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SHAPING THE ENERGY TRANSITION

MAIN TOPIC

Editorial

Dear readers,

2011 was the year of the nuclear disaster in Fukushima. In Germany it marked the beginning of a new era. On 9 June 2011, three months after a severe earthquake hit the east coast of Japan, triggering the tsunami that caused the core meltdown in three reactor blocks at the nuclear power plant Fukushima I, Chancellor Angela Merkel announced Germany's new "path to the energy of the future" in her government policy statement.

The key points of the plan: nuclear power usage was to be phased out in Germany by 2022 and renewables were to become the central pillar of the country's future energy supply. The federal government's ad-hoc legislation was met with astonishment and then considerable respect – in particular at the international level. Germany was seen as a trailblazer for the green energy transition.

Years later it is lagging behind: in the 2018 global Energy Transition Index of the World Economic Forum, Germany landed in sixteenth position. And it was only with great difficulty that the current grand coalition government was able to pass its "Climate Protection Programme 2030". The plan envisages a price tag for polluting CO₂ emissions, subsidy schemes and, as its key element, the "constant and reliable expansion of renewables." For most experts, the plan does not go far enough: the carbon pricing policy is ineffective, the expansion of wind energy across the country is being hindered more than helped, and the quest to achieve the CO₂ reduction targets by 2030 is doomed to fail, critics say.

The current state of affairs shows that the eco-friendly restructuring of the energy system impacts society as a whole and presents politics with im-

mense challenges. And yet the energy transition, the task of the century, is well underway. Many green technologies are already competitive, and innovative solutions are just waiting to be implemented.

Oldenburg researchers are also busily researching topics related to the energy transition. In this issue of EINBLICKE we introduce a few examples: from energy informatics, wind physics and energy meteorology to economic policy, sustainable production, innovation sociology and sustainability research.

We wish you a stimulating read of these and the many other articles in this magazine.

Yours truly,
the EINBLICKE editorial team



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Nations at the World Congress
on Undergraduate Research

Hosting the world in Oldenburg: in spring 2019 students from 35 countries came together at the second "World Congress on Undergraduate Research" (World CUR) on Oldenburg University's campus. Building on the success of the first World CUR in Doha (Qatar) three years ago, the number of participants in Oldenburg almost doubled. Around 450 students participated in the three-day congress and more than half of them presented the results of their research. Students received awards for the best oral and poster presentations, and participants seized on the opportunity to debate and network – among them many young people from developing and emerging countries, whose participation was facilitated by the Ministry for Science and Culture of Lower Saxony. "With the World CUR we wanted to increase the visibility of undergraduate research. And we succeeded," project manager Dr. Susanne Haberstroh said. To be continued!



A question of perspective

For decades, school absenteeism was a taboo topic in Germany's educational landscape. Now views have changed and many schools are actively confronting the problem. Heinrich Ricking of the Department of Special Needs Education and Rehabilitation has played a key role in this process

Supports is on today's timetable for the pupils of the ninth grade. In the case of 14-year-old Laura and her classmate Pia that means football – not exactly their favourite form of exercise. Furtively, they sneak out and meet with friends at a café instead. This little exploit, which would provoke a furious reaction from most parents, leaves Prof. Dr. Heinrich Ricking of the Department of Special Needs Education and Rehabilitation completely unfazed: "We know that half of all lower secondary school pupils contemplate skipping classes for no good reason – and some of them will actually skip a couple of lessons. However, it's not these pupils who give us a headache but the three to five percent who are absent on a regular basis." Experts talk of routine, chronic and habitual forms of school absenteeism. "There is a serious danger of dropout here, of these young people ending up socially marginalised," Ricking explains. Studies show that the life prospects of chronic truants are pretty grim: how do they get ahead in life without so much as a school-leaving qualification? It becomes difficult to integrate them into working life, the probability of their turning to crime increases, as does that of drug use, their health suffers and their future opportunities are limited. "This is why we need to see school absenteeism not just in the context of school but in the context of a whole future life," Ricking stresses.

Three types of school absenteeism

At the international level scientists distinguish between three types of school absenteeism: chronic truancy, fear-driven class avoidance, and parents keeping their children at home. "The first two types are already well researched and truants make up the lion's share," says Ricking. However, the phenomenon of parents keeping their children at home was unexplored until

recently because hardly anyone could imagine how widespread it was. For a long time, scientists simply assumed that parents would necessarily have a strong interest in their children receiving an education. "But in our studies we have frequently talked to girls and boys who mentioned that their parents didn't allow them to go to school," Ricking explains. According to his research there can be many different reasons for this: some parents don't want their children to attend sex education classes, or religion education, or they are critical of the school system as a whole. Then there are those who claim they need their children's help at home, and others who simply don't care whether or not their children go to school. "A panoply of motives," Ricking concludes. He and his colleagues at the Department of Special Needs Education and Rehabilitation and the School of Educational Sciences have investigated these motives intensively over the past few years. The findings were published in 2018 in a book titled "School Absenteeism and Parents," a summary of the international research. It is the only book dedicated solely to this subject in Germany to date. Ricking published it together with Karsten Speck, Professor of Research Methods in Educational Science at the Department of Educational Sciences. "We weren't able to answer all the questions, but we provided the stimulus for a more intensive analysis of the role of parents," Ricking says. An example that shows that school absenteeism is a problem with multiple causes.

A new branch of research

The 53-year-old professor of special education has been interested in this topic for decades: in the 1990s, when he was still a student, he worked part-time at a school for children with behavioural problems. One day he came across a group of teenagers who were hiding out in the middle of a cornfield instead of attending classes. "I simply wanted

to understand what made them do it," says Ricking. To some extent this was the initial spark for a branch of research that had hitherto been neglected in Germany, because until the early 2000s the topic of truancy was more or less taboo. "Some schools claimed they didn't have the problem at all, others blamed the parents. Who in turn blamed the schools," Ricking recalls. Reason enough for Ricking, a teacher and researcher at the time, to take a closer look at the situation. Published in 2003, his international report "School absenteeism as a research topic" set the ball rolling in Germany's educational landscape. Since then the perspective in education policy has changed considerably. A key factor behind this change was the book "School Absenteeism and Drop-Out", written by Ricking and two colleagues at the Department of Educational Sciences, Prof. Dr. Gisela Schulze and Prof. Dr. Manfred Wittrock. "Schools are finally confronting the problem," Ricking says, adding that much has also changed at the institutional, legal and research levels. "Only once a problem has been named can it be tackled and resolved," he stresses.

Over the years, as this new openness has developed, the focus of Ricking's research has shifted. Whereas initially he concentrated on the different types of school absenteeism, nowadays he is more preoccupied with intervention and prevention: what can schools actively do to keep children and teenagers in class? "Quite a lot in fact – even if some schools paint a different picture," says Ricking. There are studies that look at the same type of schools in the same catchment areas – yet attendance rates vary considerably, he explains.

Recognising the warning signs

In the quest to determine the causes of absenteeism Ricking's team has been working since the middle of 2019 with six schools in socially disadvantaged areas of Hamburg in a project commis-

sioned by the Joachim Herz Foundation and the Alfred Toepfer Foundation. The aim is essentially to gain insights into the processes that prompt young people to skip school. "This aversion to school doesn't develop overnight but over the course of several years, sometimes beginning in primary school," Ricking explains. Many of these young people suffer from a lack of recognition and attention at home, among their friends and in school. At the same time according to Ricking the most powerful risk factor is poor academic performance: children who frequently get poor grades and don't get on with their teachers don't like going to school. "And when these children develop a certain amount of autonomy at 13 or 14, and perhaps have friends with similar tendencies, the willingness to skip school soon emerges." Instead of waiting until the problem becomes full-blown it is thus vital to recognise the warning signs at an early stage – and this is one of the goals of the Hamburg project. "We test measures, evaluate them and determine their impact – all in close coordination with the teachers," Ricking explains. He hopes that this

will produce positive examples that convince other schools to do more in terms of prevention and intervention in order to keep pupils from dropping out of school.

Digital class registers as an opportunity?

Ricking sees digital attendance registers as an opportunity – not just to lighten the teachers' workload and cut down on analogue work steps, but also to document absences at an early stage so action can be taken more promptly.

Ricking was able to observe the efficacy of this measure in a monitoring study conducted at a model school in the UK. The school employs a person on a part-time basis with the sole task of documenting absences from class and coordinating the school's reactions. Each member of the teaching staff must enter the names of pupils who fail to turn up for class in the digital class register. All the data is gathered on this member of staff's computer and then transferred to parents' smart phones. "This means that shortly after 9 a.m.

not only are the parents informed, but there is also an updated overview of the day's absences – for each pupil," Ricking explains. In Germany the situation is altogether different: "Many schools don't even have an annual overview," Ricking points out. He believes that in general too little is being done with the available data in Germany. "This is very unfortunate because this data is the prerequisite for building up a good prevention and intervention system."

Ricking is convinced that a lot needs to happen in the coming years to prevent absentee rates from rising – also in view of the fact that classes are becoming increasingly heterogeneous. "Only if all the involved parties work together effectively on site can pupils receive the best possible educational support." It often takes a while for the results of Oldenburg's special education research to have an effect on everyday life at schools. Nonetheless, Ricking's work has already had quite an impact. His vision: "A school that everyone enjoys going to – from pupils with learning disabilities to the highly gifted. And we want to help make it happen!" (kl)



Children skip school for many reasons: some are afraid of their teachers or fellow pupils, but sometimes it's because of the parents. Oldenburg researchers are studying this phenomenon.

A positive evaluation for Oldenburg's School of Medicine

"An impressive range of courses that have been convincingly implemented." This was how the German Council of Science and Humanities rated the model degree programme "Human Medicine" of the "European Medical School Oldenburg-Groningen" (EMS) in a report published in mid-July. According to the experts of the council, which is Germany's most important scientific advisory body, the excellent standards in the areas of neurosensory science and hearing research have been fully maintained in recent years and have become the distinguishing feature of the University's medical school. They also concluded that focussing on the nascent field of health services research is strategically worthwhile and should be expanded. In the opinion of the Council, Oldenburg's School of

Medicine has built on the strengths of its founding concept and established itself as an attractive location for medical studies. The experts also welcomed the faculty's plans to expand its cooperation with the Rijksuniversiteit Groningen and the Universitair Medisch Centrum Groningen (UMCG) in the areas of research, the promotion of young scientists, specialist training, and health care. In a joint statement, University President Prof. Dr. Dr. Hans Michael Piper and the Dean of the Faculty of Medicine and Health Sciences, Prof. Dr. Hans Gerd Nothwang, welcomed this praise. However, they stressed that the critical remarks on the current situation at the faculty were equally constructive. These would contribute to further strengthening and improving cooperation with the

Oldenburg hospitals and the University of Groningen. Prior to the evaluation, the Universities of Oldenburg and Groningen and the UMCG already renewed their commitment to close cooperation in medical education and cross-border medical research. The corresponding cooperation agreement was signed in Groningen on 1 July. The renewal of the agreement originally signed in 2012 was also necessary because from the winter semester 2019/20 onwards, the number of students enrolling in the human medicine programme in Oldenburg will double from forty to eighty. The aim of the interregional cooperation is to establish cross-border networks and infrastructure for medical care services and to promote medical research, public health and the regional economy.



The medical school at the University of Oldenburg has built on the strengths of its founding concept and established itself as an attractive location for medical studies, the German Council of Science and Humanities said in its report.

DFKI Laboratory Lower Saxony up and running

In April the German Research Centre for Artificial Intelligence (DFKI) and the state of Lower Saxony expanded the DFKI branch office in Osnabrück, relaunching it as the DFKI Laboratory Lower Saxony with branches in Oldenburg and Osnabrück. The laboratory's primary research topic is environmental perception of autonomous systems. Two of the DFKI research groups are based at the University of Oldenburg: The "Industry and Production" group, run by the future occupant of the endowed professorship "Applied Artificial Intelligence", will focus on production and transport systems. Its objective is to develop automated assessment and analysis of digitalised systems using AI. Informatics professor Dr. Axel Hahn is helping with the expansion of the re-

search group, which cooperates closely with the Centre for Digital Innovations Lower Saxony (Zentrum Digitale Innovationen Niedersachsen – ZDIN) and the OFFIS - Institute for Information Technology. The focus of the second Oldenburg group is AI in marine sensor systems. Marine scientist Prof. Dr. Oliver Zielinski runs the new group "Marine Environmental Perception". Its research is geared towards developing flexible observation systems that can act autonomously in various situations and be used for tasks such as identifying damage to marine installations or controlling water pollution. The goal is to develop AI methods for the automated collection and classification of data from different sensors deployed in the marine environment.

When the North Sea's circulation is reversed

Persistent easterly winds in the spring of 2018 reversed the normal pattern of circulation in the North Sea for more than six weeks. This is the finding of a paper published jointly by the University of Oldenburg's Institute for Chemistry and Biology of the Marine Environment and the Helmholtz-Zentrum Geesthacht in the scientific journal *Continental Shelf Research*. The researchers used data from the project "Macroplastics Pollution in the Southern North Sea – Sources, Pathways and Abatement Strategies", in which residents living on the east coast of Great Britain reported to a website the locations of wooden drifters they had found. Oldenburg scientists had previously launched the drifters off the coast of the German islands of Borkum and Sylt in February 2018. Using additional data and model calculations, the researchers were able to establish that the North Sea water circulated clockwise during this period instead of its usual anti-clockwise pattern. The results contribute to a better understanding of how plastic waste is distributed in the sea.

Blockchain for freight papers

Plans are in the pipeline to introduce digital documents in the commercial shipping sector. A joint project coordinated by the University's Centre for Law in the Information Society (Zentrum für Recht der Informationsgesellschaft – ZRI) is seeking to replace load-specific transport documents on paper with electronic ones. The initiative entitled "Tradability of Physical Goods through Digital Tokens in Consortium Networks" ("Handelbarkeit physikalischer Güter durch digitale Token in Konsortialnetzwerken" – HAPTİK) will receive 1.4 million euros in funding from the German Federal Ministry for Economic Affairs and Energy. The project is run by jurist and ZRI director Prof. Dr. Jürgen Taeger. It started in January 2019 and runs over a three-year period. The team of Oldenburg researchers is using blockchain technology to produce documents whose contents cannot be tampered with – even when several parties have access to them. The use of digital freight papers based on this technology could speed up document transfer considerably and slash costs.

Learning for Teachers

In the second funding phase of the Federal and Länder government programme "Quality Initiative for Teacher Training" (Qualitätsoffensive Lehrerbildung), the University of Oldenburg received around four million euros for its project "Biographically-Oriented and Multi-Phase Teacher Training in Oldenburg" (Biographieorientierte und Phasenübergreifende Lehrerbildung in Oldenburg – OLE+). The initiative aims to establish new digital communication and information structures for improving teacher training and develop customised specialist training to refine the professional skills of undergraduates and teachers, in particular regarding media literacy. A further focus of the programme is to establish formats for research-based learning. OLE+ also reinforces practical orientation in teacher training, for example through "theory-practice spaces" in learning spaces outside the classroom. A newly established research academy is to put together an accompanying research programme. In addition, the university-wide advisory concept developed for the teacher-training degree programme in the first funding phase is to be implemented.

Ten new professorships for early career researchers

The Tenure Track Programme, a funding programme for early career researchers set up jointly by the German federal states and the Federal Ministry of Education and Research, has approved all ten tenure-track professorships applied for by the University of Oldenburg. The funding scheme aims to open up a consistent and transparent pathway to professorship for young academics. The programme gives the university new opportunities to provide individual and high-quality support

for the transition to a lifetime professorship, stressed Prof. Dr. Esther Ruijgndijk, Vice President for Early Career Researchers and International Affairs. The ten new professorships complement the university's existing focus topics of digitalisation, sustainability and diversity. The topics they incorporate range from the ethics of digitalisation, gender medicine and German as a foreign language to environmental and sustainability-related business informatics. In the area of "Digitalisation", four new

tenure-track professorships will expand the existing focus on "Cooperative Critical Systems" in the direction of the social sciences and humanities. The university's key research area of "Environment and Sustainability" will be bolstered by two new professorships. Four tenure-track professorships will be established in the focus area of "Diversity and Participation". They will address globalisation processes and cultural mobility as well as new research approaches in gender studies.

