

Food for Everyone

Meat from the 3D printer and enticing school meals – making the future of nutrition socially inclusive

PhD Without Pain

How the BUA's mental health courses strengthen the resilience of doctoral students

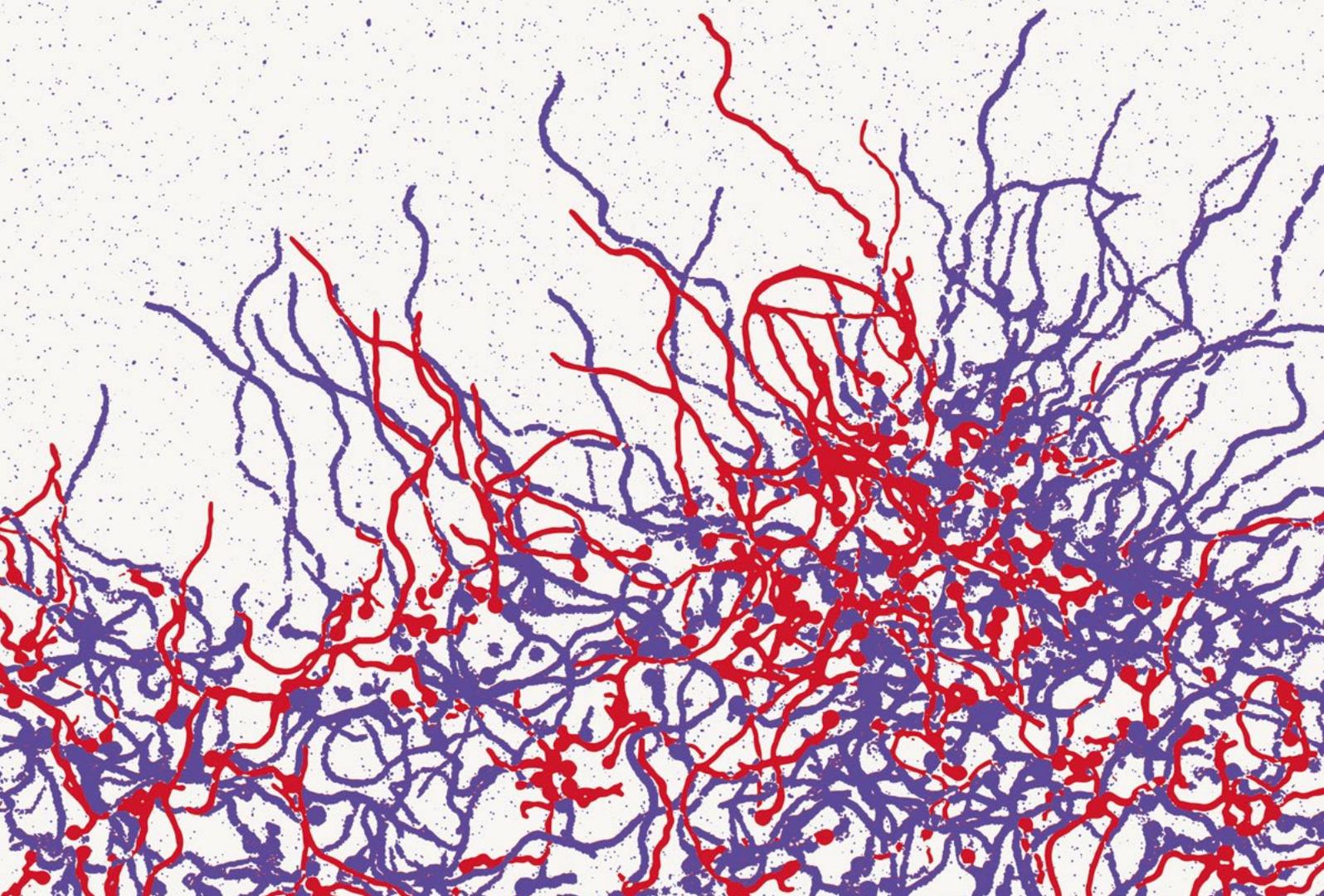
Silent Pandemic

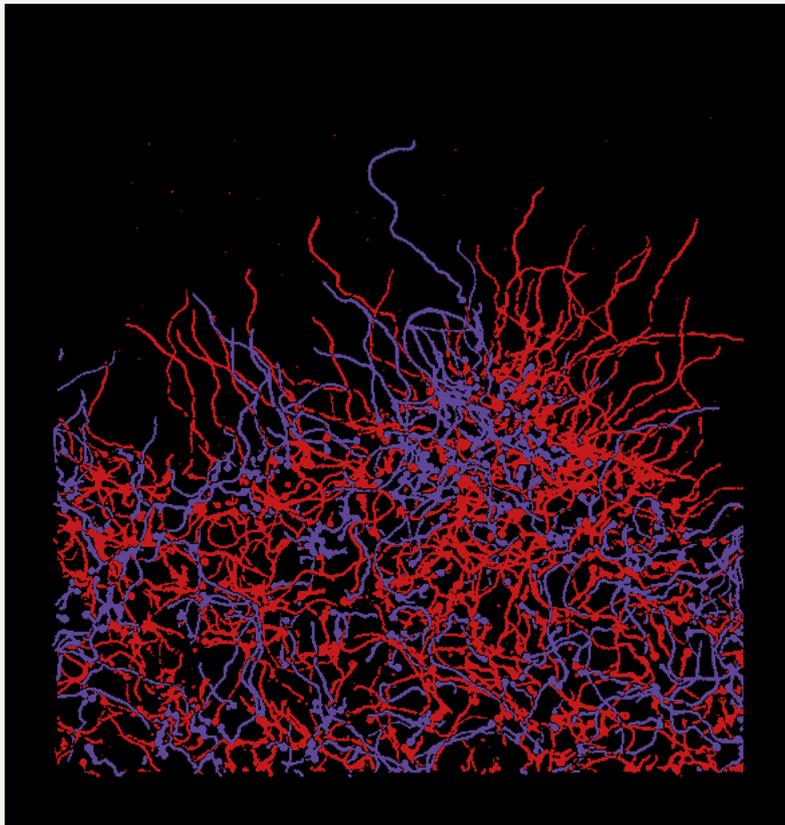
Berlin researchers are searching for new methods in the fight against antibiotic resistance



We/Four

Technische Universität Berlin in the Berlin University Alliance





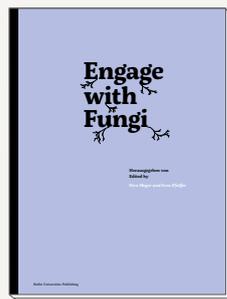
Masters of Collaboration

Our cover picture shows two mold strains of the species *Aspergillus niger* colonizing a substrate together. Fungi are true masters of collaboration. Their mycelium permeates the forest ground like a three-dimensional network. The mycelium of the basidiomycete *Fomes fomentarius* can be used for new types of building material, such as mushroom-based sustainable panels (right). Biotechnologist Professor Dr.-Ing. Vera Meyer from the Chair of Applied and Molecular Microbiology at TU Berlin has teamed up with Berlin-based fungal researchers and artists to document the many features of fungi. Engage with Fungi is the first book published by Berlin Universities Publishing (Berlin UP), the new open access publisher of the Berlin University Alliance. A masterpiece of collaboration on every level.

→ berlin-universities-publishing.de



Vera Meyer researches the potential of fungi for the building sector of the future – and reports on it in the open access volume Engage with Fungi (Berlin UP 2022).



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We/Four

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We, one of four: On 1 November 2019, Technische Universität Berlin joined forces with Freie Universität Berlin, Humboldt-Universität zu Berlin, and Charité – Universitätsmedizin Berlin to form a Consortium of Excellence. As the Berlin University Alliance (BUA), the four partners have been addressing the major challenges of our time, creating an integrated research space in Berlin to provide researchers and students with an excellent environment. This magazine showcases examples of the advantages offered by this one-of-a-kind network in Germany, of the skills and talents that TU Berlin brings to the table, and of the challenges we are approaching together as a consortium. This also includes the BUA's two Grand Challenges dedicated to the discussion of social cohesion and the research into global health.

In November 2022, TU Berlin's president Professor Dr. Geraldine Rauch started her two-year term as spokesperson for the Berlin University Alliance. This rotating position is only one element of the new collaboration between the consortium partners. In the spirit of this cooperation, the partners are also strengthening the exchange between science and society, for example, by involving young people and students in determining the topic of the Next Grand Challenge.

Follow us into the cosmos of cooperation à la Berlin to find out what we have already achieved and what we plan to accomplish.

Stefanie Terp
Chief Communication Officer of TU Berlin

“Everything Becomes Stronger Through Collaboration”



Mathematician and TU Berlin president Professor Dr. Geraldine Rauch speaks about a new culture of cooperation and the added value of joint research in the age of crises. The focus in this regard is on the development of the Berlin University Alliance (BUA).

INTERVIEW Mirco Lomoth PHOTO Saskia Uppenkamp

Why do we need the Berlin University Alliance, Ms. Rauch?

Berlin is already an outstanding research location, but everything becomes stronger through collaboration. The Berlin University Alliance is an important signal that the three major universities and Charité – Universitätsmedizin Berlin are all heading down the same path and saying the same thing, namely: Science here is not going to be conducted purely by individual institutions, because we can achieve more as a consortium.

