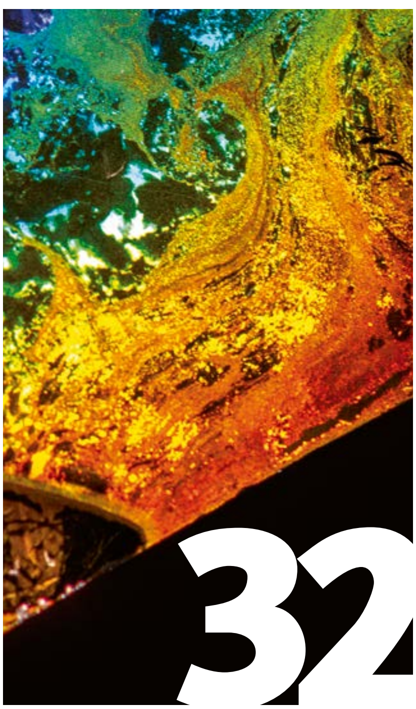
Portal Wissen

The Research Magazine of the University of Potsdam

One 2021

Universität Potsdam

CHANGE



Contents

Where the Hare Runs
How animals' movements contribute to biodiversity in agricultural landscapes 4

Planets – Profession and Passion
Prof. Katja Poppenhäger has found her niche in astrophysics 10

Moving Rocks
How climate warming changes mountain regions 16

Is There a Right to Climate Protection?
Legal expert Christian Bickenbach examines the legal foundations of climate litigation 20

Old Age Without Fragility
Young researchers are investigating how the interplay of genes, nutrition, and exercise can influence muscle loss as we age 24

Understanding Diversity
Linda Juang researches the development of children with a migrant background 28

With Light and Nanoparticles
Blazing a trail to the future of medicine 32

Education in Times of the Pandemic
How schools and universities master digitization 38

Searching for a Common Denominator
Research network "V.A. Cure" investigates rare diseases 44

The Core of Things
Comics, art, and culinary studies: Junior Professor for Cultural Semiotics and Cultures of Romance Countries Marie Schröer interprets the signs of the times 50

The Nursery of Mineral Resources
Geoscientists research ore genesis 54

Imprint

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

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

Editors: Dr. Silke Engel (resp.), Matthias Zimmermann
Contributions: Antje Horn-Conrad, Heike Kampe, Magda Pchalek, Dr. Stefanie Mikulla

Translation: Susanne Voigt, Monika Wilke

Address of the Editorial Office:
Am Neuen Palais 10, 14469 Potsdam
Phone: (0331) 977-1675, -1474, -1496
Fax: (0331) 977-1130
Email: *presse@uni-potsdam.de*

Cover picture: Andreas Töpfer

Layout/Design: unicom-berlin.de

Editorial deadline for next issue: 30. April 2021

Advertisements: unicom MediaService,
Phone: (030) 509 69 89 -15, Fax: -20
Valid advertisement price list no.1
www.hochschulmedia.de

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

CHANGE

Change makes everything different.
Let's be honest: Just about everything is constantly in transformation. Even huge massifs that seem like eternity turned to stone will eventually dissolve into dust. So is change itself the only constant? The Greek philosopher Heraclitus certainly thought so. He said, "The only thing that is constant is change."

Change is frightening.
A change that we cannot explain throws us into turmoil – like a magic trick we cannot decipher. Viruses that mutate, ecosystems that collapse, stars that perish – they all seem to threaten the fragile balance that makes our existence possible. Humanity is late in recognizing that we ourselves are all too often the impetus for dangerous transformations.

Change gives hope.
People have always been fascinated by change and felt compelled to explore its origin and essence. Quite successfully. We understand many things much better than generations before. But well enough? Not at all. Alexander von Humboldt said, "Every law of nature that reveals itself to the observer suggests a higher, as yet unrecognized one." There is still much to be done.

The current issue of *Portal Wissen* is all about change. We spoke to an astrophysicist who has found her happiness in researching the formation and change of stars. We also look at different aspects of the very earthly climate change and its consequences: A geoscientist explains how global warming affects the stability of mountain ranges. A legal expert makes clear that the call for a right to climate protection has gone largely unheard until now. How human land use affects biodiversity is being investigated by young researchers of the "BioMove" research training group, who have provided us with insights into their work on brown hares, water fleas, and mallard ducks. Other researchers focus on change in the contexts of humans. A group of nutrition scientists at the German Institute of Human Nutrition (DIfE) and sports scientists at the University of Potsdam are investigating the factors that cause our bodies to change as we age – and why some people lose muscles more quickly than others.

Despite all these changes, we do not lose sight of the diversity of research at the University of Potsdam. A visit to the laboratory of the project "OptiZeD" gives us an idea of the possibilities offered by optical sensors for the personalized medicine of tomorrow, while an educational researcher explains why cultural diversity is an asset beneficial to our education. In addition, a cultural scientist reports on the fascination of comics. They are all part of the hopeful change that science is initiating and accomplishing! Enjoy the read!

MATTHIAS ZIMMERMANN

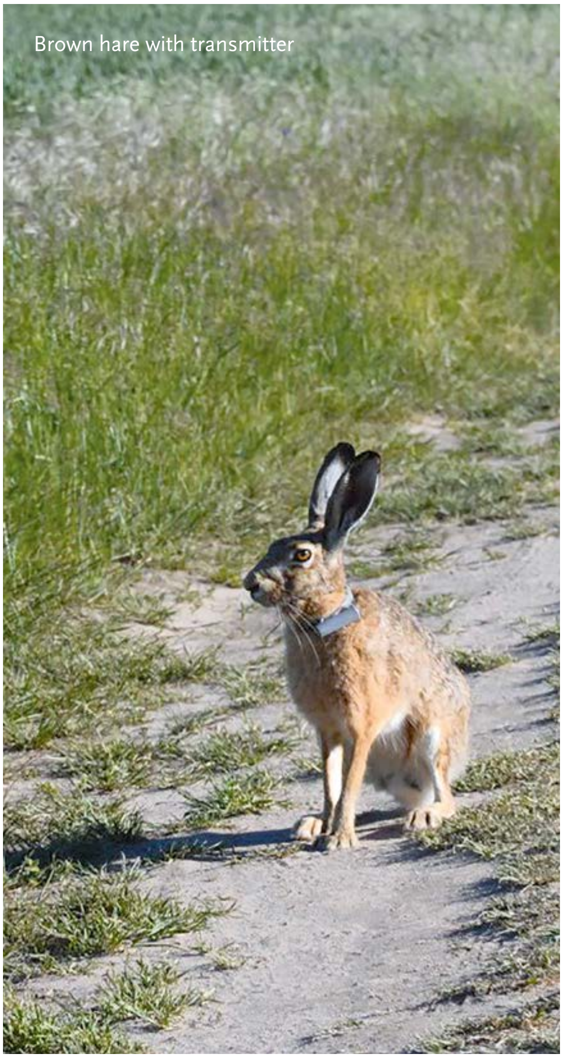
WHERE THE

HARE RUNS

How animals' movements contribute to biodiversity in agricultural landscapes

Photos: Scholz, Carolin

The preservation of biodiversity is a social mandate. In the Research Training Group "BioMove" at the University of Potsdam, experienced experts are working with young researchers towards this goal. To achieve it, they have integrated biodiversity research with movement ecology. Synergies between the two disciplines can be optimally used to better understand not only the effects of modern agriculture on the behavior of individual organisms, but also on the development of biodiversity in dynamic agricultural landscapes as a whole.



Brown hare with transmitter

Brachionus calyciflorus, a rotifer

"The ongoing intensification of land use dramatically reduces the amount of residual areas that can serve as habitats for wildlife and plants," says Prof. Florian Jeltsch, spokesperson of the Research Training Group. Yet these areas are important biodiversity hotspots in the landscape. However, their small size often leads to intensified interaction between and the displacement of species living there. "This makes a stable balance of species increasingly unlikely." To a certain extent, however, some species are able to adapt to the increasing fragmentation of their habitats and stronger competition for resources, Jeltsch explains. Among other things, this depends on their ability to adapt their movement patterns to a predominantly hostile environment. "To understand the medium- and long-term effects of different land-use options on the future of biodiversity, it is therefore important to better understand both the movement patterns of species in modern agricultural landscapes, and the changing interactions between them."

Moving organisms provide links

In the Research Training Group, ten doctoral students are investigating various facets of land use in relation to the balance of species. What all projects have in common is the model of "mobile links" originally developed to describe how moving animals provide links between communities and ecosystems that otherwise

Photos: Janssen, Bilke (top left); Kiemel, Katrin (bottom left); Scholz, Carolin (right)

Duck with transmitter

PhD student Victor Parry and postdoctoral researcher Ulrike Schlägel

PhD student Katrin Kiemel

PhD student Maxi Tomowski in the lab

remain separate. The ways organisms move in their habitats significantly impact the composition of species communities and thus biodiversity. Organisms are highly reactive to human-induced changes in climate and land use – including changing their movement patterns, which is crucial for understanding the decline in biodiversity.

Besides, all projects of the "BioMove" Research Training Group are based in a common field site: the glacial area around the River Quillow in north-eastern Brandenburg. It comprises forests and farmland, but also a system of glacial depressions known as kettle holes. Here, evolutionary biologist Katrin Kiemel studies zooplankton communities. "In the kettle holes, you find isolated populations that are representative of other isolated habitats," she says. "All across the landscape, zooplankton forms metacommunities as tiny organisms such as water fleas and rotifers are spread by wind or through mobile links such as mammals and birds." Agricultural work practices affect the structure of local communities by changing environmental conditions. So Kiemel examines water and soil samples of zooplankton in the laboratory, sometimes under a microscope, to understand the pathways along which they spread and settle, as well as the composition of species. Her research focuses on local adaptations that may be beneficial for the survival of zooplankton species in a constantly changing environment.

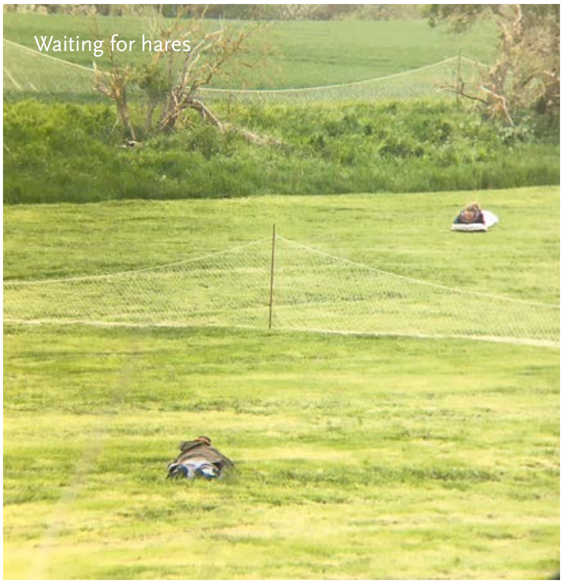
Plant seeds and zooplankton

By contrast, ecologist Maxi Tomowski is researching for her dissertation which factors influence the gene flow of plants in an agricultural landscape. "The gene flow between plant populations may be impacted by limited movements of pollinators, for instance, or a spatially limited distribution of plant seeds," she ex-

Photos: Ryl, Kevin

Setting up nets in the Quillow AgroScapeLab to capture brown hares and fit them with GPS collars

Programming GPS transmitters in the field



Waiting for hares

plains. “For a more exact determination, we need to monitor the dispersal of individual pollen and seeds.” Research in the Training Group “BioMove” has indicated time and again how closely interwoven animals and plants in a landscape area are. In a joint field experiment, Tomowski and Kiemel equipped waterfowl with GPS transmitters to analyze their movement patterns. Besides, the ducks' plumage was washed out, as it transports plant seeds and zooplankton. This way, the spatial distribution of plants or zooplankton can be compared to the ducks' movements.

Mammals also play an important role in the distribution of plant seeds as they are extremely mobile. Animal ecologist Jonas Stiegler is studying the role of the brown hare as a mobile link to find out how efficient the hare is in distributing plant seeds and what impact the type of field use has. “The European

THE PROJECT

The **“BioMove” Research Training Group** studies the effects of organismal movements in dynamic agricultural landscapes on biodiversity.

Participants: University of Potsdam, Freie Universität Berlin, Leibniz Institute for Zoo and Wildlife Research, Leibniz Centre for Agricultural Landscape Research
Funding: German Research Foundation (DFG)
Duration: 10/2015-09/2024 (extended: 10/2019)
www.biomove.org

Photos: Patanant, Kidan (top; bottom right); Seiler, Julius (bottom left)

brown hare is a typical species for agricultural landscapes," Stiegler says. "I fit brown hares with GPS collars and track their movement patterns. To quantify the correlations between the distribution of plant seeds and the hares' foraging for specific species such as wild herbs, I also used remote sensing data and network-based tools."

Finding correlations through statistical methods

Mathematician Ulrike Schlägel is a postdoctoral researcher. In the Research Training Group, she supervises the theoretical concepts of "BioMove," especially the modeling of animals, plants, and landscapes through statistical methods. Her models include both mobile links and the mechanisms allowing species with similar ecological needs to coexist rather than compete with each other. In a survey study, she compiled research findings from different ecological disciplines to find out how movement processes influence the composition of species. "When it comes to coexistence in a community of species, one or two key factors can be crucial to better predict the future development of communities and understand biodiversity patterns," she points out.

Kiemel, Tomowski, and Stiegler intend to finish their doctoral dissertations by 2021. So far, eleven PhD students have successfully completed the "BioMove" Research Training Group and made important contributions to the biodiversity debate. In October 2021, the third round will start with new PhD projects.

DR. STEFANIE MIKULLA
TRANSLATION: MONIKA WILKE

Photos: Fritze, Karla (top); Ryl, Kevin

THE RESEARCHERS

Prof. Dr. Florian Jeltsch studied physics and theoretical ecology in Marburg and has been Professor of Plant Ecology and Nature Conservation at the University of Potsdam since 2000. He is the spokesperson of the "BioMove" Research Training Group.

✉ jeltsch@uni-potsdam.de

Katrin Kiemel studied ecology, evolution, and nature conservation in Potsdam and joined the "BioMove" Research Training Group in 2018 to do her doctorate on diversity in zooplankton adaptation and dispersal.

✉ kiemel@uni-potsdam.de

Maxi Tomowski studied ecology and has been doing her PhD on the gene flow of plants in agricultural landscapes in the "BioMove" Research Training Group since 2018.

✉ mtomowsk@uni-potsdam.de

Jonas Stiegler studied animal ecology and tropical biology in Würzburg and has been doing his PhD in the "BioMove" Research Training Group on the function of animals as mobile links in agricultural landscapes since 2018.

✉ stiegler@uni-potsdam.de

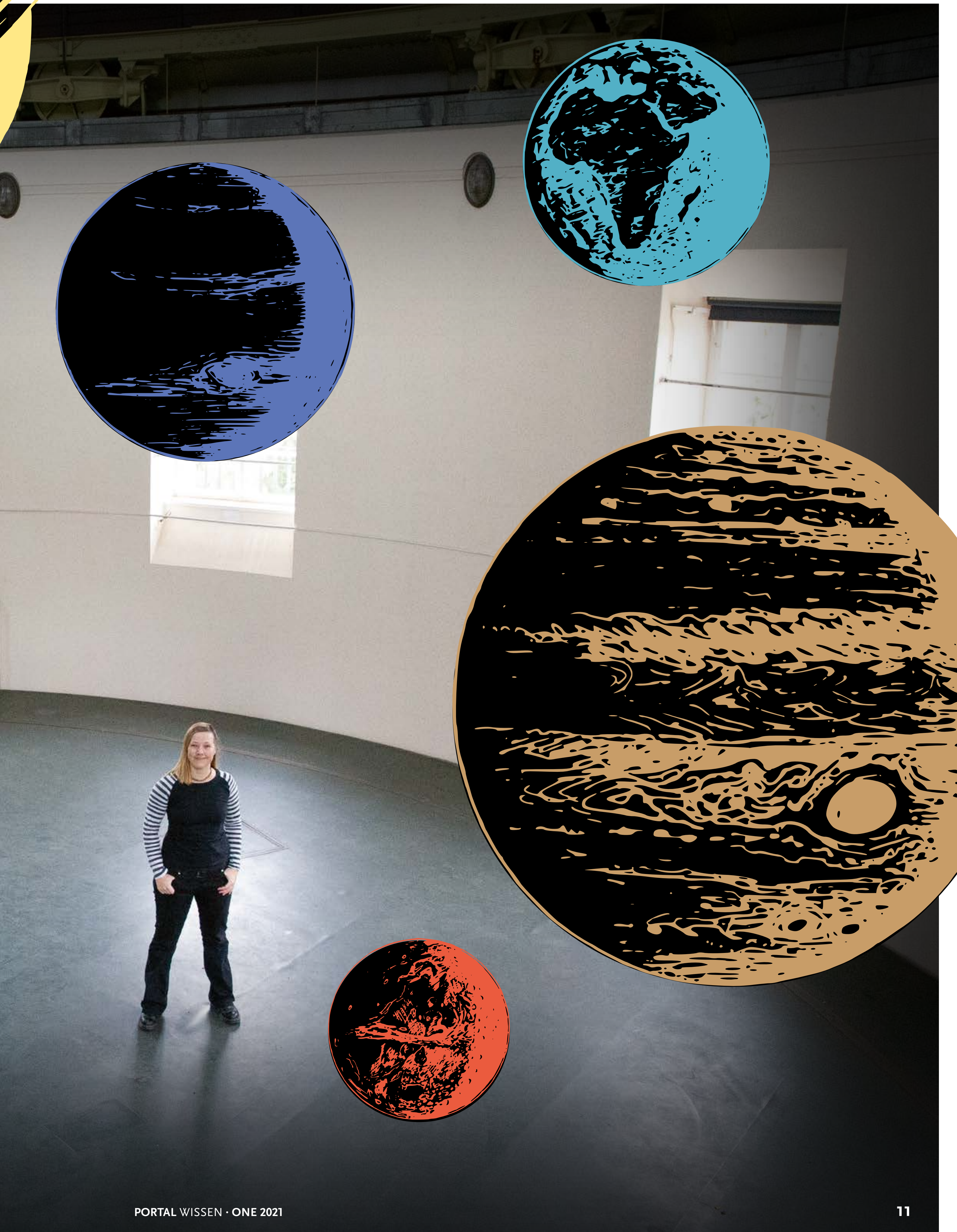
Dr. Ulrike Schlägel studied mathematics in Bielefeld and obtained her PhD in Alberta, Canada. Since 2015, she has been a postdoctoral researcher in the "Bio-Move" project with a focus on scientific synthesis and concept development. Recently, she won a grant to lead an independent junior research group in the DFG's Emmy Noether Programme.