Designing digitalisation responsibly

In all areas where applied – language assistant applications, smart home systems, intelligent energy networks or autonomous cars – digitalisation is merging the physical and virtual worlds ever more closely. In a number of projects, scientists at the University of Oldenburg are working together with partner institutions to investigate the technical and social challenges these "hu-

man-cyber-physical systems" pose. They also look at how to design them responsibly. In order to bundle activities and create synergies the university has set up an interdisciplinary research centre called "Human-Cyber-Physical Systems: Safety, Acceptance, Social and Cultural Embeddedness". It brings together professors and junior researchers from each of the university's six faculties as

well as the Jade University of Applied Sciences, the OFFIS Institute for Information Technology, the German Aerospace Centre and the Fraunhofer Institute for Digital Media Technology IDMT. The director of the research centre is computer scientist Prof. Dr. Werner Damm; the acting director is psychologist Prof. Dr. Christoph Herrmann (both from the University of Oldenburg).

How sugar and opium changed Europe

Tobacco, tea, caffeine, sugar, chocolate, and opium first arrived in Europe in the seventeenth century. In a project titled "Intoxicating Spaces", historians at the universities of Oldenburg, Sheffield (UK), Utrecht (NL) and Stockholm (SWE) are investigating how intoxicants and stimulants changed life in northern European port cities. The researchers are using the cities of Hamburg, Amsterdam, London and

Stockholm as case studies. The Oldenburg subproject, which is headed by historian Prof. Dr. Dagmar Freist, focuses on the city of Hamburg, during the early modern period already one of Europe's busiest port cities. On the basis of historical documents, the researchers are investigating the extent to which intoxicants contributed to the emergence of new types of public spaces, such as coffee houses.

The goal is to find out what other "intoxicating spaces" were created during this period, and assess the impact this had on society and politics. The team is also investigating how intoxicant use has changed over time. In all four participating countries the scientists are working closely with museums and schools. The research project is funded by the research network Humanities in the European Research Area (HERA).



The larvae of coral reef fish – in this case Yellowstriped Cardinalfish – find their way back to their reef after weeks of roaming the ocean. In a newly approved Collaborative Research Centre, Oldenburg researchers are studying the mechanisms underlying this behaviour.

How animals navigate

In a new Collaborative Research Centre (CRC), a multidisciplinary team led by biologist Prof. Dr. Henrik Mouritsen is investigating magnetoreception in vertebrates - from the molecular basis of this magnetic sense to the behavioural mechanisms it involves. The German Research Foundation (DFG) began funding the CRC "Magnetoreception and navigation in vertebrates: from biophysics to brain and behaviour" at the beginning of 2019 with an initial budget of ten million euros. Scientists from the Institutes of Biology and Environmental Sciences, Physics, Chemistry and Biology of the Marine Environment and the Department of Neuroscience at the University of Oldenburg are all working together on the project. Researchers from the Universities of Bochum and Cologne, the Institute for Bird Research "Vogelwarte Helgoland" in Wilhelmshaven,

the Max Planck Institute for Evolutionary Biology in Plön and the Weizmann Institute of Science in Rehovot (Israel) are also participating. Scientists and laypeople alike have long been fascinated by the migratory behaviour of animals. Butterflies, fish and birds use different combinations of sensory input to find their way to their breeding grounds. For birds that migrate at night, celestial bodies and the Earth's magnetic field are important navigation aids. But there is still no detailed understanding of how vertebrates sense the magnetic field and how they process the information in their brains. The multidisciplinary team therefore plans to investigate magnetoreception in fish, birds and bats, and combine findings from quantum mechanics, neurobiology and genetics with studies on sensory perception and animal behaviour. They hope that

their research will provide answers to some of the key questions in biology, such as how magnetoreception works and how the brain stores spatial information. Mouritsen and Prof. Dr. Peter Hore of the Department of Chemistry at Oxford University are also investigating the particulars of magnetoreception in the project "QuantumBirds". The aim of this project is to determine whether highly sensitive quantum processes are the decisive component of the magnetic compass in the eyes of migratory birds, as these quantum chemical effects have yet to be conclusively proven. The European Research Council (ERC) is funding the prestigious project with a Synergy Grant of 8.6 million euros. The results of these two projects could potentially be used in bird protection and also in quantum computer technology and innovative biological sensors.

Keeping an eye on things

We think of the cornea as a windscreen for the eye. But this transparent layer of tissue is far more complex than a simple protective covering. Stefan Schrader and Sonja Mertsch are pursuing new approaches to treating diseases of the ocular surface



Just a few years ago there would have been no way to help the eighty-year-old patient. The elderly woman had an ulcer on the cornea of her eye, probably caused by diabetes. Prof. Dr. Dr. Stefan Schrader and his colleagues at the University Hospital Düsseldorf, where he was still working at the time, had already tried everything: for several months the patient had taken special eye drops and the doctors had also transplanted a so-called amniotic membrane onto areas that were not healing properly several times. This membrane, which is extracted from human placenta, functions like a dressing and promotes wound healing. But the treatment wasn't working. The patient was facing the prospect of losing her eye. "All the conventional treatments had failed," explains Schrader, who since October 2018 has been Professor of Ophthalmology at the University of Oldenburg and Director of the University Eye Clinic at the Pius-Hospital Oldenburg. The lack of alternatives forced the specialists to make an unusual decision in consultation with the elderly patient: instead of performing yet another transplantation – the standard treatment in cases of acute corneal disease – the team used an artificial membrane based on collagens. These structural proteins form fibres and are an integral part of the tissue in the skin, bones and tendons. "We administered the collagen construction as a combination of basal-membrane substitute and dressing. This new procedure had a most impressive effect," Schrader says. The wounds in the cornea healed and after six months there were no signs of inflammation or irritation in the artificial material. The patient not only kept her eye but was also able to see more clearly again.

The cornea might seem unremarkable at first glance, but it plays an essential role. The small, transparent disc is extremely thin and about the size of a ten-cent coin. It forms the centre of the eye surface and covers the iris and pupil. The cornea borders with the

sclera, which encloses the rest of the eye. The tissue consists of six microscopically thin layers, the thickest of which is the stroma, which contains collagen. "The exterior layer of the cornea, which is moistened by lacrimal fluid, protects the interior of the eye like a windscreen," Schrader says – against germs, foreign bodies and UV light for example. The cornea also provides almost three-quarters of the eye's refractive power. Together with the lens, it helps the eye to optimally focus incoming light so that a sharp image forms on the retina.

When donor corneas don't help

Diseases of the cornea can have drastic consequences. "If scarring occurs as a result of bacterial or viral infections, injuries or various diseases, the cornea first of all loses transparency, and secondly, its refractive power is altered. Both these factors impair vision and can lead to total loss of eyesight. Transplantation of donor tissue can prevent complete loss of vision in most patients suffering from severe corneal diseases. Schrader performs such operations regularly at the Pius-Hospital. In some cases, doctors replace the entire cornea, in others they perform microsurgery to replace only the damaged area.

But this doesn't work for all patients. On the one hand, severe disorders of the ocular surface – for example dry eye or damage to the corneal nerves – can hinder transplantation or even render it impossible. On the other hand, there might be a shortage of donor corneas, explains Dr. Sonja Mertsch, a neurobiologist and head of the research laboratory for experimental ophthalmology on Wechloy Campus. She and Schrader are therefore investigating new options for reconstructing the ocular surface, for example the collagen gel used to treat the eighty-year-old patient, which was created at Mertsch and Schrader's previous workplace, the University Hospital Düsseldorf. "The mate-

rial is highly promising for research," emphasises Mertsch, explaining that like other types of connective tissue, the cornea consists primarily of collagen. But commercially available gels have a disadvantage in clinical practice: their viscous consistency means they can't be surgically attached to the eye. So the researchers decided to get creative and compressed the gel to remove its liquid content.

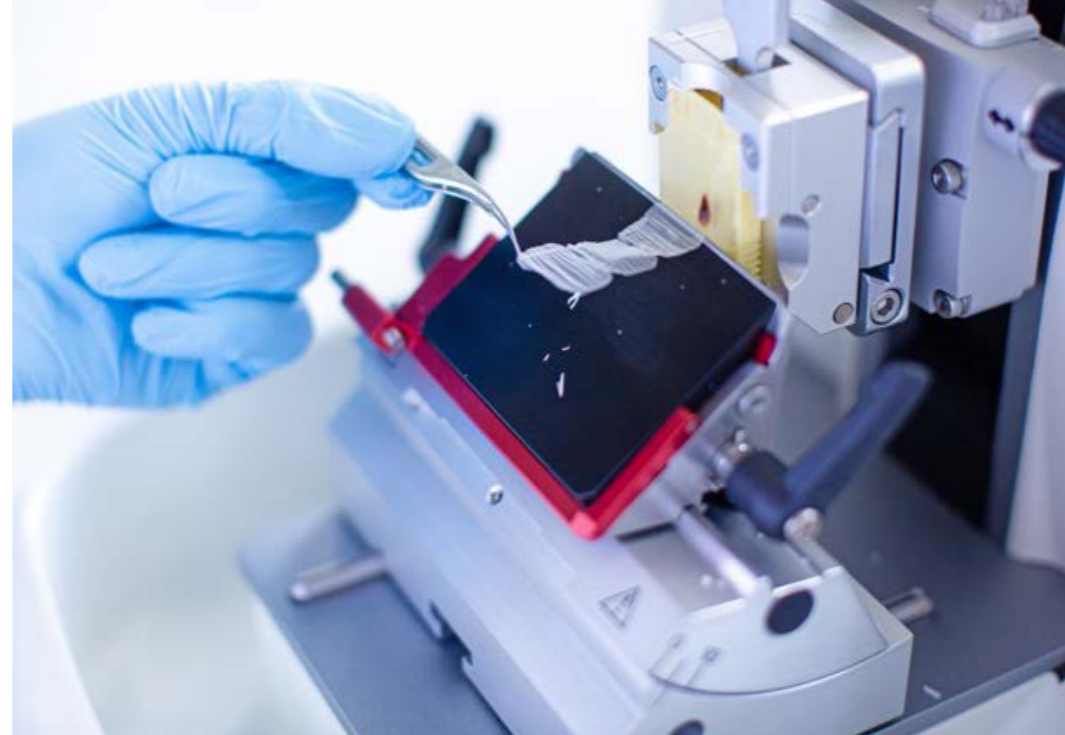
The experiment paid off: "It is indeed possible to sew this new biomaterial and use it as a transplant," Mertsch reports. Further tests followed in the lab – for example to find out more about the gel's elastic properties and biocompatibility. "We tested whether corneal cells degrade the gel, whether it is harmful for the cells, and whether they can proliferate on it," the neurobiologist explains. The researchers found no evidence of negative effects in their experiments. Since the collagen used to produce the gel had already been approved for human use in orthopaedics, there was nothing to prevent it from being used in ophthalmology. After the first successful treatment, Schrader now plans to carry out a clinical study in collaboration with the University Hospital Düsseldorf.

With the new laboratory for experimental ophthalmology on Wechloy Campus, Mertsch has already laid the foundations for this. Using state-of-the-art technology, the scientists are currently investigating various ways to improve ocular surface reconstruction. "We have everything we need here to produce new biomaterials and analyse their function and structure. We can also test the effects of drugs – all the way through to DNA and protein analysis," she says.

For example, Mertsch and her team are using a certain type of corneal cells, so-called fibroblasts, to produce replacement material for damaged corneas. Under certain conditions fibroblasts occur in the cornea, where they produce the collagen. For their experiments the eye researchers are using cells from donated corneas that are not suitable for transplantation. Schrader and



A piece of pig intestine serves as a scaffold for an artificial lacrimal gland. Active tear duct cells are already growing on it.



In the lab for experimental ophthalmology paraffin-embedded tissue samples can be sliced into razor-thin layers for examining the cells under the microscope.



Sonja Mertsch and Stefan Schrader are working on new biomaterials for the cornea. In the Wechloy lab they produce this artificial tissue, analyse its function and structure, and test drugs.

Mertsch have already developed a procedure that makes these cells grow into thin layers or “sheets”. The advantage of these so-called “cell sheets” is that they resemble natural corneal tissue much more closely than the biomaterials currently in use.

Unusually high numbers of nerve cells

After just three weeks the cell sheets are around forty micrometres thick, that is four hundredths of a millimetre, and after one year they grow to a thickness of approximately 150 micrometres. In the future, patients could potentially have their own fibroblasts removed to make tissue for corneal reconstruction. “This would minimise the risk of rejection,” Schrader says. Tests have produced positive results so far: the new material is extremely transparent, strong enough to withstand an operation, and corneal cells have no problem growing on it. The team’s current objective is to use growth factors – special molecules that stimulate cellular growth and proliferation – to reduce the time the tissue needs to reach the desired level of thickness to about three months.

Whether or not a transplant using artificial or donor tissue succeeds also depends on the nerve cells in the eye: “The cornea has an unusually high number of nerve cells,” Schrader explains. We only become aware of the functionality of these neurons when, say, we get a fly in our eye when cycling. We immediately feel a burning pain. The eyelid closes and lacrimal fluid shoots into the eye. “The nerve cells trigger a blinking reflex to keep the ocular surface intact. They also control secretion of the lacrimal glands and other glands which moisten the eye surface,” the researcher explains.

After a corneal transplant, the nerve cells grow into the new tissue again, but even twenty years later their numbers still won’t reach the original levels in many patients, Mertsch says. The problem here is the close interaction between nerve cells and corneal cells. If the nerve cells are not working properly, the cells on the surface of the cornea will atrophy. In the worst case they will die, and this can result in further damage to the eye surface. Herpes infections, laser operations on the cornea, brain tumours and diseases like diabetes or multiple sclerosis can also negatively impact nerve function to such a degree that the outer layer of

the cornea is damaged. “This is why we are trying to find drugs that stimulate nerve growth in the cornea,” Mertsch explains.

To do this the researchers need a proper model of the corneal tissue. After years of research the neurobiologist has succeeded in reproducing the tissue in the lab – using as a basis the collagen gel that gave such good results as a wound bandage. To this base all the main cell types from the various layers of the cornea are added. “We have combined all the individual components into a unified structure and this has given us a model of the cornea as a whole,” Mertsch says. The trickiest part was to get the nerve cells to grow in the lab. Using state-of-the-art molecular biological methods, the researchers are now studying which drugs influence nerve growth and which metabolic processes play a key role. They have already tracked down a number of interesting substances, the neurobiologist says.

To test the effectiveness of these substances the team is conducting various experiments, some of them on mice. Here the researchers operate the mice cornea just as they do for a human corneal transplant, and follow up with a four-week course of eye

drops. Through these tests they have identified an active substance that is particularly effective in stimulating regeneration in damaged nerves. “This substance has already been approved as a drug for another eye disease. This is a lucky break for us because it means we will soon be able to start performing patient studies,” Mertsch adds.

In the search for new treatment methods the scientists contemplate the entire ocular surface as a functional unit – including the eyelids, eyelashes and the lacrimal gland. “When one subsystem fails the entire unit is affected,” says Schrader. The lacrimal gland plays an important role here: if it doesn’t release enough fluid the eye surface dries out, sustains damage and can become inflamed. Ulcers form and vision is impaired. “Dry eye” is a very common condition and is caused by aging of tissues, autoimmune diseases and external factors such as long hours in front of the computer screen. The symptoms of dry eye can be treated using tear substitutes, so-called artificial tears. “But we are still unable to regenerate the damaged lacrimal gland. This means we lack curative treatment methods, or in other words the possibility to heal the disease,” Schrader emphasizes.

But here, too, the Oldenburg ophthalmologists have come up with some promising approaches.

Stem cells for the lacrimal gland

The researchers are using mesenchymal stem cells, for instance. These cells are found in the bone marrow or fatty tissue of human adults and, like embryonic stem cells, they can divide and transform into other cell types. Jana Dietrich, a doctoral student in the lab for experimental ophthalmology, has already shown in her doctoral thesis that these stem cells have a therapeutic effect on the damaged lacrimal gland in mice. To verify these results the researchers now plan to work with human mesenchymal stem cells. They are able to get these cells from a stem cell bank.

Alongside the work with stem cells, the researchers are trying to replace the lacrimal gland with artificial tissue, as they did with the cornea. As a scaffold for their experiments they are using sections of pig intestines from which all animal cells have been removed. The idea is to grow human cells on it in a special bioreactor. The researchers have already succeeded in delivering

a constant supply of nutrients to the constructs in the bioreactor under special cultivation conditions, similar to what takes place in the body via the blood vessels. This cultivation ensures that the lacrimal gland cells grow on the construct in several layers and are functionally active. “That was a major breakthrough,” Mertsch says. “The new tissue even produced a form of lacrimal fluid.” One challenge the researchers have yet to overcome, however, is the different conditions for growth which the many different types of cells of the lacrimal gland require.