There was already a lot of cooperation between universities in Berlin, not to mention the Clusters of Excellence and the Einstein Centers – so what value can the BUA add?

We are taking the collaboration to a new level. The BUA systematizes the cooperation between the consortium partners using common, defined development goals. In the two major thematic research blocks, which we call Grand Challenges, we address, among other issues, societal cohesion and global health from a wide range of perspectives – from medicine and engineering research to social science. We are also developing an integrated research area in Berlin and are cooperating on overarching topics such as teaching and studies, gender and diversity, knowledge transfer, or internationalization.

What ambitions for contemporary science lie behind this?

We want to bring the value of science more sharply into focus. One of our focus areas is the validity and reproducibility of research and the question: How do we even measure good research? Other focus areas are the further development of teaching, as well as the continuing education and qualification of early-stage researchers and executive staff. This goes to show that we do not simply set topics and work our way through them, but rather give ourselves a framework within which we want to devote ourselves jointly to good research.

“
A major task of the consortium is to create a scientific ecosystem in Berlin that overcomes old boundaries.
”

You have just mentioned the Grand Challenges, which deal with pressing questions of the present. Does this mean that basic research is going to fall behind?

No, not at all. I am convinced that the great challenges of our time require research at all levels. When we think about climate change, chemistry is one of the basic subjects that plays an essential role. In my view, universities have to provide both,

namely, the foundation on which applied research can take place and the direct transfer of research results to startups or industrial applications.

Can Technische Universität Berlin play a decisive role in this transfer?

Yes, because of the “T” in “TU.” As the only university of technology in the network, we bring engineering science and technical applications to the table and have a strong relationship with startups and industrial partners. However, we still cover the full range of subjects: The humanities and social sciences are represented here just as strongly as economics, and we also combine all of these disciplines with one another.

The “Fostering Knowledge Exchange” focus is an important area of expertise, to which TU Berlin contributes and through which the BUA aims to carry research ideas into society, while taking up impulses from society. For example, we involved civil society intensively in our search for the topic of our third Grand Challenge. Up till now, this kind of transdisciplinary approach has not existed to the same extent in Berlin. For a long time, transfer mainly happened in one direction – from universities to society. At the BUA, we do not see research as a one-way street, but as a give-and-take, a new way of working together.

Why is the exchange with societal players so crucial?

We live in an age of crises, and it is noticeable that society and politics want to find solutions as quickly as possible, for example, when it comes to energy supply. Acute developments play a role in this regard, but also topics that have been known for a long time, such as resilience, technological dependency, or supply chains. It is of fundamental impor-

tance that we deal with such issues over the long term and not just at the last minute. We must not research and teach in a vacuum, but need to consider now what will concern over the coming decades. To accomplish this, we urgently need input from society and politics.

The principle of transdisciplinarity had already been anchored at TU Berlin before the BUA...

True, we were able to contribute our know-how in this field to the consortium. Our Office for Science and Society deals in depth with the question of what formats are needed to get society strongly involved. This is not something you do as a sideline just because you think it would be quite nice to do.

Do you feel that the BUA has brought about a new sense of community?

I would give a clear yes to that. We should not underestimate the challenges Berlin as a center of science faced after German Reunification, which also affected the relationship between the universities. The BUA has changed the situation fundamentally. Just today we had another meeting of the board of directors, with the four of us sitting around a table and talking confidently among colleagues about how we want to shape the consortium. The Berlin University Alliance is more than a declaration of intent. We live cooperation and can rely on each other.

Do the researchers already benefit from this new culture of cooperation?

Many of them have long been used to cooperating with colleagues from other institutions. However, we are now facilitating this joint re-

search, for example, by providing access to shared infrastructure, by making funds available for collaborations, and by lowering administrative barriers. A major task of the consortium is to create a scientific ecosystem in Berlin that overcomes old boundaries.

“

We must not research and teach in a vacuum, but need to consider now what will concern us over the coming decades.

”

Is it not the case that four university administrations lead to more rather than less bureaucracy?

At some points, the cooperation is already working well, at others it is not quite there yet. This does not come as a surprise – not everything is easy in the EU as well, and yet the existence of this union is exactly the right signal. One should never assume in any consortium that the process is going to be simple. When hurdles arise, we have to ask ourselves: How can we remove them? How can we sharpen our governance?

For example, in the future, a cooperative platform organized as a cooperation under public law will support us in the use of our infrastructures and services. All four institutions have different large-scale equipment and the idea is that all researchers can book measurement times via the so-called SOURCE platform. The platform also makes it easy to share software, access rights, and databases.

Sharing devices and other infrastructure is certainly also a question of sustainability...

Absolutely. There is no point in buying two sets of the same equipment and, in the worst case, having them both sitting there unused. Many devices are insanely expensive to operate and maintain. As far as I am concerned, sharing is the only right way to go. We also cooperate in other areas. With Science & Startups, we have pooled the offerings of the four consortium partners to promote spin-offs from the institutions' scientific research. And Berlin Universities Publishing is our joint publishing house for open access publications.

With so much new common ground, is there not also a danger that the uniqueness of the individual universities will become blurred?

I do not share this fear. All four consortium partners have strong profiles, which they have every right to maintain. The idea is not to establish a joint Berlin university, but to treat each other as allies. Through the Berlin University Alliance, however, the partners can benefit more from each other, engage in friendly competition with each other, and still work together in a spirit of trust – and in this way bring about a whole new impact on the world.

WHAT MOTIVATES THE BUA?

The BUA has set itself five objectives and three cross-cutting themes. We asked TU Berlin's representatives of the associated steering committees to tell us what makes their areas special.

OBJECTIVE 1

Focusing on Grand Challenges

"Major societal challenges can best be addressed jointly. The BUA brings together experts from Berlin's universities to respond to current global challenges with innovative research and research communication. We started with research into social cohesion, the impact of the pandemic, and global health. Currently, we are working together with numerous stakeholders from society to determine the next big topic for the consortium."

Prof. Dr. Martina Löw,
Sociology of Planning
and Sociology of Architecture
(member until 2022)

OBJECTIVE 2

Fostering Knowledge Exchange

"We want to make knowledge exchange more beneficial for the transformation of research and society. This means working with stakeholders, with experts from business, politics and administration, from the arts and culture, and with citizens. We acknowledge that there are different forms of knowledge: scientific knowledge, practical knowledge, and everyday knowledge. We want to deepen and complement our knowledge together with knowledge carriers, and contribute to solving problems."

Prof. Dr.-Ing. Christine Ahrend,
Integrated Transport Planning

OBJECTIVE 3

Advancing Research Quality and Value

"The BUA supports researchers from a wide variety of domains in collaborating with and learning from each other. In the area of research quality, we ask ourselves: How can very heterogeneous disciplines come to a common understanding and mutually support each other in order to conduct even better research, within individual disciplines and across disciplines? The lecture series we developed to promote open science and quality in research exemplifies this approach in a most inspiring manner."

Prof. Dr. Manfred Hauswirth,
Open Distributed Systems

OBJECTIVE 4

Promoting Talent

"The success of universities is crucially dependent on the excellence of their researchers. The BUA works together towards creating optimal conditions for doctoral students, postdocs, and professors to develop their talents. For instance, we have joined forces to make it easier for doctoral students to start their research careers. We have established the new format of 'Joint Berlin Professorships' as the cores of cooperative, innovative research areas. Through our Berlin Leadership Academy we are fostering a new leadership culture and strengthening our identity as an alliance of excellence in Berlin."

Prof. Dr. Søren Salomo,
Technology and Innovation Management

OBJECTIVE 5

Sharing Resources

"In times of dwindling resources, it is important to pool the available funds in order to provide the best possible service for all researchers in the Berlin research area. This concerns large-scale equipment and (digital) research data, as well as IT and other services supporting research. Within the BUA, we provide everyone with unhindered access to resources. To this end, we are developing the 'SOURCE Platform' to help researchers share and make the most of large-scale equipment and other tools."

Prof. Dr.-Ing. Sebastian Möller,
Quality and Usability Lab

CROSS-CUTTING THEME 1

Diversity and Gender Equality

"The future of research and science in Berlin depends crucially on whether it is attractive to the brightest minds. And these can be found everywhere. Creativity, innovation, and excellence are independent of gender and social origin, migration background and cultural or religious affiliations, sexual orientation, age, physical ability, or skin color. Incorporating the richness of these perspectives into scientific practice is the BUA's mission."

Prof. Dr. Sabine Hark,
Interdisciplinary Women's
and Gender Studies

CROSS-CUTTING THEME 2

Teaching and Learning

"'Knowledge is the only good that increases when it is shared.' This quotation from Countess Marie von Ebner-Eschenbach is my guiding principle. The BUA provides students and teachers with targeted offerings, ranging from entire degree programs and module packages to individual lectures on BUA topics. The consortium enables students to attend events at all BUA partner institutions more easily. As part of the StuROPx program, they can also apply for funding to start up their own courses."

Christian Schröder,
Vice President for Education, Teacher Training, and Continuing Education

CROSS-CUTTING THEME 3

Internationalization

"By establishing joint structures for cooperation – such as the Berlin Center for Global Engagement or the partnership with Oxford – the BUA has enhanced our international standing. A conference on research assessment in Brussels gave us the opportunity to present ourselves as a strong science location in the European arena. We are also developing recommendations for action on how the BUA can position itself in terms of science diplomacy in an increasingly complex international environment."

