER

Factories of the Future

How cells become producers of medicine and biofuels

Cultures are exposed to light of different colors in this incubator.

Photo: Klaer, Andreas

The term is an oxymoron: synthetic biology. This field of research has been developing very rapidly for some years now, in which biologists, chemists, and engineers collaborate to create new organisms or molecules that do not exist in nature. Specific properties of an organism can be modularly transferred to another. Many people are skeptical or even frightened by this, but many examples illustrate how helpful and useful biotechnological research is for everyday life.

Katrin Messerschmidt opens the incubator door. A little flask with a cloudy liquid stands in an appliance reminiscent of an oversized microwave. Beside it is a rack of test tubes containing a yeast culture with millions of cells of ordinary baker's yeast in a nutrient fluid. Aluminum foil shields the glass door. "So no outside light shines in," the young researcher explains. Messerschmidt, a biochemist, grabs a remote control – and it starts getting colorful. Red, green, and blue – small chains of light begin to gleam on the incubator walls, which has a consistent temperature of 30°C. Messerschmidt adjusts the light color that shines on the yeast cultures with the remote control. "We still use simple party lights, but we will soon be installing diodes with a precisely defined wavelength," the researcher says. She is working on a process she calls "light-induced protein production".

Since April 2013 Messerschmidt has been the head of the junior research group "Cell2Fab" (acronym for "Synthetic Biosystems – From Cell to Fabrication") at the chair Molecular Biology. Funded by the Federal Ministry of Education and Research, Cell2Fab consists of Messerschmidt, a postdoc researcher, a technical assistant, and two PhD students who develop new procedures that aim to make baker's yeast cells into tiny factories.

Saccharomyces cerevisiae – the scientific name of baker's yeast – has been used in biotechnology for decades to produce useful substances. For this purpose the genotype of yeast cells is modified. The hormone insulin, vital for diabetics and one of the oldest genetically engineered medications, is now mainly produced from yeast cells and bacteria. Insulin used to be tediously isolated from pig pancreas. Now that insulin can be biotechnologically synthesized the use of porcine insulin has become extremely rare.

The "Cell2Fab" researchers want to go a step further because cells have so far only been able to produce rather simple molecules with biotechnological methods. In addition to insulin, fat-dissolving enzymes in detergents and certain amino acids in animal feed are produced with genetically modified organisms. To produce each protein molecule, the respective genetic information of another organism has to be isolated, reproduced and incorporated into the target organism's genetic material by using enzymes. The more information is needed and the more complex are the desired molecules, the more susceptible they are to disturbances. "The technology for quickly combining and introducing large numbers of varied genetic elements into a cell is still miss-

"Our goal is to temporally and spatially control the production in a cell."

Yeast cultures.

THE PROJECT

The **Cell2Fab Junior Researchers Group** arches the development of new methods to use the yeast *Saccharomyces cerevisiae* in biotechnological production. It receives funding as part of the strategic program "Nächste Generation biotechnologischer Verfahren – Biotechnologie 2020+" of the Federal Ministry of Education and Research.

Program period: 2013–2016, to be continued after evaluation until 2018

http://www.uni-potsdam.de/cell2fab

Photo: Klaer, Andreas

ing," Messerschmidt explains. The junior research group wants to change this. "Our goal is to develop methods to rapidly clone specific genes, integrate them into the cells, and to temporally and spatially control the production in a cell," the researcher says.

If simple organisms like yeasts end up being able to produce complex molecules, the potential applications – cancer medication, biofuels, vaccines, and even oil and plastic – would be far-reaching. Biotechnological methods also often conserve more resources and are much more cost-effective and faster than conventional production paths. Enriching bacteria and yeast with additional genetic information and cultivating them is relatively easy. Ultimately, the produced substances have only to be "harvested".

One of the project's challenges is changing the yeasts in such a way that they are able to produce the desired substances. The researchers also want to control production from the outside because allowing the modified cells to permanently synthesize a specific substance is not always desirable. The researchers are actually looking for an "on-off switch". Here is where the party lights come into play again: The yeasts start producing protein when exposed to light of a specific wavelength; the protein synthesis stops when the light goes out.

The researchers copied this principle from nature. "Plants have to know whether it is day or night. They have proteins that change their three-dimensional structure when exposed to light," the biochemist explains. Only when exposed to light do the modified proteins change the activity of specific gene sequences in plant the cells, which then culminates protein synthesis. The researchers now want to transfer this mechanism to yeast cells. "So far protein synthesis has been initiated by chemicals, for example," Messerschmidt explains. This is an expensive and elaborate procedure.

"We are working on something that combines basic and applied research."

THE RESEARCHER

Dr. Katrin Messerschmidt studied biochemistry in Potsdam and also wrote her dissertation at the University of Potsdam in 2008. Since April 2013 she has been the leader of the Junior Research Group "Synthetic Biosystems – From Cell to Fabrication" (Cell2Fab).

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

Dr. Katrin Messerschmidt.

Messerschmidt does not use the term "genetic engineering" when speaking about her work with friends. "When I tell them that I work with genetically modified organisms, their first reaction is "What?! Oh, dear!" she describes her experience, laughing. The term "genetic engineering" has a very negative connotation in Germany, Messerschmidt explains. Many people do not know that most diabetics use genetically engineered insulin. Now she often uses a little trick. "I say that I teach yeasts to produce drugs, for example. Then the people accept it."

In addition to her scientific work Messerschmidt is also in charge of human resources, procuring work equipment and furnishing offices. "Science is sometimes really simple compared to all this," she says tongue-in-cheek. She considers the practical relevance of the "Cell2Fab" research a key point. "We are working on something that combines basic and applied research and will ultimately solve problems." And she plans on doing something really big. "If we succeed, we might soon be independent from oil. Cancer medication will not cost hundreds of thousands of euros but will be able to be produced much more cheaply. We want to combine naturally occurring substances so as to achieve the greatest benefit with very little effort."

"Cell2Fab" has already found its first cooperation partner – the French National Institute for Agricultural Research (INRA) – to apply their research in the field of biological pesticides, but Messerschmidt remains tight-lipped about specifics. "A lot of exciting things are happening that we do not want to reveal too early," she says and laughs.

Messerschmidt is aware of the limits of her research. "It is generally a great challenge in synthetic biology that we lack a 100-percent understanding of complex systems," she says. Protein synthesis is a finely tuned system of genes, enzymes, and regulators influenced by countless individual factors. "Plants do not develop a biosynthetic pathway overnight. It has taken evolution several million years," Messerschmidt underlines. "Can we implement such a fine regulation in a short period? Perhaps not in five years."

HEIKE KAMPE

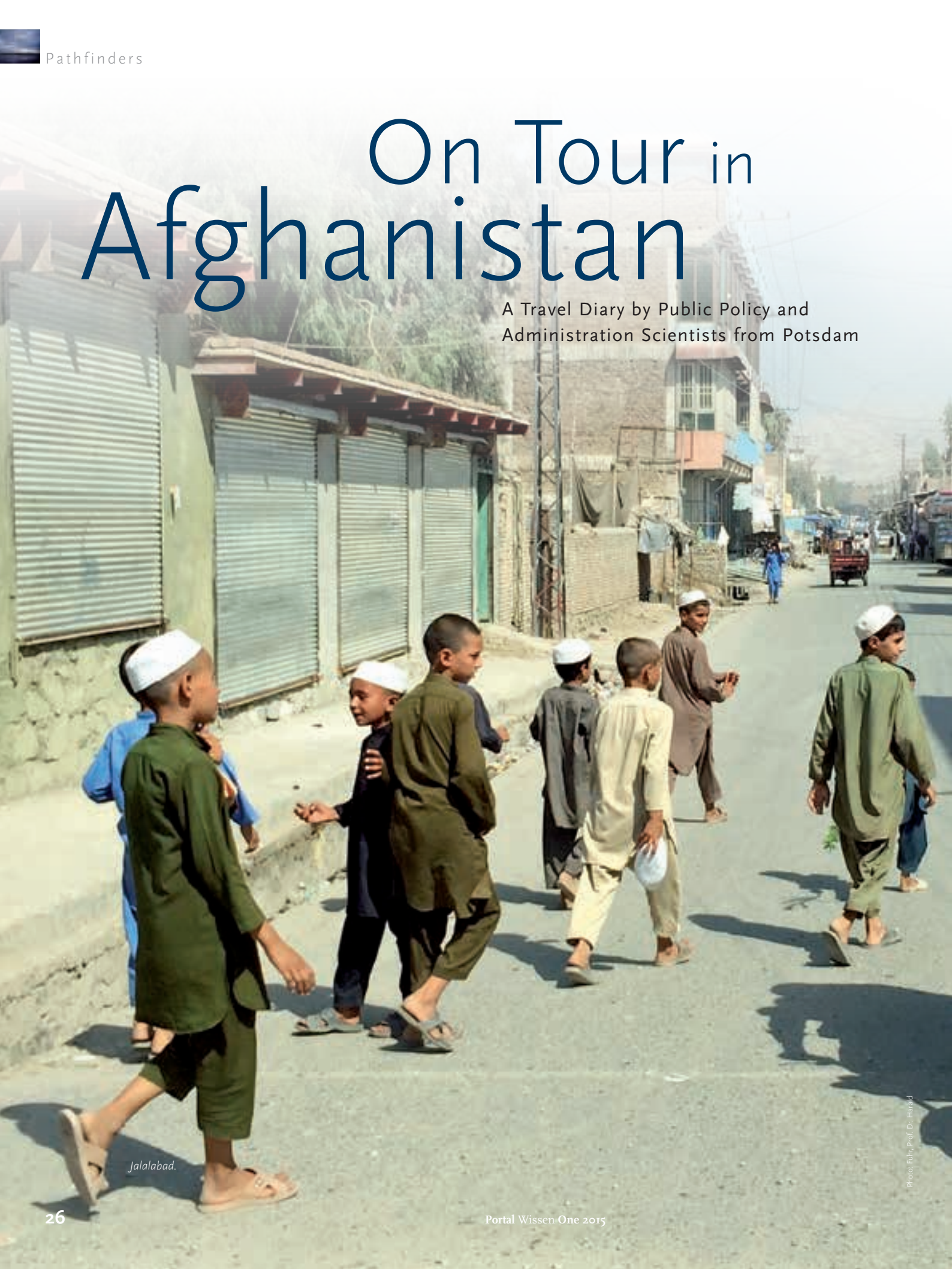
Photos: Klaer, Andreas (2)

Photo: Dall'Aglio, Aldo


PATHFINDERS

On Tour in Afghanistan

A Travel Diary by Public Policy and Administration Scientists from Potsdam



Jalalabad.