But these are not the only reasons why an artificial organ is still a distant goal: porcine intestinal tissue is simply too large to provide a good basis for a human lacrimal gland. Moreover, an artificial gland would need to be connected to nerves that control tissue activity. “This is definitely a long-term project,” Mertsch emphasizes. But the researchers are optimistic. In their new laboratory she and Schrader have everything they need to work on their many research questions. And they are clearly focused on their objective: to help and maintain vision in patients for whom conventional corneal transplants are out of the question. (uk)

The grid is key

The green energy transition was launched in 2011: Germany will phase out nuclear power and gradually increase the renewables in its energy mix. But the country's power grid, which is more than a century old, is only partially equipped for this. An entirely new infrastructure of "smart grids" is needed. In an interview, energy informatics expert Sebastian Lehnhoff explains where the challenges lie



Sebastian Lehnhoff at a site where a neighbourhood based on a modern energy concept is to be built.

Mr Lehnhoff, is there any way to achieve the energy transition in Germany by 2050?

Lehnhoff: Technologically speaking, certainly. But we would be a lot closer to our goals if renewables were already better and more flexibly integrated into the energy market and the technical infrastructure today. By this I mean business models in the photovoltaics and wind energy sectors, for example, as well as comprehensive utilization and recycling processes for storage technologies. Then there's outdated network structures. These are all major challenges. So I have my doubts about whether we will reach the CO₂ targets by 2050.

Critics are worried that the energy transition could put too much pressure on Germany's power grid, which is more than a hundred years old. Do you share this concern?

Lehnhoff: We definitely have to make

changes. Up to now we've always been able to generate energy in a very controlled process using lignite, coal and gas. But as the percentage of renewables in the energy mix increases the situation is changing dramatically. Now, in addition to a handful of large, central power stations, there is a growing number of decentralised energy plants that feed energy into the grid only when the sun shines or the wind blows – but this input doesn't necessarily coincide with demand.

What problems does this create?

Lehnhoff: Well, take electric vehicles, which will continue to rise in number. We can assume that in the future every evening after the working day large numbers of these electric vehicles will head to charging points and stations to recharge. However, due to the lack of storage facilities, the energy from photovoltaic systems is no longer available at this time of the day. That leaves

wind energy. So let's say the wind is particularly strong at 2 a.m. – most of the electric vehicles need to be charged at precisely that moment since that's when larger amounts of wind energy are being fed into the grid.

So how can we tackle this?

Lehnhoff: Until we have adequate energy storage systems, the only solution is intelligent energy management, which – sticking with the example above – would ensure that not all electric vehicles are recharged at the same time, but in a step-by-step process, perhaps also on an alternating basis. All with the goal of adjusting consumption to the infeed of renewable energy into the grid without overloading it.

You are currently carrying out research into precisely this sort of 'smart grid'. What is the aim here?

Lehnhoff: Ultimately it's about cont-

rolling power supply and demand far more actively than has been the case until now, and in real time. The biggest challenge is to predict as accurately as possible how much energy from renewables can be fed into the grid and then tailor the supply to consumer needs. The grid itself plays a key role here. Operating equipment such as power lines, cables and transformers will have to be fitted with ultra-modern information and communications technology. This is the only way to coordinate interactions between individual components, from digital electric meters in homes and adjustable local grid transformers to prediction and monitoring systems in the control centres of network operators.

That sounds like a revolution. What challenges do you see here?

Lehnhoff: Above all one that has been underestimated so far: large power plants are connected to high-perfor-

mance transmission networks – redundant, fail-proof, highly automated and equipped with modern sensor technology. But the many small plants such as wind farms and solar panels are connected to entirely different areas of the grid – the lower voltage levels of the distribution networks. And it's here that the infrastructure is lacking. If we want the supply from renewables to be equally secure and reliable, many things will have to be reorganised.

What does that mean in practice?

Lehnhoff: In Germany approximately one thousand distribution network operators deliver electricity from the transmission network to individual households. Most of them are regional utilities, in many cases small municipal utilities. In the future these operators will share the responsibility for system security. However, the structures for this don't exist yet. For example, the digitalisation necessary for moni-

toring and coordinating all small-scale prosumers connected to the network has not yet taken place.

Does digitalisation entail risks as well?

Lehnhoff: Yes, and the dangers are embedded in the system. The smart grids of the future are highly complex structures, and this automatically and dramatically increases the risk of IT problems and cyberattacks. Digitalisation technologies require regular software updates – this we know from other fields. In addition, we will be dependent on automation through artificial intelligence. Compare this with the conventional and comparatively slow systems that are currently in use, a transformer for instance. These systems are typically in use for 60 to 70 years, with at most a little maintenance required every now and then, and then at some point they're scrapped. If you wanted to disrupt this system,



Germany's power grid is only partially prepared for the energy transition because renewable energy sources like sun and wind don't feed energy into the system consistently, like coal-fired or nuclear power plants do.

you would have to actually go to the transformer and disable it on site. Now we're merging this world with the digital world.

You're working on this in a project funded by the Federal Ministry for Economic Affairs and Energy. Can you tell us more about it?

Lehnhoff: We're building a so-called Smart Grid Cyber-Resilience Laboratory, or CyResLab for short. This lab will be a unique test environment for smart grid architectures where we can test emergency procedures. We want to develop security measures for dealing with IT errors in highly interconnected systems and preventing malicious attacks. We're also testing ways to rapidly identify and respond to such incidents during continuous operation.

So how close are we to having an intelligent power grid?

Lehnhoff: In northwest Germany we're already pretty close. This is mainly thanks to projects like eTelligence or ENERA, which are funded by the Ministry for Economic Affairs and Energy (BMWi) and the energy company EWE. We were and are involved in these projects as a university and also through the OFFIS Institute for Information Technology. The goal is to roll out a smart grid in the test regions of Aurich, Friesland, Wittmund and Emden. The-

se regions will basically get a hardware update: intelligent transformers that automatically compensate for voltage fluctuations in local networks or electricity storage units for intermediate storage of wind energy.

„We need to do a lot of re-organising.“

In another research project funded by the German Research Foundation (DFG) you're working on the so-called "black start". What is this about?

Lehnhoff: The black start is an unsolved problem in smart grids. It deals with how to restart the grid after a major power failure. Large power plants have a very old-school approach to this situation: a battery starts up a small diesel generator, which in turn starts a gas turbine. With smart grids the situation is far more complex: to get the grid operating again, you have to coordinate many different decentralised generators and consumers. For this you need modern information and communications technology that automatically measures, controls and regulates. But this technology itself needs electricity to operate. So where should the electricity go to first? This chicken-and-egg dilemma requires complex management and optimisation principles, which we are studying in this project.



Lehnhoff in front of the new grid control centre, which forms part of the "Smart Grid Cyber-Resilience Laboratory". It shows a computer-simulated urban distribution network with energy generation facilities, cables, transformers and other components.

In the coming years, you will have access to a unique test environment: Oldenburg is developing a new Smart City district with a modern energy concept on the site of a former military air base...

Lehnhoff: That's right, although energy is just one aspect – this project is also about traffic, administration and quality of life. It all began with a broad-scale strategy paper "Smart City Oldenburg – a People-Centred Approach" – which the city compiled together with representatives from academia, business and public administration. In the paper we examine which of the city's tasks should be digitalised, from visits to local authorities, energy distribution and supply services to waste management and urban planning. Once the plan had been drawn up and the city convinced of its merits, we began to set up a "Living Lab Smart City" at the old air base: a place for collaboration between academia and civil society where the focus is on learning from each other in an experimental environment. The core of the whole concept is a lighthouse project, the Energetic Neighbourhood District ("Energetische Nachbarschaftsquartier" - ENaQ), which is financed by the Ministry for Economic Affairs and Energy and the Ministry of Education and Research. In this project we and other partners are specifically working on the ener-

getic neighbourhood concept for this new district. There are currently only five other projects of this scale in all of Germany.

And how will the energy supply at the air base work?

Lehnhoff: The buildings will meet modern energy standards and will be connected to an intelligent power grid with a high-security smart-meter communications infrastructure – these are meters that can send and receive data. The plan is to also use this infrastructure for things like telemedical applications in future projects. There will also be modern cogeneration systems and various energy generators such as combined heat and power units, power-to-gas plants and solar photovoltaic systems. One energy source can be converted into another to cover overall

Profile

Sebastian Lehnhoff has been Professor for Energy Information Systems at the University of Oldenburg's Department of Computing Science since 2015. He is also director of the university's OFFIS Institute for Information Technology and Chairman Executive Board Energy. His team of around 80 researchers develops information and



Lehnhoff's Energy Informatics research group creates simulations of innovative energy systems using the "mosaik" software. The software was developed by the Oldenburg scientists and is now a standard tool in this area of research.

energy requirements as efficiently as possible. The main point here is that this won't be a sealed-off astronaut colony, based on concepts that can't be transferred to the real world. The idea is that the whole neighbourhood and the surrounding area will benefit from the project by copying solutions developed here. This is why technologies with standardised interfaces are very important.

How will the future residents be involved in the project when they start moving into the new district in 2021?

Lehnhoff: They will play an active part in the energy supply system by being able to buy cheap energy from each other and sell their own surpluses at any time. Residents will have access to the necessary information via a consumer platform. To make the

process easier we're taking a playful approach to the whole thing. We all know that people tend to compare their own performance with that of others. And if the neighbour's energy balance sheet looks better than their own, perhaps this will motivate them to make a bigger effort. We want to take a closer look at these social aspects too in the living lab.

How about your own "energy balance"? Do you already drive an electric vehicle?

Lehnhoff: In my private life I only use my bike nowadays, at least for getting around the city. It's not an electric bike though; I want to stay in shape. My wife and I are seriously considering buying a cargo bike – they're powered by an electric motor.

Interview: Volker Sandmann

communications technology-based concepts and prototype systems for the energy sector. His research focuses on intelligent energy systems, also known as smart grids. The goal is to develop energy-efficient, green, cost-effective and secure power supply systems. His research interests include real-time

operation for safety-critical applications in electric energy systems and co-simulation of complex energy systems. He is the coordinator of the "Future Lab Energy" and board member of the Centre for Digital Innovations Lower Saxony (Zentrum für digitale Innovationen Niedersachsen).

Understanding the wind



The rotor blades in wind farms turn majestically and seemingly at a constant speed in the airflow – here in a wind park near Emden. But the installation's output can double or halve within seconds.

Every year, Germany produces more energy using wind turbines. This development poses many challenges – from selecting the right materials to ensuring the stability of electrical grids. The conversion of atmospheric kinetic energy into electricity begins with the wind, a constantly fluctuating energy source. At the University of Oldenburg's ForWind Centre for Wind Energy Research, scientists are working intensively to gain a better understanding of the continuously changing air flow

The eternal wanderer, the dragon with a thousand tails, the swirling dancer: the dynamic nature and power of the wind has inspired many pretty metaphors over time. But what makes atmospheric air flow so fascinating to poets is an on-going problem for physicists and meteorologists: the motion of air in the first 200 metres above the ground is so variable that it is virtually impossible to predict it using equations, approximations and model calculations.

"The physics of wind as an energy source still hasn't been adequately researched," says Prof. Dr. Joachim Peinke, a turbulence researcher at the University of Oldenburg's ForWind Center for Wind Energy Research. Although equations that describe the behaviour of the atmosphere's air flow exist, even the world's most high-performance computers can't solve them accurately. The turbulent boundary layer close to

the ground is simply too chaotic: wind speeds vary not just over days, months and years, but within minutes and seconds. A gentle breeze can be followed by a sudden squall which then subsides as quickly as it came. Some air vortexes are as large as continents, others as small as a mosquito. Obstacles such as mountains, forests and buildings change air flow in unpredictable ways.

This volatility poses a major challenge for the green energy transition. In 2018 wind was the second most important resource in the German power mix after lignite, providing 20 percent of the country's electricity. But it is far more difficult to plan electricity generation from wind energy than from fossil fuels. "In the quest to make optimum use of wind as an energy source we face various constraints" says Peinke.

The scientists at ForWind are working to improve their knowledge of the wind in order to make wind-based electricity generation more reliable

and plannable. Peinke, a renowned turbulence researcher, is among these scientists. He and his research group Turbulence, Wind Energy and Stochastic (TWIST) are trying to decipher the properties of the wind using complex mathematical methods. In addition, a team of energy meteorologists led by Dr. Detlev Heinemann measures and predicts wind flow at wind farms and across larger areas.

An atlas for wind power

Wind resource assessment plays a key role in the planning of wind farms. Until now project developers have had to rely on data from the 1980s that produced viable results only for flattish terrain like northern Germany. In the kind of hilly or mountainous terrain where a growing number of new wind farms are now being built this model has failed. This means that until now there has

been no way to reliably predict the energy yield of wind farms located outside flat terrain. Again and again, wind farm operators have ended up in financial difficulties due to planning errors. "If you make a rough calculation of the yields and the average wind speed differs from the estimate by just 0.2 metres per second, it can cost a large wind farm with 50 turbines up to five million euros – per year!" Heinemann explains.

Since June 2019, however, planners have had access to better data: the New European Wind Atlas (NEWA) now provides accurate information on wind strength at any location within the European Union as well as the North and Baltic Seas in the last thirty years. Heinemann and his colleague Dr. Björn Witha were key participants in this international project, which had a budget of approximately 13 million euros. "Our goal was to provide detailed, long-term data about the wind climate across Europe," says Witha.



Joachim Peinke (here in front of the active grid in the large wind tunnel of ForWind) uses statistical methodology to research the qualities of the wind.

Launched in 2015 and led by the Technical University of Denmark in Roskilde, around thirty institutions from eight countries participated in the mammoth project. The objective was to create a virtual grid with a three-kilometre grid spacing that spanned the entire continent, and to generate complete time-series wind datasets for the last 30 years at each node. Users would, for example, be able to call up data on the average wind speed, maximum wind speed or temperature for any given day – for heights between ten and 500 metres above ground and 30-minute intervals. For an even tighter network with a grid spacing of 50 metres, the goal was to provide at least statistical data on variables such as the frequency of specific wind speeds and directions.

The researchers had to make all these calculations on their own. They did this using a computer model commonly used for weather forecasting into which they fed the relevant weather data to determine the values at the nodes. “We couldn’t just press a button and start calculating; we had to do extensive preparatory work,” says Witha, who was largely responsible for designing and coordinating the tests. The team tested different versions of the model to determine the optimum

configuration. The researchers also examined how the selection of different physical parameters affected the results and compared the results with measurements made during four measurement campaigns conducted specifically for the project at several test sites.

Most of the preparatory model calculations were performed on the University of Oldenburg’s high-performance computing cluster, which has specifically been made available for wind energy research. For the simulations which ultimately provided the data for the Wind Atlas, the team resorted to the even greater computing capacity of the Mare Nostrum supercomputer at the University of Barcelona. Even so, the calculations took more than half a year – a standard PC would have needed around 1,600 years to complete this task.

The Wind Atlas’s new website now offers free access to interactive maps, time-series and wind-speed statistics, and other relevant parameters for wind power. “The scope and resolution of NEWA are unique,” Witha says. After publication the data quickly started generating a lot of attention, he adds. There are many interesting things to discover – for example that the wind blows less in cities like Oldenburg than

in the surrounding area, that the Brocken in the Harz mountain range is the windiest location on the German mainland, and that there is almost no wind at all in the Po Valley in northern Italy. Consulting engineers can use the website to gather all the data they need to plan a wind farm. And government authorities, farmers and water sports enthusiasts also benefit from the information it provides.

Information for farmers and authorities

As well as large-scale flow patterns and long-term average values, small-scale air turbulences also play an important role for wind power. “Wind structures of just one metre in size determine which local forces act on a wind turbine,” turbulence researcher Peinke explains. An airplane taking off in a heavy storm encounters the turbulent layer of air close to the ground only during take-off and landing, while for the rest of the flight wind currents will generally be calm. “But for wind turbines, turbulence is a permanent state,” says the researcher. This places tough demands on materials – especially as wind turbines have grown dramatically in recent decades. Whereas back



Energy meteorologists Björn Witha (l.) and Detlev Heinemann characterise the wind using weather research methodologies.

in the 1980s rotor blades were typically just seven to eight metres long, today they are around eighty metres long, surpassing the wingspan of an A380 aircraft. To keep weight down, many components are designed to function at the limits of their capacity. “If rotors were still made out of metal, as they were in the 1980s, they would break under their own weight,” says Peinke.