Dr. Ulrike Hillemann-Delaney,
International Affairs

The Major Goals

The Berlin University Alliance (BUA) – Freie Universität Berlin, Humboldt-Universität zu Berlin, Technische Universität Berlin, and Charité – Universitätsmedizin Berlin – was the only alliance to win the 2019 Excellence Strategy competition of the German state and federal governments. Its goal is to develop Berlin as an integrated research hub and Europe's leading center of science. To this end, the BUA has set itself five major

objectives and also established three overarching cross-cutting themes. The alliance receives up to 28 million euros annually from the German government and the state of Berlin, subject to a positive review every seven years. Steering committees consisting of one researcher or expert from each of the four partner institutions have been set up to develop the objectives and cross-cutting themes. An additional funding line of the

competition provides funding for internationally competitive research fields on a project-by-project basis. There are seven such Clusters of Excellence in Berlin, each receiving up to ten million euros annually. The initial funding period is seven years. However, this can be extended thereafter upon application to another seven years. The minimum requirement for an application as an Alliance of Excellence is three approved Clusters of Excellence.

Objectives

1 2 3 4 5

Focusing on Grand Challenges

Societal challenges of global importance

Steering Committee 1

In this brochure:

- Research on social cohesion: "Social Cohesion, Food & Health" [p. 16](#)
- Research on global health: "GlobalResist" [p. 24](#)
- Next Grand Challenge [p. 22](#)

Fostering Knowledge Exchange

Researching together with society

Steering Committee 2

In this brochure:

- A plea for [transdisciplinarity p. 21](#)
- Trialog research forum [p. 20](#)
- Next Grand Challenge research forum [p. 22](#)
- Science communication [p. 31](#)

Advancing Research Quality and Value

Strengthening the quality of research

Steering Committee 3

In this brochure:

- Open science and open X initiatives: a plea for open hardware [p. 27](#)
- Open Urban Climate Observatory Berlin for environmental research and applications [p. 12](#)

Promoting Talent

Attracting, advancing, and retaining talents

Steering Committee 4

In this brochure:

- Berlin Graduate Studies Support Program: Positive psychology mental health course [p. 28](#)
- Berlin Leadership Academy [p. 30](#)
- Postdoc Academy [p. 30](#)

Sharing Resources

Joint use of services and infrastructure

Steering Committee 5

In this brochure:

- Open access publishing: Berlin Universities Publishing (Berlin UP) [p. 2](#)
- Shared Resource Center (SOURCE): joint use of Brain / Body Imaging Lab by Charité and TU Berlin [p. 14](#)

The Alliance Partners in Numbers



11,500
PhD candidates



560 Mill. €
third-party
funding



540
degree
programs



21,800
staff



100,300
students



1,700
professors

Cross-Cutting Themes

1 2 3

Diversity and Gender Equality

Promoting equal treatment and access for all

Steering Committee 6

In this brochure:

- Research stay: Prof. Dr. Zethu Matebeni, South Africa Research Chair in Sexualities, Genders and Queer Studies, University of Fort Hare [p. 13](#)

Teaching and Learning

Research-based teaching and learning processes

Steering Committee 7

In this brochure:

- Student Research Opportunities Program* (StuROP*): X Tutorial Future Places [p. 11](#)
- Project Lab Science Communication [p. 31](#)

Internationalization

Researching across borders

Steering Committee 8

In this brochure:

- Berlin Center for Global Engagement (BCGE) [p. 15](#)
- International strategic partnerships [p. 15](#)

Clusters of Excellence

7

TU Berlin is applicant university for:

- The Berlin Mathematics Research Center (MATH+)
- Science of Intelligence (SCIoI)
- Unifying Systems in Catalysis (UniSysCat)

Further applicants and details beginning [p. 32](#)

- Temporal Communities
- Scripts
- NeuroCure
- Matters of Activity

With the involvement of TU Berlin

What Does Future Need?

Science is an inventor of the future. Science in Berlin dedicates itself intensively to the question of how we want to live and conduct research in the coming decades. We asked researchers, students and citizen scientists from the BUA network what is important to them.

PHOTOS Saskia Uppenkamp

“Companies Committed to Sustainable Solutions”



Palladium, gold, silver, and platinum: What look like soda pops are actually cocktails of the future. Conductive inks from the Berlin-based startup Oreltech can be used to print conductive paths for electronics or to coat surfaces with antibacterial silver. The highlight: The metallic inks are free of nanoparti-

cles and require 95 percent less energy than is normally needed for curing. As part of the X Tutorial “The Future of Future Places” at TU Berlin’s Institute of Urban and Regional Planning, students Johannes Pulvermüller and Monique van Wanrooy worked in a student team to analyze 38 startups in

the Technology Park Berlin Adlershof with regard to their future orientation. The BUA’s X Tutorials give students the chance to conduct their own research projects. 25 X Tutorials dealing with issues from urban planning to philosophy are taking place in summer semester 2023.



“Research Involving the General Public”

Are allotment gardens valuable nature contributing to the urban climate? Oliver Rudzick and Artur Gantzckow are two of more than 80 Berlin allotment gardeners who set up climate stations in their gardens to measure air temperature and humidity, precipitation, and air pressure. The BUA project “Open

Urban Climate Observatory Berlin” run by Freie Universität Berlin and TU Berlin integrates the data collected by gardening enthusiasts into a scientific measuring network in order to observe the urban climate more comprehensively – and to understand how green spaces counteract urban heat islands.

Citizen scientists Rudzick and Gantzckow are involved in the research process as co-creators. Their gardens in Wilmersdorf are soon to make way for a development. The two plan on continuing the BUA research project to find out how the new buildings will impact the urban climate locally.

“True Diversity and Decolonized Science”



Professor Dr. Zethu Matebeni is South Africa's first professor of “Sexualities, Gender and Queer Studies” and teaches at the University of Fort Hare. During her residency in Berlin, she plans to explore the connections between African queer studies and black queer studies in Europe. To this end, she will exchange ide-

as with researchers conducting black queer studies as well as with activists in Germany. Matebeni was involved in the efforts that have been made towards decolonizing South African institutions and is bringing that experience to the BUA. She will advise the BUA's Diversity and Gender Equality Network

(DiGENet) and discuss with colleagues at BUA institutions the weaknesses of diversity policies and how decolonizing the academic system can lead to true diversity. Since 2021, the BUA also promotes diversity studies in Berlin with the “Audre Lorde-BUA-Guest Professorship for Intersectional Diversity Studies”.



“A New Mentality of Sharing Ideas and Resources”

What happens in the brain when we navigate through space? And what changes when parts of the brain are damaged? To address these questions, Professor Dr. Christoph Ploner, co-director of the Department of Neurology at Charité – Universitätsmedizin Berlin, and his team are conducting clinical experiments

in the Mobile Brain/Body Imaging Lab at TU Berlin. The laboratory headed by Professor Dr. Klaus Gramann is open to all four BUA collaborative partners. It enables measurements of brain activity while the subjects move through real space. Virtual reality goggles and up to 156 electrodes provide

precise data on electrical signals from the eyes, muscles, and brain. This allows the neuronal bases of cognitive processes to be analyzed. Sharing scientific equipment is one of the five major objectives the BUA has set itself. The goal is to create a new mentality of sharing ideas and resources.

THINKING BEYOND BORDERS

Excellence needs the exchange of ideas. The BUA strengthens the cooperation between Berlin-based scientists and universities around the globe. Four collaborative projects from the BUA network.

AFRICA



Climate protection – certified in Africa

So far, African climate protection projects have been dependent on expensive certification from the Global North. As part of the project “Greening Africa Together CO₂ Compensation Committee” organized by the BUA’s Berlin Center for Global Engagement (BCGE), African universities and NGOs teamed up with TU Berlin and Humboldt-Universität zu Berlin and have now developed a certification adapted to local needs. Communities and organizations can use it to have their climate projects certified. Experts from Togo, Cameroon, Uganda, and six other African countries have already been trained. “For the first time, this will give many small projects in Africa the opportunity to finance their climate protection activities as CO₂ compensation projects,” says project coordinator Lilly Seidler from the Institute of Energy Technology at TU Berlin. The goal is to make the new standard usable across Africa. With the BCGE, the BUA is expanding Berlin’s research collaboration with the Global South.
→ greeningafricatogether.org

OXFORD



Twin pack of excellence

Oxford and Berlin form a powerful team. Since 2017, these two locations of excellence have committed themselves to a close collaboration. The Oxford Berlin Research Partnership is now being further strengthened by a joint fellowship program of the BUA and the Einstein Foundation Berlin. Four top researchers from the University of Oxford have already been selected to set up working groups in Berlin – in English studies, literary studies, stroke research, and democracy research. More are to follow.

→ oxfordinberlin.eu

SINGAPORE

Robots in the bloodstream

The idea of medical robots tiny enough to travel through the body is familiar to many from the 1966 film “Fantastic Voyage.” However, turning the idea into reality is still a long way off. Nevertheless, physicists at TU Berlin and the National University of Singapore are already thinking about how microrobots could move through the body, for example, to dislodge a life-threatening blood

clot. What algorithms could they use to learn to navigate unfamiliar terrain? “We envision them being able to sense their surroundings and decide autonomously where to go,” says Professor Dr. Holger Stark of the Institute of Theoretical Physics at TU Berlin. “For this purpose, we need to develop self-learning algorithms that rely only on a small amount of sensor data and require little technology on board.”