Photo: Fuhr, Prof. Dr. Harald

In September 2014, a group of scientists from the Potsdam Center for Politics and Management (PCPM) at the University of Potsdam traveled to Afghanistan to visit four public administration faculties as part of the "Strengthening of Public Administration Education in Afghanistan" project supported by UP Transfer GmbH. During their trip, Professors Harald Fuhr and Werner Jann, Julka Jantz and Dr. Thurid Hustedt took part in academic events at the universities and gave guest lectures. They have recorded their experiences in a travel diary.

Kabul, 22 September 2014, Day 1

After lengthy preparations, we are leaving today for our round trip to four Afghan universities – Jalalabad, Herat, Kabul, and Mazar-e Sharif – where, since 2012, we've been involved in setting up public administration faculties offering a Bachelor's degree in public administration. Afghanistan needs an efficient public administration for social development, economic growth and stability. Shortly before we leave, we receive news that comes as a great relief: After four months of negotiations, the two rival presidential candidates, Ashraf Ghani and Abdullah Abdullah, have finally agreed to a new power-sharing government for Afghanistan, something everybody had hoped for. Abdullah Abdullah, who had already abstained from voting in Hamid Karzai's favor during the last elections, was not ready to accept defeat a second time. The official election results will probably not be published – rumor has it that the run-off election result was 46% to 54% for Ghani after the vote recount – but what seems to be the most important outcome is overall consensus and hope for stability in Afghanistan.

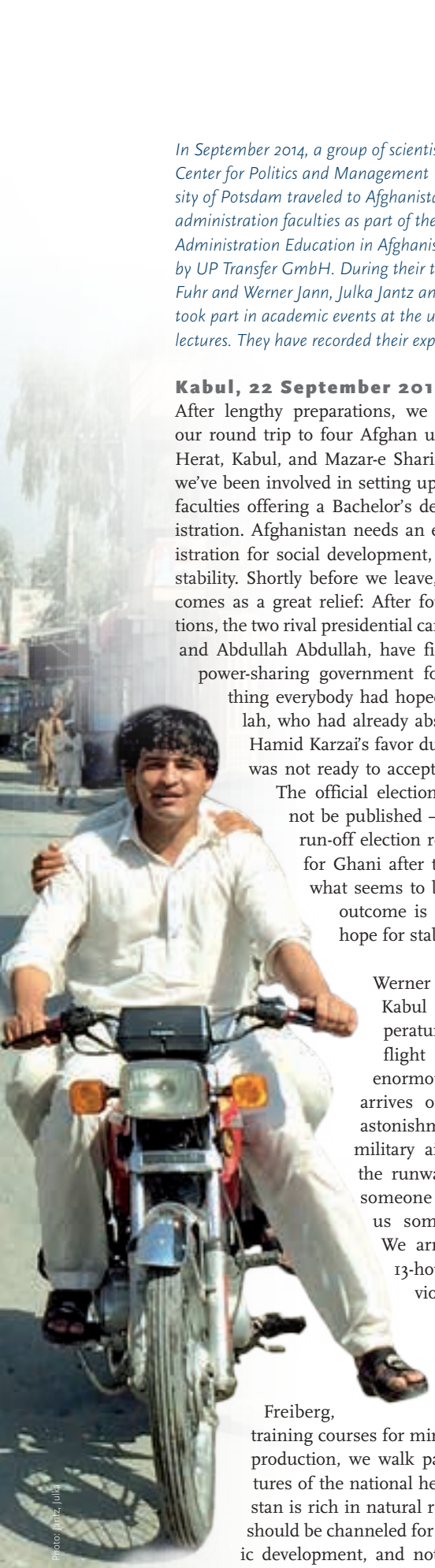


Photo: Jantz, Julka

Werner Jann and I arrive at Kabul Airport and the temperature is a mild 23°C. The flight from Istanbul in an enormous passenger airplane arrives on time. We stare in astonishment at the assembled military aircraft on the side of the runway. In the arrival hall, someone spontaneously gives us some homegrown dates. We arrive exhausted after a 13-hour journey and we obviously look it.

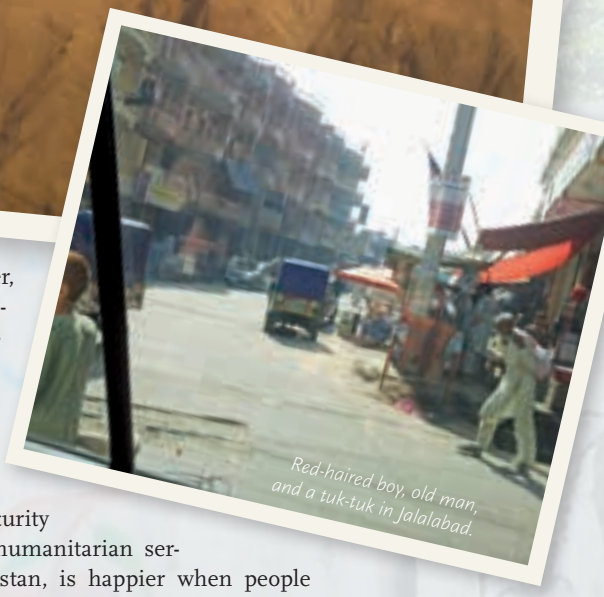
Together with our colleagues from the University of Freiberg, who are developing training courses for mining and raw materials production, we walk past larger-than-life pictures of the national hero, Massoud. Afghanistan is rich in natural resources and revenues should be channeled for the benefit of economic development, and not siphoned off by corruption and mismanagement. Fighting corruption is a major challenge and we agree that collaboration between "our" faculties is important. We cross parking area A and parking area B, where only vehicles with red diplomatic license plates can park. We don't have this privilege today and so we walk on, out into the sunshine and past the groups of Afghan families welcoming home-comers with bright yellow-pink-green garlands, a bit of welcome color amid Kabul's dust. Eventually, an armored jeep from dispatch arrives to pick us up – the airport is often a target for attacks.

Our hotel is like a fortress. A few months ago, insurgents killed several guests in a popular restaurant despite the stringent security checks. With our luggage, we go through the ordeal of three security gates, X-ray scanners, body searches, and sniffer dogs. However, the air-conditioned luxury of our hotel and the ornate garden tucked behind cold concrete walls, barbed wire, and armored steel, compensate us for our trouble. There are lots of wonderful oases nestled behind the concrete walls of Kabul and the people here are especially proud of their rose gardens.

We meet Harald Fuhr and Thurid Hustedt, who've already spent a week interviewing for another project in Kabul: How can the new government build administrative structures and processes that make them less susceptible to corruption, and pay public sector salaries that don't need donor-funded salary supplements? How can young people have a fair chance of getting a job in public services without having the right connections? The age pyramid in Afghanistan is not like that in Germany, where it's been turned upside down. Every year, thousands of young Afghans go to university. How can Afghanistan offer these young university graduates a secure future? This is a crucial question. The link between radicalization and lack of prospects seems to be too close.

The four of us have a lot to discuss on our way to the project office. Another beautiful garden behind walls, and this one even has a table set for lunch under the shade of a pomegranate tree. They all eat together – the two cooks can hardly keep up. Much later in our discussions, we move on to the topics for our presentations and go through the meticulous arrangements for our 10-day trip with Andreas Glod-

de, the office manager in Mazar-e Sharif. Logistics and security are the most important issues – we have to save numbers for security management and enter our travel data into the security system. We're given Afghan SIM cards, so that we can be reached by phone at all times. Our measurements are taken for the traditional clothes we need to wear on our trip to Jalalabad tomorrow morning. We are not allowed to go shopping on our own. At 4pm we leave for GIZ headquarters, where they will brief us about new developments and regulations in Afghanistan. It is an absolute must here that everyone abides by the rules.



Red-haired boy, old man, and a tuk-tuk in Jalalabad.

Suddenly, the traffic comes to a standstill. The new President, Ashraf Ghani, is giving a speech at a school today and the whole city center is blocked. We may miss our security briefing. We're sitting trapped between police cars, donkey carts, bicycles, and armored vehicles in the so-called "Ring of Steel," Kabul's heavily guarded city center. It gives us a queasy feeling. It's dangerous to get too close to Afghan police jeeps and military vehicles. Nobody is threatened more by deadly attacks than the Afghan security forces. It would be nice to just get out and continue on foot. After an hour, the hubbub is over and we arrive at GIZ's headquarters. What do you need to pack in a running bag? How should you behave when the police stop you? And why can't you take photos without permission...?

Slowly, our heads start spinning and we're feeling signs of altitude sickness. We probably haven't drunk enough water in this dry heat. Nevertheless, we're all O.K. and we return to the hotel for dinner. Last year, we would have gone to one of the nice, guarded restaurants and cafes, but this is now over after an attack on a restaurant that was popular among foreigners. A female Afghan journalist from Germany once referred to me as a "prisoner" – perhaps not without reason, but I was angry nonetheless. We often have to decline private invitations for security reasons, which makes us very sad. It's more important, though, that we continue with our project, and tomorrow we will be in Jalalabad for the first time. We'll fly in the small UNHAS plane used primarily for transporting essential relief supplies. The flight only takes 30 minutes. The road between Kabul and Jalalabad is considered to be one of the most dangerous in the world and is not a recommended route. (JJ)

Kabul/Jalalabad, 23 September 2014, Day 2

Today, the second day of our trip, we fly to Jalalabad. The city has about 250,000 inhabitants and is situated near the border with Pakistan. The legendary Khyber Pass, the road from Kabul to Pakistan, runs through the city. However, we're not traveling by car because the Risk Management Office (RMO), the organization in charge of managing security for all German humanitarian services in Afghanistan, is happier when people go by plane.

We fly with UNHAS, a small United Nations airline operating in different countries worldwide. It provides air services for areas with no or poor air traffic to support UN humanitarian assistance. UNHAS has its own terminal in Kabul Airport, actually a small barracks-like building but, as usual, it's heavily guarded. They use sniffer dogs to check your hand luggage – you're not allowed to take more on board with you anyway, which is actually quite reassuring. In front of the terminal desk is a small, waist-high box with sand in which you are supposed to place your weapon.