✉ ulrike.schlaegel@uni-potsdam.de

PLANETS – PROFESSION AND PASSION

Prof. Katja Poppenhäger has found her niche in astrophysics

Photo: Scholz, Sandra · Illustration: AdobeStock/vladayoung



The Leibniz Institute for Astrophysics Potsdam (AIP) is located in a residential area surrounded by old trees on the edge of Babelsberg Park. Those who arrive at the street "An der Sternwarte" will find a spacious area with both historical and modern buildings. At the end of the "Spectrum Path", which is decorated with a balustrade-like 30-meter-long diagram, lies the Humboldthaus, where astrophysicist Katja Poppenhäger and her team research the universe.

THE RESEARCHER

Prof. Dr. Katja Poppenhäger, expert on planets around other suns, has been head of the Stellar Physics and Stellar Activity Section at the Leibniz Institute for Astrophysics Potsdam (AIP) since October 2018 as well as a joint professor at the University of Potsdam.

✉ kpoppenhaeger@aip.de

"Using a star spectrum, you create a color gradient for each star, which is as individual as a fingerprint," explains the astrophysicist. "A spectrograph splits light emitted by the star into its component wavelengths – red at one end and violet at the other. The wobbly line of the diagram shows that the star shines brighter or darker depending on the color. Thus the "Spectrum Path" on our site is a whole rainbow rolled out onto 30 meters!"

Astrophysicists collect light from space to learn more about the nature of cosmic objects such as stars and galaxies. Poppenhäger mainly studies exoplanets, i.e. planets that orbit other stars. These planets, which are sometimes still very young, hold a special fascination for the physicist. "Young exoplanets are only a few million years old. Their atmospheres have just formed. In our solar system, by contrast, we are talking about a few billion years." To study the atmospheres of exoplanets, astrophysicists use a trick. "Exoplanets make a 'transit'", Poppenhäger explains. "When an exoplanet passes in front of a star from our direction of observation, we examine its atmosphere through the star behind it, which serves as a kind of background lamp."

Functionality instead of romanticism

In the corridors of Humboldthaus, historical astronomical measuring instruments are exhibited behind glass like in a technical museum. On one wall there is a modern flat screen that constantly transmits live images from "STELLA" in Tenerife, a robotic telescope of the AIP. English-language magazines of "Sky & Telescope" are stacked on small side tables; titles such as "Galactic Hoola Hoop", "Cascade of Galaxies", and "Asteroid Recon Surprises" arouse curiosity even among non-professionals. This is the world of the AIP. This is where Poppenhäger spends most of her working time. "I download observation data from the server of the European Space Agency (ESA) or the National Aeronautics and Space Administration (NASA) and search for new information about planets," says Poppenhäger. "What I enjoy most is testing my own ideas. The universe holds every conceivable fantastic possibility and I find it exciting to see whether it answers my questions with 'yes' or 'no'." What goes through her mind when she sees a falling star in the night sky? "Personally, I don't enjoy stargazing that much, as romantic as you might imagine it to be," she openly admits. "I'm more interested in how does something work? To have a realistic chance within one's own lifetime to check several theories, to collect and program data myself – I have found this mix of activities exciting and varied for over ten years now!"

For a long time, it was not clear which direction Poppenhäger would take in her career. "I'm not one of those people who always knew what they wanted to become. I found being an astronaut quite interesting, but as a child you don't really have an idea of what a scientist actually does. I thought more about becoming a firefighter or a veterinarian …" She liked science subjects at school, and after graduating from high school, she studied physics in Frankfurt/Main. Since she was not quite sure which career path to take, she worked in the private sector for a while. In 2011 – she was living in Hamburg at that time – the physics graduate attended research groups in environmental physics, particle physics, astrophysics, and biophysics. Eventually, she joined the astrophysics group of Jürgen H. M. M. Schmitt, who had a vacant PhD position at the Hamburg Observatory. "This is how I found my niche in astrophysics," she says with satisfaction.

You sometimes have to leave your comfort zone

Poppenhäger is the first in her family to have an academic degree. "My father was a civil servant and my mother a bank clerk. I often went to the library with my parents and came home with a huge stack of books," she recalls gratefully. "I'm an only child, so my parents were able to really encourage my interests, even if they didn't have a connection to these fields themselves." Meanwhile, Poppenhäger has become a mother herself. Her four-year-old daughter asks her with keen interest about what she does at work every

Humboldthaus

Spectrum Path

day. "Then I tell her about my star observations, that I write texts explaining what the stars do, or that I meet with my students." Another person who has had a profound influence on Poppenhäger's career is Andrea Dupree, who is also an astrophysicist. The two met at the Harvard-Smithsonian Center for Astrophysics (Cambridge, USA), where Poppenhäger was a young postdoctoral researcher from 2012-2015 and Dupree a senior astrophysicist and associate director. "Every morning at 10:30, there was a short coffee break meeting where everyone who had anything to do with stars and planets met. Dupree always wore colorful clothes, had fantastic hair, and talked loudly and excitedly," says Poppenhäger, describing the "grand lady of stellar physics", as she calls her. "Dupree taught me that you shouldn't hold back, that you should sit in the front row at conferences, that you can – and must – ask Nobel laureates questions without being shy. From her, I learned that the academic world is also about being seen and that you sometimes have to leave your comfort zone."

Thanks to her time as an assistant professor at Queen's University in Belfast, Northern Ireland, Poppenhäger has also been able to stand her ground in teaching, at conferences, and with various publications. Since 2018, she has been at the AIP in Potsdam, where she now leads a team of about 20 employees. As a woman, she says, she is still a bit exceptional in this field, even though some things have improved. "If you count the men and women in my research group, the numbers are pretty balanced. But that's not so surprising in our niche of exoplanets anymore. It's a young research field, so there are a lot of young female researchers." There are, however, still conscious and unconscious reservations, as can be seen, for example, when it comes to the application process for the use of the Hubble telescope. "For the past two years, there has been a double-blind selection process in which the application documents don't reveal the applicant's

Photos: Bossier-Steuerwald, Sandy

Prof. Katja Poppenhäger in the dome of the historic Babelsberg refractor

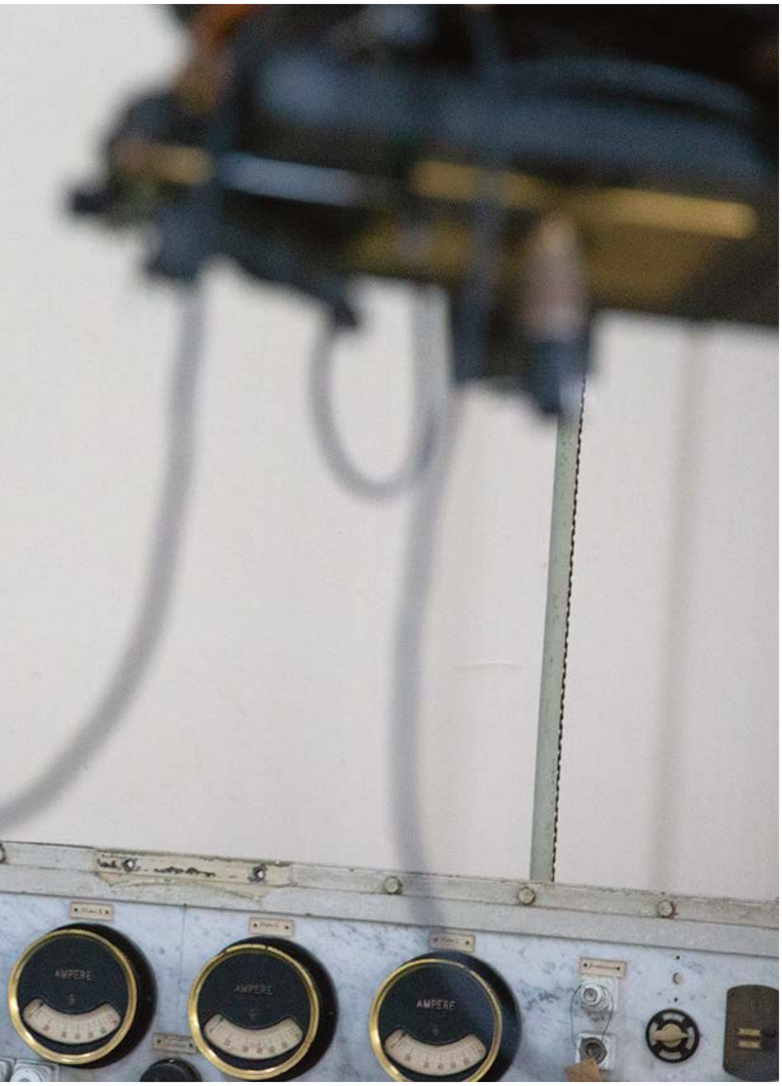
name and, therefore, also not the gender. The chances to be successful used to be evidentially lower if the name didn't sound white and masculine – now the numbers are even."

Does the large mural behind her show the Hubble telescope? "No, that is a photograph of the LBT (Large Binocular Telescope) for astronomical observations in Arizona, USA," Poppenhäger explains. With its two mirrors, each with a diameter of more than eight meters and resembling the eyes of a face, it is currently one of the world's largest optical telescopes, she says. "With the LBT, we gaze at a star, collect its light, and explore the atmospheres of already known exoplanets." Poppenhäger describes different scenarios from everyday research that are used to discover new exoplanets. "In the morning, I check the newsletter of the arxiv website, a preprint server with preview versions of astronomical papers. Sometimes you find things like 'Colleagues from Arizona have discovered two new exoplanets,' and you think 'I should definitely take a look at the atmospheres of these two'. With a bit of luck, something like that also happens to you while you're searching for planets. For example, a graduate student once stormed into my office and excitedly exclaimed, 'I've found transits of three different planets around the star K2-133!'" After all, in the first few months of 2020 alone, her colleagues around the world found 10-20 exciting exoplanets.

The universe often does the most boring things

"However, the universe often does the most boring things instead of the most exciting! You have to get used to that emotionally, just as you have to get used to rejec-

Photos: Scholz, Sandra



tions of research proposals, by the way. I think for many people this is the hardest part of the job, that a rejection is more likely than an approval." The astrophysicist is aware of the fallibility of scientific results. "What we do isn't perfect because there are many research results that are based on correct data and that made sense in the context of their time, but whose interpretation has been disproved by now." That does not discourage a passionate physicist like Poppenhäger, on the contrary. "I credit myself with doing research as well as I can, based on what we know today. Because if I didn't do anything at all, humankind wouldn't be any smarter in 100 years!" Thus, the astrophysicist indirectly also addresses questions such as: Are there planets that could be habitable? Does planet xy in the end still have an atmosphere? Has life perhaps already developed on it in the form of microbes? The most exciting question of all for her is still whether one can find evidence of life on other planets. "I think that the development of life is not that rare. I think we'll find a planet with strong evidence of life before I retire – but in the end it is, of course, a matter of luck!"

For balance: sword fighting

How does someone relax in her free time who deals with literally earth-shattering questions every day? Poppenhäger likes to exhaust herself physically. She practices historical sword fighting, an unusual sport that she came to rather accidentally. "A few years ago I was in Boston at a fantasy convention, where I took part in a trial course in historical sword fighting – basically fencing using techniques from medieval manuscripts. I was so impressed that I signed up for the club on the spot. Fortunately, there is also a sword fighting group at the Academic Sport Center in Potsdam. It is absolutely the right sport for me; it clicked immediately! You have to improvise – sometimes a tenth of a second counts – and be present in the moment, not think about the future. That grounds you." That she does not read horoscopes as an astrophysicist, is unsurprising. "I am a realist at heart, absolutely!" The astrophysicist still has a big dream though. "If I had too much money due to a crazy coincidence, I would like to fly to the ISS. To get a real feeling of how the earth floats as a ball in space would be amazing!"

SANDY BOSSIER-STEUERWALD
TRANSLATION: SUSANNE VOIGT

Photos: Scholz, Sandra

Moving Rocks

How climate warming changes mountain regions

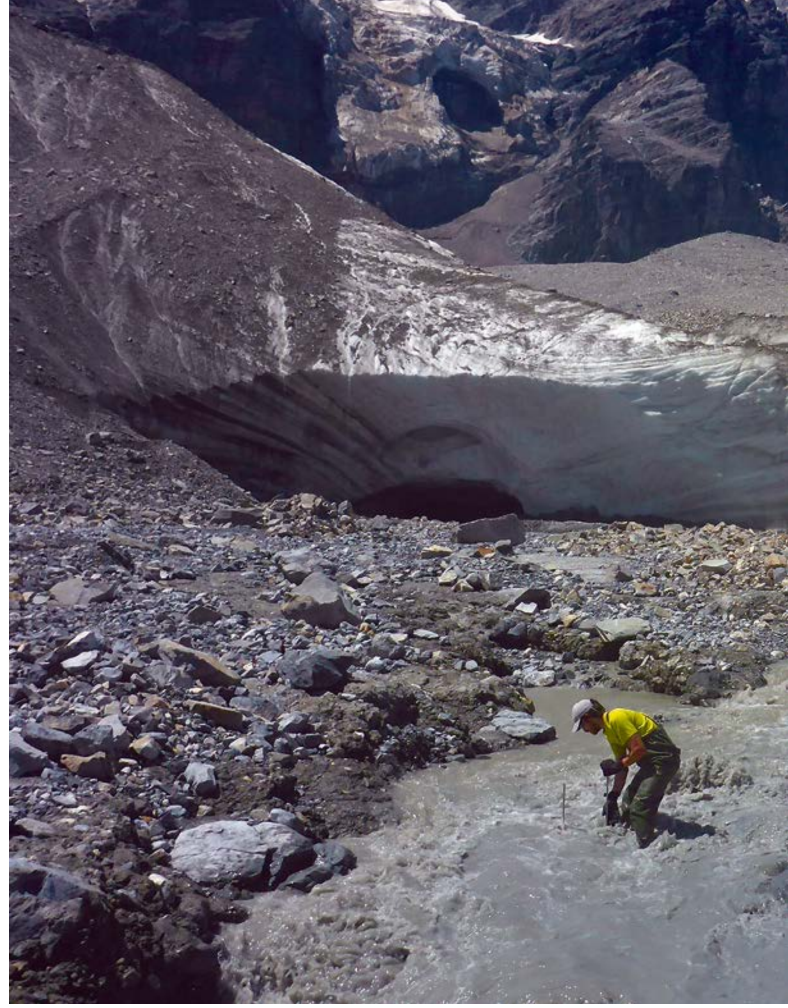
Photo: AdobeStock/Harald

THE PROJECT

In her project **"Effects of climate warming on debris flow activity and sediment supply in high mountain regions"**, Dr. Sara Savi uses different geological methods to record severity and frequency of debris flows and rock falls in a study area in South Tyrol.

Participants: University of Potsdam, the Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences, Free University of Bozen-Bolzano, Eurac Research Center Bozen, Autonomous Province of Bolzano (South Tyrol)
Funding: German Research Foundation (DFG)
Duration: 09/2018–08/2022

Since 2015, geologist Sara Savi has been researching the influence of climate on debris flows in the high mountains of Argentina. In her current research project, she wanted to address a more practical problem: What concrete dangers does climate change pose for inhabited areas in the Alps, virtually on our doorstep?



The full spectrum of the global effects of climate change cannot yet be predicted. One aspect that Sara Savi is investigating in her project funded by the German Research Foundation (DFG) is the relationship between climate change and the frequency of debris flows and rock falls in mountains, which pose a tremendous threat to humans, animals, and the economy. "I'm interested in the interaction between climate and geomorphological factors and their influence on surface processes at different temporal and spatial scales," Savi says.

Her research project benefits from a German–Italian collaboration that integrates the expertise of colleagues from all participating institutions. For the field work, she is cooperating with the Free University of Bozen-Bolzano and the Eurac Research Center in Bozen; laboratory work is being carried out at the University of Potsdam.

Thawing ground leads to rock falls

Climate changes in mountain regions primarily lead to higher temperatures in summer changes in the frequency and intensity of rainstorms in winter. If temperatures are permanently above zero degrees Celsius, the permafrost layer melts and the ground thaws. "Slopes become unstable and that can trigger landslides," Savi explains. "A prominent example is the Pizzo Cengalo rock fall in Switzerland in August 2017." However, such massive movements, which are even noticed by the general public, are quite rare. The more common, small landslides, by contrast, are difficult to observe. Savi uses aerial photos to explore how the stability of slopes has changed over the past decades. She has already been able to document that the number of small rock falls has increased since the early 1990s due to rising temperatures and melting ground ice. Rock falls have especially increased at higher altitudes as the zero-degree isotherm, i.e. the temperature line that determines the melting of snow and ice, shifts toward higher altitudes. Here, the mountain morphology shows steeper slopes and vertical rock faces that are much more susceptible to breaking off.

Savi is currently investigating a small basin in the western part of the Passo dello Stelvio in South Tyrol. "The Alps offer many advantages as a field of research because large amounts of accessible data already exist," says the geoscientist. She uses different approaches to explore the influence of climate change on sediment transport. To understand how erosion has developed in the basin, Savi collects samples of unconsolidated sediment – sand and rock fragments – on site. Due to the glacier retreat, the rivers transport more water and thus more sediment.