MELBOURNE



The city and its animals

Bats live in many Australian city parks. By observing their social networks, you can find out a lot about the state of urban ecosystems. Scientists from the University of Melbourne, Freie Universität Berlin, and TU Berlin have established a network to explore how urban ecology is changing and what role it can play in sustainable urban development. “A vibrant city of the future preserves habitats for biodiversity and promotes a healthy coexistence of humans, animals, and nature,” says Dr. Tanja Straka from the Institute of Ecology at TU Berlin.

→ twitter.com/curt4future



Food is also a social issue. In the BUA-funded project “Social Cohesion, Food & Health – Inclusive Food System Transitions,” scientists from different disciplines are developing ideas for a socially acceptable nutrition of the future – from cultured meat as a new protein source to school meal strategies that benefit all children.

TEXT Mirco Lomoth PHOTOS Cathrin Bach and Christian Kielmann

The New Table Culture

This could be delicious: The pink support structure from the 3D printer is the first step toward a lab-cultured steak that – just like burgers made from pea protein – is produced without animal suffering.

So this is what a protein source of the future looks like. A blue plastic nozzle sprays pale pink, rubber-like filaments onto the bottom of a Petri dish. A doctoral student in a white lab coat monitors the precise movements of the cartridge. What is materializing before her eyes in the 3D printer is a waffle structure the size of a post stamp that is meant to stabilize cultured meat. Meat that grows in an incubator instead of a barn. Chicken cells attach to this structure, multiply in the warmth of the incubator, and take on their functions as muscle cells – which is crucial in order to create the sensation of biting into real meat.

Previously, the support structure could only be made with animal gelatin and calf serum. Lisa Franke now wants to produce it using purely plant-based ingredients. “It is made of pea or soy proteins and alginate and involves no animal suffering whatsoever,” says the doctoral

student, who is devoting her doctoral studies at TU Berlin’s Chair of Food Biotechnology and Food Process Engineering to the production of cultured meat as a new protein source. If this is successful, the entire production of meat in the future can take place without the involvement of real animals, because the chicken cells themselves can be endlessly reproduced in the Petri dish. However, a lot of small tweaks are still required to optimize the process: How high must the nozzle pressure be to produce the optimal support structure? How liquid should the “ink” be? Is a honeycomb pattern preferable to a waffle pattern? And what composition of thickener and nutrient solution is needed for the cells to have the optimal conditions to grow into a meat product of the desired quality that can be approved as a safe food?

Cultured meat is a promising food of the future. Steaks or cutlets from the lab could

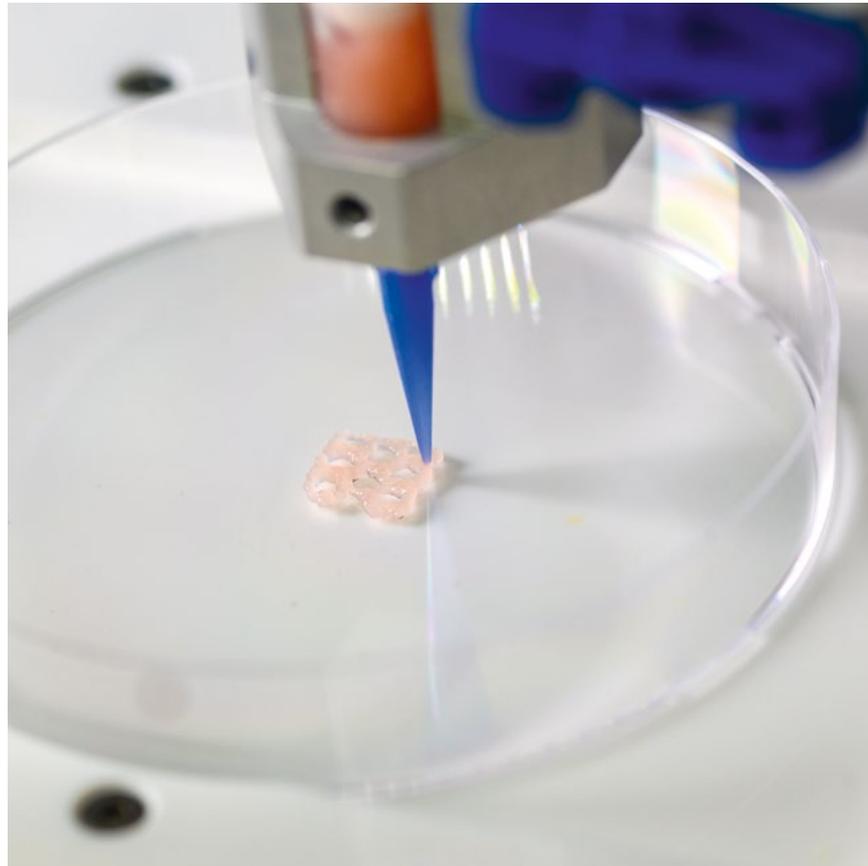
help solve pressing problems in our nutrition system. For example, cultured meat could reduce the high carbon footprint as well as the land and water requirements of livestock farming, increase food security, and avoid animal suffering and poor working conditions in the meat industry. Plant-based meat substitutes made from peas or soy have already established themselves on the market; they are being further developed at the Chair of Food Biotechnology and Food Process Engineering.

Due to its more authentic texture and predictable taste, cultured meat could encourage even more people to avoid real meat in the future. However, this technology is still in its infancy: Even though the first in-vitro burger patties have been available since 2013, their development to date has not gone beyond minced meat and smaller pieces of meat. “Many people around the world are working on growing thick beef steaks, fat and all, but no one has managed it yet because it would also need blood vessels to supply the interior cells,” says Professor Dr.-Ing. Cornelia Rauh, who heads the Chair of Food Biotechnology and Food Process Engineering at TU Berlin – one of the few institutions in Germany working on the cultivation of meat.

Who will be able to afford cultured meat at all?

Instead of merely optimizing technical features, Cornelia Rauh and doctoral student Lisa Franke are also looking into the social impact of their research. The project on cultured meat is one of a total of six case studies being conducted as part of the BUA project “Social Cohesion, Food & Health – Inclusive Food System Transitions,” which analyzes the influence of nutrition and food-related health issues on social cohesion. Across numerous disciplines and all four BUA institutions, around 20 researchers are involved in case studies that investigate the social dimension of eating habits, regional value chains, school meals, and new food technologies – with the goal of making concrete proposals to improve them.

“There are countless ways of further developing an innovation like cultured meat,” says Rauh. “Every path we take in the lab is connect-



3D printing with edible ink: Cornelia Rauh and Lisa Franke optimize support structures for cultured meat in the laboratory. The BUA funded project also explores the social dimension of this innovation.



ed to the question of its implications for society. If I devote all my energy in the lab to making the final tweaks to achieve the best texture and flavor for cultured meat, but ignore the big picture, there is a risk that my innovation will not end up having the added societal value it could have.” How must cultured meat be produced to be widely accepted in society? Who will be able to afford it? And who will be excluded?

In order to answer such questions – which go far beyond the traditional engineering perspective – the food technologists at TU Berlin’s Campus Dahlem have teamed up with innovation researcher Dr. Dagmara Weckowska from Freie Universität Berlin for the BUA project. Based on all available technical details, Weckowska determines what impact cultured meat could have on society. “Ecological aspects are often already considered; we want to understand how such innovations can be socially inclusive, at what point they unite or rather divide people, who wins and who loses.”

One added value of the project lies in the exchange of ideas – across disciplines and beyond academic boundaries.

Weckowska has designed a method to identify the potential social effects of innovations while the latter are still at their development stage. Does a detailed technical decision, such as the composition of the support structure or nutrient solution, make the final product more socially acceptable or not? Many scientists, entrepreneurs, investors, and politicians who enable innovations are not sufficiently aware of the consequences of technical solutions. “We give them a tool to make informed decisions,” says Weckowska. In order to develop her “innovation radar,” she has also been exchanging ideas intensively with the sociologists and political scientists involved in the BUA project. Together with experts from science and industry, she now wants to subject the tool to a reality check. “It is already apparent that compromises are needed, because low-cost production that

would result in an affordable product might well at the same time reduce its acceptability,” says Weckowska. According to some researchers, animal ingredients in the nutrient solution, for example, can reduce production costs, but they are by no means considered desirable in all sections of society.

Cornelia Rauh sees an added value of the BUA project precisely in this exchange across disciplines and beyond the boundaries of academia. “We all learn a lot from each other because we ask completely different questions,” Rauh says. This integrated perspective is virtually written into the DNA of the BUA project. The researchers from TU Berlin, Humboldt-Universität zu Berlin, Freie Universität Berlin, and Charité want to break new ground by considering social cohesion, nutrition, and health as one unit. This requires that disciplinary boundaries become permeable; that social, economic, health, agricultural, and engineering scientists not only complement each other, but also develop a common language.