In Afghanistan, UNHAS operates with two aircraft, one 37-seater and one 19-seat Beechcraft, which we flew in, and a helicopter. Altogether, UNHAS provides regular air services to 12 Afghan cities, although they don't run every day. During the first six months, they transported over 10,000 passengers. UNHAS is a service reserved (almost) exclusively for UN personnel and employees of other aid agencies – there are more than 160 humanitarian entities in Afghanistan. The flight is pleasant; the plane is small, more like a small coach really. We're in direct contact with our two pilots, two nice young guys, possibly from the US. We fly over the rugged mountains and the barren desert and wonder why there is so much trouble in this poor, forbidding, and harassed country.

After 30 minutes, we get off our "flying coach" at Jalalabad. The official vehicles (mostly Toyota SUVs) waiting

Photos: Jantz, Julka (2. background)

to pick us up are just a few meters away. A big, light blue UN sign dominates the scene, but there is also a red American fire engine, an armored transport vehicle, and several pick-ups with cargo platforms full of armed soldiers turn the corner. The city reminds you of India and Pakistan: It is a very lively place. There are tuk-tuks everywhere, and some of them are richly decorated. The *Taj Mahal Guesthouse*, where we're staying, is located in a dead-end street and is heavily guarded. The undersides of vehicles are always inspected with mirrors because of incidents with limpets. The guesthouse is nothing fancy; in fact it's more like a youth hostel.

We're visiting the University and the Faculty of Administrative Sciences tomorrow to discuss latest developments with the Dean, the Chancellor, and other colleagues. In the afternoon, we plan to give a couple of short lectures. We're dressed like Afghans so as not to attract too much attention. Prof. Fuhr and I are wearing a traditional shalwar kameez, a long shirt over loose trousers. This is what Karzai always wears under his green vest. Mine is a typical sand color and Prof. Fuhr's is black. Our two female colleagues are modestly dressed in traditional long dresses with a shawl, ensuring their legs, arms and head are covered. Over 90% of Jalalabad's population is Pashtun. You hardly see any women on the streets during the day, but when you do they're all wearing blue burkas. This takes some getting used to. Progress here will require a strong, centralized and efficient public administration. To contribute to Afghanistan's development – that's why we're here. (WJ)

Julka Jantz with a girl on the Jalalabad campus.

Jalalabad/Nangahar, 24 September 2014, Day 3

Back from the university, we relax on the guesthouse's terrace. It's 6pm and the sun is going down. This is the time when the bats and geckos come out to hunt for mosquitoes. The furniture in my room is covered with a layer of black dirt – not surprising really when you see all the grime that the generator puffs out in the backyard. Our janitor apologizes and says that nobody has visited them in four months. Jalalabad is quite cut off from international development aid and there is only one GIZ project for business promotion. When we're not here, the generator is switched off. No cold Coke (as we'd hoped) because the fridges have been switched off all day.

Photos: Fuhr, Prof. Dr. Harald (2)

Students at the Faculty of Administrative Sciences in Jalalabad.

Afghanistan could easily provide enough water and solar energy, but gasoline and generators are still the most reliable source of electricity, especially for heating. It's not just an economic problem in a developing country that has no developed oil sector – the deserted drilling rigs from Soviet times are rusting away – the environment also suffers. During the ice cold winters, those who don't have enough money to buy fuel burn anything they can find; the poorest burn plastic bags or faecal sludge from the sewage. It's said that those who breathe in the wrong direction get sick in Kabul. There have been some nascent attempts to solve these problems. The street lighting in Mazar and Kabul is now powered by solar energy, and at the roadside in Jalalabad they sell little solar panels "to go" for domestic use. The university gets its electricity from a small dam. One big advantage is that electricity is nearly always available, and the air conditioning in the student hostels makes the overcrowded shared rooms bearable. The men and women are strictly separated, and the women's hostel is surrounded by barbed wire fences and high walls. When female students enter campus through the steel gate, they're dressed in light blue burkas or black chadors with holes for the eyes, but in the seminar rooms they only need to wear a headscarf. Families, though, still fear for their daughters' integrity, which is why there are so few women, we are told. Many families give their consent for their daughters to study medicine or teacher training. The faculties of veterinary medicine and agricultural sciences also have a higher percentage of women, since it's considered acceptable for women to work in hospitals, schools, and in agriculture.

Thurid and I are basically wearing a piece of cloth towel; we're all wearing local traditional dress today. Although we're not used to it, we feel quite comfortable in our traditional outfit with loose trousers made in thin material. Only Werner Jann is wearing an outfit made from a high-quality, khaki-green wool blend fabric. In the sweltering 37°C heat, he can be spotted looking enviously at everyone else in their light cotton tunics.

THE PROJECT

Since April 2012, the UP Transfer GmbH has been supporting the **"Strengthening of Public Administration Education in Afghanistan"** project funded by the German Foreign Office and the "Deutsche Gesellschaft für Internationale Zusammenarbeit" (GIZ) in close cooperation with the PCPM at the University of Potsdam. As part of its academic component, five new public administration faculties have been established at the universities in Mazar / Balkh, Kabul, Herat, Kandahar, and Nangahar.

The team, led by Prof. Harald Fuhr and Prof. Werner Jann, assists the Afghan universities both in academic and organizational matters. The project includes the continuing education of Afghan lecturers as well as advice on establishing and developing the faculties, for example developing curricula or teaching materials. The content is geared to the needs of the Afghan universities and focuses on the expansion of South-South cooperation, as well as establishing a sustainable academic network that will continue beyond the end of the project in 2014. For this reason, professors hold several coaching sessions at different locations in Afghanistan every year. Supplementary intensive coaching lasting for several weeks is held in cooperation with local government academies in Ankara (TODAIE) and New Delhi (IIPA).

The climate here is sub-tropical. The university campus, located to the west of the city, is a paradise of very old palm and eucalyptus trees, cypresses, bright flowers, and head high grass. Exotic colorful pheasants, geese, ducks, and chicken strut through the grass. Jalalabad doesn't have much in common with the Afghanistan we know from Kabul and Mazar. Dean Doudiyal describes the city as a mixture of India and Pakistan. The city's irrigation systems and electrification date from the time of the Soviet occupation. The engineers working on these modernization projects lived in the buildings that would later become the university, which moved into the complex in 1963 with initially eight professors and 48 students. Today, the university has about 500 teachers and 14,000 students. On the one hand, this can be seen as a positive step, but it's a lot of hard work for everyone involved. The countless flashy advertising by private universities does little to improve the situation. Since a certificate can be obtained via bribing some private universities, degrees from state institutions enjoy a better reputation. "Auch bei uns ist nicht alles Gold," ("All that glisters is not gold here either") says University President Dr. Enayat in fantastic German. His beacon of hope is Ashraf Ghani who wants to fight sleaze and patronage. Dr. Enayat, who has himself only been in office for 10 days, also wants to raise expectations. A life devoted to science, he studied in Jalalabad together with Dean Doudiyal while the Mujahideen went to battle in the streets, obtained a doctorate in Italy, was Director of Kabul Education University, President of Kabul University for five years, and an advisor to the Minister of Education, who finally called him back from Germany to his roots. "Education is the most important investment for the future," he explains. Afghanistan's state institutions don't charge its students tuition fees. If a student's place of residence is more than 35 km away, meals on campus and a place in a dormitory are free. Whoever decides to apply for a place at university needs to take the Kankor, a national university entrance exam similar to the former Central Office for the Allocation of Study Places in Germany. The examination results decide what and where you will study. The programs are listed in order of popularity. If you achieve a high score, you can study medicine or law. Administrative sciences managed to get into the top third of the allocation list in just two years. This is, of course, a very positive result, but a real burden for the 15 teachers whom we're meeting today. One of them has a doctoral degree and the others have Bachelor degrees in related disciplines such as economics, law, and political sciences. "Why choose administrative sciences as a course of study?" the students ask after listening to the presentations given by Jann, Fuhr, and Hustedt. It just seems to be a mix of law, economics, and politics, offering no real expertise in any one subject. "Look at medicine," Jann explains. "Chemistry, biology, psychology – you have to know all these, but you need more to be able to heal someone." "Yes," agrees a lecturer, "and our country is an extremely sick patient, so we have to become very, very good." We're impressed by the analytical and critical thinking of the first-year students. These young people want to understand concepts and hold discussions, not just learn something by heart and repeat it. (JJ)

The team in front of the Faculty with Dean Doudiyal.

Photo: Mr. Sadeqar

Jalalabad/Kabul, 25 September 2014, Day 4

Today we're planning to meet our female colleagues from Kabul University to discuss how we can further support them. We need to be cautious when we speak


UNHAS aircraft.

to them because they want to be recognized for their ability and don't want any kind of "special status" that would invoke the jealousy of their male colleagues. "We have to be very, very good, then they will accept us," says one teacher. Unfortunately, the UNHAS plane arriving from Islamabad has a technical problem and we cannot leave Jalalabad until late in the afternoon. The meeting is therefore postponed to Sunday after our return from Herat.

We spend most of the day going through different security checks and waiting in Jalalabad's heat, until finally we hear the sound of an aircraft propeller... it really is the little things that make people happy! Before we get on the plane, the Canadian UNHAS pilot personally checks all the items of hand luggage. When it's my turn, he hesitates and asks if he can search my bag. Men in Afghanistan are not allowed to search women's bags. This is why there is always a female member of staff to check the women in a partitioned area. I answer, "Sure, I'll help you", and take off my headscarf. It seems my traditional clothes have confused him; after all, there are also blond Afghan women. In fact, security management complimented Thurid and me on our clothing before we left. But when we arrive back at the guesthouse in Kabul, the first thing we do is put on a pair of jeans and a blouse again. What a nice feeling! (JJ)

Kabul/Herat, 26 September 2014, Day 5

We meet our DAAD colleagues for the obligatory Friday hotel brunch and pick up our discussion where we left off at the airport on the first day. How can we dovetail the Master's in mining with administrative sciences? What valuable experience have we gained? What worked, what didn't, and why? This type of discussion doesn't happen often enough, and project participants working in the same field often don't know each other, only from what they read. "Freaking empty here!" the Kabul office manager suddenly cries out. You normally need to make a reservation, but today only three other tables are occupied and the staff looks forlorn. The musicians, however, are busy playing very loudly and seem to be in state of trance. We decide to move to the courtyard after our meal. Today there is a market for the guests offering emeralds, rubies, topaz, lapis lazuli, aquamarine, silk, embroidery, and carpets – what's missing from this Ali Baba scene, though, are the customers.