THE RESEARCHER

Dr. Sara Savi studied geology at the University of Milan (Italy). In 2013, she started her postdoc position in the working group General Geology headed by Prof. Manfred Strecker, Ph.D., and Prof. Peter van der Beek.

✉ sara.savi@uni-potsdam.de

Radioisotopes and drilling cores in the lab

The subsequent steps take place in the laboratory for cosmogenic isotopes at the Institute for Geosciences of the University of Potsdam. For the geochemical analysis, Savi works together with Prof. Manfred Streck-

Photos: privat (l.); Savi, Dr. Sara

Dr. Savi collecting sand for geochemical analyses

er and Prof. Bodo Bookhagen, and the student Pia Petzold supports the laboratory work. The cosmogenic nuclide 10Be, a radioactive isotope of beryllium, is extracted from the sediment samples and then analyzed with an accelerator mass spectrometer. The amount of 10Be can be used to determine how long the sediments were in the river. With this method, the researcher can look several thousand years back into the past.

To track down the frequency of debris flow activities in the mountains, Savi also uses dendrochronology, a method for determining the age of wood. Five-millimeter-thick cores are taken from tree trunks in the immediate vicinity of slope movements. The cores are used to determine changes in tree growth that indicate altered conditions triggered by landslides

One of the channels that may lead to debris flows

Core sample from a tree

or rock falls. This enables the researcher to reconstruct the sequence of such events during the lifetime of a tree and, depending on the age of the trees, to look up to 200 years back into the past.

All three methods cover different time scales: Through aerial photographs, Savi can reconstruct the past 50 years, dendrochronology allows conclusions to be drawn for an age of up to 200 years, and the analysis of cosmogenic nuclides even allows scientific statements to be made about the past 2000 years. The researcher is particularly interested in the current implications of climate change: “I want to use my observations to identify what is happening in the present and what has changed in recent years and decades compared to today.”

In the future, a further increase in rock falls can be expected, which is why measures must be taken to protect people, residential areas, and infrastructure in mountain regions. In addition, new tourism concepts will be needed to ensure that the Alps can be used safely as a recreational area in the future. Sara Savi’s research project and her findings can help to develop such concepts.

DR. STEFANIE MIKULLA
TRANSLATION: SUSANNE VOIGT

Photos: Coviello, Velio (l.); Savi, Dr. Sara

Illustration: Töpfer, Andreas

Is There a Right to Climate Protection?

Legal expert Christian Bickenbach examines the legal foundations of climate litigation

The dry summers of recent years are taking their toll. The effects of global warming, such as long heat waves or floods, cause damage running into billions of euros in forestry, agriculture, and inland water transportation. In addition to economic losses, they repeatedly claim lives. Does the state need to better protect its citizens from the dangers of climate change? Where does this duty to protect begin and where does it end? These questions are increasingly the subject of litigation.

The first climate lawsuit against the German federal government was decided in October 2019 – and it was sobering for the plaintiffs. The Berlin Administrative Court dismissed their complaint as inadmissible. The plaintiffs included three families from the organic farming sector and the environmental organization Greenpeace. They wanted the court to require the German government by court decision to comply with the National Climate Protection Target it had set in 2014. The cabinet decision stipulated that greenhouse gas emissions should be reduced by 40% by 2020 compared to the reference year 1990. For a long time, it looked as if Germany would fall short of this target. Only as a result of the Covid-19 crisis, it seems to be within reach after all – but nobody could have known this at the time of the decision by the Berlin Administrative Court.

Environmental protection is enshrined in the Basic Law

Farmers are experiencing harvest losses due to droughts or heavy rainfall – weather events that are becoming more severe and frequent with climate change. The families from Brandenburg, the Altes Land region near Hamburg, and the North Sea island of Pellworm based their lawsuits on freedom of property and occupational choice and the fundamental right to life and health. Bickenbach is Professor of Administrative Law, specialized in regulatory and infrastructure law, and notes with increasing legal interest the phenomenon of so-called "climate lawsuits," because the question whether there is a right to climate protection is not easy to answer. It is true that environmental protection is enshrined in the German constitution as a state objective. But a state objective – in legal parlance – does not create a right or entitlement and is therefore not enforceable.

In the current case, the Berlin Administrative Court saw the German government's climate target as a "political commitment and not a legally binding regulation." In addition, the plaintiffs lacked the standing to sue. Currently, the courts are dealing with other lawsuits involving climate protection: Nine young people, including climate activist Luisa Neubauer, filed a constitutional complaint with the Federal Constitutional Court in February 2020. In their opinion, the climate package adopted in 2019 is far too lax. They demand revised and stricter regulations. The Peruvian farmer Saúl Luciano Lliuya has already been suing the energy company RWE since 2015. The farmer believes that global warming is threatening his livelihood – and that RWE's emissions are partially responsible for this. The European General Court (ECJ) is hearing the case brought by ten families from the EU, Kenya and Fiji, as well as a Sami youth association, who want to achieve stricter EU climate targets. In the first instance, the Court of Justice of the European Union (EGC) had dismissed the case. The plaintiffs appealed.

DER THE RESEARCHER

Prof. Dr. Christian Bickenbach studied law at Johannes Gutenberg University in Mainz. Since 2015, he has been a Professor of Administrative Law, with a special focus on regulatory and infrastructure law, at the University of Potsdam.

✉ christian.bickenbach@uni-potsdam.de

The absolute minimum of climate protection

"It's always about the violation of fundamental rights," says Bickenbach, describing the legal foundations of the lawsuits. "Fundamental rights are generally rights to which an individual is entitled vis-à-vis the state." The protection of human dignity, the right to freedom of assembly or the right to freedom of expression are typical examples. "Greenhouse gases are mainly emitted by companies and private individuals though," explains Bickenbach. "So you have no state activity here where the fundamental rights can constitute a defense against the state." The most interesting legal question is whether the state violates its duty to protect if it does not adequately protect its citizens from the consequences of climate change. Does the legislator do enough to protect life, health, property, and the freedom of occupational choice?

"The decisive point for us lawyers is: Where does the so-called prohibition of insufficient means be-

For a long time now, initiatives for more climate protection have existed not only on the streets but also in the courtroom.

Photos: privat (top l.); AdobeStock/Nicola (top r.); AdobeStock/Animaflora PicsStock

The consequences of climate change also seriously affect agriculture.

gin?" Bickenbach says. This prohibition obligates the state to ensure an adequate and effective protection of the legal interests protected by fundamental rights. The nature, proximity, and extent of possible dangers determine the necessity and content of legal regulations, whereby the level of protection must not fall below a certain level. But what is legally necessary and sufficient with regard to climate protection? "What is the minimum that the German federal government must do for climate protection and the protection of fundamental rights?" Bickenbach asks. A decision is difficult – also because the causes of climate change are global and not limited by national borders.

Past decisions as a blueprint for the future

From a researcher's point of view, Bickenbach is fascinated on the one hand by the legal diversity of climate claims, which have to be litigated before both administrative and constitutional courts. On the other hand, the climate issue also leads to fundamental questions in law that have to be reassessed juridically.

Christian Bickenbach also uses his "wall of decisions" for this purpose. In his office, the over 150 gray volumes of the Official Collection of the Senates of the Federal Constitutional Court fill several meters of shelves. The work meticulously and comprehensively lists all Senate decisions, argumentations and justifications on all kinds of legal issues and constitutional complaints since 1951. Here you can read, for example, how the ban on commercial euthanasia was overturned as unconstitutional. Three more volumes are added each year. Bickenbach searches the volumes for possible blueprints for legal issues related to climate protection. The overriding question is: "Which of our existing constitutional provisions could provide solutions to these new problems?"

This is a great challenge, particularly because there are not many laws in climate protection yet, he says. "That is only emerging gradually," Bickenbach says. Previous decisions on duties to protect – for example against aircraft noise, the dangers of nuclear energy or chemical weapons stationed in Germany – could provide the lines of argumentation that are also helpful in legal questions on climate protection. "But when the Federal Republic of Germany enacts laws to fulfill duties to protect, these always also interfere with the fundamental rights of others," Bickenbach points out. How sensitive this topic actually is becomes clear these days when fundamental rights are being restricted to protect against infections with Covid-19. "The difference, however, is that infection control measures are locally and temporally limited," Bickenbach says. Protection against climate change, on the other hand, requires permanent regulations.

Meanwhile, the story of Germany's first climate lawsuit has come to an end before it has even really begun. Although the Berlin Administrative Court had permitted an appeal, the plaintiffs did not use this opportunity. "It only had a small chance of success", Bickenbach assumes. Instead, they are now pursuing their goal with a constitutional complaint at the Federal Constitutional Court to enforce a right to climate protection in this way. Bickenbach things that also this hardly has a chance to be successful. Of about 6,000 complaints each year, only 1-2% are successful. "But it's also about publicity, attention, and political pressure," he says. In the future, climate protection issues will probably create and exert all this in court even more frequently.

HEIKE KAMPE
TRANSLATION: SUSANNE VOIGT

Photo: AdobeStock/Scott

OLD AGE WITHOUT FRAGILITY

Young researchers are investigating how the interplay of genes, nutrition, and exercise can influence muscle loss as we age

Photo: AdobeStock/andreusK

From the age of 50, many people feel that their strength is gradually diminishing and movements are becoming more and more difficult. This is normal because in this phase of life everyone loses about 1–2% of their muscle mass every year. In some people, however, this age-related muscle loss is particularly severe. They suffer from a phenomenon known in medicine as sarcopenia. About 5–10% of all people who are 60–70 years old, and even up to 50% of those over 80, rapidly lose muscle strength and become frail. This also increases the risk of injury from falls. A junior research group is investigating which triggers play a role in sarcopenia and how to prevent it.

Why some people lose muscles faster than others as they age is not yet fully understood. "Sarcopenia is a very complex disease that involves various interacting factors," explains biologist Heike Vogel. Diet and exercise but also genetic predisposition, diabetes, inflammation in the body, and obesity seem to be related to the disease. Heike Vogel is a researcher at the German Institute of Human Nutrition (DIfE) and head of a junior research group that wants to find out how individual factors interact with each other, what the molecular causes of age-related muscle atrophy are, and how diet and exercise can keep it at bay or even prevent it.

What we eat and how we move are the two key elements that the researchers want to analyze in depth. At the DIfE, Vogel works on the genetic and molecular level. The PhD project that she is supervising will use mice to determine which genes are particularly active or inactive in sarcopenia and how exercise and diet can affect the activity of these genes.

Mass alone is not the decisive point

At the same time, PhD student Dominik Sonnenburg is examining a group of about 60 subjects at the University of Potsdam's outpatient clinic. They are all 55 – 65 years old, overweight, do not exercise much in everyday life, and are therefore considered patients at risk for sarcopenia. "They are people who are still pursuing a professional career, but who mainly have, for example, a sedentary job," says Sonnenburg, describing his clientele. The nutritionist wants to find out whether these people can reduce their risk of sarcopenia when they eat differently and follow a special training program.

"It's not just about muscle mass," emphasizes Tilman Engel, who is supervising Dominik Sonnenburg's work as a scientific tandem partner. After all, the loss of muscle mass alone cannot explain the deterioration of performance in sarcopenia patients. Today, medicine and research assume that muscular composition, interaction of nerves and muscle fibers, and thus the function of muscles, also change in sarcopenia. With a special eight-week program – known as eccentric training – Engel and Sonnenburg focus on exactly this point. The exercises address that movement phase in which the muscles stretch against resistance and become longer. In biceps training, for example, lifting a weight is the concentric work phase in which the biceps contracts. When the weight is lowered, the muscle is in the eccentric phase. Eccentric training is aimed less at building muscle and more at improving muscle strength and function. In the study, for example, participants will squat with one leg with a weight on their back and push themselves back up with both legs. "What matters most here are neuromuscular processes, i.e. the interaction of nerves and muscles," Engel explains. The training focuses on the leg and back muscles. After all, these muscle groups are particularly important for preventing falls and providing stability. In addition to a comparison with conventional weight training, the investigation primarily tests the feasibility of the training approach for this risk group.

THE RESEARCHERS

Dr. Heike Vogel studied biology at the University of Potsdam. Since 2015, she has been working as a researcher at the German Institute of Human Nutrition (DIfE) and is head of the Junior Research Group "Molecular Mechanisms and Clinical Interventions of Metabolic Diseases".

✉ heikevogel@dife.de

Dr. Tilman Engel studied sports therapy and prevention as well as clinical exercise science at the University of Potsdam. Since 2014, he has been working as a researcher at the Outpatient Clinic of the University of Potsdam.

✉ tiengel@uni-potsdam.de

Dominik Sonnenburg studied nutritional sciences at Kiel University (CAU) and is currently writing his doctoral thesis at the University of Potsdam.

✉ sonnenburg@uni-potsdam.de

Photos: Ruprecht, Susann/DIfE (top); Steffen, Florian (center); Kaczynski, Ernst (bottom)

Exercises

THE RESEARCH GROUP

In seven PhD projects, the **Junior Research Group "Molecular Mechanisms and Clinical Interventions of Metabolic Diseases"** investigates sarcopenia focusing on the question of how exercise and diet programs could affect this disease.

Participants: German Institute of Human Nutrition Potsdam-Rehbrücke (DIfE), Network Health Sciences of the University of Potsdam
Duration: 2020–2023

In the DIfE lab

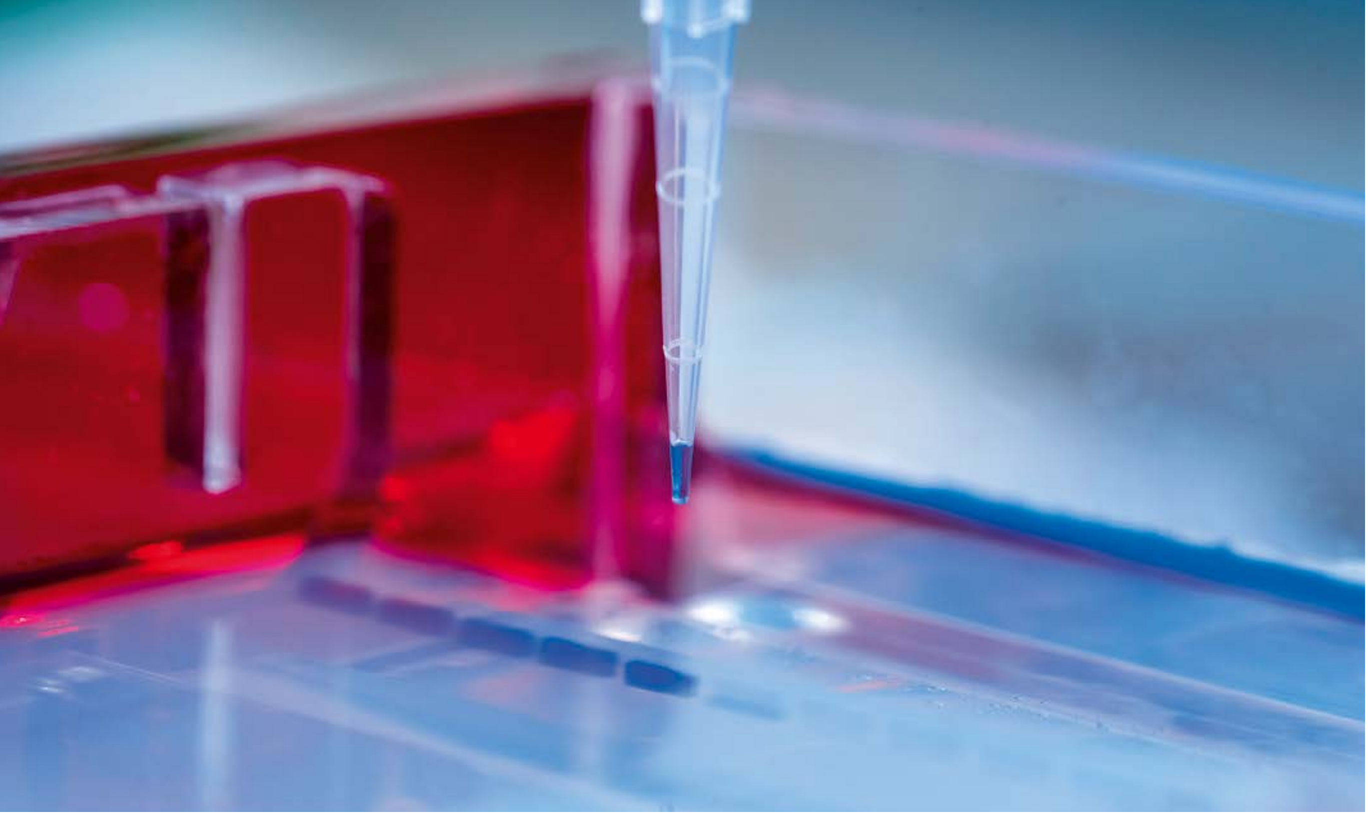
What are the effects of exercise and diet?

In addition to the exercises, the participants in the study receive regular nutritional counseling to ensure a balanced supply of nutrients and to reduce the risk of obesity. The goal is to gradually change eating habits. "But always in such a way that everyone can later implement them sustainably, i.e. adapt their lifestyle," emphasizes Sonnenburg. A strict ban on sweets, for example, usually lasts only for a short time. If you want to impact your health through your diet, you have to keep at it much longer.

Ultimately, ultrasound, MRI, mobility tests, and strength measurements on sports equipment show how the test persons' muscle quality, strength, and coordination have developed. In addition, blood samples are taken at the beginning and end of the study, which provide information on the health status such as fat metabolism and blood glucose level. Inflammation parameters are also expected to provide valuable information about a possible risk of sarcopenia. "Ideally, we will eventually have an exercise concept that positively changes the mobility and strength of those at risk and prevents sarcopenia," says Sonnenburg.