Shared school meals as the new normal

In the cafeteria at Ernst-Reuter-Schule, a secondary school in Berlin-Mitte, a mixed group has come together on a Tuesday afternoon. Teachers, the principal, the pupils’ representative, parents’ representatives, and the head of the network office for school meals (Vernetzungsstelle Kita- und Schulverpflegung Berlin e.V.) are present. On a screen, Dr. Benjamin Hennchen projects the results of a survey he conducted for a case study on inclusive food systems transitions as part of the BUA project. The survey is about the acceptance of school meals in Berlin’s integrated secondary schools. Hennchen, who is a research associate at TU Berlin’s Center for Technology and Society (ZTG), reports that an average of two-thirds of Berlin’s secondary school pupils do not take school lunches, and those who do are for the most part “rather dissatisfied.” Summarizing the respondents’ wishes, he adds that they would like more time to eat or would prefer the dining area to be more appealing. Shortly after the presentation, a lively discussion breaks out about how the situation could be improved.

“School meals are a great opportunity to provide healthy and sustainable meals to all sections of the population,” says Professor Dr. Dr. Martina Schäfer. She leads the case study on communal food strategies within the BUA project and works closely with 25 secondary schools in Berlin, the Senate Department of Education, Youth and Family, and the network office for school meals. Her goal is to use surveys and data collection to better understand the existing situation in Berlin’s school cafeterias and to develop strategies to ensure that more children take school meals, which could, in turn, strengthen social cohesion. “Based on our research, we advise each school individually on how to make the lunch service more attractive.” For example, it can make a big difference whether a class goes to lunch together with the teacher and establishes the cafeteria as a space for sharing and communicating, or whether everyone has lunch on their own. Asking the pupils from time to time how they like the meals, or letting them have a say in what they eat, could also increase acceptance. In the survey, the pupils complain that they are hardly ever involved in decisions concerning the lunch and dining area.

A constructive dialog with civil society

“We hope to network with other schools that have already tried out measures that might make sense for us, too,” says Julia Hansen, who is responsible for implementing the concept of the all-day school at Ernst-Reuter-Schule. Several of the participating Berlin schools have already decided to initiate a comprehensive transformation process together with the network office for school meals. Martina Schäfer hopes that the impulses from the BUA project could bring about a new normality in which school meals have a more unifying effect.

Similarly, in the five other case studies concerning initiatives such as the “Citizens’ Stock Corporation for Organic Agriculture,” the BUA project deliberately focuses on exchange with society and on knowledge from outside the academic world. The BUA team of TU Berlin’s Research Forums supports transdisciplinary research and has developed a tailor-made



exchange format for this purpose. So-called “Trialogs” bring together representatives from politics, business, and organized civil society for constructive discussions with science. In late November 2022, around 60 players – from a state secretary to a food-sharing activist, from a representative of the state poverty conference to a spokesperson for an organic supermarket – discussed what constitutes social cohesion in the field of nutrition, what could be done to promote it, and where the problems lie. The results and the recommendations for action that emerged were evaluated by the research team and published in the form of a digital discussion atlas at viz.governance-platform.org. “The transformation of the food system will bring about many conflicts,” says Martina Schäfer. “It is therefore important that we consider the social dimension from the outset.”

→ ifst-berlin.de

Martina Schäfer and her team have analyzed the existing situation in 25 Berlin school cafeterias. In workshops, such as this one at the Ernst-Reuter-Schule in Berlin-Mitte, she presents strategies to promote social cohesion through school meals.

A Plea: We Need to Swap More Information!

BY Audrey Podann, Head of the Office for Science and Society at TU Berlin

Transdisciplinarity” is a daunting word. Outside of science, many people shut down when they hear it, but even among researchers there is a feeling of uncertainty. For us, transdisciplinarity means that science opens up and seeks exchange with society. Ideally, it enables a co-research process in which practical and scientific knowledge come together and where even the research question has been formulated jointly.

Transdisciplinary research projects have a very high potential for solving problems. They are well suited to addressing so-called “wicked problems” – that is, major societal issues such as climate change, mobility, or demographic change – which are so complex that the best possible solutions cannot be found by applying a scientific perspective alone. Transdisciplinarity can help explore the wealth of knowledge to be found outside academia and counteract the decoupling of science from society.

In my view, transdisciplinarity is not a must, but you should be able to use this approach if it is the right one for the question you are asking. Of course, it makes less sense in basic research than in applied research. If you connect with society at an early stage, you can avoid a situation where a great project is carried forward to completion, but no one then understands the result or is able to apply it.

Unfortunately, there are huge deficits in resources. One main problem is the short funding period for sci-

entific projects, since it takes a lot of time to build trust with external partners and to find a common language. You cannot do that quickly on the side while working on other tasks. Ideally, experts should organize this exchange professionally. Funding agencies need to redesign their programs so that transdisciplinary

processes can be conducted in a serious manner. And transdisciplinary achievements should also be more strongly weighted in the appointment criteria for professorships, so that they do not become useless details in CVs.

TU Berlin is a pioneer in the field of transdisciplinarity. We have brought our expertise to the BUA and now want to use it to break new ground together. For example, in the second funding round, we developed a review process in which research projects are also evaluated with regard to their methodology. The reviewers were recruited from the community of world-leading transdisciplinary experts.

Within the BUA, we support researchers in developing excellent transdisciplinary formats. In this way, we are compiling a modular system of formats from which all four BUA institutions can benefit. Because even if transdisciplinarity is a daunting word, it is both refreshing and enriching to learn about the perspectives of people whose days are not spent predominantly at university.



“I Went About Things With A Lot More Vigor”

Young people have proposed research topics for the BUA's Next Grand Challenge. In the chat, the pupils Elida and Leoni talk about what they learned in the workshops, how they went about it, and what big questions are on their minds.

INTERVIEW Daniel Kastner

Daniel Soooo... is everyone here?

Leoni I'm here. 😊

Elida Me too. 😊

Daniel So tell me: What were your topics for the Next Grand Challenge?

Elida My group proposed the school and education system.

Leoni Ours were climate-neutral cities, energy, and sustainable living.

Daniel And these were the topics you signed up with for the Next Grand Challenge?

Elida No. We started developing the themes in the workshops.

Leoni Initially, you only had to be interested. 😊

Daniel How did you come across the program?

Leoni I discovered it myself, online. I was actually looking for a science project or a competition.

Daniel Why were you looking?

Leoni To be honest, I was rather bored by the science classes at school. 😊

Daniel Why is that?

Leoni We did an awful lot of writing, but I'm more the practical type. And because of the pandemic, we couldn't do experiments for a long time. I just wanted to know more and discover things for myself.

Daniel @Elida, how was it for you?

Elida I got an email from the Children's and Youth Parliament about a cool workshop.

Daniel What do you do at the Children's and Youth Parliament?

Elida Among other things, we write motions for the district council and suggest improvements.

Daniel What happened in the workshops for the Next Grand Challenge?

Elida The first thing we did was introduce ourselves and play games to get to know each other better. Then we wrote our interests on these little cards and used them to make posters.

Elida On the posters, we marked the things that we thought were important or not so important.

Elida And then everyone had to stand in front of the poster that interested them the most. After that, we started the research.

Daniel What sort of things were you researching?

Elida For example, I looked for information on block teaching and teacher shortages, and how to make school subjects more exciting.

Leoni I wanted to find out whether you could build houses with moss on the walls. For cooling or as an air filter, for instance.

Daniel Why are these issues important to you?

Elida Because they will partly determine our future. Whether it's teaching, as in my case, or climate change, as in Leoni's.

Leoni I think it's important to make cities more climate-neutral and to use technologies that already exist. It has to happen fast and sustainably, because more and more people will be living in cities.

Daniel How did your own research differ from what you do in school?

Leoni Somehow, it gave me a different feeling. I went about things with a lot more vigor because I was really interested in the topic.

Elida In school, you don't spend hours researching just one topic. You've got several subjects in one day; everything is jumbled up together in your mind.

Daniel And did you discuss your research findings afterwards?

Leoni We presented the topics to each other and got feedback; this made them better and better.

Elida In our group, we had quite different ideas and didn't always agree. But we didn't really argue either. 😊

Daniel You had to present your topics. How did that go exactly?

Elida We sat on chairs in a circle and everyone could say what they wanted. We threw a ball around, and whoever caught the ball had the floor.

Daniel That sounds really brave. I've always found speaking in front of people terrible.

Elida Really? 😊😊

Leoni I'd already given presentations at school before. But this time, we were really trained.

Daniel What did you learn?

Leoni For example, the best way to breathe to calm myself down. And we worked on our posture. Standing up straight but not rigid, head up, without letting your back fall forward.

Daniel And what about rhetorical tricks?

Leoni In one exercise, we were given an object and had to keep talking about it for two minutes, from apple to tree, you know.

Leoni It helped me because I realized that if I say something wrong, I can correct it and still keep talking without having to go quiet or say "um." 😊

Daniel How did the workshop end?

Elida We filled in a form with our ideas and information and received a certificate.

Leoni And a flower. 🌸

Daniel What will happen to your themes now?

Leoni A committee is going to select one of them, which will then be researched for three years.

Elida It would be a pity if there was no further research on these themes, because they're still important topics – for us and for society.

Daniel Did you draw any lessons from the workshops, for life or for school?

Leoni I've become more independent and learned to work with people I didn't know beforehand. Now I'm less afraid of talking to strangers. For example, when I can't find something in a store.

Elida And I got to know ideas other than my own. Thoughts that wouldn't have occurred to me.