By the end of 2014, a large part of the military will have withdrawn and many projects will have been completed. Due to accumulated special leave, the work in Afghanistan will be finished for many. The remaining projects will have been pared down and some donor sources will have dried up. The decision to extend our project to 2015 was only taken this year. Apart from the locals and the office manager, almost everyone else will have left. Many of our contact partners in the ministries and state organizations will have been called to new posts following the change of government. Many effective working relations will cease to exist. "The golden times are over," the Afghans say. But here also lies their biggest opportunity. In recent years, parallel structures have been set up in the ministries and the donor budget is many times higher than the regular Afghan budget. This additional support makes sense, but only for a transitional period. It will take time before the system will work without assistance – perhaps it will never work.

Shortly before our departure, we receive some good news: One of our interpreters has won a scholarship to join the Research Training Group in Potsdam. "Now we can switch off our mobiles," says Fuhr, "it won't get any better today."

We arrive at Herat Airport at 6pm and the temperature outside is 36°C. Five body checks and three luggage inspections are behind us before we get to the counter of


Fortress Herat.

Photos: Fuhr, Prof. Dr. Harald (top); Jantz, Julka (bottom, background)

Afghan KAM Air in Kabul. Because of the security measures, it really does make sense to be at the airport two hours before departure. After five days of drinking water and sweating under the desert sun, we feel sufficiently detoxed to enjoy a cool beer after work. But, sadly, there's not much chance of that. We have to wait to break our "fast" till we get to the German camp in Mazar.

A poster with "Welcome to the International Security Conference" welcomes our fellow passengers: journalists, military staff, and security experts from other provinces. Waiting in line, we're able to admire Afghanistan's full ethnic diversity. Police presence is high along the main streets lined with pine trees. This desert city near the Iranian border is an Afghan gem. There is a neatly kept bazaar and Herat citadel, restored with the help of Humboldt University in Berlin, is home to one of the best museums for Islamic cultural history. Under different circumstances, Herat would be a major tourist attraction. We had this wonderful place to ourselves during our last visit, yet this was an experience that made us feel uncomfortable. (JJ)

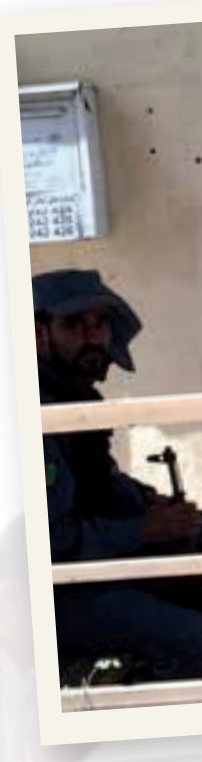
Herat, 27 September 2014, Day 6

Right away we notice the many female students in the first seminar room. What a contrast to Jalalabad! The men are sitting on one side of the room, the women on the other. Dean Shahidzada proudly announces that: "42% of the students at Herat University are women and we want to increase this proportion to 50%." The female students wear headscarves in the seminar room, but as soon as they leave the room they throw over their chador – a full-length semi-circle of printed fabric, mostly in black or muted colors, that covers the head and body. Unlike a burka, the face remains uncovered. The chador is held tightly closed in front with one hand, which isn't very practical because this only leaves one hand free. You also see some women wearing the typical blue burka in the streets, but here close to the Iranian border the chador-clad women dominate the street scene and you look in vain to see the simple headscarf that so many women casually wear in Kabul.

During our opulent lunch together with all the faculty members, I talk to the head of the organization who helps our students to find internships. We discuss the status of women in this city. "Many things have improved since the end of the Taliban regime," she says. It's become acceptable for women to study and work. When she started her job 14 years ago, she had to keep moving every six months to remain unrecognized for as long as possible. Working women faced considerable dangers and threats. Nowadays, they work in all kinds of fields, set up their own businesses and some even hold executive positions. Unlike in other parts of the country, women drive cars in Herat and it's not a problem to go out and socialize with a female friend in the evening. However, women have to be at home between 9pm and 10pm at the latest. "Riding a bike here is impossible," my conversation partner laments. Nevertheless, a dedicated woman like her running her own business with a staff of 65 women and 4 men can live a freer and more self-determined life here than in other parts of the country. I am inclined to believe that. Female students, and women in general, appear more self-confident than the women in Jalalabad, where the few we saw or talked to were extremely shy. My doubts remain, though – what with the omnipresent chador, the strict gender-separated seating arrangements, and the sporting restrictions against women. I also wonder how much freedom women have outside the city of Herat in the province's rural districts. (TH)

Kabul, 28 September 2014, Day 7

We started in Herat this morning at 6am. Due to the usual morning traffic jams we only have about an hour to freshen up in our hotel before visiting the university. Tomorrow, Monday, the new President Ashraf Ghani will be inaugurated. They're expecting VIPs from many different countries; perhaps even Angela Merkel will



Photos: Jantz, Julka (2. background)

Lecture by Prof. Jann (2nd from left) at the University of Herat.

Colleagues of the University of Kabul and the Potsdam team.

come. That would be a good gesture. Since half of the city will be closed off for security reasons, the authorities have decreed a holiday for Kabul. The university will be closed too, because the students won't be able to get through security.

It's really amazing that finally everything works out. The faculty quickly reschedules all their plans by one day. Fortunately, Sunday is a normal working day – the weekend starts on Friday.

We are very happy to meet Dean Rahmani and his team again. I feel particular sympathy and admiration for his three female colleagues who had a hard time locked away at home for years under the Taliban regime. It was dangerous to own or even be seen reading books.

Sitting here with the women – each one has cooked her own specialty: bolani, my favorite mantu, small dumplings filled with lentils and yogurt sauce, cake and semolina pudding with cardamom, pistachios and rosewater – I'm extremely proud of these young people, who are standing up for their future. If the wrong government were to come to power, all the odds would stack up against young academics. They soak up as much information as they can: How can we do a good job later? What is the right approach for our country?

They ask these fundamental questions over and over, and again after Thurid's guest lecture. Our Afghan partners seem almost disappointed that we can't come up with a single solution. We explain that it also took over 30 years until the old structures in Germany were

THE RESEARCHERS

Prof. Harald Fuhr (HF) studied political sciences, sociology, economics, economic and social history at Goethe University, Frankfurt-am-Main and the Philipps-Universität Marburg/Lahn from 1972 to 1979; PhD (1985) and habilitation (1993) in Constance. Since 1997, he has been Professor of International Politics at the University of Potsdam.

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

Prof. Werner Jann (WJ) studied political sciences, mathematics and economics in Berlin and Edinburgh from 1970 to 1976; PhD (1982) and habilitation (1989) at the German University of Administrative Sciences – Speyer. Since 1993, he has been Professor of Political Science, Administration, and Organization at the Faculty of Economics and Social Sciences of the University of Potsdam.

Contact
✉ jann@uni-potsdam.de

Julka Jantz (JJ) studied economics, international relations, and public administration in Stuttgart, Potsdam, and Paris. Since 2006, she has been a research fellow at the chair of International Politics and is now Project Coordinator for the project "Strengthening of Public Administration Education in Afghanistan."

Contact
✉ jjantz@uni-potsdam.de

Dr. Thurid Hustedt (TH) studied political and administrative sciences at the University of Potsdam and also did her PhD (2012) there. Since 2014, she has been a post-doc researcher at the Research Training Group "Wicked Problems, Contested Administrations."

Contact
✉ hustedt@uni-potsdam.de

Photos: Fuhr, Prof. Dr. Harald (left top); Jantz, Julka (left bottom, background, right 3rd from the top); Fritze, Karla (right top, right 2nd from the top,, right bottom)

broken up after the war. The reform process is slow, and at the end of one reform is often the beginning of the next and, at best, you've learned something new in the process.

But a teacher once told us that this exact approach is part of the success in our coaching – to know the fact that there's not one true way of doing things, and that there are no blueprints. (JJ)

Kabul, 29 September 2014, Day 8

We are stranded at Kabul Airport. Airport Road has been closed since 6am for the high-ranking guests of the president's inauguration. Civil flights have also been postponed for an indefinite time – including ours to Mazar. The pilots and crew have arrived too late at the police blockade and haven't been allowed to pass. Even when our flight is eventually cancelled, it doesn't help us very much because the dispatcher cannot pick us up at the airport anyway. The city holds its breath. There's nothing we can do: We just have to sit and patiently wait for eight hours to catch the next flight to Mazar. Travel time in Afghanistan usually seems to involve 50% waiting, discussion, and planning. Mr. Sadeqar, who is accompanying us on our journey, is permanently on the phone, rescheduling appointments and changing all the relevant details, remaining friendly and good-humored throughout. I admire him for that!

At some point, we start to relax and a sense of fatalism creeps in – the most important thing to do now is to find something to eat and drink and a get book to read. I head off with my Afghan escort to fetch food and drinks.

Arrival at Mazar-e Sharif Airport.

We manage to park in parking area three – after all, it is a special holiday. On our return, we walk past the security checkpoints laden with coffee pots, bottles of Coke, packets of cookies and nuts. The guards either laugh or shake their heads. It's so baking hot at noon that the soldiers of the presidential guard put up blue and yellow sunshades over their black and grey tanks, and now I have to laugh. Mr. Sadeqar notices a famous singer from Herat in front of us, whom the guards quickly wave through. We've now organized basic provisions for a long wait. The deeper we rummage through our suitcases, the more "valuable" things we find: Harald Fuhr still has an entire bag of Haribo gummy bears, and Thurid Hustedt has found some fruit bars. Well, here we go... computer, gummy bears, and a good book.

We get a string of text messages telling us about the latest attacks and explosions, but it was obvious that the city wouldn't remain peaceful on a day like this. Hopefully, we'll soon be in Mazar. The prospect of moving freely, perhaps taking a walk to the blue mosque and across the bazaar, appeases us. And, we're still looking forward to the highlight of our trip: a visit to the new faculty building, the project's infrastructural component.