Already in 2015, mice were used as experimental animals in the DIfE laboratories and provided another important piece of the puzzle for holistic research into sarcopenia. At that time, the nutrition scientists found that mice that were fed a calorie-restricted diet

Photos: Engel, Dr. Tilman (top); Ausserhofer, David/DIfE



or fed only every second day developed less diabetes. Intermittent fasting seemed to be particularly effective at suppressing the disease. In additional tests, mice exercised on a treadmill five days a week for 30 to 50 minutes each day. The mice in the control group, on the other hand, were allowed to be lazy. The training not only reduced the mice's fat reserves, but also altered the activity of certain genes responsible for building muscles.

Targeted activation of genes

Both results can be groundbreaking for research into sarcopenia, which is closely linked to diabetes and obesity. Vogel hopes to find a so-called "candidate gene" among the genes that have been identified as relevant so far, which is clearly associated with sarcopenia and diabetes. If this is successful, future studies could show whether the gene's activity – and thus the development of the disease – can be specifically altered by exercise or diet. This would provide the foundation for future therapy. It is also possible that the researchers will discover other previously undiscovered regulatory factors.

Obesity and diabetes have been the known risks so far. But it is unclear what comes first – chicken or egg – that is, whether muscle atrophy in old age is the cause or consequence of these diseases. "There aren't any biomarkers yet that can provide information, for example in blood samples, on whether and at what stage the patient suffers from sarcopenia," says Vogel, describing the need for research. Until now, muscle mass and muscle function have been the decisive diagnostic parameters. However, measuring them is difficult and time-consuming.

"Achieving the greatest possible effect with the smallest possible effort" is how Heike Vogel describes the goal of future therapies. In order to achieve this, the researchers need to identify the influencing parameters that have the greatest positive effects. "What really helps against sarcopenia?" is the key question. The answer to this question could help determine whether more people will be able to lead healthy lives in the second half of their life in the future.

HEIKE KAMPE

TRANSLATION: SUSANNE VOIGT

Photo: Ausserhofer, David/DIfE

Linda Juang's office shows the diversity of American society

Photo: Scholz, Sandra

UNDERSTANDING DIVERSITY

Linda Juang researches the development of children with a migrant background

Linda Juang is US American with Taiwanese roots. In 2014, the University of Potsdam offered her a position as Professor of Heterogeneity in Institutionalized Educational Processes. With her research, Juang hopes to make an important contribution to the educational success of immigrant children.

Linda Juang seems uncomfortable as she is being photographed for this article. Later in the interview she gets more comfortable, particularly when talking about her field. It is obvious that she does not like talking about private matters, but when it comes to her research, her expression brightens up and she gets very lively. Juang studies how societies – in Germany, but also elsewhere – can deal well with the fact that they are becoming more culturally diverse. In her research, she focuses on young people and how they can learn to communicate in light of their different cultural backgrounds. How can students, teachers, and parents understand each other in spite of different worldviews? With this in mind, Juang researches how young people with a migrant background evolve within society, and under what circumstances they grow up. For those growing up with a different cultural background in a majority society, she has found that cultural identities mix. Culture and identity are not static, she says.

Understanding your own background through exchange with others

Juang developed her research interest while doing her bachelor's degree in child development. It struck her that not much scholarship had been done on children from immigrant families. "The study program offered just one course on black children and their development. Obviously, there was not enough research on these issues – a fundamental gap actually!" So Juang set out to change that by writing her PhD thesis on Asian American college students. "Maybe it was the course by my only African-American professor in Minnesota that made me consider becoming a researcher myself. My professor was one of the few who focused on black children and their development. Today I'm certain: She inspired me more than I realized at the time."

Juang's own background certainly had a major impact on her path in life, too. "My parents immigrated from Taiwan to Minnesota. And I noticed early on that in my family things were done differently than in my classmates' families, starting with lunch." Over time, she became very American which only struck her when she moved to Germany. "I think that I'm more exuberant than most Germans are." The relevance of

Photos: Scholz, Sandra

her research topic is also apparent in her own life. “Me and my two children are undergoing acculturation, that is finding our way in another culture and adapting parts of it. My children, for example, are genuine Berliners – Taiwanese-American-German-Austrian-Californian-Berliners, I would say. By contrast, I will never be a Berliner, because I came here as an adult,” says Juang, who now lives in the Berlin district of Charlottenburg.

In her research, she wants to understand children with a migrant background and their families. “I want to capture relevant aspects of their childhood experiences and development. And I want to help make the world a more peaceful place again. To achieve this, you have to start at an early age.” In light of these considerations, Juang is doing an intervention study at schools. “My field research is based on the Identity Project, which we have adapted in Germany. We ask young people to speak about their cultural backgrounds. In so doing, everybody learns something about their own worldviews and origins which helps them better understand and respect others’ perspectives. At least this is the hypothesis we are exploring at a school in the Berlin district of Neukölln,” Juang says. “In addition, we offer courses for student teachers to provide them with some theoretical background and prepare them for their future tasks. We hope to equip them with the skills they need to see cultural diversity in the classroom as a resource.” Some student teachers are already participating in a research project in the classroom – and quite a few of them represent a culturally diverse society themselves. “That's fantastic! When students with a migrant background meet teachers with a migrant background, their eyes light up,” Juang says, beaming.

Exploring migrant background as a strength

In the long run, she hopes, her research will make life easier for children and young people with migration backgrounds by creating more understanding. “But that is still a long way off. Research in developmental psychology cannot do this alone, sociologists and political scientists also have to come in. Much needs to be done and understood.” All in all she feels that there is not enough research on ethnicity and cultural diversity being conducted in Germany. “In the US, resource-oriented research on ethnic minorities began in the 1950s and '60s.” In Germany, this focus emerged only at the turn of the millennium. Until then, a deficit-oriented perspective on cultural and ethnic minorities prevailed. “Only now people are realizing the strengths and resilience factors of children and young people with a migrant background,” Juang states. Yet there is still a lot of research on language, and not enough on the social-emotional development of children and youths with migrant backgrounds. It may be more straightforward to assess language skills than evaluate the school climate statistically, although this is no less important. “The seventh graders we are doing the intervention study with are real, their problems are real. I love meeting them in the classroom, and working with them,” Juang says.

“The call of the University of Potsdam was a stroke of luck for me,” she says. As a city with many immigrants, Berlin provides ideal conditions for Juang’s research. So she gladly accepted the call to nearby Potsdam. Before, she taught at the University of California at Santa Barbara, but also gained some experience in Germany. “After I had completed my PhD thesis I wanted to go to Europe, and my former statistics professor, a German, recommended Jena, where youth development is a research priority. At the University of Jena, East and West German children and adolescents and their development were a research focus. It was a good fit. Later on, I worked at TU Berlin, so I could very well imagine returning to Germany and pursuing my research there,” Juang says. So it was probably also due to her focus on cultural diversity that she was offered a professorship in inclusion education in Potsdam. “Inclusion is often associated with disability in Germany. The UN uses a broader definition, and by offering a chair to me – a researcher with a focus on the social-emotional development of children who fled their country or have a migration background – the University of Potsdam adopted this broader definition.” Looking back she says it was a good decision: “I really enjoy working at the University of Potsdam, and also training student teachers. I am especially happy that we have secured funding for the research project in which student teachers go to schools. Hopefully, this will help them become teachers who are not overwhelmed by cultural diversity.”

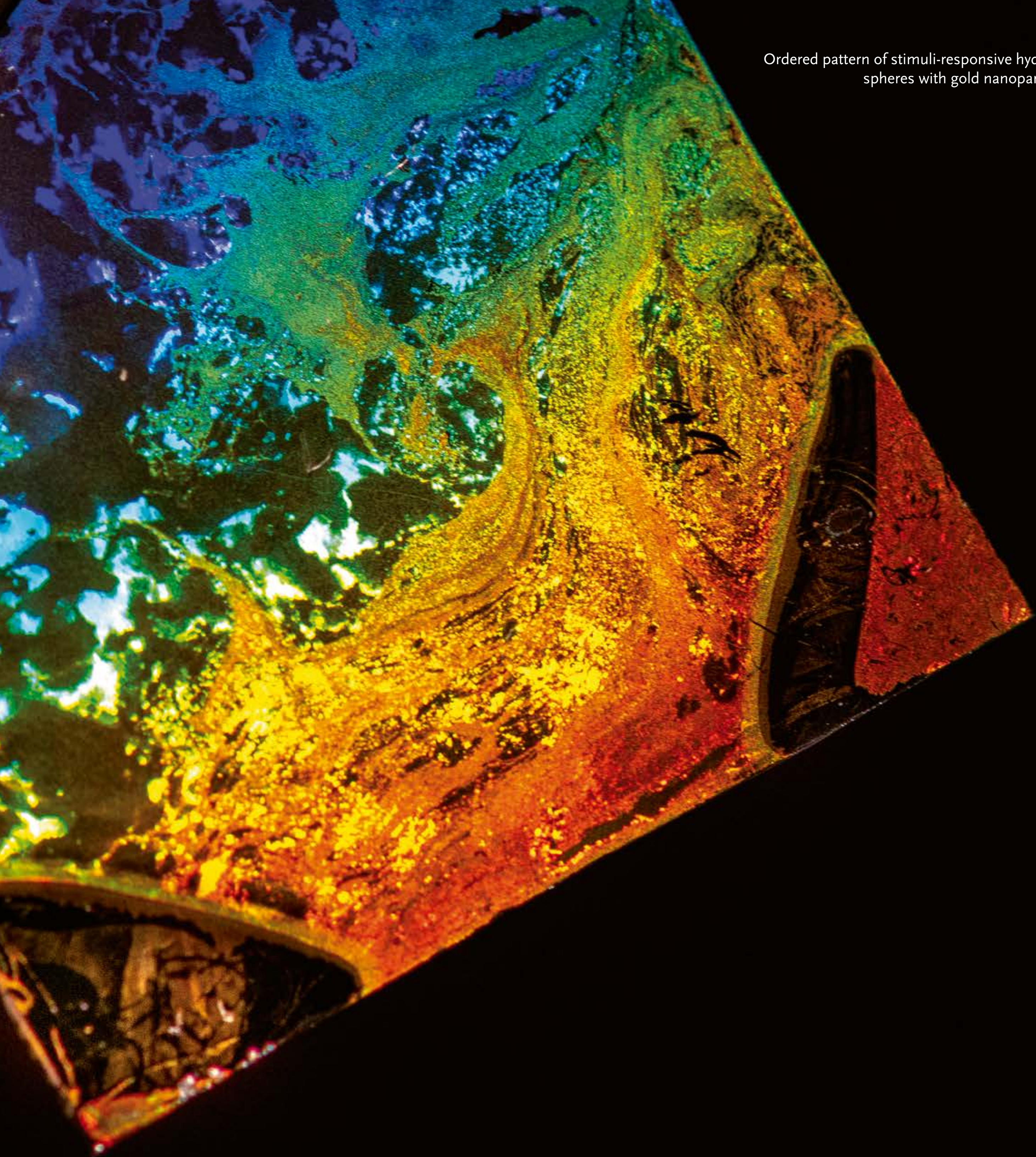
MAGDA PCHALEK
TRANSLATION: MONIKA WILKE

THE RESEARCHER

Prof. Dr. Linda Juang studied Child Development in Minnesota and Developmental Psychology in Michigan where she also earned her PhD. She has been Professor of Heterogeneity in Institutionalized Educational Processes at the University of Potsdam since 2014.

✉ juang@uni-potsdam.de

Photo: Scholz, Sandra



Ordered pattern of stimuli-responsive hydrogel spheres with gold nanoparticles

innoFSPEC is a research and innovation center pursuing multidisciplinary research in the field of optical fiber spectroscopy and sensing. The center was created as a joint venture of the Leibniz Institute for Astrophysics Potsdam (AIP) and the Physical Chemistry group of the University of Potsdam (UP).

https://innofspec.de

Photo: Roese, Thomas

WITH LIGHT AND NANOPARTICLES

Blazing a trail to the future of medicine

Optical fiber tips mounted with different functional nanomaterials (gold nanostructures, porous silicon, stimuli-responsive hydrogels)

Photo: Roese, Thomas

In the 21st century, it is often promised, medical treatment will be personalized, with diagnoses and therapies tailored to the needs of the individual patient. This may be achieved not only with the help of big data and new pharmacological developments, but also the activities of the new "OptiZeD" research network. In it, researchers from the University of Potsdam and Technische Universität Dresden have joined forces to develop a single device that enables doctors to diagnose, treat, and observe patients' reactions precisely and in real time.

In a hospital, an oncologist examines a patient with a plain instrument that looks much like an electric cable connected to a small box. At the tip of the instrument, there seems to be a light source. The physician inserts the instrument through a small incision and "illuminates" some suspicious-looking tissue to check for tumor cells. No sample needs to be taken, no laboratory results to be waited for. The device, a multi-parameter biosensor system, or MBS, is able to identify tumor cells reliably in just a few seconds. A little later, the doctor uses the same MBS to administer a drug that fights the cancer with perfect precision, and afterwards the MBS records changes in the tissue as tumor cells die.

Optical fibers for precise diagnostics

Sounds like science fiction? It is – but maybe it won't be long until the researchers of the "OptiZeD" consortium have attained their goal and developed the device, at once a tool for medical analysis, diagnosis, and therapy. "It would be an important step towards meeting the challenges of personalized medicine," says chemist Prof. Dr. Ilko Bald. Together with Dr. Claudia Pacholski he leads the Potsdam research groups that take part in the project. Both have their research focus on nanomaterials which play a key role in the MBS as its core consists of optical fibers coated with nanostructures serving as sensors. "For example, they could help identify inflammatory or cancer biomarkers. During an examination, the device sends an optical signal through the fibers. If the searched-for biomarkers dock on the nanomaterials, the signal will change and the physician can tell whether it is an inflammation or cancer," Bald explains.

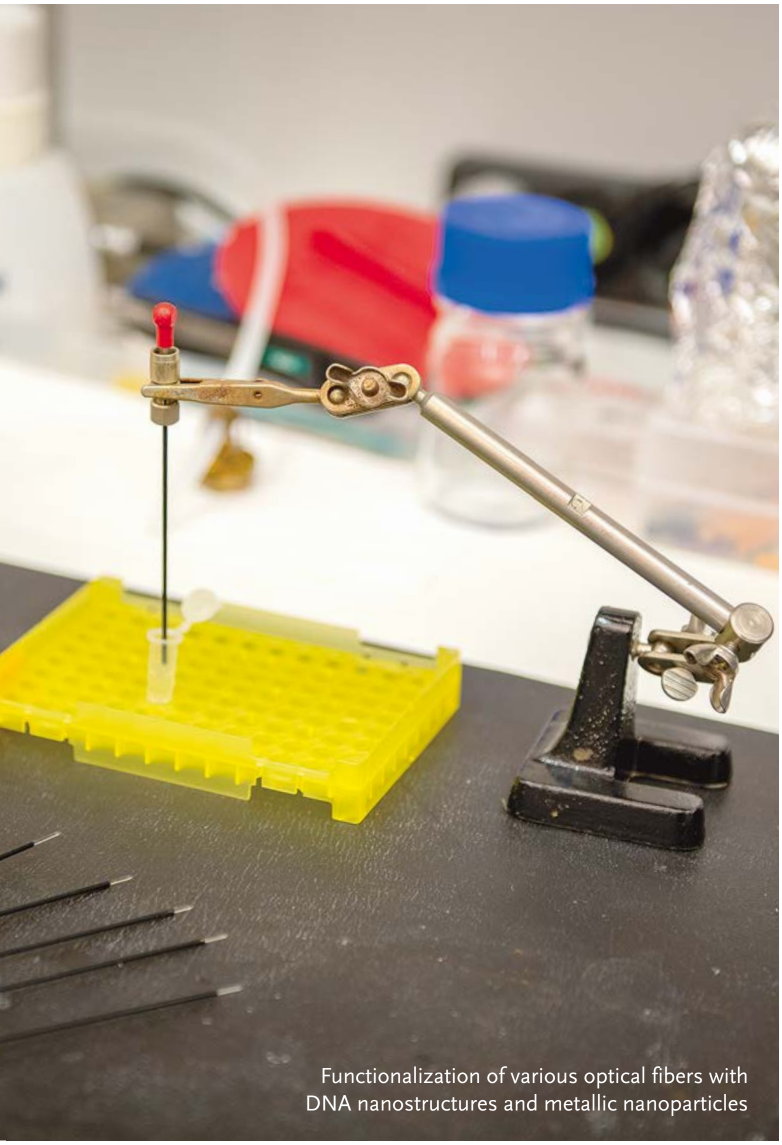
How optical fibers can be used for measuring has been studied for a number of years at the research and innovation center "innoFSPEC" in Potsdam where Bald, Pacholski, and their working groups are also based. "There is a lot of prior knowledge about optical fibers here, which helps enormously," Pacholski says. Three working groups from TU Dresden

Photo: Roese, Thomas

are also participating in the project. Their research objective is to fit optical fibers with active substances to be released at the end of a medical examination, if required. This way, diagnosis and treatment could be combined, and therapies administered to the exact site of the disease. Besides, treated tissue could be directly observed to see whether a drug is working. A very comfortable solution, and by no means extraordinarily costly, as Pacholski points out: "It's quite conceivable that this sort of tool will be available at every specialist's practice one day. And the – coated – optical fibers would even be the cheapest part of it. They could be disposable and thus absolutely hygienic to use."