Manufacturers use turbulence models to calculate the forces a turbine must withstand. But small-scale turbulences in particular are difficult to predict. “There are so many local fluctuations in the wind that surprises are not rare,” says Peinke. To learn more about the mysteries of turbulence he and his colleagues use complex mathematical methods to study, for example, how best to characterize small-scale fluctuations, or whether properties exist that are common to all turbulent flows. Here they look into questions such as how much small-scale turbulences depend on the structure of the large-scale flow from which they emerge, or whether details such as the duration or stability of a wind gust depend on environmental conditions.

Peinke’s research group also carries out experiments in the ForWind Research Center’s purpose-built, 30-me-

tre wind tunnel. Inside the tunnel a one-of-a-kind grid with almost a thousand movable, diamond-shaped aluminium blades creates natural wind fields, including large and small turbulences. “The great thing about the wind tunnel is that, unlike in nature, we can repeat certain turbulence patterns to see what impact they have on model systems,” explains Dr. Michael Hölling, a colleague of Peinke who is responsible for the wind tunnel.

Statistics offers another possibility for analysing the properties of flow patterns. Peinke and his research group study physical parameters such as turbulence intensity in air flows and wind speed distribution in order to deduce general rules. In a scientific publication from 2012, the team demonstrated that a special statistical principle applies for wind gusts: extreme fluctuations in wind speed occur far more frequently than the statistics currently used by industry suggest, meaning that in some cases the frequency of extreme events is drastically underestimated. “An extreme event that – according to the Gaussian statistics applied to date should only occur once every 1,250 years – actually occurs once every hour,” Peinke explains. The scientists were also able to establish that this property of the wind, known as intermittency,

is present at all stages of the process of converting wind energy into electricity, from the forces acting on the turbine to the electricity generation process. By comparing measurement data the team established that all these variables fluctuate just as much as wind speeds do. “For example the amount of power generated by a wind turbine can increase or decrease by fifty percent within seconds,” Peinke explains.

Fluctuations in the power grid

Gusts of wind and whirlwinds that occur locally without affecting all the turbines in a wind farm or a larger area still have an impact on the power grid as a whole – and in particular on the grid frequency, as a team led by Peinke and his PhD student Hauke Hähne demonstrated in a paper published in 2018 in the science journal *Europhysics Letters*. The researchers studied the oscillations of the AC voltage in the regional power grid over a period of four-and-a-half months. “The mains frequency indicates the current ratio of electricity production to consumption, and is thus a stability parameter,” explains Peinke. If several megawatts of wind power are suddenly fed into the

grid without consumption rising at the same time, the frequency changes. If it deviates too much from the desired value - 50 hertz, or 50 oscillations per second - within a few seconds a control mechanism intervenes to ensure that the power grid remains stable. Minor fluctuations are automatically compensated for by rotational inertia in large power stations.

To find out how gusts of wind and other turbulences affect this interaction, the team made 10,000 measurements per second of the frequency, allowing the researchers to record fluctuations on very small timescales. Their analysis showed that the phenomenon of intermittency is also present in the grid frequency: its fluctuations obey a statistical law similar to that which governs wind speed distribution, with relatively large fluctuations occurring far more frequently than expected. The researchers also discovered that the more wind energy was fed into the grid within a given period, the more frequently strong fluctuations in frequency occurred. "This suggests that the fluctuations in wind power caused the fluctuations in frequency," says Peinke. The documented frequency fluctuations were so small that they

didn't pose a threat to the power grid. But in the future, if the proportion of renewable energies in electricity generation increases, the fluctuations could increase. The observed probability distribution can help scientists to correctly identify risks and develop control strategies, Peinke explains. "It's essential to have a precise knowledge of the fluctuations in order to be able to correctly assess the probability of large, potentially critical fluctuations."

Solar energy is even more disruptive for the power grid than wind energy: "On days when the sky is alternately cloudless and cloudy, solar power systems switch on and off repeatedly within very short periods," says Peinke. Such episodes are particularly likely to destabilise smaller subnetworks, which are expected to multiply as the energy transition advances. In 2017, a team of ForWind turbulence research and energy meteorology scientists working in collaboration with electrical engineers from the Clausthal University of Technology published a study in the science journal *Solar Energy*. It provides a mathematical description of the erratic nature of solar energy. In their paper the researchers present a method for deriving para-

meters directly from a measured time series that describe the stochastic - i.e. random - properties of solar power. Network operators could potentially use these parameters to develop an algorithm to filter out and suppress dramatic fluctuations. Batteries, capacitors and inverters with just a few percent of the installed capacity can be used to stabilise microgrids, including those running on a high proportion of renewable energies, Peinke points out.

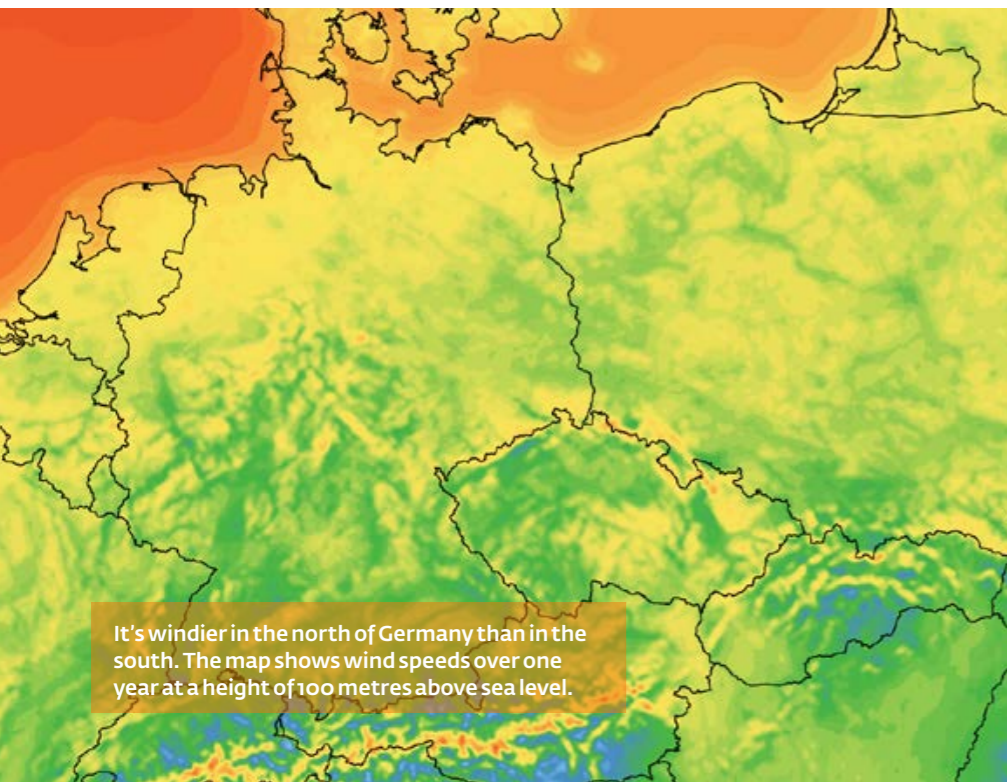
Word is now spreading in the wind energy sector that the complex challenges of wind energy can be tackled using statistics and turbulence research. Peinke is currently preparing a project for monitoring the condition of wind turbines using statistical data analysis. "We want to develop a kind of wind turbine doctor," says Dr. Matthias Wächter, who runs the project. Each wind turbine contains hundreds of sensors that monitor numerous parameters, from the oil level of the generator to the bending moment of the rotors. "Because the turbines wobble constantly, the data is very noisy and so far hardly anyone has been able to do anything with it," explains Peinke. He and his team now want to work with computer scientists to evaluate and analyse these mountains of data using big data technologies. They aim to extract information from the noise such as whether everything is running smoothly or whether certain components of a system, for instance the motors, are showing signs of fatigue and need replacing.

Particularly in the case of offshore turbines, which are difficult to access, it would be useful to be able to better plan maintenance work so that it can be carried out when the wind is low. "The costs for outages and maintenance work account for a significant proportion of wind energy costs," stresses Peinke. "To reduce these costs, it will be necessary not only to increase the efficiency of wind turbines, but to understand them better - so that they can operate maintenance-free even in turbulent times." (uk)

EINBLICKE 2019/20

The energy calculator

Germany wants to make the transition to an environmentally-friendly energy supply. But the shift to a sustainable system also calls for drastic economic policy measures, for instance the introduction of a carbon pricing. Energy management expert Christoph Böhringer uses sophisticated mathematical models to study the impact of such measures. His work is producing interesting insights which, among other things, have the potential to make the discussion about the future energy supply more concrete and objective



It's windier in the north of Germany than in the south. The map shows wind speeds over one year at a height of 100 metres above sea level.



You don't have to study business and economics from the outset to become a professor of economic policy. "As a student I was more interested in engineering and IT – I only attended the introductory lectures for economic and business studies," says Christoph Böhringer. But as a student of industrial engineering at the University of Karlsruhe, Böhringer also learned the basics of applied economic policy analysis using computer-aided simulation models.

The economic world in a model

Mathematical model calculations and simulations are still the focus of his research today. Böhringer and his colleagues at the department of economic policy are currently using these methods to quantify the impact on businesses and consumers of economic policy interventions such as carbon pricing or phasing out coal. But the simulation analyses are not restricted to energy and climate policy measures. They also cover other areas of economic policy such as trading and taxation policy – a current example is the analysis of the trade conflict between the US and China.

The core of his research may sound abstract but it has real political implications: "What I do is commonly described as 'numerical simulation'," Böhringer says. It allows him to apply textbook scenarios to real economies to simulate the effects of specific economic policy interventions on prices, as well as on the supply and demand behaviour of consumers, trade or industry. He is currently studying the potential impact of the German state's carbon pricing policy, which entails charging industrial companies or private individuals for the climate-damaging carbon emissions they produce through their consumption of gas, coal and oil. The payer might be a company that uses electricity which is partially pro-

duced by coal, or a private individual who heats their home with natural gas or consumes kerosene through air travel. Carbon pricing is meant to raise awareness among consumers of the cost of the environmental damage they cause and encourage them to adopt more environmentally friendly behaviour.

"With the climate package it passed in September, the German government plans to introduce carbon pricing in the agricultural, transportation and building sectors, which are currently not covered by the European Emissions Trading System. However, the envisaged price plan for CO₂ for the next ten years is set too low to achieve the ambitious national targets by 2030," Böhringer says. In his eyes, achieving socio-political acceptance of higher carbon prices will require a climate policy that is socially compatible. However, critics warn that high CO₂ prices would be unfair and immoral as they would place a bigger burden on people with lower incomes than on the wealthy. For high earners, a tax on petrol, oil, electricity or air travel would be less painful than for those who have to count every penny.

Revenues are to be redistributed among the population

The topic is being hashed over again and again on talk shows. Böhringer prefers to let the facts speak for themselves. Using his model-based calculations, he has come up with a tax model that would be less hard on the poor. "The task is to reduce the regressive impact of higher carbon pricing, in other words to diminish the effect whereby lower income earners who have comparatively high energy costs are hardest hit." This can be achieved with a CO₂ tax reform in which part of the revenue generated by higher carbon pricing is paid back to households in a lump sum: a fixed sum would be reimbursed per capita, and this rebate would be more substantial

relative to income for those with lower incomes compared to those with higher incomes. This would reduce or even cancel out the regressive impact of higher carbon prices without detracting from the steering effect of carbon pricing in terms of cutting carbon consumption.

People must pay for producing emissions

Greenhouse gas emissions need to be cut drastically if we are to avoid a climate catastrophe. This means there is no alternative to considerably increasing the prices for industrial activities that are harmful to the environment. According to Böhringer, however, it is essential that CO₂ is reduced in the most obvious areas of consumption – for example heating oil or petrol – and that measures are taken to cushion the impact on low earners. The CO₂ tax reform outlined above would ensure precisely that.

For Böhringer, designing a sustainable energy sector has always been an important topic. In his dissertation he programmed a database for the Mannheimer Versorgungs- und Verkehrsgesellschaft, one of Germany's leading energy suppliers, with which the district heating network can be coordinated for increased energy-efficiency. After completing his Diplom degree in Karlsruhe, Böhringer moved to the Institute for Energy Economics and Rational Energy Use at the University of Stuttgart in the early 1990s to do his PhD, and wrote his thesis on CO₂ taxes and coal phase-out.

Well positioned in the green energy sector

He notes that what influenced him most during his doctoral studies was a study year abroad at the University of Colorado Boulder under Professor Thomas F. Rutherford. "Rutherford is known around the world as the pope of numerical equilibrium

analysis. I learned so much from him and we continue to collaborate in the field of applied economic research." Böhringer's expertise in numerical simulation analyses for economic policy proved to be the ticket to his later career. After his PhD, he moved to Mannheim and the Leibniz Centre for European Economic Research (ZEW), where he was made head of the "Environmental and Resource Economics, Environmental Management" Research Department. In 2004, he was given tenure at the University of Heidelberg, before finally transferring to Oldenburg in 2007. "The economics department is small here, but its reputation is impressive. And Oldenburg has always been particularly well positioned in environmental economics." Since 2012, Böhringer has been a member of the "Commission of Experts for Research

and Innovation" (EFI) – a think tank established by Angela Merkel in 2008 to advise the government on key questions relating to research and innovation policy.

Carbon dioxide will continue to be the focus of his work in the future. Böhringer is currently coordinating the project "Carbon Pricing after Paris" together with the Kiel Institute for the World Economy and Stanford University. The project brings together renowned research teams from various continents to work out how to achieve the greenhouse gas reduction targets agreed at the UN Climate Change Conference in Paris through coordinated and appropriate carbon dioxide pricing. As with other global challenges, the key to solving the greenhouse gas problem lies in close international collaboration. (ts)



Christoph Böhringer, Professor of Economic Policy at the University of Oldenburg, has been a leading economic policy researcher in the German-speaking world for many years.

Infobox

Carbon pricing: the German government's plans

The centrepiece of the German government's climate protection programme is "carbon pricing for transport and heating" from 2021. Under the EU's Emissions Trading System, carbon pricing already applies for the energy sector and for energy-intensive industries, but in Germany it will also apply in the transport and building sectors. The German government plans to reinvest the revenues in climate protection measures or pass them on to the public in a form that has yet to be specified.

The national emissions trading system (nationale Emissionshandelsystem – nEHS) will be launched in 2021 on the basis of a fixed-price system, meaning that the per tonne price of CO₂ will be fixed and set by the state. Certificates will be sold to companies that trade in heating or motor fuels. Thus companies producing heating oil, liquid gas, natural gas, petrol or diesel will need to purchase a certificate – allowing them to cause pollution – for each tonne of CO₂ that these fuels produce when consumed.

The fixed price will start out at ten euros per tonne and increase to 35 euros per tonne of CO₂ by 2025. From 2026 onwards, the price will reflect the market price provided it lies somewhere between the stipulated minimum and maximum price. According to the German government, the total amount of certificates issued across Germany will then generate enough funds to meet the requirements for achieving German and European climate targets.

Source: The homepage of the German government (current as of: 30 October 2019)

Power to the people



Reforming the energy system requires not just technical expertise, but also knowledge of the social structures and processes that support the transition. This is where Oldenburg researchers from various disciplines are giving their input and showing the way forward. They investigate factors such as how the parties involved in the energy transition build mutual trust, and how communities can find ways to cover their own energy demands with local initiatives

An idyllic country village: lonely country roads lined with gnarled trees, cornfields stretching all the way to the horizon, rare birds rendezvousing on the forest edge. Here, where there is so much space for nature and humans, a wind farm is to be built. But among the villagers, recent arrivals and long-time residents alike, a row breaks out: What about protecting the birds? Who benefits from the new wind turbines? And where should they be erected?

Wind energy is only the backdrop for Juli Zeh's socio-critical novel "Unterleuten". But the old and new disputes that flare up between the inhabitants of a fictitious village in Brandenburg illustrate how producing green electricity to support the "Energiewende" (energy transition) raises not just technical questions, but also human ones. "The energy transition is a social process," says Prof. Dr. Jannika Mattes.