After 12 long hours we finally land at the new airport in Mazar, which was built with German assistance. The capital of the northern province Balkh is a boomtown and is designated to become a logistics hub for the whole region. Plans are already under way to convert the halls at the large German army base next to the airport, Camp Marmal, which will soon be vacated. Much of the logistics of the Afghanistan mission, and now also its redeployment, is being managed here. The infrastructure could ideally be adapted for civilian purposes in future. Let's see how the situation develops here. The present Governor Atta, who uses ruthless methods to ensure peace and quiet, the former warlord General Dostum, and the Northern Alliance are split between the followers of Ashraf Ghani and Abdullah Abdullah. The new government will be put under severe pressure here. (JJ)

Mazar, 30 September 2014, Day 9

We are heading north on a ruler-straight street towards Mazar-e Sharif International Airport. A lot has changed since we arrived here for the first time in March 2012. At that time, we drove along bumpy streets with potholes and down unexpectedly narrowing lanes. Most street surfaces are paved now and the left and right lanes are clearly marked. Along with a strikingly large number of new gas stations, there are new settlements and small shops and business premises on both sides of

Photo: Jantz, Julka

the street. Next to the fruit, vegetable and drink stands, there are outlets and repair shops for all kinds of vehicles. On the side of one of the parked trucks we can still make out the German lettering and we ask ourselves, how did a *Nürnberger Kloß-Teige* (Nuremberg Dumpling Dough) truck wind up here?

About half way down we turn into one of the development areas. The outside temperature is about 40 °C. After passing a number of rusted skeletons of abandoned military vehicles at the side of a dusty road, we finally arrive at the newly built University of Balkh. A new wing will be inaugurated in a few weeks, and we and our colleagues in Mazar are particularly interested in having a look around at the new Faculty of Administrative Sciences.


Lunch at Dean Sharaf's in Mazar.

We are pleasantly surprised at how much the pale yellow building with its brown stripes between the four floors reminds us of Bauhaus architecture and how well the color fits into the barren, desert-like landscape. Although we're told that something's wrong with the power supply in this part of the city and they have to use a generator, it seems to us that everything else is going according to plan. The temperature here is often above 40°C in summer and -15°C in winter, so most of the new seminar rooms and lecture halls are equipped with a heating system and double-glazed windows, unlike the old buildings in the city center. The rooms on the first floor are bright and spacious, not only the Dean's Office, but also the offices for professors and assistants, we note with envy. Construction workers are beavering away, assembling office furniture and countless tip-up seats in the lecture halls, installing power lines and polishing stairs.

The new building – Insha'Allah – will be officially inaugurated on 9 October 2014 with representatives from the German Foreign Office attending, because the building has been financed by the German Government under the "Strengthening of Public Administration Education in Afghanistan" (SPA) project. From here, we can look across and see the little white zeppelin on the horizon that's used for air surveillance in Mazar-e Sharif at the base of the camps for the Scandinavian and German troops.

When we leave the campus, there's not a breath of wind and the midday heat is sweltering. Nearby, we see another German commercial vehicle; this time it's green, and – no kidding – the sign reads: *"Getränke Lambert – Licher Bier"*. If only the workers knew what a blasphemous vehicle they were using for transporting their construction materials ...

We are now hurrying towards the city center because we are invited for lunch at noon at the Dean's house of the Faculty of Administrative Sciences. After lunch, we're scheduled to give two lectures at 2pm. The food is rich, as is usual for private invitations, and served on a tablecloth on the floor. We sit on cushions in a rectangle and enjoy the company, especially after the lost day at the airport in Kabul yesterday.

Prof. Sharaf has accomplished amazing things during the past two years since the faculty was founded. He and his ten colleagues supervise about 400 students of administrative sciences. Although we noticed a few students typing on their smartphones during our presentations today, most of them seem to be interested in learning about the new subject and the job prospects it might offer them. The students ask most of their questions in English; they are specific and to the point and do not seem to have prepared their questions in advance.

Unfortunately, at about 4pm the intense sun starts to pierce through the drooping, pink curtains and it's getting really hot and muggy in the lecture hall of the old main building. The wood paneled walls and stage remind us of a theater. The huge ventilators they've wheeled in to cool the room are obviously from another century and produce a lot of noise instead of blowing out cooler air. We finish our presentations with an appraisal of the virtues of the air-conditioned lecture halls on the new campus. This draws enthusiastic applause from the audience. The end. We drive back to our hotel. (HF)

Photos: Fuhr, Prof. Dr. Harald (background)

Photo: Dall'Aglio, Aldo

PATHLESS

Surviving in Space

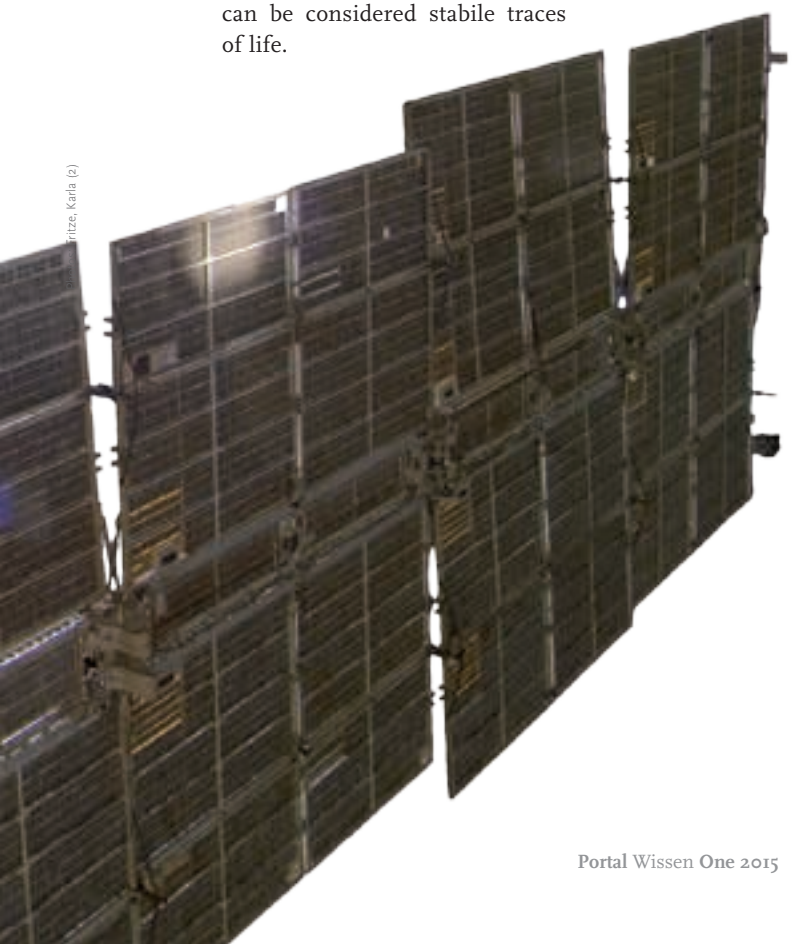
Why There's Moss on the ISS

The ISS with the attached "Potsdam" moss (in the red circle)

Photo: ESA

All the lights on campus are off. Only in Björn Huwe's office a screen is flickering. The biologist is sitting at his desk in the institute building of the Botanical Garden, spellbound by the monitor. Over three and a half thousand kilometers away, at the Baikonur Cosmodrome, a Soyus rocket is taking off into space. Onboard is also biological cargo from Potsdam – moss and bacteria. Huwe watches it live on NASA-TV, anxious and fascinated at the same time and also a bit proud despite the uncertainty. Will it all work out? In what condition will the samples arrive at the ISS? Will it be possible to attach them to the space station's Zvezda Module? For the young researcher it is a kind of letting go. What happens from now on is out of his control...

It is indeed an unusual story that began about five years ago. "It was at the time when increasing efforts to research extraterrestrial life were being made worldwide," says the biology professor Jasmin Joshi, amusedly remembering some exotic suggestions like cultivating tulips on the Moon. Some projects, though, have been seriously pursued. These examine the behavior of extreme organisms under extraterrestrial conditions, among them the biological Mars experiment BIOMEX that was started in 2014. Bacteria, alga, lichens, and moss have been mounted on the exterior of ISS and are being exposed to vacuum and radiation in space. The researchers want to find out if the organisms can survive these extreme conditions and later endure transport between Earth and Mars. They are concentrating on the stability of cell structure, proteins, and DNA as well as on changes in certain pigments. If the cell components withstand space and Mars-like conditions in low earth orbit, they can be considered stabile traces of life.



Fritze, Karla (2)

BIOMEX includes 12 different packages of experiments from 25 German and international institutions. The principal investigator is the astrobiologist Jean-Pierre Paul de Vera of the DLR-Institute for Planet Research in Berlin-Adlershof. "When he asked us if we would like to contribute something, it literally seemed very far out at first," Joshi remembers. "After looking at it more closely, we realized the potential added value for our basic research." Moss, Joshi says, has not been exhaustively investigated yet. They do not belong to the useful plants. Research, if any, has concentrated on its secondary compounds. Geneticists have only recently discovered moss as a model plant, the biologist explains.

> *"Geneticists have only recently discovered moss as a model plant."*

Mosses are mostly haploid, i.e. they have only one set of chromosomes in contrast to higher plants. Their ability to survive long dry periods and resist the stress of large temperature fluctuations has aroused interest in the genetic properties of these evolutionarily important organisms, properties that were probably crucial in plant colonization of land about 450 million years ago.

After deciding to send moss for BIOMEX to space, the Potsdam scientists became immediately aware not just any nondescript plants from the roadside or domes-

THE RESEARCHERS

The biologist **Prof. Jasmin Joshi** studied at the University of Zurich, and completed her PhD at the University of Basel. Since 2008 she has been Professor of Biodiversity Research and Botany at the University of Potsdam. Her research interests include invasion biology and functional biodiversity research.

Contact
Universität Potsdam
Institut für Biochemie und Biologie
Maulbeerallee 1
14469 Potsdam
✉ jjoshi@uni-potsdam.de

Björn Huwe studied biology at the University of Potsdam and is currently a PhD student here. He is involved in the BIOMEX – Project **"BIOlogy and Mars Experiment"**.

Contact
✉ bhuwe@uni-potsdam.de

THE PROJECT

The **BIOMEX "BIOlogy and Mars Experiment"** involves 25 institutes from around the world. It is part of ESA's space experiment EXPOSE-R2 on the International Space Station (ISS) and is funded by the European Space Agency (ESA) and the German Aerospace Centre (DLR).