To achieve this, we still have a long way to go, Bald knows. "Today, we are laying the groundwork by developing the model and the necessary technologies. Compared to that, attaching different sensors later on will be a walk in the park." So for now, what nanomaterials are suitable for what type of sensor? How

Photos: Roese, Thomas (2x bottom); Hopfgarten, Tobias (2x top)



Functionalization of various optical fibers with DNA nanostructures and metallic nanoparticles

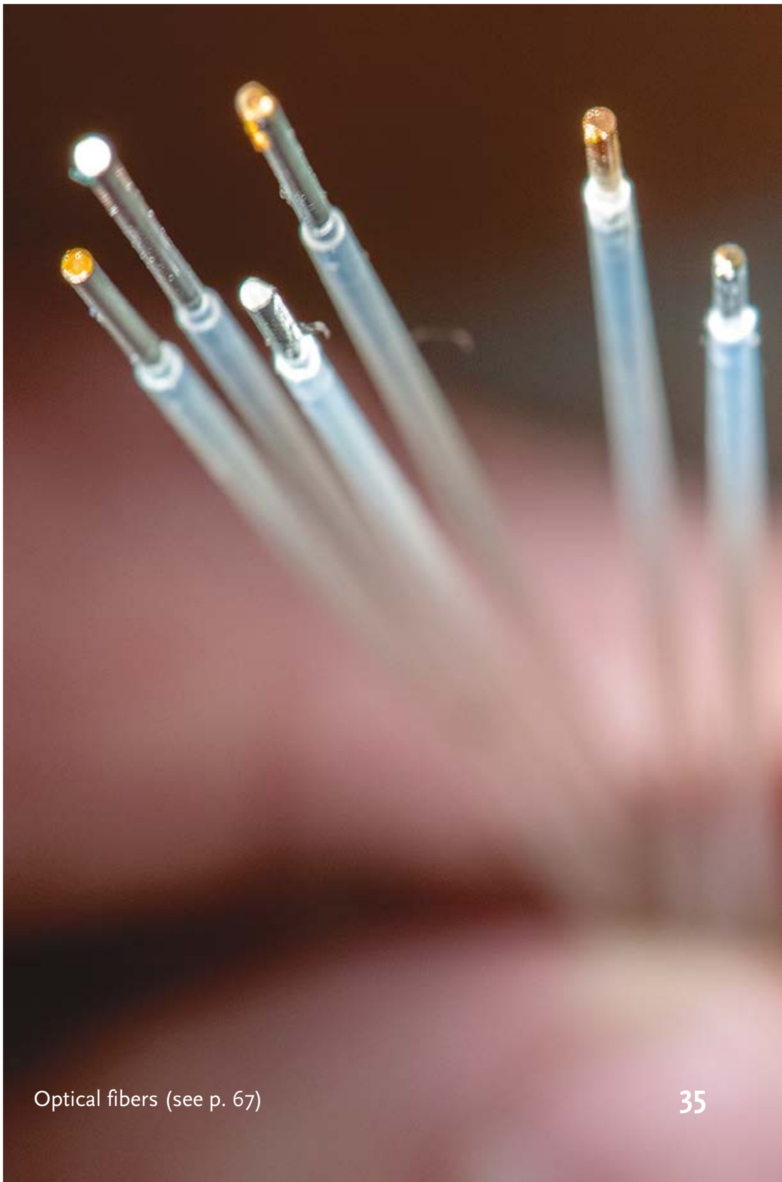
THE RESEARCHERS

Dr. Claudia Pacholski studied food chemistry at the University of Hamburg. She has been a Heisenberg Fellow at the Institute of Chemistry at the University of Potsdam and head of the "Functional Nanomaterials" group since 2016.

✉ claudia.pacholski@uni-potsdam.de

Prof. Dr. Ilko Bald studied chemistry at FU Berlin. In 2013, he became Junior Professor for Optical Spectroscopy and Chemical Imaging at the University of Potsdam, where he has been Professor for Hybrid Nanostructures since 2019.

✉ ilko.bald@uni-potsdam.de



Optical fibers (see p. 67)

Dr. Claudia Pacholski

THE PROJECT

For their project **"Optical Cell Diagnosis and Manipulation" (OptiZeD)**, the centers for innovation competence Center for Molecular Bioengineering (B CUBE) at TU Dresden and Innovative Optical Fiber Spectroscopy and Sensing (innoFSPEC) at the University of Potsdam receive funding to the tune of approximately three million euros from the German Federal Ministry of Education and Research (BMBF). A novel, miniaturized multi-parameter biosensor system (MBS) will allow innovative methods to be used in personalized medicine.

can they be firmly fixed to optical fibers? And how can they be modified to become sensors for detecting biomarkers, cells, or sounding an alarm when certain values are exceeded? "This is a major technological challenge," Pacholski states. "We are testing various materials to cover different sensory functions."

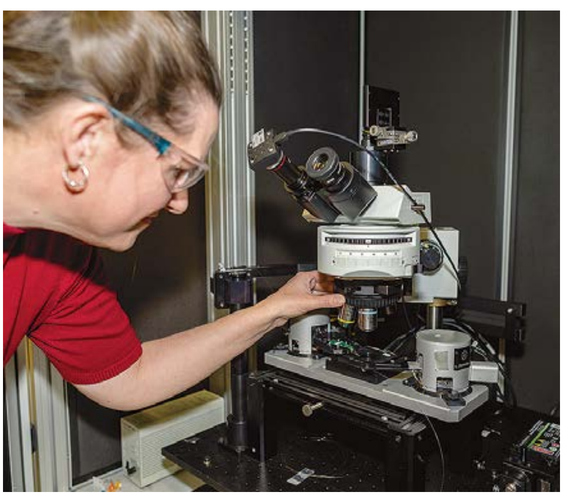
Foldable DNA structures and versatile gold particles

Bald has been researching DNA nanostructures for years. Using DNA origami, he folds DNA to create two- or three-dimensional structures. "The great thing is that these structures can be controlled very precisely," he says. As part of the "OptiZeD" project, Bald plans to use them to develop two sensor systems:

Prof. Ilko Bald in the lab

One to measure the ambient pH value. "This is quite instructive for some disease patterns," Bald remarks. For this purpose, the researchers use fluorescent dyes that change their fluorescence at certain pH values. "As the signal of the optical fibers is modified, too, we can use it to calculate pH levels," Bald says. In this case, the fluorescent dye practically binds to the DNA

Photos: Hopfgarten, Tobias



structure. In the second application, DNA segments will be used as sensors. "Our Dresden partners have developed a sequence that can serve as a receptor for certain molecules – for example those indicating inflammatory processes." Now, Bald and his team are planning to incorporate these sequences into nanostructures to be used for the coating of optical fibers.

In contrast to that, Pacholski works with metallic nanostructures such as hole pattern structures or gold particles. "They have great properties," she says. "It's easy to fix molecules to them, and they can amplify signals." In addition, gold-coated optical fibers can be used to heat pathological tissue and kill cancer cells, for example. "It could be possible to develop a thermal therapy for cancer on this basis. We are experimenting in several directions."

Exchange at a distance

Due to the Corona pandemic, collaboration with the Dresden partners has been limited to video conferences and communication by e-mail or mail over the last few months. "We planned to see each other much more often, and work together in the lab," Bald states. Unfortunately, this has not been possible. But as researchers, they have been used to digital cooperation for a while. "We even held virtual meetings to align lab setups for experiments," Pacholski adds. And the required data and preparations can be exchanged by e-mail or mail.

With or without Corona – Bald, Pacholski, and their partners need a lot of staying power. Bald believes that it may well take years until the MBS will finally be available: "'OptiZeD' has a duration of three years. Even so, we are already planning for three phases: The first is our current project, intended to provide the proof of principle. In the second, we intend to transfer our results to real cell systems and test them in their entirety at the cellular level." And in a third phase, we will look at the technical realization of the device and test it in medically relevant settings. The long road ahead does not dampen the two researchers' enthusiasm. "The work is fascinating," Pacholski says. "I'm thrilled by the prospect of finding practical applications for these seemingly very abstract nanostructures."

MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE

Photos: Hopfgarten, Tobias

Illustartion: Töpfer, Andreas

EDUCATION IN TIMES OF THE PANDEMIC

HOW SCHOOLS AND UNIVERSITIES MASTER DIGITIZATION

The Covid-19 pandemic and the resulting restrictions on public life led to a kind of forced fast-track digitization in spring 2020. This has affected many fields of work as well as education – in schools and universities. But did it work? Which digital formats have probably turned out to be better than face-to-face instructions and what fell by the wayside? And what lessons can schools and universities draw from the crisis for their digitization strategies? Matthias Zimmermann spoke about these issues with Dr. Gergana Vladova and Dr. Antonia Köster who are studying the effects of digitization on society in general and education in particular.

Dr. Köster, Dr. Vladova: You both conduct research on digitization in educational contexts. What are your conclusions after nine months: Has digitization worked?

Köster: The Corona pandemic and the concomitant closing of schools in spring 2020 confronted all schools in Germany with the task of developing a broad range of digital learning opportunities for students to be able to provide hybrid and distance learning. The closing of schools was a particularly great challenge for elementary schools since not all teachers had the necessary (digital) skills, and appropriate digital learning opportunities were not available for all subjects. In addition, some school children did not have access to digital end devices or were not yet trained in using them. Where digital devices were not available, teachers also personally took teaching materials to the children's homes or sent them by mail while schools were closed. It became apparent how important it is for children to retain a connection to school and their social environment as well as to take part in a regular school day.

Vladova: The transition was much smoother at universities. Lecturers and students managed it very well and gained very important experience. Methodological and didactic skills increasingly gained priority. Many things were tried out and applied, and the opportunities, possibilities, and limitations of the digital classroom also became apparent.

How has digitization changed education in times of Corona?

Köster: At the Chair of Business Informatics, Social Media and Society of Prof. Hanna Krasnova, we conducted two empirical studies on this question.

We interviewed parents of school children in the U.S. about the current situation, and we interviewed school administrators and teachers of elementary schools in Germany after schools had been closed down. School administrators and teachers reported that attitudes toward digital learning methods had changed among the teaching staff. In this exceptional situation, teachers noticed that well-trodden paths cannot be followed, that they have to act more flexibly and are dependent on digitization and digital end devices. In higher grades, the use of digital learning opportunities often worked smoothly. While the schools were closed, communication among the teaching staff was also largely digital, and their feedback on experiences with video conferencing was quite positive. The interviews show that the schools have a more positive attitude toward digitization because today's world needs digital learning opportunities. This is not least due to Corona.

Vladova: The lockdown situation inevitably required fast actions and all those who acted gained a lot of empirical knowledge. Uncertainties and the fear of making mistakes were thus minimized. Teachers and students were able to build competencies.

Köster: An online survey of over 300 parents in the U.S. in April 2020 also showed that the vast majority were in favor of digital education, and only very few parents expressed a negative attitude toward it.

What is the bottom line for teachers and students after the first lockdown?

Köster: Parents of elementary school children were especially grateful that the time of homeschooling was coming to an end and that their families could return to a more or less regular daily routine without childcare challenges. Parents gained direct experience with conveying knowledge, and showed a greater appreciation for teachers' work. This appreciation had long been missing, and the schools reported very positively about it. Students were pleased to be able to return to school and to their friends. Social learning, which is so important for development, basically does not take place during digital instruction. It is a fact that hybrid and distance learning do not match the quality of face-to-face instruction at elementary schools because younger students do not have the same learning skills without adult support.

Which content and learning formats can be successfully conveyed digitally, and which are more difficult or impossible to convey?

Köster: The elementary schools reported in the interviews that teaching first reading strategies and literacy

THE RESEARCHERS

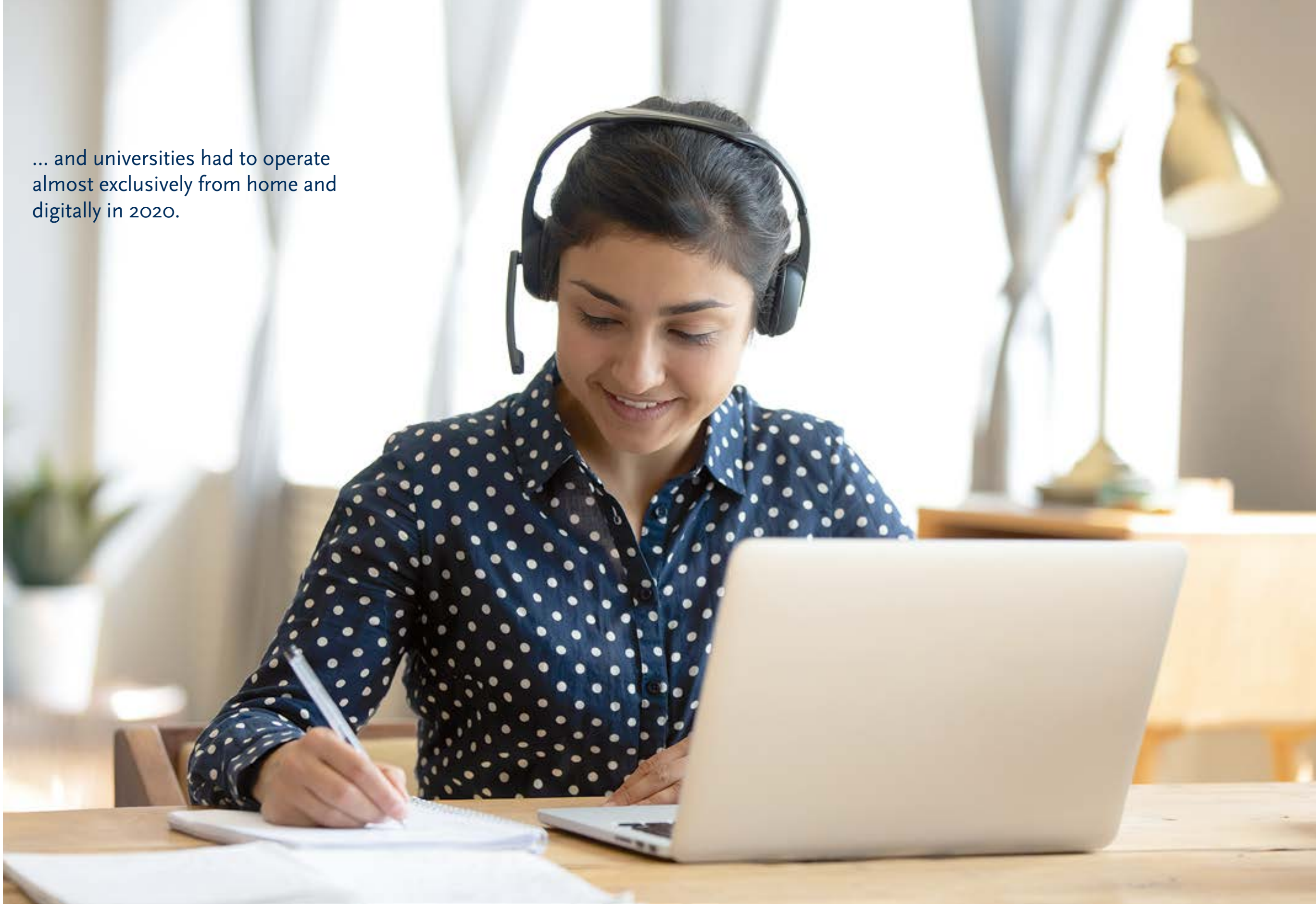
Dr. Antonia Köster studied business administration at the Ludwig-Maximilians-Universität München (LMU Munich). Since 2018, she has been doing research at the Chair of Business Informatics, Social Media, and Society. She is the group leader of the research group "Digital Integration" at the Weizenbaum Institute for the Networked Society in Berlin.

✉ antonia.koester@uni-potsdam.de

Dr. Gergana Vladova studied international economic relations at the University of National and World Economy in Sofia (Bulgaria), and communication sciences and economics at Freie Universität Berlin. Since 2009, she has been doing research at the Chair of Business Informatics, Processes and Systems, and since 2017 she has been group leader of the research group "Education and Advanced Training in the Digital Society" at the Weizenbaum Institute for the Networked Society in Berlin.

✉ gergana.vladova@wi.uni-potsdam.de

Schools ...



… and universities had to operate almost exclusively from home and digitally in 2020.

can only be implemented to a limited extent digitally. Content such as theater, music, and sports is not really suitable for distance learning either. Artistic and natural science topics were popular with elementary school children, and German and English exercises are also well suited for digital distance learning.

Vladova: In the academic context, the Chair of Business Informatics, Processes and Systems of Prof. Norbert Gronau conducted a survey with about 900 students from different universities. In principle, they expressed a positive attitude toward digital education. There are, however, differences in the expectations of students from different disciplines and with regard to teaching formats. Lectures can be digitalized without any problems, and this has various advantages (e.g. the possibility of watching recorded lectures several times or flexibly). On the other hand, exercises, project work, and internships present greater challenges when it comes to digital instruction. It is even more difficult to design suitable instruction formats for subjects such as creative studies, art, music or theater classes. These rely very much on the social component of teaching.