The Danish municipality of Ringkøbing-Skjern, partner in the EU-funded project COBEN, has set itself the goal of covering all its energy needs with renewables by 2020. In addition to wind, of which there is no shortage here, it uses solar energy for heating water for example.

"And social processes are complicated." Mattes, a social scientist and Professor of Organisation and Innovation at the University of Oldenburg, knows what she's talking about. In the junior research group REENEA, which is funded by the German Research Foundation (DFG), she is studying the social background of the energy transition on the basis of regional case studies. Although the restructuring of Germany's energy system is the subject of continual public debate, little is known about the role of the individual parties involved, she explains. And little is known about which factors advance or hinder it. Mattes and her team of three researchers aim to fill this knowledge gap.

Mattes is focussing on the wind energy sector as a case study for her research. The German government wants 60 percent of the electricity consumed in Germany to come from renewable energy sources by 2030. Currently, wind power accounts for just under 18 percent of the country's gross elec-

tricity consumption. There are more than 29,000 land-based turbines in Germany, almost a third of which are in Lower Saxony, along with a growing number of offshore farms. But even though the proportion of wind power in Germany's energy mix has grown steadily since 1987, when the first wind farm was built in Schleswig-Holstein, land-based expansion is now slowing down – for very diverse reasons.

Providing subsidies on a random basis doesn't work

One of them is that energy policy has changed significantly since the amendment of the Renewable Energy Sources Act (EEG). Among other things fixed subsidy rates were abolished, affecting remuneration for electricity fed into the grid. "This has upset many companies and left investors feeling abandoned," says Mattes. Then there's

the fact that public opposition to green expansion measures is growing – for example when they interfere with nature conservation, or when citizens feel their own concerns are being ignored. "Most people accept that the green energy transition is necessary," the social scientist stresses, "but they don't want the expansion to take place on their own doorstep."

Mattes experiences this first-hand in her research: she and her team are laboriously interviewing people who are directly affected by the restructuring of the energy system – from turbine manufacturers, service providers and planners to political decision-makers, conservationists and members of the general public. The researchers also comb through documents and attend public discussions. Yet the massive problems with acceptance are just one aspect they are encountering.

"We're interested in the roles the affected parties see themselves in, the knowhow they can contribute, the fac-

tors that influence their decisions, and the power structures in place,” Mattes explains. To do full justice to the complexity of the issue, the individual case studies go deep. The team has conducted more than thirty one-to-two-hour interviews based on a common interview guideline in the Oldenburg area alone. The researchers then evaluate the interviews and documents, assigning them to different categories in or-

der to identify overarching themes and similarities as well as contradictions. “We’re conducting standard empirical social research,” says Mattes.

Although not all the case studies have been completed yet – Mattes’ team is studying the energy transition in five other regions in addition to Oldenburg, including the Uckermark, North Frisia and Hamburg – she has already arrived at certain conclusi-

ons. The results show that the social dimensions of the energy transition vary from region to region and that requirements also vary. In rural areas like the Uckermark in Brandenburg there is a complete lack of infrastructure, for instance institutions or formal networks that could support the transition and ultimately implement the necessary changes. In Oldenburg, by contrast, wind energy has high priority and numerous companies, most of them connected to the university, have been established over the years. Here, both official and personal networks facilitate dialogue among the various parties involved in the process.

For Mattes, these initial findings – as predictable as some of them may be – contain an “important message to policy-makers”: namely that providing subsidies on a random basis doesn’t work because it fails to address specific needs. She also draws another important conclusion: a region will be more receptive to the energy transition if the necessary processes have grown over time and the parties involved trust each other. “In such cases wind energy is not perceived as a burden but forms part of the self-image of a region that supplies itself and others with electricity,” says the social scientist.

Christian Busse, Professor of Sustainable Production Management at Oldenburg University, and his colleague Julien Minnemann are also well aware that trust is a key aspect in the energy transition – and that the people involved at the local level play a fundamental role. “The debate about the energy transition is highly emotional and politicised,” says Busse. In addition, the global discussion of the topic is inevitably followed by action at a predominantly local level, Minnemann points out. But to be able to implement the energy transition locally it is vital to secure acceptance among the public. This requires a basis of trust between members of the public on the one hand and the implementing agents, such as energy suppliers, on the other, Busse stresses.

In a project funded by the state of Lower

Saxony, the researchers are therefore focussing on municipal utilities that take this aspect of the transition into account. “As local, municipally-run energy suppliers, these utilities are in direct contact with their customers. This makes them important partners for implementing the energy transition at the local level,” Busse explains. “And in most cases their customers trust them.”

In nine case studies planned for the next three years, the researchers aim to learn how municipal utilities are rethinking and revising their existing business models and strategies to meet the economic challenges of the energy transition. In this way the researchers hope to integrate the utilities – as important agents of the transition – into the vital dialogue between the public and the politicians, thus paving the way for greater acceptance.

Dr. Thomas Klenke and Gerard McGovern, two scientists at the university’s Centre for Environment and Sustainability Research (COAST), are also involved in initiatives aimed at encouraging communities to assume responsibility in the energy transition. They are leading the COBEN project, which is supported by the European Regional Development Fund. The project focusses on concrete approaches that enable local players to actively shape the energy transition. A major challenge is to embed climate protection in communities by creating new energy infrastructures while at the same time combining this with other local development goals. “We want to enable communities to generate and consume energy independently and set up efficient structures to do so – from energy sources to energy generation and marketing,” says Klenke.

Communities themselves become drivers of the energy transition

By setting up local energy initiatives, the six regions participating in the project in Germany, the Netherlands,

Belgium, Scotland and Denmark are pioneering a transition that has only just begun at the European level. “Civic energy” is the name of this approach, for which the European Commission paved the way in May 2019 with its latest decisions on the legislative package “Clean Energy for all Europeans”. Under the new legislation, energy producers and consumers will no longer have to follow the specifications of major power grid operators. Instead, they will be able to generate, store and distribute electricity and thermal energy independently. This has not been possible until now, for legal as well as other reasons. “Civic energy thus offers a genuine alternative to the traditional, centralised energy supply network,” McGovern, the project coordinator, explains. “That’s pretty revolutionary.”

This brings the scientists in the COBEN project closer to one of their goals, which is to ensure that ultimately communities and the people who live in them benefit from the results of the energy transition. The idea is that the added value and thus the financial revenues remain within the community. “But that’s easier said than done,” says McGovern. So the participants in the six pilot regions first of all work out the requirements of each community: How much heat or electricity do they need? What about mobility? What are the potential energy sources? And what are the advantages for communities of setting up their own value-creation cycles for energy?

“What’s special about this is that we are combining the energy transition with other goals in community development,” says Klenke. “But the focus is always on the people”. The Danish municipality of Ringkøbing-Skjern, for example, has set itself the goal of covering all its energy needs from renewable sources by 2020. The advantage in this windy region is that wind power already generates more electricity for the community than its companies and residents actually need. “The Danish partners are now looking at how they can use this surplus to secure further

advantages for rural structures,” McGovern explains – for example a new local transport system that is not dependent on fossil fuels.

This example shows how the entire community can benefit from the goals of the project, says Klenke. “The advantage is that communities themselves become the drivers of the energy transition.” The task of the Oldenburg scientists is to draw general conclusions from the six regional initiatives. To do this they outline the various processes that are necessary to implement the structural changes for paving the way to climate-friendly communities. This will gradually result in a roadmap for civic energy. In addition, the researchers will summarise their findings from the case studies in twelve different business models with the aim of encouraging other regions to follow suit. “The most important aspect in this process is that communities or regions clearly define their social, societal and environmental development targets from the beginning,” McGovern emphasises.

Ultimately, COBEN aims to put the energy supply process back into the hands of communities – independently of the control of big energy companies and network operators, the researchers explain. Naturally there are still technical challenges ahead, such as the creation of local networks, Klenke stresses. He points out that new decentralised structures could take over tasks of centralised systems, for example. The idea of producing and distributing electricity in new ways also has to be financially attractive, he adds. But the work has begun: “As a project partnership we are quite proud that the positive interim results of our project have been incorporated into the amended EU resolution,” he says. Now the EU member states must implement the new directives into national law. Klenke and McGovern hope that the concept of civic energy will not be watered down in the process, so that efficient, community-run civic energy systems can become a reality. (cb)



Most people accept that the green energy transition is necessary. But frequently controversies arise when the expansion takes place on their own doorstep.

Microbes under the microscope

What tools do bacteria in the sea or in soil use to break down organic pollutants? This is the type of question the research group General and Molecular Microbiology led by Ralf Rabus addresses. The scientists are studying the proteome – the entire set of proteins present in a cell – to gain a better understanding of how certain microbes function. A journey from tiny to even tinier

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1 Bacteria are no more than a few thousands of a millimetre in size. Yet these tiny cells can do all the things larger organisms do – for example breathe, take up and use nutrients, and excrete metabolic waste.

2 At least a thousand different proteins bring bacteria to life – here in the image they have been separated and appear as fluorescent dots on a separating gel. The green-coloured protein spots are produced in larger amounts by the cells under the conditions studied.

3 The bacteria that the researchers are interested in live in the sea, in oxygen depleted zones of the seabed or in the soil. Lab technician Christina Hinrichs presents two samples from the Janssand sandbank near Spiekeroog.

EINBLICKE 2019/20

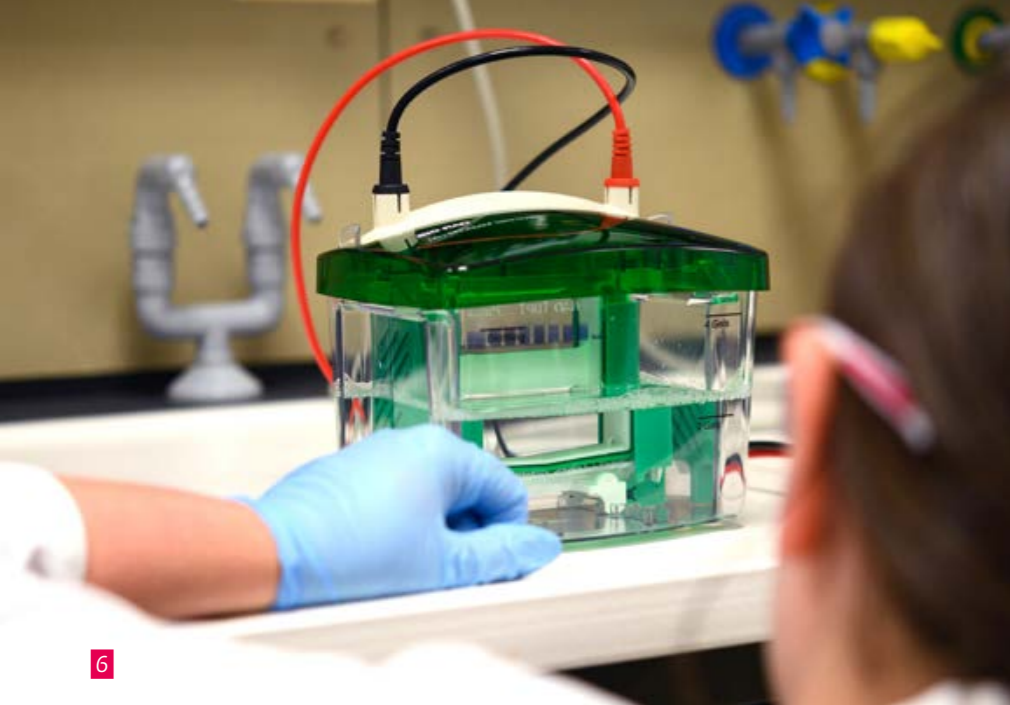
4 Many bacteria are difficult to culture in the lab, in particular those that naturally live in oxygen-free conditions. The researchers have to heat special syringes in order to treat culture vials with nitrogen under sterile conditions. This allows the bacteria to grow without oxygen in the laboratory.

5 The bacteria grow under controlled conditions in the stainless steel bioreactor. Feeding them specific substances makes it possible to determine which proteins are used in biodegradation processes. Microbiologist Dr. Daniel Wunsch checks how much cell mass has formed. The number of newly isolated environmental bacteria generally doubles within a few hours or days.

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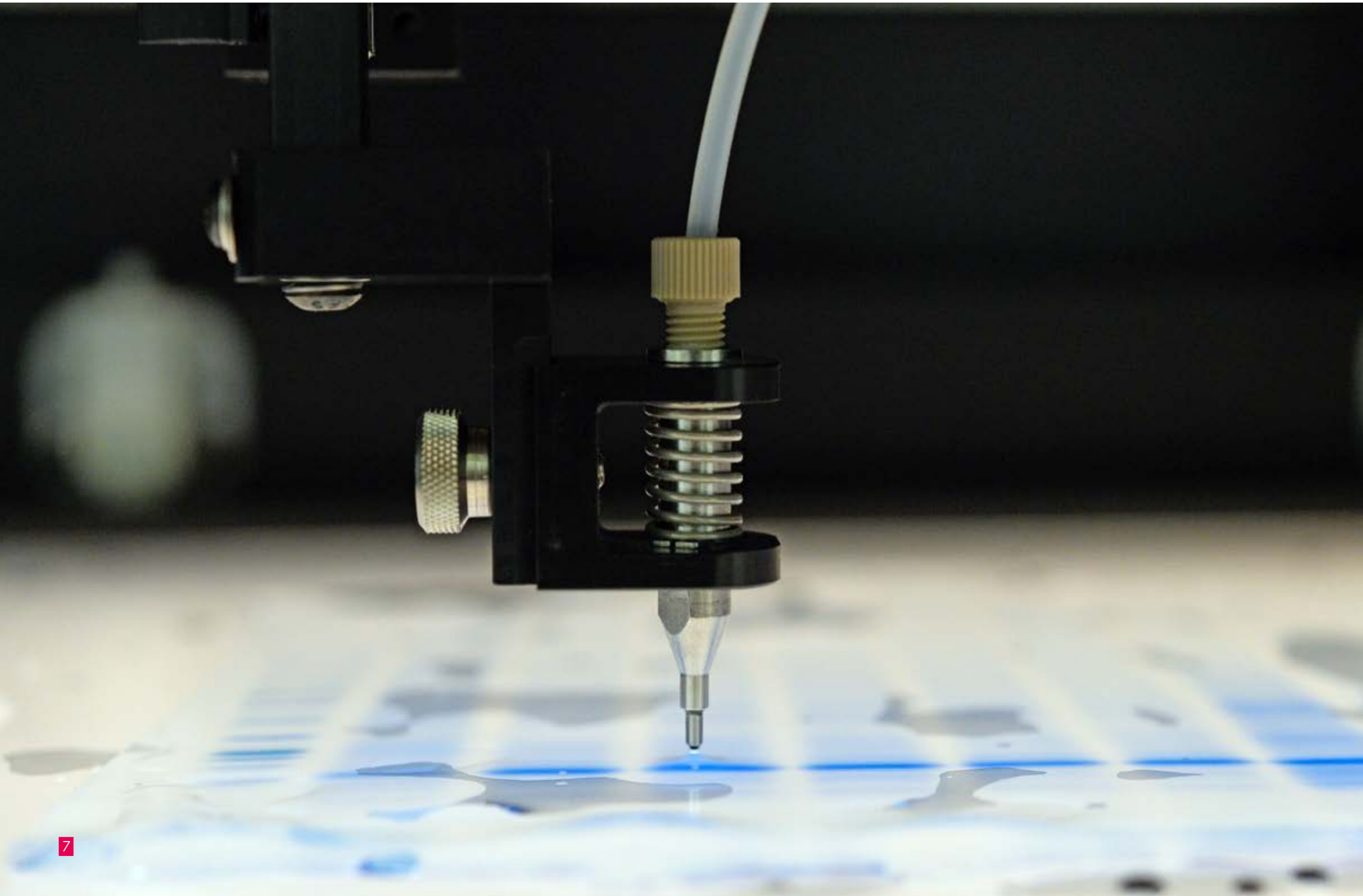
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6 A few steps later, the researchers have isolated the proteins from the cells. The resulting liquid contains one to two thousand different proteins from the cultured cells. The process of gel electrophoresis separates the proteins using an electric field. Within two to three hours the protein molecules that have been dyed blue have moved towards the positive electrode within the gel. This produces thin blue bands with proteins of similar size and charge.