Elida, 15, is in the 10th grade of an integrated secondary school in Berlin-Tempelhof. She campaigns for the interests of her generation in the Children's and Youth Parliament and is currently learning to play the piano.



Leoni, 15, is in the 9th grade of an academic high school in Berlin-Tiergarten. Her school's "Social Projects" club collects donations for charities such as Doctors Without Borders. She is class representative and also represents her school in the pupils' council for the district of Berlin-Mitte.

THE NEXT GRAND CHALLENGE

Young people, students, and researchers submitted a total of 43 proposals for the BUA's Next Grand Challenge. The involvement of young people in the search for topics began in September 2022 and included workshops on academic work, creativity, and presentation techniques. As the next step, the ideas were further developed at an ideas camp. In early 2023, all proposals were commented on by experts and presented to the BUA's board of directors for a final decision.



Silent

Pandemic

Antibiotic resistance is on the rise worldwide. A BUA-funded team of researchers is developing a device that can predict resistance before it occurs. The technology has the potential to open up new avenues of attack in the fight against the antibiotic crisis. Ethicists are also on board the “GlobalResist” project to assess at an early stage the potential negative consequences of the innovation.

TEXT Dietrich von Richthofen

Looking into the future and saving lives by doing so is the goal of the team headed by Professor Dr. Jens Rolff. The evolutionary biologist from Freie Universität Berlin has developed a laboratory method to predict which bacterial pathogens are likely to develop resistance to various antibiotics and with what probability. The “GlobalResist” project supported by the BUA now wants to apply the method to a device that would make the technology available to clinics worldwide – a kind of resistance detector that doctors can use in the future to make better decisions about their use of antibiotics.

Antibiotic resistance is on the rise worldwide. Today, the emergence of more and more new, multi-resistant pathogens – that is, pathogens that are no longer defeatable, not even with several active agents – is considered one of the greatest health threats of the 21st century. The World Health Organization (WHO) has even called it a “silent pandemic.” According to projections, by 2050, more people could die from resistant bacteria than from cancer, namely up to 50 million per year.

Attempts to use drugs more cautiously and in a more targeted manner have been underway for some time, for example through faster and more accurate diagnostics or better medical education about infectious diseases – important building blocks of the global Antibiotic Stewardship Initiative. “But the measures taken so far are not sufficient,” says Rolff. On average, the first resistance to an active ingredient emerges two to three years after it enters the market. The use of antibiotics in animal husbandry and their frequent occurrence in wastewater accelerate the process. In view of the threatening future scenarios, Rolff now wants to offer another pillar in the fight against the development of resistance. The idea is that, in

the future, the new detector could allow health-care professionals at the point of choosing an antibiotic to factor in the likelihood of resistance developing. “In this way, we hope to enable a more sustainable use of antibiotics,” says Rolff, a zoologist who has long researched defense mechanisms against infections in insects, and in recent years has increasingly turned his attention to human medical issues.

A new optical technology

A prototype of the resistance detector already exists. Rolff developed it in close collaboration with Ulrich Kertzsch, head of the Biofluid Mechanics Lab at Charité – Universitätsmedizin Berlin, with funding from the European Research Council (ERC). As part of the BUA’s Grand Challenge Initiative “Global Health,” the prototype is now to be further developed in a transdisciplinary three-year funding program involving researchers from Freie Universität Berlin, Charité, and TU Berlin. “From the very beginning, we have worked together across the various disciplines as equals – this allows us to develop the technology with a view to rapid deployment in everyday clinical practice,” says Professor Dr.-Ing. Dirk Oberschmidt, who is head of the Chair of Micro- and Precision Devices at TU Berlin and responsible for designing the device’s optical detection unit.

The technology is based on culture media made of the gelling agent agar agar, to which various antibiotics are added in different concentrations and combinations in special Petri dishes. Under the right culture conditions, bacteria only need a few weeks before they start growing on these media that are actually toxic for them. Depending on the active ingredient and the concentration, the duration of this adaptation varies and, in this way, shows against

which antibiotics the respective pathogen can develop resistance especially quickly. In clinical practice, these mechanisms of resistance formation require several years – a time advantage that enables predictions for future scenarios.

However, numerous technical details still need to be resolved before the system is ready for use. For example, how do you measure bacterial growth as quickly and accurately as possible? “We want to capture even the first cell divisions,” is how Oberschmidt describes the challenge. “Many microorganisms spread not only horizontally, but also vertically. This is what makes it so difficult to determine growth using conventional methods.” To monitor the growth of the various cultures at scales as small as a few micrometers, Oberschmidt relies on a lensless microscope. The technology, which is based on a digital optical sensor, has only existed for a few years and is being further developed by the TU Berlin working group.

Instead of using a lens to zoom in on individual sections, the entire area of the Petri dish must be constantly monitored. Expansion in the third dimension entails additional challenges. One possible solution could be digital holography, which can be used to image even the smallest changes in volume.

Identifying undesirable developments and aftereffects at an early stage

In the future, the resistance detector could provide microbiological support for infection therapy in hospitals worldwide. Accordingly, the technology must be both easy to use and capable of being integrated into everyday clinical practice. Future users, including a clinic in Uganda and an environmental engineering office in Colombia, are already involved in the

BUA project. “The early exchange with various stakeholders allows ethical considerations to be embedded in technology development from the very beginning, thereby intercepting unintended effects,” says Professor Dr. Sabine Ammon, head of the Chair of Knowledge Dynamics and Sustainable Technology at TU Berlin.

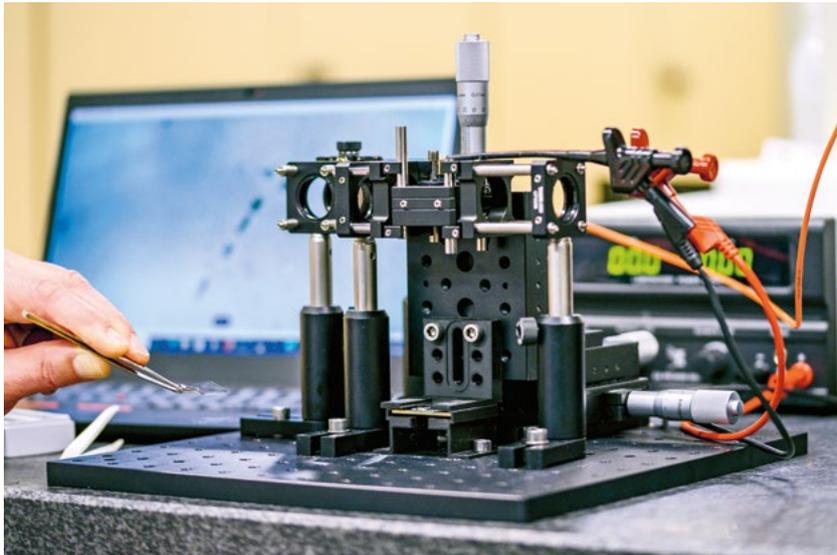
“Many methods we apply in our research draw on transdisciplinary approaches,” says Ammon, who is a technology assessment expert. Her participation enabled the project to meet one of the key BUA funding criteria. Together with research assistant Nils Neuhaus,

Ammon organizes workshops for the project partners and addresses ethical issues early on so that any undesirable developments and problematic after-effects can be corrected at an early stage.

“For example, a rebound effect could occur after the technology has entered the market,” Ammon says.

Just as the development of more fuel-efficient engines has led to consumers driving ever larger and more powerful cars, the fear is that the introduction of resistance prediction could lead to a carelessness among physicians and ultimately to an increase in the use of antibiotics.

Philosopher and ethicist Sabine Ammon finds it especially useful to be involved in the project from the very beginning. “In the past, our task was to offer an accompanying or subsequent evaluation of technological developments and their societal consequences,” she says. The BUA project now makes it possible for her to be involved in the development on an equal footing – in the sense of integrated ethics. Ammon says: “In this project, our ethical considerations can have an immediate impact on the technological development and lead to adjustments.”



Built to watch bacteria grow and anticipate the development of resistance: the lensless microscope developed by Dirk Oberschmidt's research group at TU Berlin.

A Plea: We Need Open Hardware!

BY Dipl.-Ing. Robert Mies, research associate at the Chair of Quality Science at TU Berlin's Institute for Machine Tools and Factory Management.

Free and open software was instrumental in building the Internet. Professional developers collaborated on a free basis to make this possible. This idea later gave rise to the concept of open hardware. In the beginning, it was all about people coming together to build electronics with open circuit diagrams. In no time, however, designs and building instructions were also being developed for hardware in many fields – such as robotics, art, and medical technology – and shared via platforms such as GitHub or GitLab. Through our BUA-funded project Open.Make, we ask the question of what significance the open hardware emerging from research can have for the future. How can it advance both research itself as well as innovation and sustainability? To this end, we have analyzed several initiatives, including a technology developed in the U.S. – and independently produced in Berlin – that enables the operations on laboratory animals' skulls used to measure brain function to be conducted more gently than before.