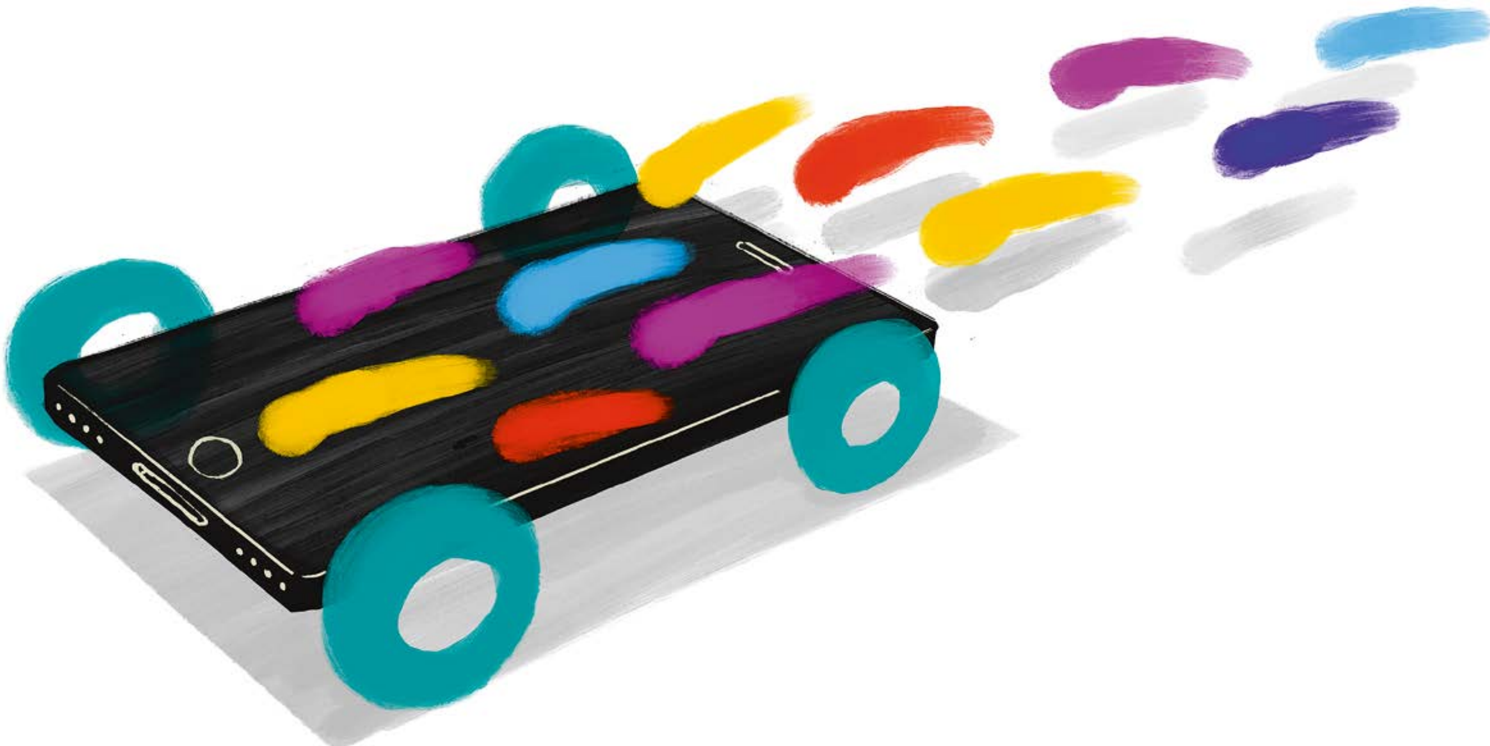
What needs to be done to prepare schools and universities even better for the digital future?

Köster: Schools in Germany differ greatly with regard to their digital equipment and, depending on the

subject matter, the digital offers are more or less extensive. For the future, digital learning offers that are compatible with the curriculum are planned, and the technical equipment of schools is already underway. In addition, mandatory in-house training courses at schools would bring the entire teaching staff consistently up to date.

Vladova: Our surveys among lecturers and students suggest that challenges are, among other things, particularly apparent in the central organization and coordination of the digital learning processes as well as the appropriate didactic concepts. For this purpose, working groups or networking opportunities and the exchange of experiences would be recommended. Moreover, it is necessary to provide advanced training for teachers. There are various offers of this kind. It

Photos: AdobeStock/fizkes (top); AdobeStock/Rido (bottom)



would be conceivable to set up a central office and commission it to recommend and specifically inform about these training offers. Overall, acceptance by teachers and students is seen as the lowest hurdle. The technical requirements are also regarded as less critical compared to organization. And yet, as I already said, not all types of courses can be prepared digitally in the same way. Hybrid forms of learning, for example, are important in this regard. In general, however, the transformation to digital teaching is easier to design at universities than at schools. One reason is that university students as learners are not as dependent on social interaction in class and are generally also better able to organize themselves.

Does the digital transformation (of education) help reduce existing inequalities – or have they even become bigger? Why?

Köster: Our survey among elementary schools showed that the education gap widened during the distance learning phase. Based on the experience of the first lockdown, the following observations particularly suggest that hybrid and distance learning have not been able to match the quality of face-to-face instruction. Students from socially disadvantaged families notably have a harder time participating successfully in distance learning. Children from families with an immigrant background with only basic German language skills also lack the necessary support at home. In this respect, the Corona time has even led to a situation where weaker students, who had little support at home, had to abandon educational goals they had already achieved before the lockdown because there was no revision and regular confrontation with the content. By contrast, students who were supported at home were actually able to make greater progress. Policymakers responded to the challenges associated with distance learning and the revelation of educational inequities with policy measures and the recognition that face-to-face instruction in elementary schools, but also schools in general, is of particular importance during the Corona crisis.

Vladova: In the context of the COVID 19 crisis, a difference on a global level has become evident. Reports from developing countries show that it was not as easy as in Germany to continue studies there. Such inequalities must be taken into consideration because – not only in this extreme situation – access to knowledge and information is a decisive competitive and educational advantage in our age. We also have rural regions with poorer home networks. Besides, a quiet

Illustration: Topfer, Andreas

workspace at home or outside the university is crucial for the success of digital education. This sounds trivial but only existed for 64% of the university members surveyed. About the same percentage said that their internet connection had been sufficiently stable.

Of course, potential social isolation is also an undesirable effect. Universities are there to impart knowledge but also to provide a framework for social life. Traditional university learning processes are structured, which is why self-motivation and organization are not necessary to the same extent as in digital classes. And these can be quite overwhelming, especially at the beginning of one's studies. In addition, it is much easier to get distracted than in the traditional classroom environment. As discussed before, direct contact is important for us as social beings to construct a shared social reality. It is still questionable whether technological development as well as the next generations' affinity for technology will change this. Current studies show that the Net generation also considers social contact to be particularly important in the learning context.

Do you think that digitization in education will be established in the long term? Which developments are to be expected?

Köster: The benefits of digital education have become clearly noticeable during the lockdown. There will certainly be attempts to integrate these findings and experiences into everyday school life. In the long term, one should take into consideration that digital learning offers opportunities tailored to individual needs thus enabling children who work completely individually to achieve learning progress. However they lack social interaction and cohesion in a group. Especially younger pupils learn in school to interact in a larger community. If digital learning becomes generally established and social learning no longer takes place in daily interactions, we do not know yet how this will affect society in the future.

Vladova: At universities, there is a clear trend in this direction. The use of digital self-study tools is an increasingly integral part of academic studies. Hybrid teaching methods, in particular, will become increasingly established after the Corona crisis.

Which ratio of digital to analog would you consider appropriate in education?

Köster: The younger the students, the more face-to-face education should be offered because the skills of pupils at elementary schools are closely linked to the support and assistance from teachers. The older the students, the more digital components can be offered.

Vladova: It is very important not to make any general claims here. The answers of the participants in the survey did not show a clear line either. The teachers' needs, their competencies as well as the type of knowledge to be imparted must be taken into account when making a decision.

MATTHIAS ZIMMERMANN

TRANSLATION: SUSANNE VOIGT

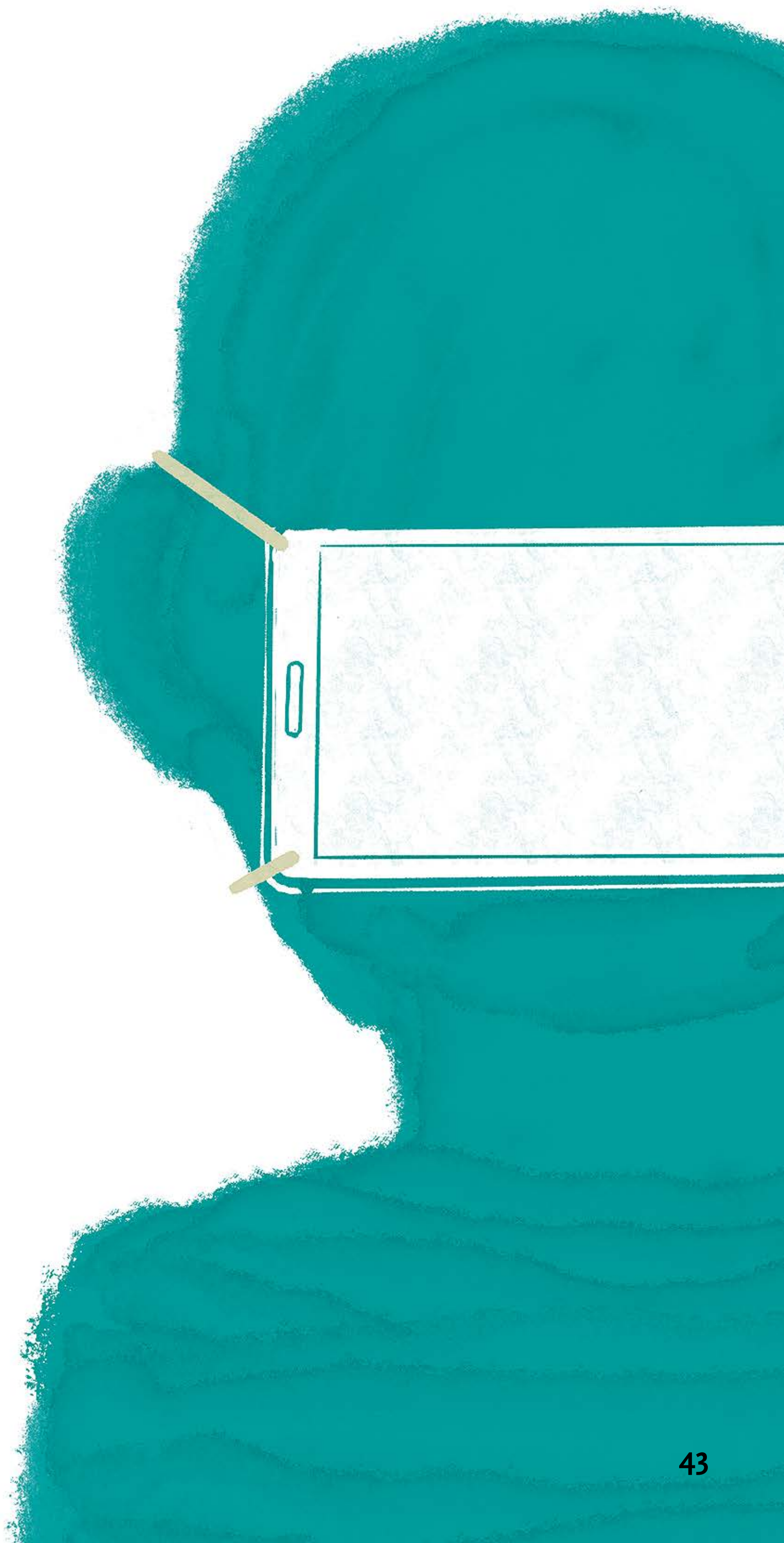


Illustration: Töpfer, Andreas

Zebrafish embryos under the microscope

Photo: Ryl, Kevin

THE PROJECT

“V.A. Cure” is an international PhD program for 14 PhD students. It receives funding from the European Union under a Marie Skłodowska-Curie grant agreement. In their research projects, the PhD students investigate defects in blood or lymphatic vessels, in particular those resulting in malformations or morphological abnormalities.

Duration: 2019-2023
Funding: European Union
Participants: Research Institutions: De Duve Institute (Belgium), Institut National de la Santé et de la Recherché Médicale (France), Karolinska Institutet (Sweden), Max Planck Institute for Heart and Lung Research (Germany), University of Potsdam, University of Oulu (Finland), Uppsala University (Sweden); Companies: Finnadvance (Finland), AstraZeneca (Sweden).

https://vacure.eu

SEARCHING FOR A COMMON DENOMINATOR

Research network "V.A. Cure" investigates rare diseases

How do you research rare diseases for which there is no lobby? With the help of zebrafish, Potsdam University's physiologist Prof. Dr. Salim Seyfried says. The zebrafish is not only closer to humans than you might think, but also has amazing characteristics.

Most diseases go unnoticed for a long time before they are diagnosed: A virus attaching itself to mucous membranes or a cancer metastasizing when a genetic mutation has damaged cells in such a way that they can no longer function properly. So only the consequences will be seen or felt. This makes not only their treatment difficult, but also research of the disease etiology (development). What if a transparent organism could be used in research so that changes inside the organism could be observed to help understand why humans develop certain diseases? That's all still up in the air? No, it isn't! For many years, Prof. Dr. Salim Seyfried has been researching rare human diseases using zebrafish eggs. Zebrafish are vertebrates, as are humans, and therefore genetically more similar to us than one would expect. In addition, zebrafish eggs and embryos are transparent and can therefore be studied very well under a microscope. "Using state-of-the-art techniques such as light sheet microscopy or high-resolution confocal microscopy, we are conducting research on zebrafish eggs and hope to gain major insights into the development of rare diseases," Seyfried explains.

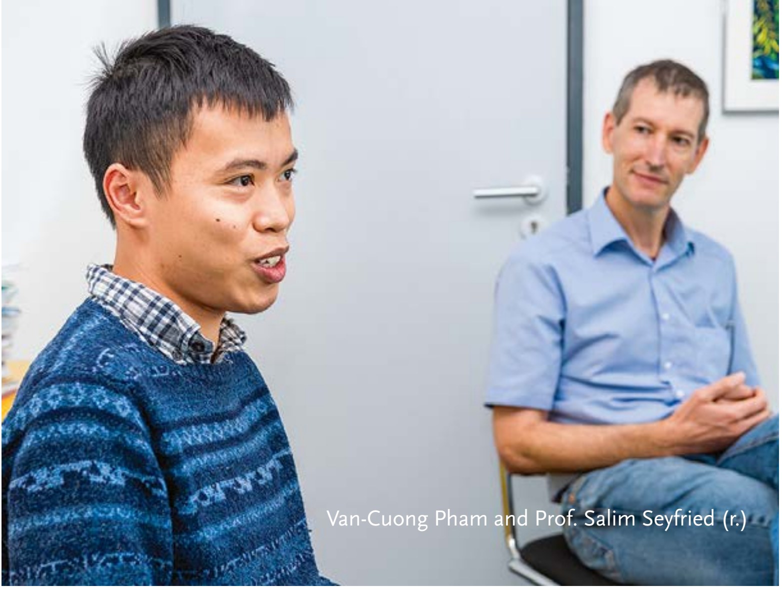
Know-how from all over Europe for a common goal

Since autumn 2019, Seyfried and his team have been sharing their expertise and methods in the PhD program "V.A. Cure" funded by the EU. The consortium consists of researchers from nine universities and research institutes in six countries and has set itself the goal of researching vascular anomalies (VAs), as Seyfried explains. "Those affected often suffer from chronic pain and a massive reduction in their quality of life." But vascular anomalies are very rare, so there is not much research into them, as pharmaceutical companies are often guided by economic interests. The EU wants to counter this by funding projects investigating such orphan diseases. "We are happy our project was selected from among a large number of excellent applications. After all, only 2.5 percent of submissions were selected in 2019."

In "V.A. Cure", researchers are studying a whole group of diseases – malformations of larger blood vessels and smaller capillaries and of lymphatic vessels. One example is the rare disease cerebral cavernous malformations (CCM), a genetic condition that causes malformations of small brain capillaries. What all these diseases have in common are underlying genetic defects. "It's a bit like cancer," Seyfried explains. "In some patients, cells of the vasculature can become affected already in childhood, in others

PhD student Van-Cuong Pham in the lab

Photo: Ryl, Kevin



Van-Cuong Pham and Prof. Salim Seyfried (r.)

PhD student Nastasja Grdseloff

not until they are 50 or older – and we want to find out why." To investigate the function of genes implicated in these diseases, the researchers use zebrafish eggs. In addition, they use cell cultures of human cells, some of which have been taken directly from patients. With these, molecular and cellular changes can be studied and pharmacological agents tested. But before therapies can be designed, a deeper understanding of the diseases is needed, as Seyfried emphasizes. "Take Covid-19: Initially thought to be a respiratory illness, we now know that it is also a disease of blood vessels and smooth muscle cells and may damage organs with fine capillary systems. Without the intensive research conducted over the past few months, this would not be known and could not be treated."