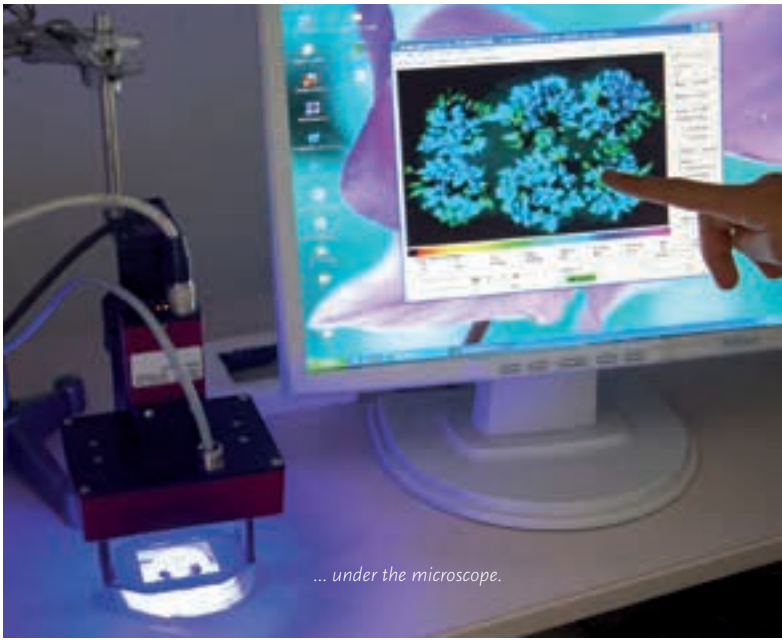
tic forests would do. They needed the strongest and most robust, those that have already proven on Earth that they can survive drought and heat as well as frost and extreme UV radiation. They chose moss cushions from the Swiss Alps. PhD student Huwe climbed 3,000 meters up the mountains and brought down the "masters of survival" to the lab in Potsdam, where they were prepared for their space expedition. Certainly no easy task! "All samples had to look the same. We also had to exclude any interaction with other organisms," the young biologist reports. He and the MA student Annelie Fiedler developed a special design. They painstakingly separated 50 thin stems from the moss cushions, washed them several times in double-distilled water, and reassembled them. They used original Alpine rock as soil but also Lunar and Mars-analog material from the Museum für Naturkunde Berlin and the German Aerospace Center (DLR). "Simulating space conditions

"PhD student Huwe climbed 3,000 meters up the mountains and brought down the 'masters of survival' to the lab in Potsdam."

Photo: Fritze, Karla

Björn Huwe and Annelie Fiedler made the moss fit for space.


Moss samples ...


... under the microscope.

as closely as possible was important," Huwe says, explaining how they exposed the samples to different gas mixtures, UV radiation, and extreme temperatures in self-made climate chambers to find out if moss had any chance of survival, if its journey to space would be worth the effort.

Preparing moss plants' delicate spore capsules for space requires fine-motor skills. Fiedler found a practical solution. She designed tiny pockets of breathable, radiolucent foil, affixed them to the plants with "space glue", and placed each capsule into bags so they would not just "fly away".

The mosses that survived all their stress tests got their ticket to space from the European Space Agency (ESA). Only the departure date remained written in the stars. A grueling waiting period began for the researchers. As launch after launch was being postponed, the samples were drying up. Then, in early 2014, everything happened very quickly. The rocket launch was scheduled for the end of July. Fresh plants had to be fetched and prepared. "That was not easy," Huwe remembers. "There was still snow in the mountains." Before Easter the team of biologists worked two weeks in the lab separating, washing, reassembling, and gluing the plants onto rock pellets and then attaching Fiedler's mini-bags. The researchers took a number of zero measurements to get reference values. Then the biological load was carefully packed, mailed to Cologne, and carried in the hand luggage of colleagues to Moscow and Baikonur.

"They have to make do without nutrients and moisture in space vacuum under Mars-like conditions for a year and a half."

On 23 July 2014, at 23:00 Central European Time, a space transporter took off from Baikonur for the ISS. In August the samples were attached to the exterior wall of the Zvezda Module. They remained covered at first to prevent any reaction between the residual gas in the samples and the radiation that could have impaired the glass filters. In October the astronauts removed this last protective covering during a second extra-vehicular activity. Since then the plants have been tested under extreme conditions. They have to make do without nutrients and moisture in space vacuum under Mars-like conditions for a year and a half. Joshi, however, is optimistic. She thinks that the mosses can withstand a lot. "They are most resilient under dry condition."

When the plants return to Earth, the researchers will examine if photosynthesis is still possible and if cell structures will have changed. Genetic damage can be diagnosed on samples of *Marchantia Polymorpha*, the common liverwort, which biologists from the University of Zurich added to the freight. "This species was completely sequenced before the experiment," Joshi explains, which enables a before-after comparison.

Dirk Wagner, Professor of Geomicrobiology and Geobiology, eagerly awaits the return of the Potsdam cargo. He contributed archaea – methanogens – to the stay in space to learn more about their survivability and detectability in Mars-analog substrate. After all, the results of the BIOMEX experiments are supposed to help in the search and identification of life on the red planet. Future Mars mission will benefit from it.

ANTJE HORN-CONRAD

Photos: Fritze, Karla (2)

Photo: Schindler, Taylor

The Andes in northwestern Argentina.

On Precipices

Landscape Response to Climate Change

Landscapes change over hundreds of thousands, even millions of years. Tectonic events and erosion create mountain ranges and remove them again. The climate also leaves traces in the landscape over time, particularly if it changes dramatically. Such processes occur faster in some places than others, like in the Argentinian Andes, reason enough for Taylor Schildgen and her team from the Institute of Earth and Environmental Science to travel to northwestern Argentina and examine how extensive climate changes have affected a landscape – in the distant and recent past – and will probably also affect it in the future.

On foot along a riverbed.

Big mountain ranges with steep slopes like the Andes particularly appeal to geoscientists and environmental scientists: "We hope for explicit results at such places," Schildgen says enthusiastically. Steep slopes often show greater erosion and thus change more rapidly, and even neighboring landscapes can differ greatly. The geologist would know given her intimate and long-term relationship with the Andes. Her dissertation at the renowned Massachusetts Institute of Technology (MIT) dealt with the development of the world's longest mountain range, which extends throughout South America. During her Peruvian expeditions the American researcher met the very German scientists she now works with side-by-side. She moved to Potsdam in 2008 after completing her dissertation, but never lost interest in the Andes. "In the meantime I have been working in many other regions, mainly on the Anatolian Plateau," she says. "In 2009, I returned to the Andes. I applied for this project in 2012, and we got started in February 2013."

This project, the Emmy Noether Junior Research Group, includes three PhD positions and a post-doc position that Schildgen, as the group leader, can fill depending on research requirements. It is a new responsibility for the young researcher, as she herself admits. She embraces it because she would not be able to manage the project by herself. The group is confronted with a mountain of work – literally. She is investigating how certain landscapes react to climate change, in her case the Andes. The challenge lies in the word "change". Landscapes have always changed and been influenced by various factors. Schildgen and her team, however, are interested in the effects of drastic climate changes. This is why her

"Big mountain ranges with steep slopes like the Andes particularly appeal to earth scientists and environmental scientists."

Two levels of fluvial terraces overgrown with vegetation. Today's riverbed lies a few meters lower than during the time the fluvial terraces were formed.

Photos: Schildgen, Taylor (2)

Sediment sample, ready for chemical analysis.

"journey" has taken her through Andean history – by analyzing sediments. "We can 'read' the previous erosion rates in the isotopic composition of sediments and reconstruct how the system responds to different – wet and dry – periods," Schildgen explains. In principle, researchers assume that landscapes have different levels of sensitivity to climate change. Comparing older and more recent erosion rates offers more details and might show how long it takes for a landscape to respond to climate change, how strong the reactions are, and how long it takes for new, stable conditions to be created. The geoscientists also hope to be able to describe processes that influence landscape changes. "We want to get past our qualitative understanding of increased precipitation leading to higher erosion rates," Schildgen asserts. "Our main goal is to be able to predict specifically how landscapes react to climate change."

"Our main goal is to be able to predict specifically how landscapes react to climate change."

A central aspect is developing models based on analyzing the collected data but the project goes even further. One group member will be focusing only on modelling. Schildgen is looking forward to this project phase. "It is a bit like a game from which we expect a lot." Ideally these models will be applied to other landscapes, but first, sediment samples have to be collected and analyzed. Schildgen and PhD student Fabiana Castino were onsite in July 2014. The many small bags that now line the shelves of their office on the Golm campus await Stefanie Tofelde, the team's other PhD student, who chemically analyzes samples and determines erosion rates of the investigated area at different times – and how they relate

Taylor Schildgen, PhD.

Photos: Fritze, Karla (2)

Railway bridge in the Humahuaca Basin, photo taken in 2012. The initial distance between riverbed and bridge has been almost completely filled due to intensive deposition. The railway line had to be closed.

Photos: Schildgen, Taylor (2)

to climatic changes. "We use two different methods," she explains. "To determine the erosion rate, we isolate specific minerals from the sediment, in this case quartz, and measure the concentration of a certain isotope (beryllium-10)." Sedimentary deposits reveal past erosion, and the team gets current comparative values from "young" river samples. Tofelde then collects information about past and present climatic conditions and changes, again measuring isotopes but this time in organic material that has been subjected to changing climatic conditions. "The principle is the same," she says, "Material from today's rivers reflects the current climate. Material deposited long ago provides information about the climate in the past." Although this procedure sounds very simple, the actual work is complex and tedious. Chemical lab analyses often take several months, and it may even take up to year before results are available.

Sampling of biomarkers from old fluvial terraces in Humahuaca.

Inspecting the "objects of desire" is undoubtedly beneficial from time to time. Tofelde spent a few weeks in Argentina in March 2014 looking for suitable deposits and will return again in March 2015 to do geological fieldwork. She explains that the reason for this rhythm is very simple: "There are no teaching commitments because it is semester break, and the rainy season in Argentina is over." For Tofelde, who studied biology and geology, the project is more than a stroke of luck. The variation of working in the field, in the lab, and at the desk especially appeals to her. "Each project helps you to understand a bit better why a landscape looks the way it does and how it might look in the future."