7 Large image: A separating gel formed using this method, is placed on the light table. A robot arm cuts pinhead-sized pieces from the gel before inserting the individual pieces into the indentations of a microtiter plate – a plastic tray with multiple “wells” used as small test tubes. Each of these gel pieces can contain from just a few to more than hundred proteins.

8 In order to sort the proteins even more precisely, the Oldenburg microbiologists use a nano ultrahigh-performance liquid chromatography system. The pre-sorted proteins are cut up very precisely using molecular scissors, then dissolved in a liquid and passed through miniature columns under high pressure. The chromatograph slowly releases tiny droplets containing the fragments of just a few proteins.

9 The final step on the path to deciphering the proteome is the mass spectrometer in the research group’s lab. Once inside, the protein fragments are vaporized, electrically charged and accelerated into a vacuum pipe. The large molecules fly slowly through the pipe, the smaller ones more quickly. This allows the device to calculate the mass of the separated fragments with such precision that each individual protein can be identified.



A range of perspectives is needed to understand the linguistic challenges in the classroom, Juliana Goschler and Martin Butler say.

Language-sensitive teaching and learning

Language plays a central role in schools as a medium for communication and education. Multilingual pupils are generally taught in single-language lessons, and expectations relating to subject-specific language come up against everyday language. Oldenburg researchers are examining the complexities of language and its usage in classroom learning processes

It is almost twenty years since the results of the first PISA study caused a furore in Germany. Not only was the performance of German students below average, the most shocking finding was that in Germany, more than in any other country, educational achievement was linked to social background.

According to the study, in particular children with an immigration background – something PISA links to certain socioeconomic criteria – have few chances of success in the education system. One of the main causes for this correlation was quickly identified: poor language skills.

But immigration-related multilingualism is not the determining factor in how well or poorly children and adolescents deal with linguistic challenges in the classroom, explains Juliana Goschler, Professor for German as a Second Language and German as a Foreign Language. The real issue, she

says, is so-called “educational-language” skills. “The term “educational language” differentiates between the language spoken in everyday life and the language used in the classroom. And this linguistic register is not mastered by all students equally,” Goschler says. Moreover, the linguistic challenges vary from subject to subject: “This can be a specific vocabulary, but certain subjects also use specific sentence structures or verb tenses,” she explains. History textbooks, for example, are often written in the simple past tense, which is never used in other subjects. In science subjects, on the other hand, you often find formulaic phrasing such as “To calculate x, we have to...” Such linguistic norms often remain implicit, Goschler explains. This not only makes it harder for pupils to understand the linguistic patterns and reproduce them, but also to learn the content of the lessons.

Which makes it all the more important that future teachers of all subjects are sensitised to the importance of language in schools and lessons, Goschler says. “Teachers need to address the language they use for teaching and the language used in textbooks, they need to identify the language skills of their pupils and build on that, and finally they need to develop a critical and reflective attitude to language and language acquisition.” How to implement this was a key focus of Goschler’s 2014–2017 research project “Structuring Upheavals – Promoting and Teaching Language as an Integral Part of Innovative Teaching Training in Lower Saxony” (“Umbrüche gestalten – Sprachenförderung und -bildung als integrale Bestandteile innovativer Lehramtsausbildung in Niedersachsen”). One thing she learned during this period was that the linguistics perspective alone cannot account for and convey the linguistic challenges of the various subjects. “This is where the teachers of the individual subjects come in,” the linguistics professor says, “because they are the ones who best understand the teaching and learning processes particular to their subject.”

Since 2016, when the Department for Language-Sensitive Teaching and Learning (Arbeitsstelle Sprachsensibles Lehren und Lernen), which is run by Goschler, was set up at the Centre for Teacher Education (Zentrum für Lehrkräftebildung - Didaktisches Zentrum, DiZ), the University of Oldenburg has had an institution dedicated to this topic. A number of recently approved projects for professionalising teacher training have since picked up on this: as part of the project “Biographically-Oriented and Multi-Phase Teacher Education in Oldenburg” (“Biographieorientierte und Phasenübergreifende Lehrerbildung in Oldenburg – OLE+”), researchers from a number of disciplines are investigating the complexity of linguistic interactions in schools and other educational contexts. One focus area of the DiOLL project (Digitalisation in Oldenburg Teacher Training) is to investigate the challenges of language-sensitive teaching across the curriculum.

Language in learning contexts

In order to bring together the Oldenburg research on the topic and give it visibility, Goschler worked with Prof. Dr. Martin Butler, cultural studies scholar and head of the DiZ, to launch a series of publications entitled “Language Sensitivity in Educational Processes” (“Sprachsensibilität in Bildungsprozessen”). The first publication is a collection of articles edited by Butler and Goschler and titled “Language-Sensitive Teaching across the Curriculum. Interdisciplinary Perspective on Opportunities and Challenges” (“Sprachsensibler Fachunterricht. Chancen und Herausforderungen in interdisziplinärer Perspektive”). “The articles by a number of Oldenburg researchers elucidate subject-specific, linguistic, educational and cultural studies perspectives on language in school learning contexts,” Butler explains. They examine language or text-related challenges in the class-

room or the questions such as whether metaphors like “packets” or “clouds” make sense when it comes to learning in computer science classes. One article explains how practice-oriented lessons – in other words technology lessons based on specific exercises – can influence language-acquisition processes by creating opportunities for spontaneous, authentic communication.

Language sensitivity in teacher training

The subjectivising effects of language in school is another topic. How the way we talk to each other organises and regulates social relations is examined here. How does continually being referred to as “pupils with an immigration background” affect the self-image of children and adolescents? “Language serves to categorise people,” Goschler explains. Every description we use invokes particular characteristics and stereotypes; it assigns people to a certain group or excludes them from it. Particularly when dealing with relations in an immigration society, it is important to further explore these dimensions of language and to sensitise students to this with a view to their future careers in schools, Butler adds.

The collection also includes an article by the Research Group for History Didactics, which is led by Prof. Dr. Dietmar von Reeken. There’s nothing new in saying that language is incredibly important for history as a subject, the historian observes. “This is because access to the past generally takes place through language, above all through available written sources or written descriptions of history.” In history didactics research, however, the role of language has never been explicitly raised as an issue. And history as a subject contains very particular linguistic challenges: “We don’t have language that is explicitly specific to the subject, as science subjects do, for example,” von Reeken explains. “Terms like king or citizen are familiar from everyday

usage, but in historical contexts, they often have a very different meaning.” So pupils have to constantly translate texts from historical language into everyday language. On top of that, in history lessons pupils are also meant to be developing narrative skills – in other words, the ability to understand history and to retell it – and of course “in a linguistically appropriate manner,” von Reeken stresses. This means that the challenge for teachers is not just to teach the subject matter of any particular subject, but also the linguistic skills that accompany it. The latter, the historian says, are not systematically included as part of the lesson. “It is somehow just expected that they will be learned along the way.”

Sinje Eichner and Max-Simon Kaestner, doctoral students under von Reeken, are researching how teachers can help their pupils to acquire the

necessary linguistic skills for studying history. Eichner is investigating the role of spoken language in school history lessons – a topic that has received little attention to date even though speaking is such a prominent part of history lessons. Kaestner is focussing on writing. For his PhD he has designed and evaluated a unit that aims to support pupils in writing historical assessments. “In linguistic terms, historical thinking is expressed in recurring patterns of words and phrases, known in German as Textprozeduren” he explains. An historical assessment takes the form of expressions such as “according to contemporary moral ideas” or “from today’s perspective”. In order to learn these Textprozeduren, pupils first work with text-models. “They analyse how Textprozeduren are used and reflect on how they demonstrate historical thinking. In the final step

they practise writing argumentative essays themselves,” Kaestner explains. The historian has already assessed the efficiency of his writing instruction in a preliminary study.

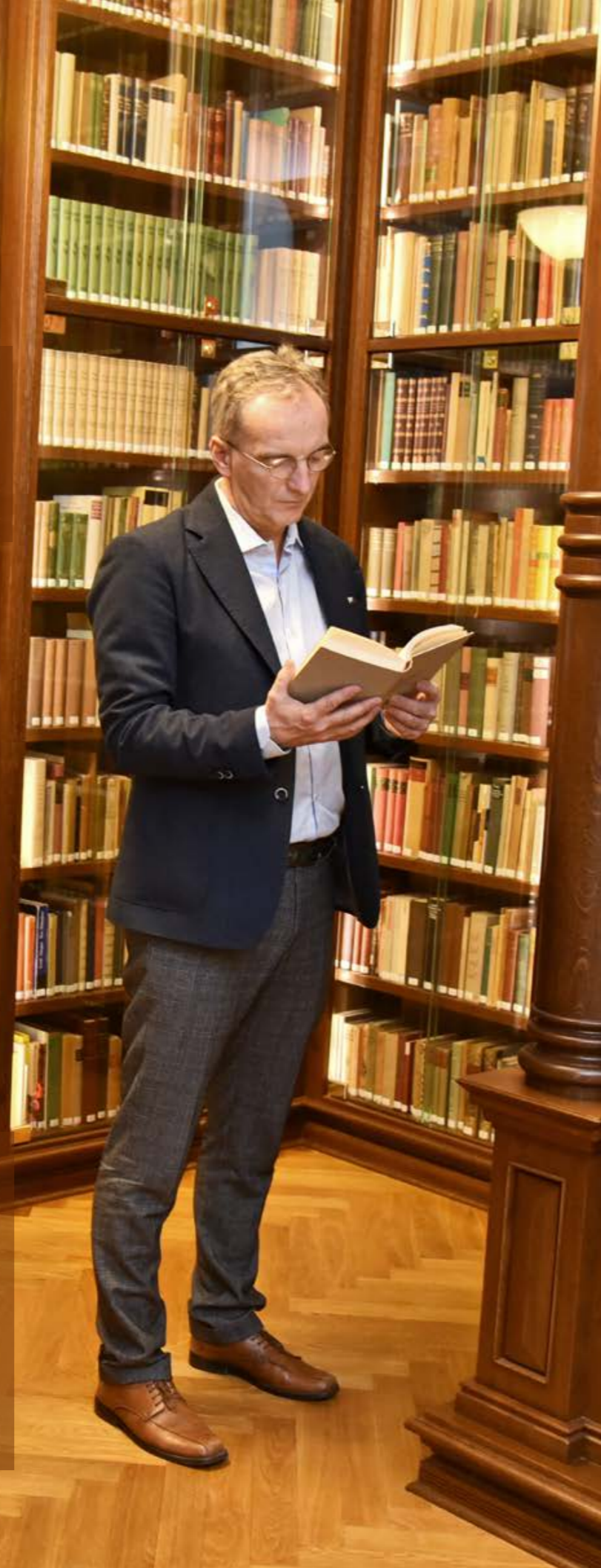
If such support instructions tool-kits are to find their way into schools, von Reeken says, it is essential to embed the topic of language into teacher training. Goschler and Butler support this demand. While language-related modules have long been mandatory for student teachers in Berlin and North Rhine-Westphalia, other federal states have been slow to catch up. “The regulations governing Master’s degrees in Lower Saxony stipulate that the language issue must be addressed. But there are no education-policy rules specifying that this must be integrated into teacher-training modules. This has to change,” Goschler stresses. (nc)



Specialists in history teaching, Dietmar von Reeken (middle), Sinje Eichner and Max-Simon Kaestner are researching the role of language in history lessons.

Disenchanted World

As a philosopher and Jaspers expert Matthias Bormuth considers it his mission to give people food for thought. His new collection of Karl Jaspers' letters – published on the fiftieth anniversary of the great thinker's death – does just that. The book guides us through Jaspers' life and work, shining a light on intellectual luminaries and philosophical ideas of the twentieth century



It is the awareness of truth, that is not tangible, a bright room that opens to us. It is there in what the tradition has handed down to us, and it is present when the kind words of a friend reach us.“ These are the words of one of the great German thinkers of the twentieth century, Karl Jaspers, written in December 1945 to his former student Hannah Arendt, who as a Jew had fled from Germany and the National Socialism in 1933 and later emigrated to the US.

Unlike Arendt Jaspers decided to remain in Germany, hoping that he would be able to exert some influence there. It was a decision for which he would pay dearly: because of his wife's Jewish ancestry Jaspers was forced to leave his teaching position at Heidelberg University in 1937. He spent seven years in internal emigration – shunned by former colleagues and the public. After this dark time “Jaspers was overwhelmed by the revival of his friendship with Arendt through their correspondence,” says the director of the Karl Jaspers-Haus in Oldenburg, Prof. Dr. Matthias Bormuth.

The correspondence brought the philosopher into first contact with the ideas of American thinkers who knew Arendt and who were officers in Allied-occupied Germany. This was how he discovered that academics in the US were researching the work of sociologist Max Weber, Jaspers' friend and role model. “It meant Jaspers was one of the first people after the war to understand that liberal America also represented a new political opportunity,” Bormuth explains. As such he is a key figure in the academic and philosophical history of the young German Federal Republic.

This was reason enough to include the post-war letter to Arendt in the collection, which was published in 2019 on the fiftieth anniversary of the philosopher's death. “Life as a Limit Situation” is the name of the book, in which Bormuth uses Jaspers' letters to trace his biographical and intellectual

path from psychiatrist to existential philosopher to political philosopher, scrutinising all the while the social and political life of the Federal Republic.

The volume brings together sixty-eight letters to psychiatrists, philosophers and writers. His correspondence partners include Martin Heidegger, Golo Mann and Albert Schweitzer – as well as fellow psychiatrists and his own parents. Then there are his diary entries. Brief introductions provide a context for the letters and notes. In total Bormuth has drawn from a pool of some 3,000 pages of already published critical editions of Jaspers' letters to compose a biographical outline that aims to synthesise key moments in his life.

Philosophical ideas are relevant to every person's life

Told this way, Bormuth says, the Jaspers biography is also a form of historiography. “The book is like a model of the philosopher's reality and thinking – as shaped by the time he lived in, his conversation partners and his own personality,” he says. As a professor for Intellectual History Bormuth wants to place the philosopher and his world of ideas within history and the history of science.

It is here that the diary entries included in the volume from Jaspers' youth and the early 1940s are particularly fascinating, says Malte Unverzagt, research associate at the Karl Jaspers-Haus: “They show Jaspers' self doubt and his attempts to think clearly about how to behave in extreme situations.” This also entailed the idea of suicide, which Jaspers and his wife were considering in the midst of World War II in case they would be deported by the Nazis.

It is extreme situations like these that shaped the philosopher's thinking. Jaspers coined the term “limit

situation” in his 1919 book “Psychologie der Weltanschauungen“ (The Psychology of World Views). “This is one of his fundamental concerns: how can one possibly find a sense of purpose for oneself in a disenchanted world,” Bormuth says. These personal and societal limit situations, such as Jaspers' early diagnosis of lung disease or his experiences under the Nazi regime and the question of guilt after 1945, run like a red thread through the letters.

With the concept of limit situations, Jaspers addressed the mental and spiritual climate of his time, which for him entailed reflection on human existence and how it orientates itself towards a higher truth. It is only in crisis situations that human beings seek a greater meaning to carry them through, Bormuth explains. The engagement with the ideas that Jaspers grappled with necessarily led Bormuth to other intellectuals who had either found themselves in limit situations or actively sought them out.

“Drawing up a comparative history of ideas means comparing the lives of intellectuals in their respective situations and from their own personal perspectives and asking what the various views and truths mean for us today,” Bormuth explains. This is the motivation for the collection of essays he is currently working on about “casualties”, people like Ingeborg Bachmann, Uwe Johnson, Jean Améry and Ulrike Meinhof who, like Jaspers, represented a critical element in a self-satisfied and restorative post-war society, but were unable to find a liveable way out of the situation.

Bormuth is aware that his books and essays only show excerpts of history. But this limited form of history writing provides an opportunity to achieve something very different, he says: “Much of what these writers and artists think seems unusual to us, even extreme. But by retracing these extreme ideas and giving them context one can prompt people to reflect on their own lives.” (cb)

UGO awards for young researchers



Delighted with their awards: Annika Raapke (left), Jan Vogelsang and Stefanie Kerbstadt.

At the beginning of the new academic year the University Society of Oldenburg e.V. (UGO) once again honoured selected Oldenburg researchers. The “Award for Excellent Research”, including 5,000 euros in prize money, went to historian Dr. Annika Raapke. The “Outstanding Doctoral Thesis Award”, endowed with 2,000 euros, was presented twice this time - to the two physicists Dr. Stefanie Kerbstadt and Dr. Jan Vogelsang. The award ceremony took place as part of the AUF-TAKT 19/20 event.