Training young researchers from all over the world

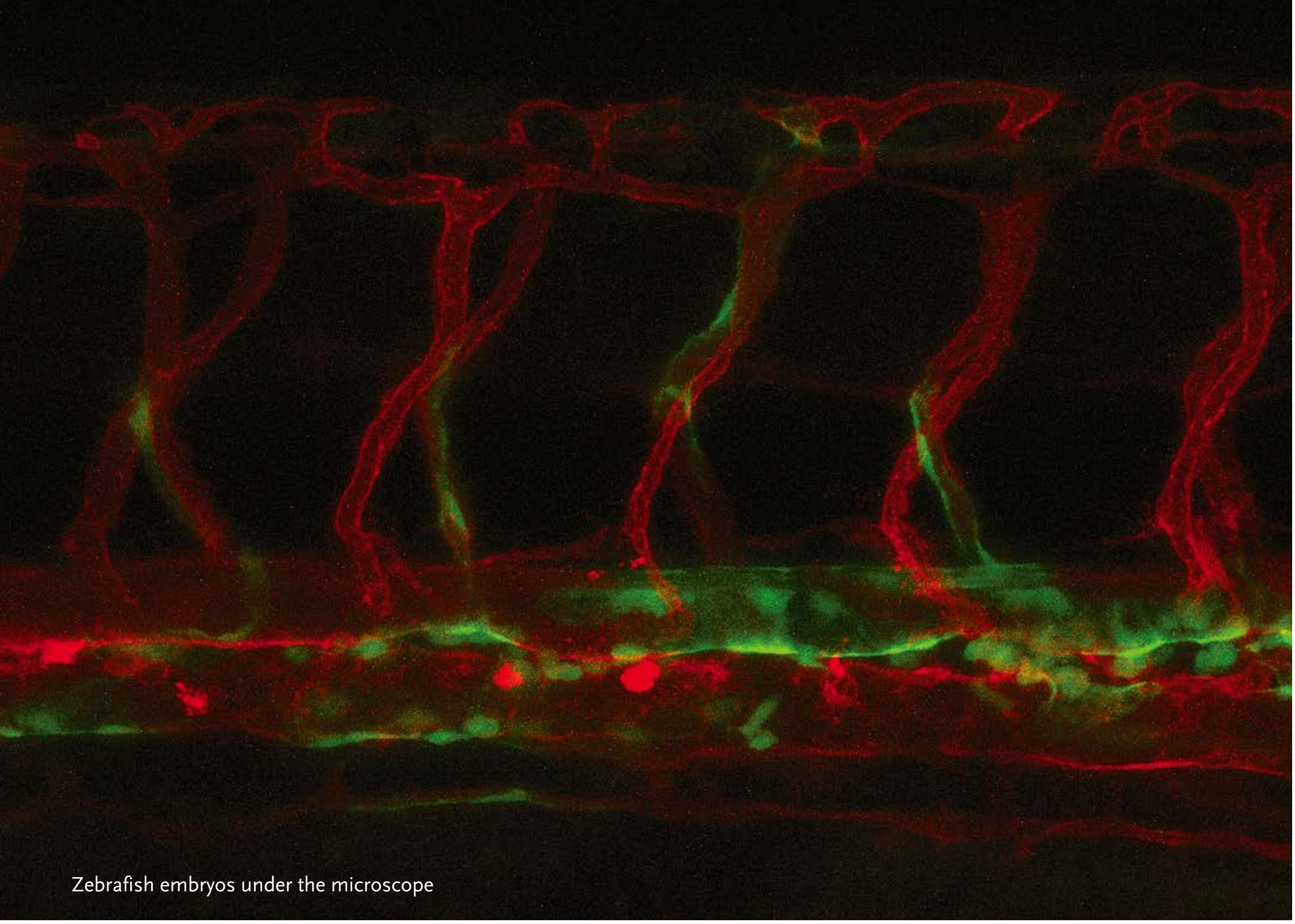
"V.A. Cure" is a PhD program with a focus on training young researchers. "We want the doctoral students in this project to grow through their research – and help fight these diseases," Seyfried says. This is also what brought Nastasja Grdseloff and Van-Cuong Pham to Potsdam. "The network is a perfect fit for me: It allows me to develop myself as a researcher while helping to understand diseases and hopefully help patients, too" says Pham, who is from Vietnam. After studying for his master's degree at Kyushu University in Japan, he is now doing research outside Asia for the first time. This is definitely a major change for him, not only in his research experience but also in his day-to-day life: "I miss Vietnamese food, and Japan's retail and grocery stores." For his PhD thesis, he is doing research on CCM, a disease for which neurosurgery is the only therapeutic option today. If the affected blood vessels are located too deep in the brain or near vital brain regions, surgery cannot be done. "That's why we urgently need a drug," Seyfried says. In zebrafish eggs, Pham studies what cellular changes are triggered during this disease – and what can be done for prevention. To this end, he modifies the DNA using the CRISPR-Cas genome editing technique by which precise gene sections can be replaced or "switched off". "Using the genetically modified zebrafish eggs, we can then observe how modified cells develop and what behaviors they show," Pham says.

Nastasja Grdseloff did not have to travel far to come to Potsdam; yet the Austrian-born researcher admits she had to "adapt her German a little". As a student, she used cell cultures, stem cells, and heart organoids in her research. Now she is working with zebrafish as well. She is interested in whether there are commonalities at the molecular level between different vascular diseases. It is already known that various vascular diseases are caused by different mutations. Yet, blood vessel cells show similar abnormalities and cannot be distinguished from one another. "This raises the question whether these diseases have a common denominator. Finding it could provide the basis for novel therapeutic strategies," Grdseloff says. She, too, uses CRISPR-Cas genome editing to replicate the genetic modifications causing vascular diseases in humans to zebrafish eggs. "This way I can observe modifications from the very beginning and follow their development in real time – you can't do that in humans."

Corona makes inventive

In November 2019, the network had its kick-off meeting in Brussels. "It was the first and last time all participants met before the Corona pandemic prevented further meetings," Seyfried says. "It's a pity, since it is above all the diversity of the researchers involved that makes our network so special." In fact, research

Photos: Ryl, Kevin



Zebrafish embryos under the microscope

THE RESEARCHERS

Prof. Dr. Salim Seyfried studied biology. He has been Professor of Zoophysiology at the University of Potsdam since 2015.

✉ salim.seyfried@uni-potsdam.de

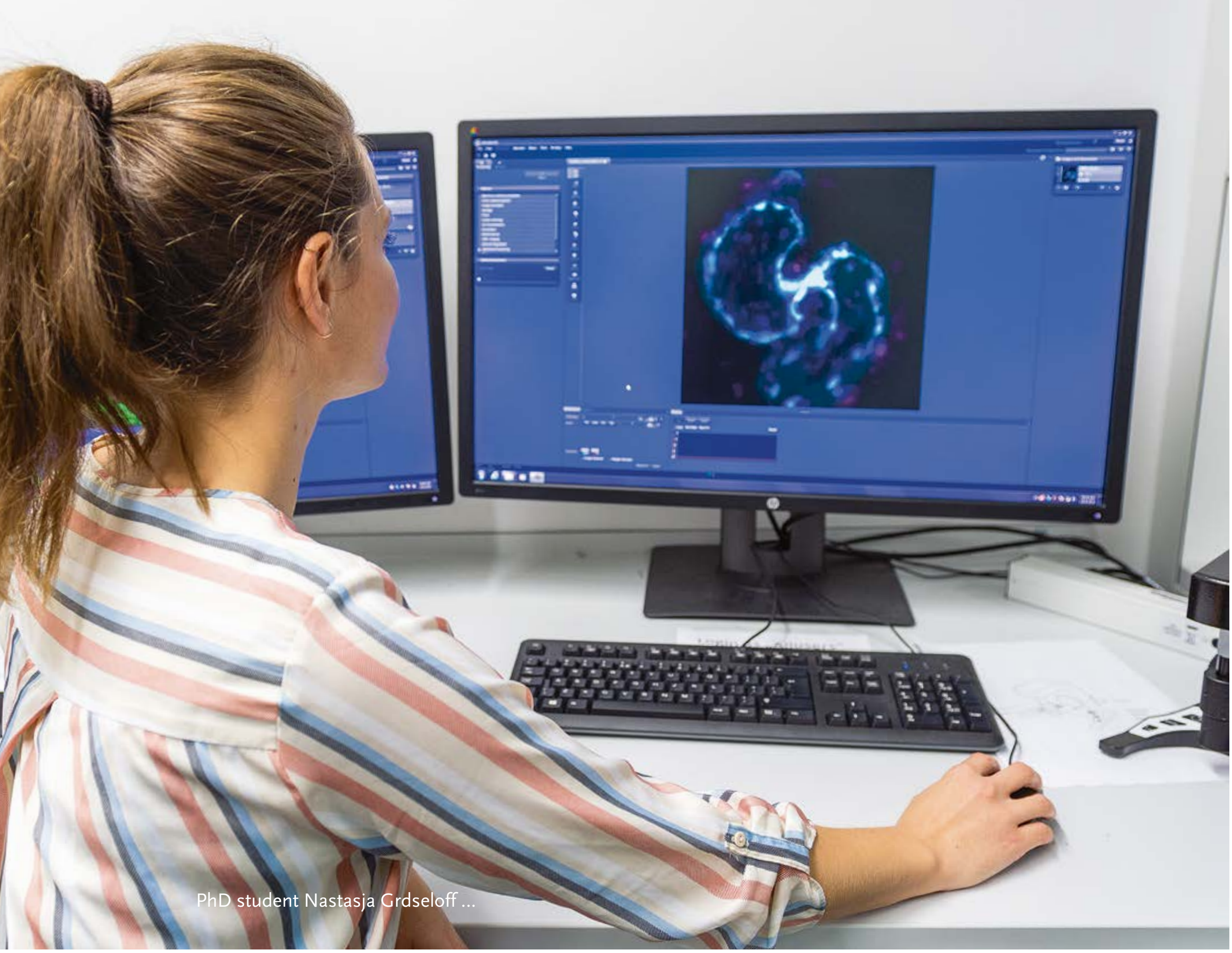
Nastasja Grdseloff studied biomedicine and biotechnology in Vienna and Miami as well as medical and pharmaceutical biotechnology in Krems. She has been a PhD student in the "V.A. Cure" network since 2019.

✉ grdseloff@uni-potsdam.de

Van-Cuong Pham studied biology in Hanoi and Kyushu. He has been a PhD student in the "V.A. Cure" network since 2019.

✉ pham1@uni-potsdam.de

in "V.A. Cure" largely benefits from its interdisciplinarity – the consortium comprises excellent partner laboratories with expertise in molecular biology and biomedicine as well as biomedical and pharmaceutical companies including Bayer Schering AG and AstraZeneca. "When it comes to researching diseases, each team and company has its limits," Seyfried points out. "Whereas basic researchers often lack patient contacts, medical doctors are often unable to confirm hypotheses or assumptions in scientific experiments as they lack the necessary molecular research methods." The biomedical and pharmaceutical industries face completely different constraints: Here, economic interests may lead to "rare diseases" receiving little attention. But these diseases are by no means as rare as their name suggests: In the EU alone, an estimated 40 to 50 million people are affected by them. The PhD students will benefit the most from close collaborations, as Seyfried emphasizes. They will not only work in their respective lab, but also have the opportunity to spend some time in collaborating laboratories. The students discuss their research results in regular teleconferences. However, their annual training at one of the partner facilities has also been moved online. Yet the exchange with other research groups – even if only from a distance – and the prospect of working at other facilities and examining research issues from different perspectives is especially important to Grdseloff and Pham: "These collaborations allow me to gain insights into

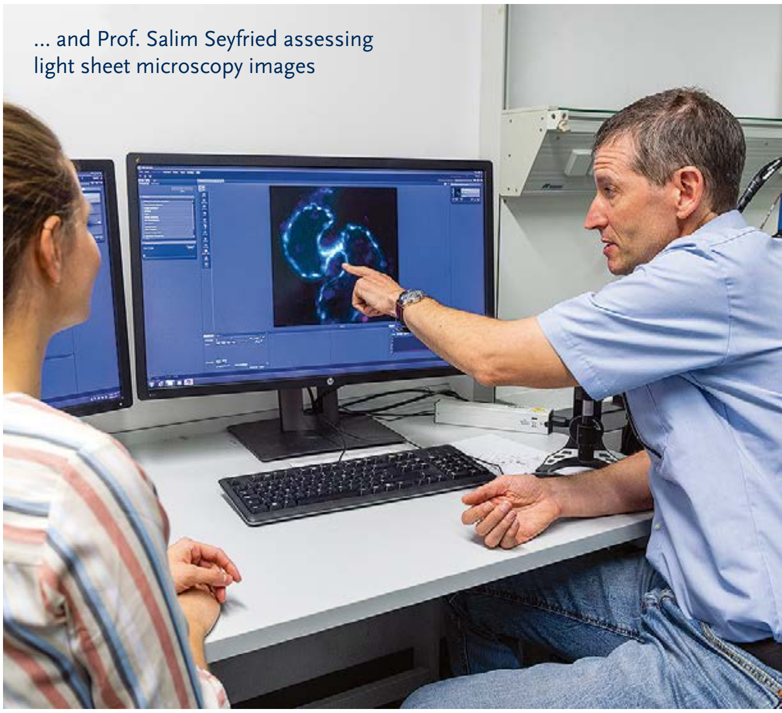


PhD student Nastasja Grdseloff ...

their work and give me an opportunity to initiate new projects with them," Grdseloff says. "For me, interactions between the teams and the training program of lectures and meetings are among the most valuable aspects of the network," Pham adds. "Most importantly, I am part of a research team with a bigger goal – to understand these terrible diseases in order to have better therapeutic options one day."

And there is yet another aspect which made the meeting in Brussels very valuable, as Seyfried states: "Meeting representatives of patients' organizations was eye-opening to us." Here, the researchers could learn first-hand about the daily suffering of those affected. "We usually deal with diseases at the molecular level and through the eyes of a researcher. The meetings revealed to what an extent even children suffer from these diseases. It was distressing for us to see their suffering, but also very motivating! It showed how important our work is."

MATTHIAS ZIMMERMANN
TRANSLATION: MONIKA WILKE



... and Prof. Salim Seyfried assessing light sheet microscopy images

Photos: Ryl, Kevin

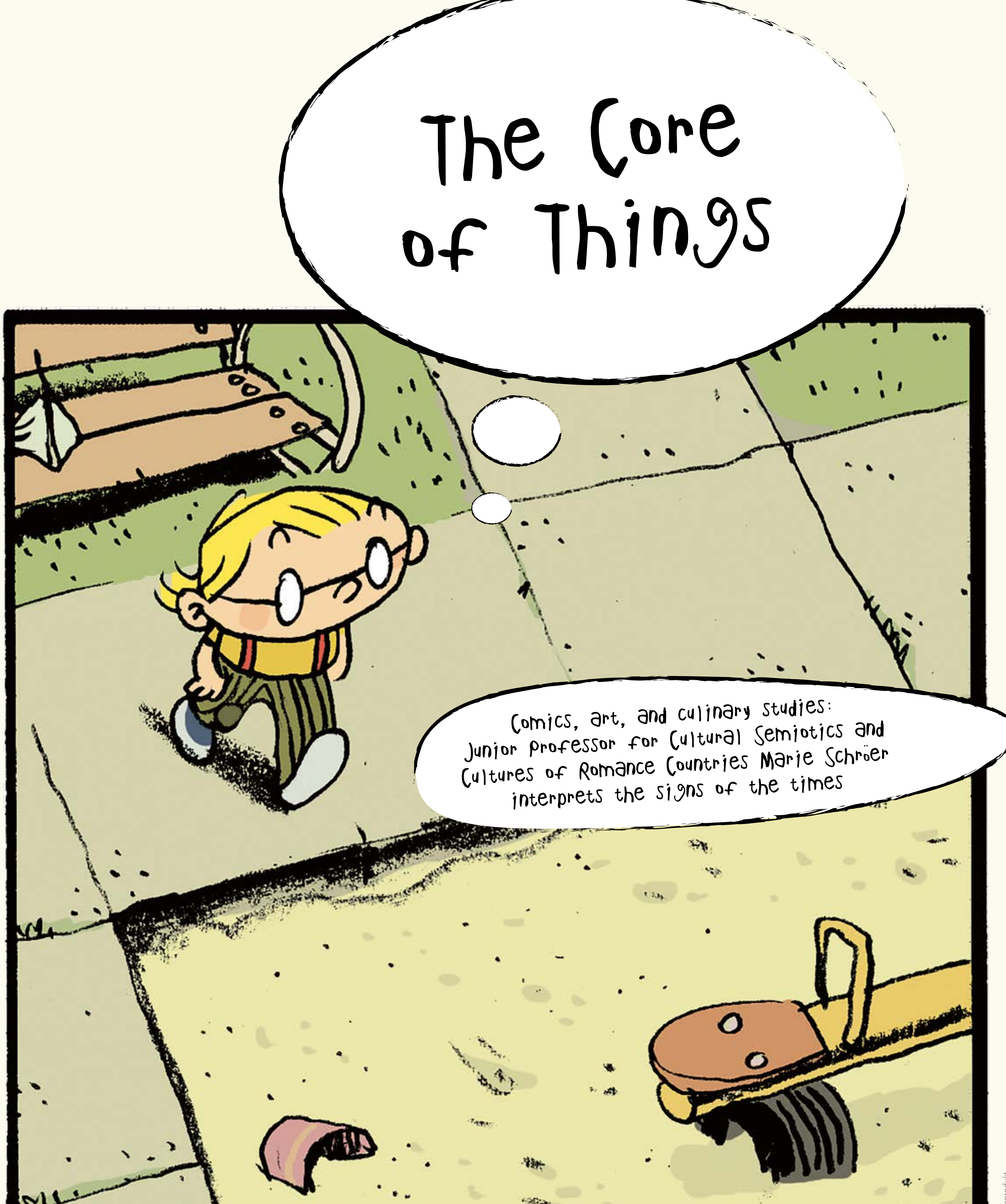


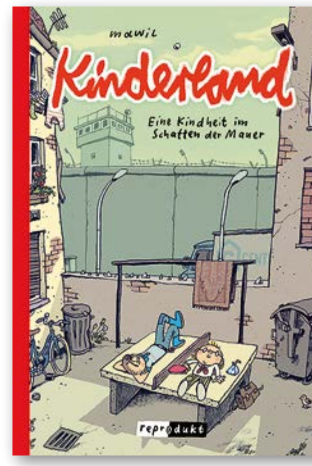
Illustration: Mawil/Reprodukt

She is the daughter of a French mother: Little Nicolas, Tintin, Asterix and Obelix walked through the picture stories of her childhood. Growing up in the fabulous world of Franco-Belgian bandes dessinées, Marie Schröer never faced the problem of having to overcome the stereotypes that stick to comic strips in this country like adhesive tape: they are trivial and lurid, but above all funny – as the name suggests. "And that despite the fact that there are now a large number of comics, some of which have been filmed, with serious content," says the literary scholar, adding that these often go under the label of graphic novel. At least since Art Spiegelmann documented his father's Auschwitz memories in "Maus" and Marjane Satrapis told the story of an Iranian woman growing up against the backdrop of the Islamic Revolution in "Persepolis," the artistic diversity and professionalism of the genre have become obvious.

With an open mind and scientific curiosity, Marie Schröer had already intensively studied comics as a student teacher for French and English at the University of Potsdam. Her lecturer, the cultural semiotician Eva Kimminich, supported her idea for an exam paper on drawn autobiographies. Even then, Schröer was fascinated by the seamless transitions between two different sign systems: text and graphics. She looked at graphic memoirs and explored the expanded scope of creativity that opened up to authors writing in drawings to artistically present themselves.

A few years of research later, Schröer submitted her doctoral dissertation "On the Interplay between Comics, Autobiography, and *Bildungsroman*" and defended it summa cum laude. "The usual narrative conventions of comics on the one hand and of autobiography on the other were suspended when they were being combined, and innovation virtually became the formal principle of this liaison," she wrote in an essay. Instead of stereotypical heroes and adventurers, the focus is now on antiheroes, strong and weak, hopeful and full of doubts in their view of the world and the way they deal with their own history. Schröer refers to the example of Mirko Watzke, who stutters, flees into fantasy worlds, and passionately plays table tennis. The 13-year-old is the protagonist of the award-winning comic strip "Kinderland – A Childhood in East Berlin" in which author Markus Witzel, pen name mawil, recalls in autofiction his own childhood in the GDR.