The open-source approach opens up a whole new range of possibilities. This is because every researcher is now left free to develop this device further – for instance for potential use in human brain surgery – and a globally distributed user community can exchange knowledge about it. A lot of hardware is developed within the research community. The rights to it are usually protected and then transferred to startups

and companies that are not primarily concerned with addressing overarching societal problems. But we need to think about how we want to shape the technology of tomorrow – for example, should a medical technology that determines life and death really be under the control of an oligopoly? Researchers must be free to decide how the hardware they develop is used. Right now, the path to open access is obstructed by too many barriers. The guidelines of the German Research Foundation (DFG) or the European Commission fail to take into account that hardware created with public funding should also be exploited for the benefit of society. What is needed is a new appreciation of open hardware; it must be recognized as an output of science. Technology transfer experts at universities need to advise the university community about the opportunities presented by open hardware; libraries need to ensure that blueprints are accessible; and the work of researchers taking this path needs to be made more visible.

The goal is not to make everything openly accessible, but we still need to consider from an early stage more open ways of exploiting and disseminating open hardware. This is also a question of research quality, since quality and trust in science also arise from its reproducibility. If we enable researchers to freely exchange ideas about hardware developments, this will ultimately also improve the results of their research.



“Find Something That Really Gets You To Switch Off Completely”



Doing a doctorate can be extremely strenuous – psychologically too. Positive psychology provides methods that enable students to navigate more happily through the tough stages of writing a doctoral thesis. Psychologist Dr. Nicole Torjus from TU Berlin holds mental health courses for the BUA. She wants to encourage doctoral students to take their problems into their own hands.

INTERVIEW Nora Lessing PHOTO Saskia Uppenkamp

Ms. Torjus, people starting a doctorate are usually motivated and ready to put in a lot of work. Why does the BUA offer mental health support specifically to doctoral students?

Studies have shown that this group is six times more likely than the general population to develop a mental illness. About two in three doctoral students experience anxiety and depression at least once during the doctoral program. The exact reasons for this are disputed. Many negative factors come together: Project positions are usually funded for three or four years, although many doctorates last four to eight years. One of TU Berlin's achievements is that research assistants here receive a five-year contract to complete their doctorates as well as a full-time position. In addition to frequent financial worries, many doctoral students experience fear of failure and a lot of competitive pressure. It is a bit like trying to climb Mount Everest on your own and without any training: It is expensive, you need to be in extremely good shape, and the weather changes all the time. A range of different activities to strengthen psychological resilience can help students avoid falling into a crevasse.

Psychologist Dr. Nicole Torjus from the Center for Scientific Continuing Education and Cooperation at TU Berlin leads training courses in mental health and self-management. The certified trainer for positive psychology finds strength and peace by spending time with her horses.

How exactly does the BUA strengthen this resilience?

As part of the BUA's Graduate Studies Support Program, or GSSP, we offer, among other things, the mental health module "Luck ahoy!". The participants spend two workshop days in the countryside, where we work with them very intensively. We raise their awareness of the fact that doctoral studies can also be a psychological strain and we provide them with tips and methods from positive psychology that they can use to strengthen their mental health.

What kind of methods are we talking about?

It can be small things like conscious breathing or making sure to stretch when you have been sitting at your desk for a long time. But it is also about bigger things – for example, thinking about who in your circle of friends and acquaintances is good for you, who you want to spend your time with. Networking with other doctoral students is important too. In addition, we try out methods like keeping gratitude diaries. By doing this, the participants learn to focus their attention on the good things in life, and to foster an appreciation of what is going well. Then we accompany the participants online for four weeks: Every week, we give them at least one new tool to try out. This is followed by weekly meetings where we discuss which tools have worked especially well for them. By the end

of the course, the participants know they are not alone in their concerns and can draw on many resources to maintain and improve their mental health.

And do doctoral students take up this offer?

Our first mental health module took place online in spring 2020. It was the time of the first lockdown, and the numbers of people looking for help just exploded: We had 160 registrations for 40 places and eventually ended up with far more participants than originally planned. In the meantime, around 5,500 doctoral students have taken advantage of the GSSP's different types of support.

Would you say that the BUA has improved the range of continuing education activities on offer for members of all four consortium partners?

I see a huge benefit in the new activities on offer: There are overarching events such as the GSSP and the Berlin Leadership Academy; in addition, the continuing education program of all institutions has been opened up to the consortium partners. If a course is fully booked at TU Berlin, I can now go to one of the other three universities. I think it is of enormous benefit to the students, doctoral students, and academic staff that they can get to know so many new things and can also strike up conversations with others across the BUA. Another advantage is that not every institution has to reinvent the wheel over and over again, but that we can offer a customized range of activities to different target groups. Through its flagship program "Strengthening Strengths" aimed at professors, TU Berlin has made a significant contribution in the field of positive psychology.

What problems do workshop participants come to you with?

Some are struggling with writer's block, others have difficulties with experiments, or their grants are running out with their theses far from finished. Another issue frequently mentioned is supervision. Some participants do not receive any feedback, or the supervisor puts a thousand other things on their plate, leaving them with the feeling they have no time left to work on their doctorates. In addition, many are concerned about their career paths: What opportunities do they have outside of academia? What happens if they do not complete their doctorates?

Many of these problems are related to the structure of the German academic system. How can positive psychology help?

Our program can do little to change the conditions, but it can change behavior – and that ultimately influences the conditions. With positive psychology, you can learn to pause in order to create. For my parents' generation there was still the mid-day nap, and telephone calls after 21:00 were taboo. Today, you yourself have got to create these sorts of protected spaces and times for yourself. Doctoral students often ask us: "Can't you teach us that in 90 minutes? We don't have time for a two-day workshop." But that is precisely the time you need to find and free up! Positive psychology cannot solve all problems, nor can it make everyone permanently happy – but that is also not the goal. Instead, it is more about helping people recognize and exploit the areas in their lives where there is scope for action. If you start at a teeny-weeny point, then all of a sudden you come to realize: I am part of the system! And if I change, something in the system changes too.

Sounds good. But isn't positive psychology more a means of proping up the system? One could argue that it promotes self-optimization...

Positive psychology is like nuclear fission: It can be used to generate energy, but it might also kill people. The users are responsible for what they do with it – and any improper use is precisely that. At the core of these methods, however, is precisely this sense of taking a pause and thinking anew: How can we live well with each other? How do we develop compassion – for ourselves and for others? One of the basic ideas is to set limits. When I reach the point where I realize I am exploiting myself, it is time to say no and stop. This is also in line with the motto of the German Society for Positive Psychology: Be the change you want to see in the world.

“

It is about helping people recognize and exploit the areas in their lives where there is scope for action.

”

How do participants respond to your mental health courses?

The first face-to-face course after two years of pandemic and isolation, in particular, was very tearful. Afterwards, some participants came to us and said: "Thank you. I've decided to seek counseling or therapy." In general, participants perceive it as a huge gain to get to know doctoral students from other universities and disciplines, because the problems are often the same. The most common thing we hear is: "Thank you so much – it's so good to know that it's

not just me!" A year after being on the course, 90 percent of the participants still regularly use the methods we taught them.

What advice do you have for people considering a doctorate?

The most important thing is to be clear about one's goal. We frequently have participants with hazy expectations about their doctorates. Pursuing a doctorate just because I want the title or because I want to please my parents is really not a good starting point. You should set yourself a goal that you specifically want to achieve with a doctorate – a professorship, for example – and work towards achieving it. It is also important to build a good network from the very beginning. In principle, I recommend that you find something that really gets you to switch off completely. It can be meditation, walking the dog, or something else entirely. It is about having something that really does you a lot of good. Once you have found that for yourself, you should nurture and cherish it. And then everything else will follow of its own accord.

**CONTINUING EDUCATION
PROGRAM OFFERED
BY THE BUA NETWORK**

The BUA supports researchers of all experience levels by offering a wide range of courses. In the Berlin Graduate Studies Support Program (GSSP), doctoral students can learn not only methods for maintaining good mental health but also good academic practice or writing strategies; professors and junior research group leaders can develop their leadership skills at the Berlin Leadership Academy, while post-doctoral students can plan their careers at the Postdoc Academy.

AS YOU LIKE IT

Knowledge must reach the people. The BUA promotes creative formats for science communication that researchers can use to share their focuses and enthusiasm – and to generate interest in their research.

ANTHROPOSCENES



News from the desert planet

The end of humanity is a glittering party for an intergalactic group of extraterrestrials. That is, at least, in the play “The World Flames Like a Disco Ball (Styx Speaking)” by RambaZamba Theater in Prenzlauer Berg. Droughts and pollution have rid the Earth of Homo sapiens. But, despite everything, will human love eventually return? The play is one of many creative performances staged by Anthroposcenes, an experimental laboratory for science communication funded by the BUA. It combines theater and science to entertain a broad audience and encourage it to think about a sustainable future for water.
→ anthroposcenes.de

TRASH GAMES

Infinite Fun

Circular economy? It’s on everyone’s lips. But what does it mean? “Waste What?” players must learn to repair old items, reuse the materials inside them, and thereby reduce Berlin’s mountains of waste. In an experimental laboratory supported by the

BUA, Professor Dr.-Ing. Vera Rotter from the Chair of Circular Economy and Recycling Technology at TU Berlin developed the creative commons game together with the Stadtlabor for Multimodal Anthropology at Humboldt Universität zu Berlin. Their goal is to shed a light on the potential of waste by bringing it to life in a playful manner.