> *"Material from today's rivers reflects the current climate. Material deposited long ago provides information about the climate in the past."*

In the lab, the young researcher works with material that is usually between a few thousand and 100,000 years old. Some of the current samples are only about 60 years old. The scientists are particularly interested in the Humahuaca Basin, which has changed dramatically over the past decades, Schildgen says: "Some rivers are filling with sediments extremely fast, sometimes 2.5 meters in just 20 years. This sediment has buried much of the transportation infrastructure, which will have to be completely rebuilt."

"Some rivers are filling with sediments extremely fast."

The climate changes that preceded these abrupt erosion rate changes happened only a few decades ago. The researchers can even refer to data from the regional meteorological station. Castino traveled to this region in summer 2014 to examine this data. It shows the potential of the project, should the models be successfully transferred and be able to predict the landscape changes due to climate change. Schildgen knows this very well. "Political stakeholders have already expressed interest in our research. After all, creating action plans would be a big step forward and could restore stability in regions like Humahuaca." But until then it will remain a rocky path.

MATTHIAS ZIMMERMANN

THE RESEARCHERS

Taylor Schildgen, PhD studied geology in Edinburgh and Williamstown, MA. She came to the University of Potsdam in 2008 after finishing her dissertation at the Massachusetts Institute of Technology. Since February 2013 she has been the group leader of the Emmy Noether Junior Research Group "Geologic reconstructions of changes in erosion rates and hillslope processes in response to climate forcing".

Contact
Universität Potsdam
Institut für Erd- und Umweltwissenschaften
Karl-Liebknecht-Str. 24–25, 14476 Potsdam
✉ tschild@uni-potsdam.de

Stefanie Tofelde studied biology in Constance and geology in Potsdam. Since 2014 she has been a PhD student in the Emmy Noether Junior Research Group "Geologic reconstructions of changes in erosion rates and hillslope processes in response to climate forcing".

Contact
✉ tofelde@uni-potsdam.de

A mudslide in 2012 buried half of a restaurant on a main road through the Humahuaca Basin.

Photos: Fritz; Karla (top); Keuning, Annet (center); Schildgen, Taylor (bottom)

Photo: Dall'Aglio, Aldo

Photo: Fotolia.com/photophonie

Stop the Pain!

Psychologist Petra Warschburger provides training programs for children suffering from functional abdominal pain as part of a trial

While adults often suffer from backache or headache, children repeatedly complain of twinges and pain in their tummies. The reason could be an infection or organic disease of the gastrointestinal tracts, but in most children no physical cause for the pain can be found. The pain is real, but medical results offer no explanation.

Petra Warschburger, Professor of Counseling Psychology at the University of Potsdam, knows this problem. Her research focuses on chronically ill children and adolescents suffering functional abdominal pain. "This is recurrent abdominal pain that the children experience but for which doctors find no organic cause," she explains. This topic is not new to her. Warschburger and her team have been focusing on the quality of life of chronically ill children for some years now, particularly of those with abdominal pain syndromes. Some children suffer severe psychological strain that may even be worsened by endless visits to doctors and waiting in vain for a diagnosis. "These children have the impression that people think they are lying and then feel even worse," the psychologist says. Warschburger intensively investigated functional abdominal pain as part of the Graduate School of Developmental Psychopathology and Evidence-based Intervention she led together with Professor Günter Esser from 2007-2010. She and a PhD student developed a program for psychological interventions to show children an alternative way of coping with pain. The promising results of the final evaluation highlighted the efficacy.

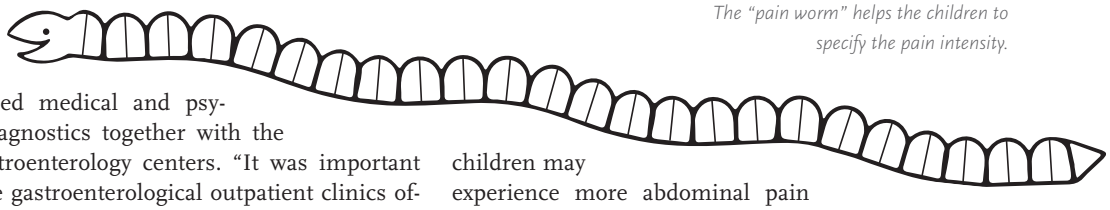
Her current clinical trial "Stop the Pain" picks up on this research. The multicenter examination, running from October 2013 to September 2016, is being funded by the German Research Association (DFG). Patients are recruited for the trial in outpatient clinics together with certified pediatric gastroenterologists in Berlin, Ulm, Düsseldorf, Darmstadt, and Hamburg. They look for children who have had abdominal pain for more than 2 months with episodes occurring at least once a week. Detailed examinations first clarify whether there are organic causes, for example lactose or fructose intolerance. "If there are no organic causes and the pain still persists, we talk about functional abdominal pain. The parents are then asked if they would like their children to participate in the study," Warschburger explains. She and her assistant Claudia Calvano are developing

> *"These children have the impression that people think they are lying and then feel even worse."*

THE PROJECT

Stop the pain – A multicenter, randomized-controlled study of a cognitive-behavioral intervention for children with functional abdominal pain

Duration: 2013–2016
Participating: Prof. Dr. Petra Warschburger (Head), Dipl.-Psych. Claudia Calvano
Funded by: German Research Association (DFG)



The "pain worm" helps the children to specify the pain intensity.

guideline-based medical and psychological diagnostics together with the pediatric gastroenterology centers. "It was important to us that the gastroenterological outpatient clinics offer our program on site. Psychologists do provide the training for the children but it takes place in a different context, which makes participation in the treatment easier and will increase its acceptance."

The children in the study are randomized into two training groups. The two training programs and random allocation are key criteria to validate and interpret the results.

Altogether 112 girls and boys aged 7-12 will to take part in the intervention program. The children initially attend six training sessions. Two additional sessions are for the parent groups. Two weeks after the training, three and twelve months after the training, parents and children are asked to fill in questionnaires to report how they experienced pain and associated factors, and short interviews are conducted with the children. Prof. Warschburger and her team then evaluate if and to what extent the intervention groups differ, for example with respect to pain reduction, increasing health-related quality of life, and improved self-efficacy.

"The children regularly observe their pain and keep a 'pain' diary."

In general, group sessions proofed to be very helpful. There are 3-8 children in each group session. By meeting other children with the same problem, they learn that they are not alone. They can learn from and support each other. "Apart from that, simply having other children around is much more fun and an important motivating factor," Warschburger says.

The aim is to establish a positive experience that the girls and boys can integrate into their everyday lives. The children regularly observe their pain and keep a "pain diary". "There are, of course, also concerns that the children may experience more abdominal pain by dealing with and thinking about the topic so much. Our studies, however, produced no evidence of this," the researcher explains. "We will only be able to give a definite answer after the study has been completed."

Experience shows, Warschburger says, that adolescents suffering from functional abdominal pain often develop a life of ailment: Abdominal pain often turns into headaches in adolescence and back pain in adulthood. Parents of children suffering from functional abdominal pain often had similar problems themselves. The history of pain is sometimes passed on from generation to generation because children learn from their parents how to deal with pain, and inappropriate pain management strategies are passed on. "Acute pain is a clear warning but chronic pain has lost this function. The traffic lights are permanently yellow, so to speak. These people begin to restrict their activities in everyday life. This is the point when intervention is necessary to head off potential isolation from the psychosocial environment."

In addition to functional abdominal pain, Warschburger also engage in treatment of children suffering from atopic dermatitis, asthma, or obesity. Her aim is to develop training programs to help parents and children to cope with various disorders. In the long-term, the psychological methods are expected to change symptoms and improve quality of life. The counselling psychologist and her team collaborate with nutritionists and physicians but focus on psychosocial aspects. "Many diseases, for example obesity, are closely related to diet and physical activity. Genetics may play a role as well," Warschburger explains. "There are also psychosocial aspects. We eat not only when we are hungry but also when we are under stress. Stress occurs when we are teased, for example. Teasing someone for being overweight leads to more eating, and a vicious cycle ensues. There are often a number of factors for a disorder.

The counselling psychologist's research has a direct practical reference, as in the case of functional abdominal pain. Some colleagues approached her and pointed out the urgent need for functional pain treatment, which ultimately led to a successful symbiosis between research and health care routine. "If our program can verify the efficacy, we will have valid arguments to demand that the therapy becomes a statutory benefit, i.e. health insurance companies will cover it," Warschburger says. "Since this field still lacks standard treatment, mere alleviation for children and their parents would be a big step."

SOPHIE JÄGER

THE RESEARCHER

Prof. Petra Warschburger is Professor at the Chair of Counselling Psychology at the University of Potsdam and Head of the Patient Training and Counselling Center (PTZ).

Contact
Universität Potsdam
Department Psychologie
Karl-Liebknecht-Str. 24–25
14476 Potsdam
✉ warschb@uni-potsdam.de

Photo: Warschburger, Prof. Dr. Petra (top); Fritze, Karla (bottom)