Dr. Annika Raapke conducts research within the “Prize Papers” project funded by the Academies’ Programme of the Union of German Academies of Sciences and Humanities. The project is under the aegis of Prof. Dr. Dagmar Freist at the Institute of History. Raapke’s research focuses on the history of the body and medicine in the early modern period. One of the

main questions she is studying is how social reality is produced and represented through bodily practices. To gain insights, Raapke is also studying the physical experiences of European men and women who populated colonial structures in the Caribbean in the eighteenth century. Her work is based on letters which were written in the Caribbean between 1744 and 1826 and intended for recipients in France, but were confiscated by the British when they captured enemy ships.

Dr. Stefanie Kerbstadt completed her PhD under Prof. Dr. Matthias Wollehaupt at the Institute of Physics. In the course of her research she developed a new construction that allows her to produce highly defined laser pulses of just a few femtoseconds (quadrillionths of a second) in duration. Kerbstadt used these customised flashes of light to observe and manipulate the physical processes underlying the

interaction of light and material. This also enabled her to steer the electrons released during the process of photo-ionisation. The physicist is currently conducting research at the Center for Free-Electron Laser Science (CFEL) in Hamburg.

Dr. Jan Vogelsang, currently a post-doctoral researcher at the University of Lund in Sweden, also completed his doctorate at the Institute of Physics. Under the instruction of Prof. Dr. Christoph Lienau, Vogelsang constructed a new type of electron microscope that can capture the movement of electrons on video. He was able to film processes such as charge separation in nanostructures with a spatial resolution of 20 nanometres and a temporal resolution of 20 femtoseconds. The achievement of such a high level of spatial and temporal resolution simultaneously set a new world record.

New Appointments



Maximilian Bockhorn
General and Visceral Surgery

Dr. Maximilian Bockhorn has been appointed Professor of General and Visceral Surgery at the Department of Human Medicine. He is also Director of the University Clinic for General and Visceral Surgery at the Klinikum Oldenburg. Before coming to Oldenburg Bockhorn was senior consultant and deputy director at the Clinic for General, Visceral and Thoracic Surgery at the Universitätsklinikum Hamburg-Eppendorf (UKE). Bockhorn studied human medicine in Tübingen and Hamburg and received his doctorate in 1996. In 1998, he transferred to the Clinic for General, Abdominal and Transplant Surgery at Essen University Hospital for his specialist training. From 2000 to 2002 he conducted research at Harvard Medical School, Boston (USA). After earning his Habilitation, Bockhorn returned to the UKE in 2008. He became a certified specialist in abdominal surgery in 2012 and in thoracic surgery in 2016, Bockhorn’s clinical focus is oncological surgery and minimally invasive surgery in tumour diseases of the liver, stomach and other organs. In his research he is investigating the role of inflammation in tumour development.



Oliver Dewald
Heart Surgery

Prof. Dr. Oliver Dewald has been appointed Professor of Heart Surgery at the Department of Human Medicine. He is also director of the University Department for Cardiac Surgery at the Klinikum Oldenburg. Previously Dewald worked at the Department for Cardiac Surgery at the University Hospital Bonn, where he was head of the Section for Congenital Heart Surgery in Children and Adults. Dewald studied human medicine at the LMU Munich, where he earned his doctorate in 1999. A two-year research grant from the German Research Foundation (DFG) took him to Baylor College of Medicine in Houston, Texas (US). Before earning his Habilitation and consultancy licence in 2008 he was a junior doctor at the Department for Cardiac Surgery at the University Hospital Bonn. He then became consultant and in 2015 head of the pediatric heart surgery programme at the University Hospital Bonn. His work focuses on inflammatory responses and tissue remodelling in diseased hearts.



Mathias Dietz
Physiology and Modelling of Auditory Perception

Prof. Dr. Mathias Dietz has been appointed Professor of Physiology and Modelling of Auditory Perception at the Department of Medical Physics and Acoustics. Previously, he was an associate professor at the National Centre for Audiology at Western University in London, Ontario (Canada). Dietz studied physics at the University of Münster before becoming a research assistant in the German Research Foundation (DFG)-funded Transregio Collaborative Research Centre “The Active Auditory System” at University of Oldenburg. Here he earned his PhD in 2009 with a thesis on directional hearing. From 2011 to 2012 he conducted research on a fellowship from the Alexander von Humboldt Foundation at the Ear Institute of the University College London (UK). He then led a junior research group in the Cluster of Excellence “Hearing4all” at the University of Oldenburg until 2015. Since 2018 Dietz’s work has been funded by a 1.5 million euro Starting Grant from the European Research Council (ERC). Much of his research into binaural hearing is conducted with the help of sophisticated computer simulations of sound processing in the brain.

New Appointments



Axel Hamprecht
Medical Microbiology

Prof. Dr. Axel Hamprecht has been appointed Professor of Medical Microbiology at the Department of Human Medicine. He is also Director of the University Institute of Medical Microbiology and Virology at the Klinikum Oldenburg. Hamprecht was previously a professor at the Institute for Medical Microbiology, Immunology and Hygiene at the University of Cologne. He studied human medicine at the Universities of Heidelberg, Berlin and Bordeaux (France) and earned his doctorate in Berlin in 2005. After a junior doctor post at the Department for Dermatology at the University of Bonn he moved to the Institute for Medical Microbiology, Immunology and Hygiene at the University Hospital Cologne in 2008. Hamprecht became a consultant in 2014. Following his Habilitation he was appointed to a professorship on Antibiotic Resistance of Gram-Negative Pathogens at the University of Cologne in 2018. His research focuses on the genetic background of multidrug resistance and the transmission of genes encoding beta-lactamases. Additionally, he works on the development of new methods for the rapid detection of multidrug-resistant organisms.



Axel Heep
Paediatrics

Prof. Dr. Axel Heep was appointed as Professor of Paediatrics at the Department of Human Medicine. He is also Executive Director of the University Clinic for Paediatrics at the Klinikum Oldenburg. On his previous appointment in the UK, Heep worked as neonatal consultant and research lead at the North Bristol NHS Trust. At the University of Bristol he was conducting research activity as honorary clinical lecturer and member of the Stem Cell and Neuroregeneration research group. Since his appointment in Oldenburg, Heep has set up joint research projects between the two academic sites as well as with partners at the University of Oldenburg. Heep studied medicine at the University of Cologne. He has worked as a paediatric specialist and neonatologist since 1996. He was senior consultant and research lead at the University of Bonn and Clinical Director of Paediatric service at the Städtisches Klinikum München (Munich). Heep's focus is neonatal neurology, in particular the causes of diseases of the central nervous system in premature and newborn babies and the functional development of the brain after premature birth.



Jörn Hoppmann
Management

Prof. Dr. Jörn Hoppmann has been appointed Professor of Management at the Department of Business Administration, Economics and Law. He had held the Chair of Strategic Management and Corporate Sustainability in an interim capacity since 2017. Hoppmann earned his Habilitation in 2018 at ETH Zurich, where he had also completed his PhD in 2013. He gained his diploma in Business Administration and Mechanical Engineering in 2009 at the Braunschweig University of Technology. Research trips have taken him to Harvard University and MIT (both Cambridge, USA), the University of Waterloo in Canada, and IMD Business School in Lausanne (Switzerland). Hoppmann has received numerous awards for his work; for his lecture series "Introduction to Business Administration" he won the University of Oldenburg's 2018 teaching award for the best course. Hoppmann conducts research at the intersection of strategic management, sustainability, and innovation, particularly in the context of the energy and mobility sectors. A focus area of his research is mechanisms that enable businesses to act more sustainably.



René Hurlemann
Psychiatry and Psychotherapy

Prof. Dr. Dr. René Hurlemann has been appointed Professor of Psychiatry and Psychotherapy at the Department of Human Medicine. He is also Director of the University Clinic for Psychiatry and Psychotherapy at the Karl-Jaspers-Klinik in Oldenburg. Hurlemann was previously deputy director of the Clinic and Polyclinic for Psychiatry and Psychotherapy at University Hospital of Bonn and director of the department of medical psychology there. He studied human medicine at the University of Bonn, where he earned his doctorate in 2001. During his time as a junior doctor he studied neuroscience at the University of Maastricht (Netherlands) and also received a doctorate in this field. After completing his specialist training Hurlemann became a consultant at the Clinic and Polyclinic for Psychiatry and Psychotherapy in Bonn and was appointed Professor of Medical Psychology in 2013. Hurlemann's main area of clinical expertise is affective and schizophrenic disorders. In the treatment of depressive disorders, he uses non-invasive brain stimulation methods, which he is further developing in his research.



Cristian Huse
Applied Microeconomics

Prof. Dr. Cristian Huse has been appointed Professor of Applied Microeconomics at the Department of Business Administration, Economics and Law. Previously he was associate professor at the Stockholm School of Economics. Huse, who holds both German and Brazilian citizenships, studied economics at the Federal University of Rio de Janeiro. He gained his Masters in Economics at the Getulio Vargas Foundation in Rio de Janeiro and a second Masters in Econometrics and Mathematical Economics at the London School of Economics, where he also completed his doctorate in 2009. From 2007 to 2016 he was assistant professor and then from 2016 associate professor at the Stockholm School of Economics. Huse's main research interests lie in environmental and energy economics, applied microeconomics, industrial economics, and applied econometrics. He has studied policies aimed at reducing CO₂ emissions in the new vehicle market, for instance. Since 2013 Huse has been involved in organising the annual workshop "Economics of Low-Carbon Markets" in São Paulo. Huse's work has been distinguished by numerous awards and published in both economics and the natural sciences.



Claus-Henning Köhne
Internal Medicine:
Haematology and Oncology

Prof. Dr. Claus-Henning Köhne has been appointed Professor of Internal Medicine with a Focus on Haematology and Oncology at the Department of Human Medicine after holding the position in an interim capacity. He is also director of the University Clinic for Internal Medicine – Oncology und Haematology at the Klinikum Oldenburg. Köhne studied human medicine at the Hannover Medical School (MHH), where he gained his medical licence in 1985. After earning his doctorate in 1987 he completed his specialist medical training at the MHH in internal medicine as well internal medicine, haematology and internal oncology. From 1995 to 1998 Köhne was consultant for haematology/oncology and tumour immunology at the Charité – Universitätsmedizin Berlin before transferring to the Clinic and Polyclinic for Internal Medicine at the University of Rostock. From 2001 to 2004 Köhne was Professor of Internal Medicine with a Focus on Internal Oncology at the University Hospital of the Technical University Dresden. He is currently conducting research in the field of internal oncology, with a focus on solid tumours and gastrointestinal and mammary carcinomas.

New Appointments



Eduard Malik
Gynaecology and Obstetrics

Prof. Dr. Eduard Malik has been appointed to the Chair of Gynaecology and Obstetrics at the Department of Human Medicine, which he held as an interim capacity as of 2013. Malik has been the Director of the University Clinic for Gynaecology and Obstetrics at the Klinikum Oldenburg since 2006 before it became a University facility in 2013. Formerly, he was a senior consultant and deputy clinical director at the University Hospital of Gynaecology and Obstetrics of the University of Regensburg. Malik studied medicine in Hamburg, received his doctorate from the Goethe University Frankfurt and earned his Habilitation at the University Hospital Lübeck in 2000. From 2002 to 2004 he was senior consultant and deputy clinical director at the University Hospital Aachen, and in 2004 he received a professorship at the University of Regensburg. As a gynaecologist and obstetrician, Malik has profound experience in the fields of gynaecological oncology, perinatal medicine as well as minimally invasive surgery. His research focuses on endometriosis, one of the most common benign diseases in women, and vascular growth in gynaecological and obstetric diseases.



Jannika Mattes
Organisation and Innovation

Prof. Dr. Jannika Mattes, previously Junior Professor for the Sociology of European Societies at the Institute of Social Sciences, has been appointed Professor of Organisation and Innovation. Since 2018 the sociologist has led the three-member Emmy Noether Independent Junior Research Group REENEA dedicated to studying the regional energy transition. Mattes studied European Economic and Business Studies at the University of Bamberg and then took up a postgraduate research position in 2006. She completed her doctorate in Oldenburg in 2010 with a thesis which also earned her the “Weser-Ems Science Award for an Outstanding Thesis”. A year later she was appointed to the Junior Professor post. In 2017 Mattes won the “Prize for Excellent Research” awarded by the University Society of Oldenburg (Universitätsgesellschaft Oldenburg) and in 2018 the “Lower Saxony Science Award” from the Ministry of Science. Her research interests include innovation research, organisation sociology, energy transition and regional and international societal change processes.



Ivan Milenkovic
Physiology

Dr. Ivan Milenkovic has been appointed Professor of Physiology at the Department of Human Medicine. Prior to his appointment in Oldenburg he led a research group and held an associate professor position at the medical faculty of Leipzig University. Milenkovic studied molecular biology, physiology and neurophysiology at the University of Belgrade, Serbia. In 2000 he moved to Leipzig University’s Paul Flechsig Institute for Brain Research, where he received his doctorate in 2002. He then took a postdoctoral research post at the Department of Neurobiology in Leipzig, where he earned his Habilitation in 2010 in the field of neurobiology/developmental biology. Research stays took Milenkovic to the National Institutes of Health in Bethesda, USA, among others. Since 2014 he moved to the Carl Ludwig Institute of Physiology at Leipzig University’s medical faculty where he led an independent research group. By employing various electrophysiological methods, Milenkovic investigates the activity-dependent development of neuronal networks in the central auditory system.



Tonio Oeftering
Political Education

Prof. Dr. Tonio Oeftering has been appointed Professor of Political Education at the Institute for Social Sciences. Previously he was Junior Professor of Political Education at the Institute of Political Science at Leuphana University Lüneburg. After training in commerce Oeftering studied to become a secondary school teacher in politics and English at the Freiburg University of Education, where he passed the first state exam. He went on to gain a diploma in educational science there, specialising in adult education with a focus on political science. In 2012 he earned his doctorate in political science. From 2011 to 2013 Oeftering was also a research associate at the Institute for Political Science at the Leibniz Universität Hannover. From 2013 to 2014 he took on interim professorships in Hannover and at the Catholic University Eichstätt-Ingolstadt. Oeftering is an active member on numerous advisory boards and since 2018 he has been federal chairman of the “Deutsche Vereinigung für Politische Bildung” (DVPB).



Katharina Pahnke-May
Marine Isotope Geochemistry

Dr. Katharina Pahnke-May has been appointed Professor of Marine Isotope Geochemistry at the Institute for Chemistry and Biology of the Marine Environment (ICBM). From 2011 until 2019 she led the Max Planck Research Group for Marine Isotope Geochemistry, a collaboration between the ICBM and the Max Planck Institute for Marine Microbiology in Bremen. Pahnke-May studied geology in Göttingen and Kiel and received her doctorate from Cardiff University, Wales, in 2004. She spent her postdoctoral period in the USA, first at the Massachusetts Institute of Technology in Cambridge and then at Columbia University’s Lamont-Doherty Earth Observatory in New York. Before coming to Oldenburg she was an Associate Research Professor at the University of Hawaii from 2008 to 2011. In her research Pahnke-May uses trace elements and their isotopes to determine the origin of water masses and reconstruct geochemical processes and conditions in the present and past ocean. Her research group is involved in the major international “GEOTRACES program”, that studies global biogeochemical cycles of trace elements and isotopes in the ocean.



Andreas Radeloff
Otorhinolaryngology

Prof. Dr. Andreas Radeloff has been appointed Professor of Otorhinolaryngology at the Department of Human Medicine. He had held the professorship in an interim capacity since 2016. He is also Director of the University Clinic for Otorhinolaryngology at the Evangelisches Krankenhaus Oldenburg. Radeloff studied medicine at the Goethe University Frankfurt and then became a junior physician in the Otorhinolaryngology department. He earned his doctorate in 2005 before transferring to the Julius-Maximilians-Universität Würzburg (JMU). Here he completed his specialist training as an ear, nose and throat doctor and earned his Habilitation in 2011. Radeloff then took a consultant position at the Clinic and Polyclinic for Ear, Nose and Throat Diseases, Plastic and Aesthetic Operations. Between 2010 and 2016 he ran the “Implantable Hearing Systems” section at the Comprehensive Hearing Centre of the University Hospital Würzburg, initially in an interim capacity and from 2014 with full responsibility. In 2017 he was made adjunct professor at the JMU. In his research Radeloff focuses on improving auditory rehabilitation in patients with impaired hearing.