"Kinderland" by mawil



When Marie Schröer tells her students about it today, she might show them the personal dedication that mawil drew for her. In this drawing, Schröer is kneeling in front of a box of old comics in a second-hand bookstore, which are 50 cents apiece. When she admits that she found a rarity, the bookseller spontaneously demands 20 euros. She's sure to make everybody laugh along with her – and also prove that comics can still be funny.

Personal dedication by mawil for Marie Schröer

About fake news and conspiracy myths

After working in Koblenz-Landau and Valenciennes, Schröer has now returned to the University of Potsdam as a Junior Professor of Cultural Semiotics and Cultures of Romance Countries. One of the projects closest to her heart here is a subject-specific online bibliography. Together with Prof. Kimminich, she is building a virtual center for cultural semiotics at the Department of Romance Studies, which will prepare the latest findings of semiotic research in such a way that they are comprehensible and useful for the general public. For example, what is behind conspiracy myths that spread like wildfire in times of crisis? How are images of the world and people passed on? How are stereotypes created?

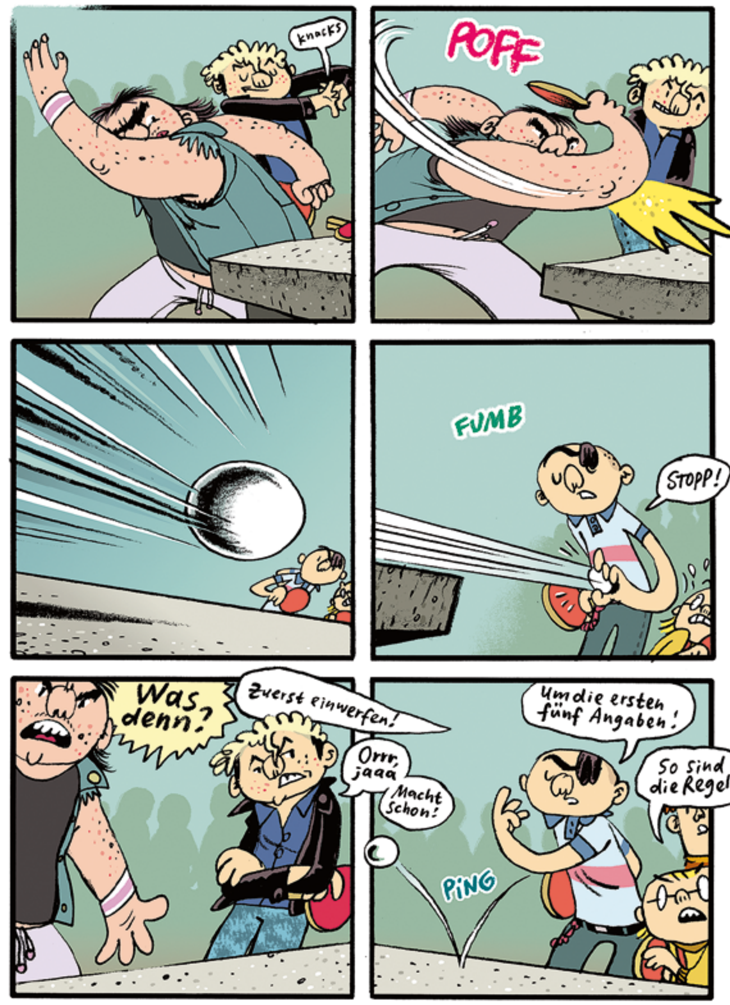
Exhibitions, explanatory videos and study material co-designed by students are intended to encourage a critical debate in schools and educational institutions in the future. The center will also be a practice field for various forms of communication, for example for marketing, culture and education, or journalism. In 2021, the annual "Semiotic Week," which Marie Schröer is co-organizing, will focus on fake news. How can I tell if a news story is real? What metaphors and rhetorical tricks are used, and what aesthetic preferences are nourished to spread conspiracy "theories"? Comics are also among the "Signs of Our Times" whose effect will be analyzed and discussed during the semiotics week of the same name. An online workshop, for example, will deal with the flourishing genre of nonfiction comics, which aim to impart knowledge, inform, and raise political awareness.

Schröer and colleagues from other universities are planning a symposium on the topic of "Race, Class, Gender & Beyond," for the fall of 2021, which will focus on intersectional approaches to comics research. The VW Foundation has just confirmed funding for the international meeting at the Xplanatorium Schloss Herrenhausen in Hanover – a thrust of motivation for the junior professor.

Prof. Marie Schröer

Photos: Roese, Thomas

Drawings from mawil's "Kinderland"



During the short period that she has been researching and teaching in Potsdam, and which has been dominated by the pandemic, Marie Schröer has only experienced highly motivated students despite, or perhaps because of, the online formats, especially when it comes to the practical and creative parts of the seminars. Of course, podcasts, videos, posters, and comics are appealing means of expression, she says, whose own student years are not that long ago. The basis for all of this, however, remains intensive reading and writing, which she wants to encourage again, for example in a joint project of various seminars that deals with the cultural semiotic interpretation of masks – from the change of identity in carnival and the expression of protest to the currently ubiquitous protection against infections. Before students will produce explanatory videos about this topic and even build real masks, they will immerse themselves in different eras and cultures, learn about setting the scene for gods, saints, and demons in religious ceremonies, learn about the scold's bridle, and, of course, study the characters behind traditional theatrical masks.

What comes next? Job profiles for graduates

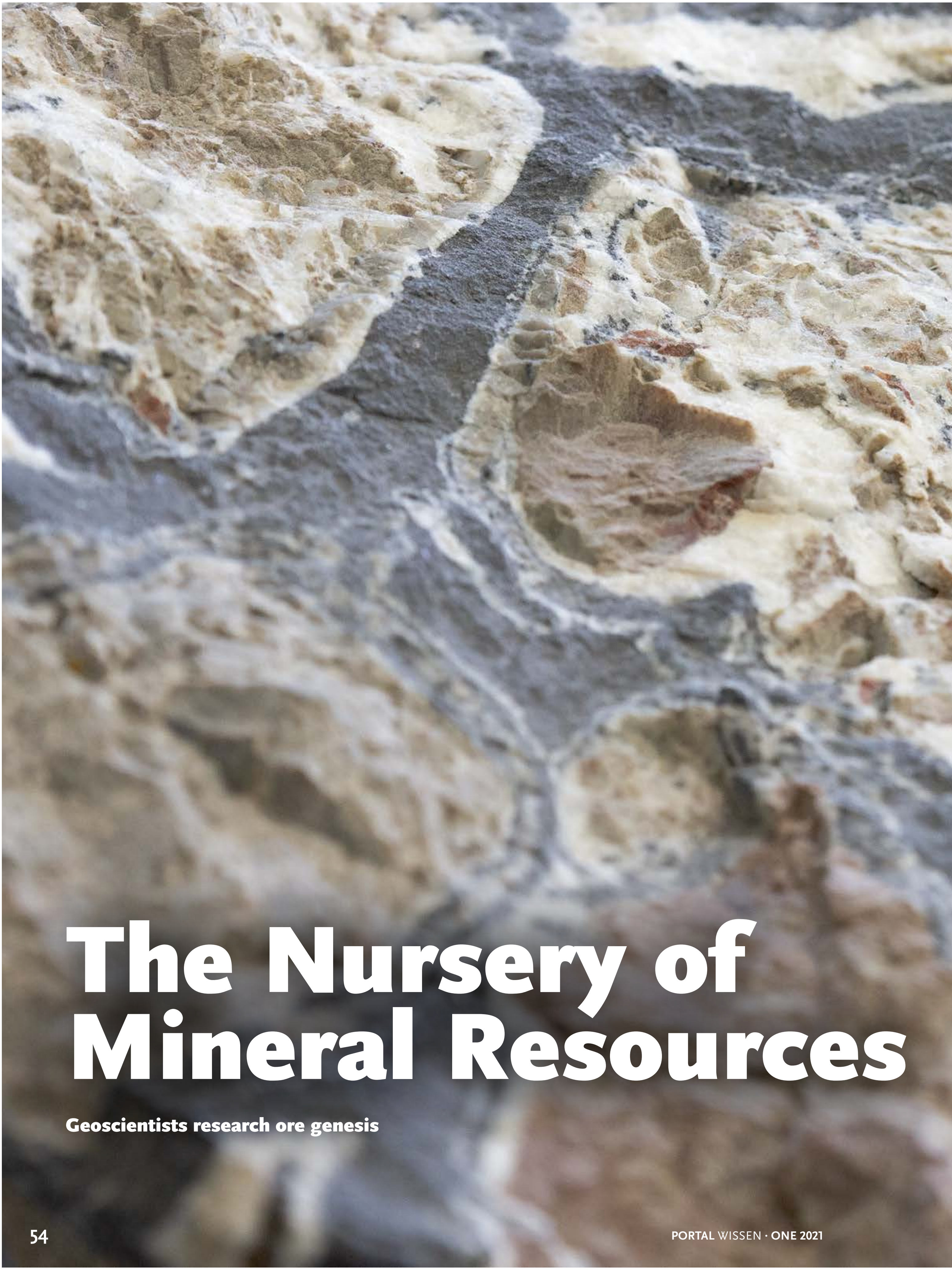
To help students with their next career steps, Schröer is preparing a seminar on practical applications where graduates of cultural studies programs, and soon also of the cultural semiotics program, will report on their work in museums, theaters, and editorial offices. The Virtual Center for Cultural Semiotics will also provide a forum where alumni can present their profiles, master's theses, and specific competencies and get in contact with companies and institutions, among them possibly also catering companies or cookbook publishers. After all, anyone who studies with Schröer will always learn something about culinary studies, especially about the phenomenon known as food porn, i.e. millions of photographs of food shared online. As in baroque paintings, the opulent staging of culinary still lifes currently knows no limits, says the scientist, who once again cannot deny her French roots here. In any case, this is a topic that works up your appetite.

ANTJE HORN-CONRAD
TRANSLATION: SUSANNE VOIGT

THE RESEARCHER

Prof. Dr. Marie Schröer studied French and English for teaching and did her doctorate at the University of Potsdam where she has been Junior Professor for Cultural Semiotics and Cultures of Romance Countries since 2020.

✉ marie.schroeer.1@uni-potsdam.de



The Nursery of Mineral Resources

Geoscientists research ore genesis

Photo: Scholz, Sandra

They come in all kinds of colors and shapes – black, white, green, blue or shiny silver, as nondescript as rock or formed into impressive crystals. Ores have aroused the interest of mankind for thousands of years. Hidden deep in the earth, the precious mixtures of rock and metal need to be found, mined, and processed by miners. Using a combination of geological field exploration, laboratory experiments, and computer modeling, researchers from geology, mineralogy, economic geology, petrology, and geochemistry are now digging for new insights into the formation of ore deposits as part of a priority program of the German Research Foundation (DFG).

A sample of mineralized rock lies on the table between the two geoscientists Maximilian Korges and Max Wilke. For non-experts, it is just a large stone with different colors, but for the two experts it is a witness to transformational processes in the Earth's crust. "It is residual ore, a special form of vein mineralization, which was being mined in the Upper Harz mountains for almost 1,000 years," Wilke explains. "The mine it came from was closed in 1992." Maximilian Korges explains what a geologist can see in such a piece of rock. "A fluid came from below, probably an aqueous solution. It burst the rock and filled the cavities." The former liquid crystallized and now surrounds the pieces of rock as a dark gray mass. Particularly those processes that occur at the interfaces of liquid and rock or magma and rock as well as in cavities are crucial for ore genesis because here the individual components react with each other and new ones as well as the typical ore crystals are formed.

New impulses for geology of mineral deposits

Residual ore is exemplary for ore genesis resulting from the interaction of pressure, heat, rock, and fluids in the Earth's crust. Much of what goes on in this process, however, is still unknown. "We know that metals are dissolved by magmatic or aqueous fluids, are then transported into the Earth's upper layers and precipitate there as ore," Wilke explains. It is only partially known at what pressures, temperatures, and chemical conditions this happens in various ores, and how long these processes take – hours, days, years, or millennia – is actually even largely unexplored.

Together with about 70 researchers from 18 scientific institutions across Germany, Korges and Wilke want to shed light on this subject. Together with researchers from the German Research Center for Geosciences (GFZ), the University of Münster and the University of Freiburg, they are coordinating a priority program of the German Research Foundation (DFG) that includes 26 individual projects. Using laboratory experiments and computer models, the researchers want to elucidate the formation of ores, their composition, and where the subsurface offers particularly good conditions for the formation of ore deposits. The findings will also support economic geology research in Germany.

Ore for the energy revolution

For a long time, little attention was paid to this field of research in Germany. "Ores and metals were bought in other countries, and the supply seemed secure," says Wilke. In recent years, however, it has become clear that the supply of some metals is by no means as secure as it had seemed for a long time, while consumption is simultaneously increasing. Especially since many raw materials are indispensable to a transformation toward sustainable and climate-friendly economic systems. "For the past ten years or so, economic geology has become more attractive again, partly also because it has been invigorated by modern

Residual ore

methods," says Wilke, who would like to introduce this field of research particularly to young researchers. "It is hardly known what lies beneath two to three kilometer thick sedimentary layers, for example in the North German Basin," says Korges, describing the research gaps that are to be closed in the future.

Basically all ores are of interest to the researchers of the priority program. However, there are some of particular interest. These include ores containing the element molybdenum. This transition metal is extremely heat-resistant and therefore of interest to the aerospace industry. It is part of numerous electronic components and thin-film solar cells. Rare earth metals, which include a total of 17 metals, are also promising research fields. "We are talking about so-called critical metals here," Korges explains. "There are only a few suppliers for these elements. For example, 90% of the demand for rare earths is covered by the Asian market." The supply of these raw materials to the in-

Photos: Scholz, Sandra


Maximilian Korges

THE PROJECT

The DFG-funded Priority Program **"Dynamics of Ore Metals Enrichment" (DOME) (SPP2238)** includes 26 research projects on ore genesis. By using a coordinated approach of empirical field-related studies, experimental work, and numerical models, the researchers will develop new exploration models for deeply buried deposits.

Duration: 2020–2026
Funding: German Research Foundation (DFG)
Participants: University of Potsdam, University of Bayreuth, University of Bremen, Leibniz University Hannover, Johannes Gutenberg University Mainz, GeoZentrum Nordbayern, Friedrich-Alexander Universität Erlangen-Nürnberg, TU Bergakademie Freiberg, GEOMAR Kiel, Goethe University Frankfurt (M), University of Freiburg, RWTH Aachen University, University of Tübingen, GFZ German Research Centre for Geosciences, University of Cologne, University of Münster, Karlsruhe Institute of Technology, Helmholtz-Institute Freiberg for Resource Technology

Coordination Committee: Prof. David Dolejš, University of Freiburg; Prof. Sarah Gleeson, GFZ German Research Centre for Geosciences / FU Berlin; Prof. Carmen Sanchez-Valle, University of Münster; Dr. Robert Trumbull, GFZ German Research Centre for Geosciences; PrivDoz. Dr. Philipp Weis, GFZ
www.uni-potsdam.de/en/spp2238


Prof. Max Wilke

Mine tunnel

dustry is highly susceptible to disruption – while at the same time they are economically extremely significant. Without them, smartphones, wind turbines, and many other key technologies would not work.

In order to know where ores might form, you must know, for example, how well they can dissolve in thermal fluids. “However, knowledge about this aspect is very limited and has only been studied for certain ranges of pressure and temperature so far,” Wilke explains. Detailed knowledge about the properties of the metals in ores is necessary to feed the computer models that will ultimately provide information about possible deposits.

THE RESEARCHERS

Dr. Maximilian Korges studied applied geosciences at Martin Luther University Halle-Wittenberg. Since 2020, he has been a postdoctoral fellow in the working group Mineralogy of the Institute for Geosciences of the University of Potsdam.

✉ korges@uni-potsdam.de

Prof. Dr. Max Wilke studied mineralogy at Leibniz University Hannover. Since 2015, he has been head of the working group Mineralogy at the Institute for Geosciences of the University of Potsdam.

✉ wilkem@uni-potsdam.de

Ore crystals in a pressure cooker

The researchers obtain this important data, for example, with the help of experiments in pressure vessels. The ore is “cooked” in a liquid at high pressure and high temperature. The researchers use X-rays to measure how much ore dissolves in the liquid. “It’s like a sugar cube,” Wilke compares. “At some point, the solution is saturated and the sugar doesn’t dissolve any further.” It is the same with ore. How much of it can dissolve in an aqueous liquid depends on temperature, pressure, and the composition of the aqueous solution. Once the exact correlations are known, the researchers will be able to deduce which conditions are necessary to form solid ores from the solution again – just as it happens in natural ore systems in the earth.

Laboratory experiments, computer simulations, and also field-based geological explorations and excursions – for example to the German Ore Mountains, to Portugal, Greece, and Kyrgyzstan – will ultimately provide an overall picture of the ore properties and the locations in the subsurface suitable for potential deposits. The researchers may also find new approaches to the processing and recycling of ores. “When I know how the ore is formed, I know how to dissolve and mine it,” Wilke says. “And the best way to do this is to use more environmentally friendly methods.”

The results will also be interesting for the industry because they will enable a more targeted search for deposits of valuable ores. “Especially in deeper layers, exploration is very expensive. If we understand more about the systems, certain sites can be excluded from the outset while others become interesting. That saves money, of course,” Wilke emphasizes. And it could pave the way to new ore deposits that are as yet undiscovered.

HEIKE KAMPE

TRANSLATION: SUSANNE VOIGT

Photos: AdobeStock/Mishainik (top); Scholz, Sandra (bottom)

Where Knowledge grows

www.uni-potsdam.de