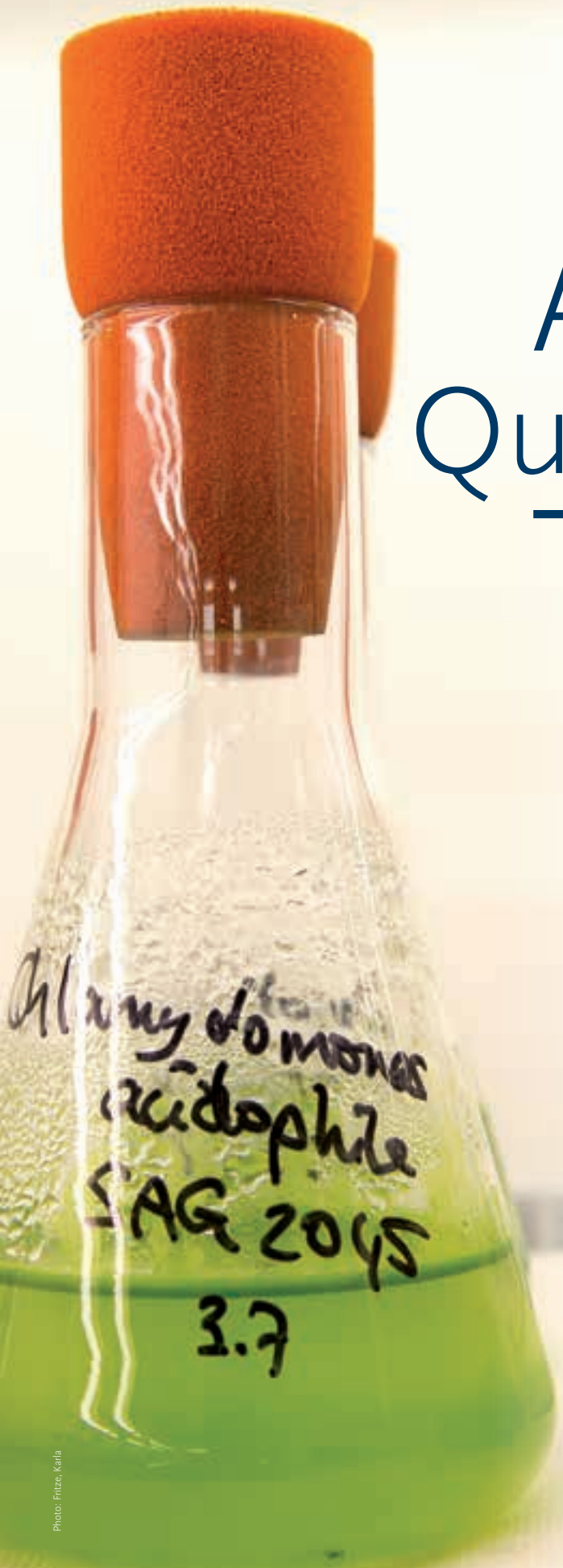


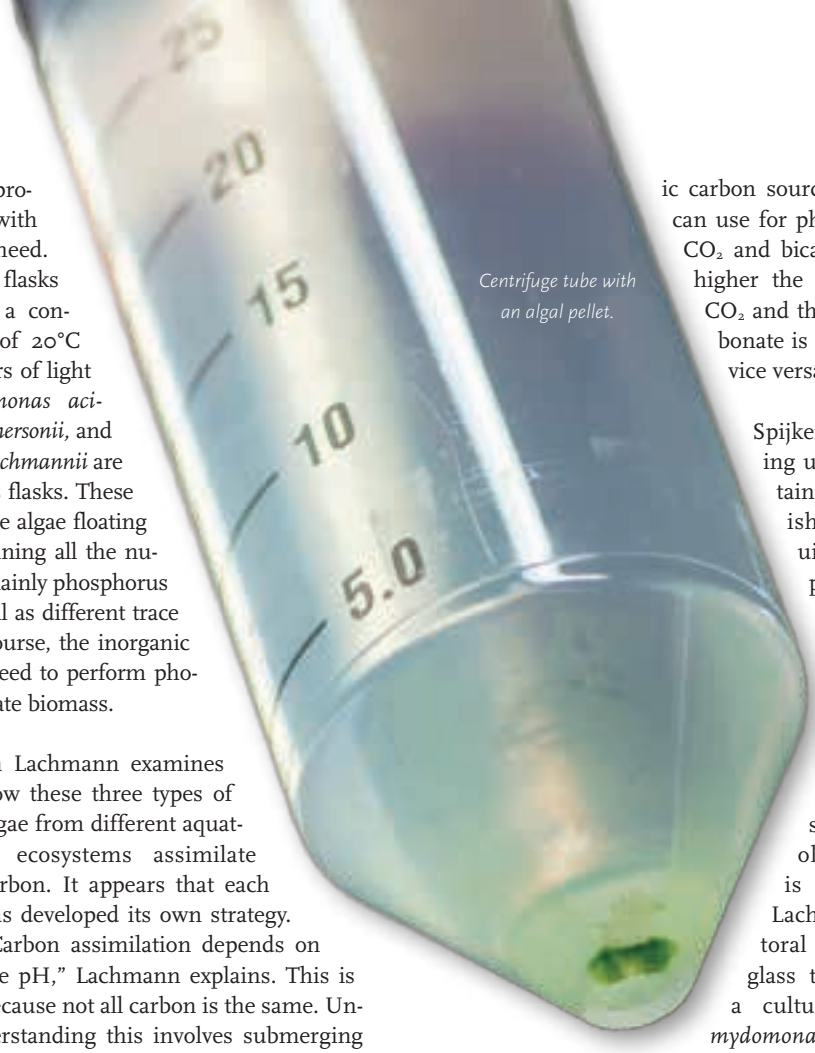
Photo: Fritze, Karla

A Question of Transport

Microalgae Fixate Carbon Dioxide – And Take Different Pathways

They are invisible to the naked eye. Only in massive quantities do they color water green. Aquatic microalgae are tiny organisms, which usually consist of a single cell and sometimes a few connected cells. The biologists Elly Spijkerman and Sabrina Lachmann are interested in the carbon uptake of these organisms because algae, as green terrestrial plants, contain chlorophyll and carry out photosynthesis. These inconspicuous little organisms play a large role in the global carbon cycle. They fix a considerable amount of the greenhouse gas carbon dioxide (CO_2). The different species of algae seem to use different strategies for CO_2-fixation. Spijkerman and Lachmann, both researchers at the chair Ecology and Ecosystem Modelling, want to find out which metabolic pathways algae can use and how these are influenced by environmental conditions.

The nutrient solution contains everything the algae need: phosphorus, nitrogen, and carbon.



Centrifuge tube with an algal pellet.

A culture cabinet provides the algae with everything they need. The small culture flasks stand on racks at a constant temperature of 20°C and receive 16 hours of light a day. *Chlamydomonas acidophila, Chlorella emersonii,* and *Chlamydomonas pitschmannii* are written on the glass flasks. These are the names of the algae floating in a solution containing all the nutrients they need, mainly phosphorus and nitrogen as well as different trace elements and, of course, the inorganic carbon that algae need to perform photosynthesis and create biomass.

In her dissertation Lachmann examines how these three types of algae from different aquatic ecosystems assimilate carbon. It appears that each has developed its own strategy. "Carbon assimilation depends on the pH," Lachmann explains. This is because not all carbon is the same. Understanding this involves submerging into water chemistry. Water has basically two inorganic carbon sources that algae can use for photosynthesis: CO_2 and bicarbonate. The higher the pH, the less CO_2 and the more bicarbonate is available, and vice versa.

"She examines how these three species of algae from different aquatic ecosystems assimilate carbon."

Spijkerman is holding up a tube containing a greenish-brown liquid. "When the pH is above 6.3, the inorganic carbon is primarily bicarbonate, which is useless to this alga," says the biologist who is supervising Lachmann's doctoral thesis. The glass tube contains a culture of *Chlamydomonas acidophila,* whose name says that it "loves acid", and can be found in the extremely acidic mining lakes in Lusatia. It would "starve" if it had only bicarbonate. It lacks the transport mechanism to subsist on this type of carbon.

Most rivers, lakes, and oceans have very little carbon dioxide and much bicarbonate. The algae, however, need a special transporter to be able to use bicarbonate as a carbon source – a disadvantage because the uptake requires additional energy and nutrients. Aquatic ecologists therefore want to unravel which environmental conditions promise an efficient strategy of carbon assimilation.

"We want to understand the mechanisms of carbon assimilation and how they affect the ecosystem," Spijkerman describes their research goal. For this the biologists have performed growth tests with different algae and under different conditions. They let the algae grow with either a sufficient supply of nutrients or a nutrient deficiency and regularly checked the cultures' pH. "The algae change the pH of the medium by photosynthesis", Lachmann explains. The pH increases until all usable carbon has been consumed. The researchers have been able to establish which type of carbon the different algae species can use and if the nutrient supply influenced it.

The results of these and previous experiments show the complexity of carbon assimilation system. "It is fasci-

THE RESEARCHERS

Dr. Elly Spijkerman studied biology at University of Amsterdam. Since 2002 she worked at the University of Potsdam. She examines how stress factors influence algae physiology. In 2015 she will start working at a company dealing with the commercial use of microalgae.

Contact
Universität Potsdam
Institut für Biochemie und Biologie
Maulbeerallee 2
14469 Potsdam
✉ spijker@uni-potsdam.de

Sabrina Lachmann studied biosciences and ecology at the University of Potsdam. Since 2013 she has been working on her doctoral thesis, which analyzes the carbon assimilation of different types of algae.

Contact
✉ salachma@uni-potsdam.de

nating," Spijkerman explains, "that the algae can use two different carbon sources and three to four different mechanisms for each source to channel carbon into the cell". Each strategy requires different physiological adaptations.

As already mentioned, *Chlamydomonas acidophila* prefers an acidic environment. The alga occurs globally in acidic waters with a pH between 1.5 and 5 and uses CO_2 exclusively for photosynthesis. It lacks an assimilation system for bicarbonate. Its strategy exhausts little energy and few nutrients, but only works with enough CO_2. *Chlorella emersonii*, on the other hand, is a "normal alga that occurs in neutral waters," Spijkerman says. It uses both CO_2 and bicarbonate. This, however, increases its nutrient requirements. Nutrient shortage inhibits the alga's ingestion. Unlike some other species it can use two different carbon sources if there are enough nutrients. The third alga is a real all-rounder compared to the others. *Chlamydomonas pitschmannii* grows both in acidic and alkaline waters and even likes it a bit hotter. In addition to CO_2 it also uses bicarbonate. The two researchers are currently examining how this species of alga reacts to nutrient shortage.

Biologists are not the only ones interested in which conditions allow algae to assimilate carbon most efficiently and build up biomass. Determining how they physiologically adapt to optimally utilize the carbon source could prove important for industrial biomass production. This is all the more important because algae cultures do not compete with food production like biomass agriculture, such as corn and rapeseed. They do not use up any arable land. Research into the use of microalgae as a future source of raw material has been underway for years now. The organisms' physiology is significant because the less energy a cell needs for transport and conversion, the more energy it has for growth, leading to higher yields.

> *"The less energy a cell needs for transport and conversion, the more energy it has for growth, leading to higher yields."*

Spijkerman will soon be able to apply her knowledge. She will be leaving the university to continue research at a Berlin company that produces ethanol from marine blue-green algae, a base substance for biofuels. "I will be directly engaging in the commercial use of microalgae," the researcher says.

HEIKE KAMPE

Photos: Fritze, Karla (2)

Dr. Elly Spijkerman holding an algae culture.

In their experiments the researchers grow the algae under specific conditions.


Where Knowledge grows
www.uni-potsdam.de