New Appointments



Stefan Schrader
Ophthalmology

Prof. Dr. Dr. Stefan Schrader has been appointed Professor of Ophthalmology at the Department of Human Medicine. He is also Director of the University Clinic for Ophthalmology at the Pius-Hospital Oldenburg. Previously Schrader was senior consultant at the Clinic for Ophthalmology at the University Hospital Düsseldorf, where he also held a Lichtenberg-endowed Chair from 2014. Schrader studied human medicine at the University of Lübeck and completed his MD thesis there in 2005. He was a visiting researcher at University College London (UK), where he also earned the degree “Doctor of Philosophy” (PhD). In 2012 Schrader became a consultant in Düsseldorf and in 2013 he earned his Habilitation in Ophthalmology at the medical faculty. He was head of the clinical focus area of corneal diseases there from 2016. Schrader researches and treats diseases of the eye surface. His speciality is corneal transplantations and reconstructions of the ocular surface as well as surgical procedures to the retina and vitreous body of the eye.



Mark Schweda
Medical Ethics

Dr. Mark Schweda has been appointed Professor of Medical Ethics at the Department of Health Services Research. Previously Schweda was a research associate at the Department of Medical Ethics and History of Medicine at the University Medical Center Göttingen. He studied philosophy and modern German literature at the Humboldt-Universität at Berlin (HU Berlin) and the University of Nottingham (UK). He earned his doctorate at the HU Berlin's Institute of Philosophy in 2012. He was also a research associate at the Institute for Ethics and History of Medicine at the University of Tübingen and Junior Research Fellow at the Lichtenberg-Kolleg – Göttingen Institute for Advanced Study. He spent research stays in the UK and the USA. In 2015, Schweda earned his Habilitation at the medical faculty of the University of Göttingen with a thesis on “Concepts of Aging in Medicine and Healthcare” which won him the faculty Habilitation prize. His research centres on ethical aspects of aging and old age, assistive technologies and the impact of digitalisation in healthcare.



Dirk Weyhe
Visceral Surgery

Prof. Dr. Dirk Weyhe has been appointed Professor of Visceral Surgery at the Department of Human Medicine. He has been Director of the University Clinic for Visceral Surgery at the Pius-Hospital Oldenburg since 2007 and had held the professorship in an interim capacity since 2013. Weyhe studied human medicine at the Ruhr-Universität Bochum, where he received his doctorate in 1998 and his Habilitation in 2008. He specialised in surgery, visceral surgery and special visceral surgery with additional qualifications in surgical intensive care and emergency medicine and was a consultant at the St. Josef Hospital of the Ruhr-University Bochum from 2002 to 2007. In 2005 he became head of the molecular experimental surgery laboratory for gene expression analysis at the hospital. Before moving to Oldenburg, he was senior consultant at the Pancreas Centre of the St. Josef Hospital of the Ruhr-University Bochum. Weyhe's main clinical focus is complex oncological visceral surgery, including pancreatic, oesophageal, gastric and colon cancer surgery. His research concept centres on further improving patient safety in surgical procedures.



Johannes Woitzik
Neurosurgery

Dr. Johannes Woitzik has been appointed Professor of Neurosurgery at the Department of Human Medicine and Director of the Department of Neurosurgery at the Evangelisches Krankenhaus Oldenburg. Before coming to Oldenburg Woitzik served as deputy director and senior consultant of the Department of Neurosurgery at the Charité University Hospital in Berlin. Woitzik attended medical school at the Universities of Lübeck and Heidelberg. After graduating in 2001, he performed his residency training at the Department of Neurosurgery of the University Hospital Mannheim, where he later served as consultant. During this period in Mannheim, he completed his MD thesis and received his board certification. In 2007 Woitzik transitioned to the Charité in Berlin, where he received his Habilitation in 2008. His main areas of clinical expertise are the treatment of brain tumours, aneurysms, stroke and diseases of the spine and cerebrospinal fluid system. He is also developing novel treatment options for stroke as well as imaging techniques for displaying metabolic processes in the brain during surgery.



Oliver Wurl
Processes and Sensing
of Marine Interfaces

Dr. Oliver Wurl, leader of the Marine Interfaces research group, has been appointed Professor of Processes and Sensing of Marine Interfaces at the Institute of Chemistry and Biology of the Marine Environment (ICBM). Wurl has been teaching and researching in Oldenburg since 2014 – initially on a generous “starting grant” from the European Research Council (ERC). Wurl studied environmental technology at the Hamburg University of Applied Sciences and then worked for four years in research and industry. In 2006 he received his doctorate from the National University of Singapore. From 2008 to 2012 he was a research associate at the Institute of Ocean Sciences of the State Department “Fisheries and Oceans” in Canada and then at Old Dominion University in Norfolk, USA. In 2012 Wurl moved to the Leibniz Institute for Baltic Sea Research in Warnemünde, before coming to Oldenburg in 2014. His research focuses on sea surfaces and their influence on the global climate. Among other things he is studying the role of the thin boundary layer between water and air in the absorption of carbon dioxide by the ocean.



Tania Zieschang
Geriatrics

Dr. Tania Zieschang has been appointed Professor of Geriatrics at the Department of Health Services Research. She is also Director of the University Clinic for Geriatric Medicine at the Klinikum Oldenburg and Head of the Clinic for Geriatric Rehabilitation at the Rehasentrum Oldenburg. Previously she was a consultant and acting medical director at the Agaplesion Bethanien Krankenhaus in Heidelberg. Zieschang studied mathematics and medicine at the University of Bochum, where she finished her doctoral thesis in 1994. She completed her practical year of Medical School in the USA. From 1998 to 2006 she received her training as an internist at the Bethanien Krankenhaus, the Centre for Geriatric Medicine of Heidelberg University, and at the University Hospital in Heidelberg. In the following years she received a research grant from the Robert Bosch Foundation and gained additional qualifications in clinical geriatrics and palliative medicine. Her main areas of research and clinical focus are training interventions for older people with dementia and the improvement of acute somatic care in patients with dementia.

Doctorates

Fakultät I Bildungs- und Sozialwissenschaften

SVENJA MAREIKE BEDENLIER, Thema: „Internationalisierung von Hochschulen: Inhaltliche Bestimmung und Untersuchung ihrer Auswirkungen auf Wissenschaftlerinnen und Wissenschaftler“ [Pädagogik](#)

ASTRID BEERMANN-KASSNER, Thema: „Veränderungsprozesse professioneller und persönlicher Entwicklung – Wirkfaktoren und Wirkungsweisen in Professionalisierungsprozessen am Beispiel von Supervisoren, Coaches und Organisationsentwicklern“ [Pädagogik](#)

LISA MARIE BLASCHKE, Thema: „The Heutagogic (Self-Determined Learning) Approach and Social Media in Online Learning Environments“ [Pädagogik](#)

ARZU ÇIÇEK, Thema: „Vom Unbehagen an der Zugehörigkeit – Eine migrationspädagogische Derridalektüre“ [Pädagogik](#)

ANIKA EIBEN, Thema: „Ressourcen älterer Eltern in der Versorgung ihrer erwachsenen Töchter und Söhne mit geistiger Behinderung im häuslichen Umfeld“ [Sonderpädagogik](#)

MAREIKE GRUNDMANN, Thema: „Erstellung und Evaluation einer Fragebogenbatterie zur Messung der Lebensqualität nach einer Versorgung mit Cochlea-Implantaten“ [Sonderpädagogik](#)

JOHANNES HYKEL, Thema: „Der Konflikt um die Eröffnung einer Asylunterkunft in Berlin-Hellersdorf im Sommer 2013. Eine rassismuskritische Analyse“ [Pädagogik](#)

THOMAS JACKWERTH, Thema: „The openness of corporate innovation processes – A mechanism-based analysis of innovation projects in the wind energy industry“ [Sozialwissenschaften](#)

FRANK OCKENGA, Thema: „Das ist (nicht) meine Aufgabe! Zum Aufgabenverständnis von Sonderpädagoginnen und Sonderpädagogen in Beratungs- und Unterstützungssystemen sowie mobilen Diensten im Förderschwerpunkt emotionale und soziale Entwicklung in Niedersachsen“ [Sonderpädagogik](#)

FLORIAN ÖHLER, Thema: „Lehrer und Schüler rahmen den gemeinsamen Unterricht. Eine Rahmen-Analyse von Unterricht in der Primarstufe“ [Sonderpädagogik](#)

MARTIN PODSZUS, Thema: „Bedarfe von Studierenden mit körperlich-motorischen Beeinträchtigungen im Hinblick auf den Einsatz von Blended-Learning in der Hochschullehre unter besonderer Berücksichtigung der MINT-Fächer“ [Sonderpädagogik](#)

MONIKA REIMER, Thema: „Der Inhalt Energie als Thema für den Sachunterricht – Eine qualitative Studie zu Vorstellungen von Grundschulkindern zu Energie“ [Pädagogik](#)

ALISSA SALE, Thema: „Alltagsnahe Förderung mathematischer Vorläuferkompetenzen bei vorliegenden Entwicklungsrisiken – Evaluation einer Fördermaßnahme in der Transition Kindergarten-Schule“ [Sonderpädagogik](#)

SAPHIRA SHURE, Thema: „(De)Thematisierung migrationsgesellschaftlicher Ordnungen. Lehramtsstudium als Ort der Bedeutungsproduktion“ [Pädagogik](#)

DAVID SSEKAMATTE, Thema: „The Opportunities and Challenges for Climate Change Education at Universities in the African Context: A Comparative Case Study of Makerere University (Uganda) and University of Dar es Salaam (Tanzania)“ [Pädagogik](#)

SUSANNE TÜBEL, Thema: „Leibliches und zeithaftes Erleben der Beschneidung im Judentum – Zur rituellen Struktur transzendenzvermittelter Inklusion“ [Sozialwissenschaften](#)

Fakultät II Informatik, Wirtschafts- und Rechtswissenschaften

MARKUS BORTOLAMEDI, Thema: „Ensuring security of energy supply. Four essays on assessing regional energy security performance, and related policy interventions into energy markets“ [Wirtschafts- u. Rechtswissenschaften](#)

KATARINA BÖTTCHER, Thema: „Economic Consequences of Board Members? Characteristics and Board Diversity“ [Wirtschafts- u. Rechtswissenschaften](#)

DAVID CHATTERJEE, Thema: „Evergreening – Voraussetzungen der Patentfähigkeit im deutschen, europäischen und indischen Recht“ [Wirtschafts- u. Rechtswissenschaften](#)

DANIEL DETZER, Thema: „Finance, Financialisation and Financial Regulation – the changing financial environment in Germany and its macroeconomic effects?“ [Wirtschafts- u. Rechtswissenschaften](#)

MAIKE IRMSCHER, Thema: „Der Beitrag von individuellen Lern- und Denkstilen“ [Wirtschafts- u. Rechtswissenschaften](#)

HEIKE JAHNCKE, Thema: „(Selbst-)Reflexionsfähigkeit – Modellierung, Differenzierung und Beförderung mittels eines Kompetenzentwicklungsportfolios“ [Wirtschafts- und Rechtswissenschaften](#)

MATHIAS MIER, Thema: „The Economics of Electricity Markets with Renewable Energies?“ [Wirtschafts- u. Rechtswissenschaften](#)

OLIVER NORKUS, Thema: „IT-Architekturentwicklung für BI in der Cloud“ [Informatik](#)

MARIA REAL PERDOMO, Thema: „The Insect Economy – Sustainable Business Opportunities based on Insects as Biological Resources“ [Wirtschafts- u. Rechtswissenschaften](#)

CHRISTINA SCHNELL, Thema: „Standardisierte Tests als Instrumente zur Individualdiagnostik in der ökonomischen Bildung: Konzeption und Auswertung einer empirischen Studie an niedersächsischen Schulen der Sekundarstufe I“ [Ökonomische Bildung](#)

ANDREAS SLOPINSKI, Thema: „Individuelles und organisationales Lernen zur Generierung nachhaltigkeitsorientierter Innovationen in Unternehmen“ [Wirtschafts- u. Rechtswissenschaften](#)

JOHANN TRENKLE, Thema: „The Role of Monitoring and Signaling in Investment Decisions“ [Wirtschafts- u. Rechtswissenschaften](#)

FLORIAN WAGNER, Thema: „Anonymität und Transparenz der Investmentanlagen. Auskunftsansprüche und Schutz personenbezogener Anlegerdaten“ [Wirtschafts- u. Rechtswissenschaften](#)

KLARA JOHANNA WINKLER, Thema: „Once more with feeling: Harnessing human-nature relationships for the governance of social-ecological systems“ [Wirtschafts- u. Rechtswissenschaften](#)

Fakultät III Sprach- und Kulturwissenschaften

KATRIN KÖPPERT, Thema: „Queer Pain. Schmerz als Solidarisation, Fotografie als Affizierung zu den Fotografien von Albrecht Becker (1920er- bis 1990er-Jahre)“ [Kunst und Medien](#)

BIANCA PATRICIA PICK, Thema: „Distanznahme als Strategie in der Literatur von Überlebenden der Shoah“ [Germanistik](#)

Doctorates

ANASTASIA REIS, Thema: „Endogener und exogener flexionsmorphologischer Wandel in Kleinsprachen: Der Fall des Lemkischen zwischen Polnisch, Slowakisch und Ukrainisch“ [Slawistik](#)

HEIMO PAUL STIEMER, Thema: „Das Habitat der mondblaunen Maus. Eine feldtheoretische Untersuchung der pragerdeutschen Literatur (1890 bis 1938)“ [Niederlandistik](#)

Fakultät IV Human- und Gesellschaftswissenschaften

HERTA HOFFMANN, Thema: „ ‚eine seule des Landes‘ – Sibylla Elisabeth, Gräfin von Oldenburg und Delmenhorst. Handlungsspielräume einer adligen Frau in der Frühen Neuzeit“ [Geschichte](#)

Fakultät V Mathematik und Naturwissenschaften

OLIYA SADRILLAEVNA ABDULLAEVA, Thema: „Activation of Voltage-Gated Ion Channels in Neuroblastoma Cells by an Organic Artificial Photoreceptor“ [Physik](#)

ALAA ALHAMWI, Thema: „Evaluation of Renewable Energy and Flexibilisation Technologies for the Deployment of Smart Cities through the Application of Geographic Information Systems“ [Physik](#)

ZAHRA ALTAHA MOTAHAR, Thema: „Neutron stars in Scalar Tensor Theories of Gravity“ [Physik](#)

LEA AUEN, Thema: „Eine qualitative Untersuchung der diagnostischen Fähigkeiten von angehenden Lehrkräften im Bereich der experimentellen Kompetenzen von Schülerinnen und Schülern“ [Biologie u. Umweltwissenschaften](#)

MARC BROMM, Thema: „Deflection of wind turbine wakes by yaw misalignment – simulation and field testing“ [Physik](#)

VASCO BRUMMER, Thema: „Governance und Konflikt handhabung in Community Energy am Beispiel von Bürgerenergiegenossenschaften in Deutschland – Im Vergleich des gesellschaftlichen Rahmens in Deutschland, den USA und dem Vereinigten Königreich“ [Biologie u. Umweltwissenschaften](#)

LUCAS GARDAI COLLODEL, Thema: „On the structure of rotating bosons and their sectimes“ [Physik](#)

MARKUS DAFINGER, Thema: „Invariant Source Forms, Conservation Laws and the Inverse Problem of the Calculus of Variations“ [Mathematik](#)

TOBIAS DE TAILLEZ, Thema: „Binaural Enhancement of Simulated Hearing Aids and Auditory Models Based on Deep Learning for Analyzing Neurophysiological Processes“ [Physik](#)

WILKE DONONELLI, Thema: „Mechanistic Insights into CO and Methanol Oxidation on unsupported mono- and bi-metallic Coinage Metal Catalysts“ [Chemie](#)

EDUARDO DOS SANTOS SARDINHA, Thema: „Reactivity and Compositional Analysis of the Solid Electrolyte Interphase and the Cathode Electrolyte Interphase in Different Electrodes for Li-ion Batteries“ [Chemie](#)

BASTIAN DOSE, Thema: „Fluid-structure coupled computations of wind turbine rotors by means of CFD“ [Physik](#)

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