PROJECT LAB WISSKOMM



Jellyfish are among us

For most people, jellyfish are alien, slimy creatures. Students at TU Berlin created a three-meter-high artwork resembling a jellyfish to draw attention to the fascinating abilities of the species *Aequorea victoria*. It possesses special proteins that cause its body to glow. The work was created in the BUA-funded Project Lab Science Communication and has been exhibited at a number of festivals. Since 2021, around 60 students have used the opportunity offered by this course to experiment with new formats of science communication and to hone their skills for interacting with the general public.
→ project-sci.com

SCIENCE POETRY SLAM



The desire for pain

The moment when philosopher Teresa Geisler reaches into a bowl and throws sachets of wasabi nuts into the audience is an ice-breaker. Loud cheering resounds in the “Säälchen am Holzmarkt” – and Geisler has got everybody on her side. On this night, eight researchers have the courage to present their topics on stage at the BUA’s “Science Poetry Slam,” just as Geisler did. The BUA has used workshops to prepare them for their performances. Geisler bluntly describes the beauty of the pain she feels when she bites down on the spicy nuts. According to a theory proposed in the doctoral thesis she is writing at TU Berlin’s Institute of History and Philosophy of Science, Technology, and Literature, the pleasure of pain is neither pathological nor perverse. It is an everyday experience of life: We like pain because it makes us feel alive. For example, when the spiciness of the wasabi stings our noses. More BUA science poetry slams are to follow in 2023.

Berlin. Excellent.

The Berlin research region continues to grow together. Apart from the BUA, the Excellence Strategy of the German federal and state governments supports seven Clusters of Excellence in Berlin, in which scientists are developing answers to contemporary questions. TU Berlin is applicant university for three clusters. With them, Berlin has positioned itself at the forefront of mathematics, catalysis, and intelligence research in Europe.

Transport planning of the future

Traffic jams at Funkturm Berlin are no rarity. Every day, around 230,000 vehicles pass through this highway junction in Berlin. It is soon to be rebuilt. Mathematicians have long been waiting for the chance to optimize such a junction point. At the Cluster of Excellence MATH+, they are developing algorithms that can be used to predict the consequences of transport planning. They regard road transport as a “dynamic network flow problem” with discrete elements – namely, the cars. To solve this problem, the algorithms traditionally applied in discrete mathematics need to be extended by the factor time. MATH+’s new algorithms can simulate a wide range of factors in real time – even human behavior that is difficult to calculate – and they can do so significantly faster than ever before. In this way, a reliable basis for the transport planning of the future is created.

MATH+

The Berlin Mathematics Research Center

The Cluster of Excellence MATH+ develops new methods for handling ever-increasing amounts of data as well as for solving problems in a wide range of application fields – from transport planning to individualized medicine or to the social sciences.

Funding period: 2019–2025

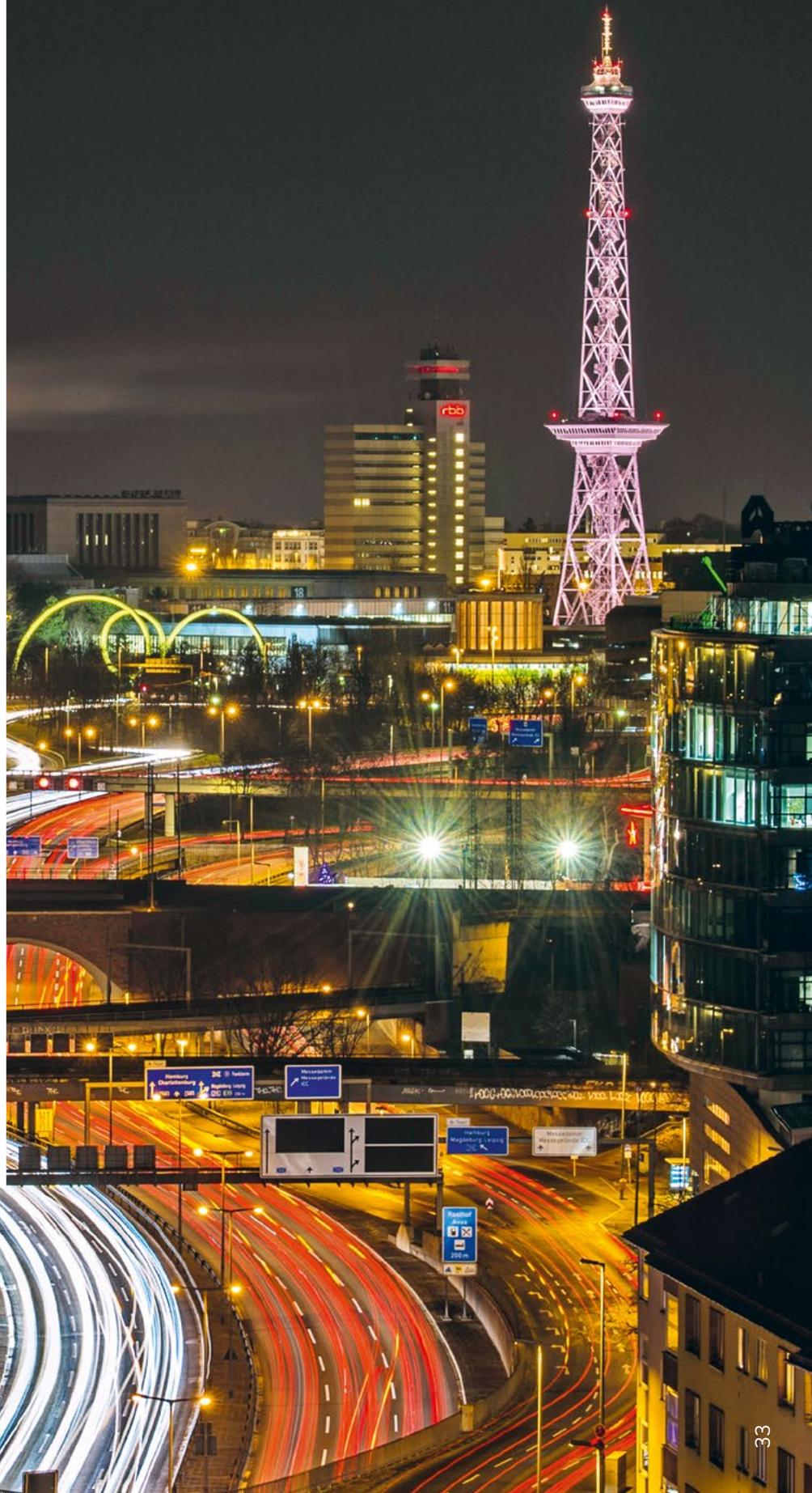
Participants: currently, more than 500 researchers in over 100 projects

Publications: 482

Collaborations: more than 200 research projects

Applicants: FU Berlin, HU Berlin, TU Berlin with Weierstrass Institute for Applied Analysis and Stochastics, Zuse Institute Berlin

→ mathplus.de



Refineries of the future

What a powerhouse! Hydrogenase is a giant molecule with nothing less than miraculous capabilities. It can split hydrogen molecules and also form new ones, store and generate energy – and all while remaining completely unchanged. It is one of the many catalysts that scientists at the Cluster of Excellence Unifying Systems in Catalysis (UniSysCat) are researching and optimizing for technological applications. Hydrogenase is a biocatalyst or, more precisely, an enzyme that helps microorganisms in nature to split and produce hydrogen. The UniSysCat researchers now want to understand this process down to the smallest detail – and make it usable. Among other future applications, hydrogenase coupled with another enzyme could convert climate-damaging CO₂ into hydrocarbons for the chemical industry.

UNISYSCAT

Unifying Systems in Catalysis

The Cluster of Excellence UniSysCat aims to understand complex catalytic reactions and enable their application in industry. Nature is the underlying model in this regard. The result is green chemistry that uses less energy, avoids pollutants, waste, and CO₂ – and delivers solutions for a more sustainable future.

Funding period: 2019–2025

Budget: 42.7 million euros

Participants:

around 330 researchers – 32% of them women – in 56 working groups

Publications: 509

Collaborations: with more than 100 researchers from about 30 institutions

Applicant: TU Berlin

→ unisyscat.de



Swarms of the future

Taken by themselves, the “kilobots” developed at the Cluster of Excellence Science of Intelligence (SCIOI) are simple creatures. They can communicate within a radius of just ten centimeters and can process little data. Their intelligence only unfolds in the collective. Together, they solve relatively complex problems in “decentralized networks” without a central control unit – similar to the way a school of fish escapes a shark’s feeding frenzy. The SCIOI scientists analyze swarm behavior in nature and apply the principles to algorithms that control mini-robots. In experiments, they observe how swarms of robots come to decisions – and how intelligence emerges in the collective. In the future, this knowledge could help optimize autonomous driving, among other technologies.

SCIOI

Science of Intelligence

The Cluster of Excellence SCIOI observes, analyzes, and simulates the principles of intelligent behavior in order to better understand intelligence and make it usable for the technology of the future. Through the involvement of many disciplines, a unified, interdisciplinary understanding of intelligence is now emerging for the first time.

Funding period: 2019–2025

Budget: around 40 million euros

Participants: around 115 researchers in more than 50 research projects

Publications: 140

Collaborations: with more than 140 researchers from around 40 institutions

Applicants: TU Berlin, HU Berlin

→ scienceofintelligence.de

We've got the brains for the future.
For the benefit of society.

