

2022/23 Issue

THE UNIVERSITY OF OLDENBURG'S RESEARCH MAGAZINE

EINBLICKE 67



Fresh perspectives

How the ambitious next generation
of scientists is making headway

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immer eine gute Idee



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Dear reader,

A critical problem for electric mobility would be solved if electric car batteries could be charged in a matter of seconds. This might seem utopian, but Dmitry Momotenko believes it can be achieved. The Oldenburg chemist is developing a new 3D printing technique for nanoscale metal structures which he hopes will pave the way for batteries with radically shorter charging times.

Momotenko is one of the outstanding young researchers we introduce in this magazine: women and men who shake things up in innovative fields such as molecular ecology, psychoacoustics and human geography, making their mark with exceptional scientific achievements, attracting top-level third-party funding and assuming leading roles in large collaborative projects.

In Germany, academics who conduct independent research but have not yet been given tenure are known as "Nachwuchsforschende" meaning junior scientists or early career

researchers. These terms can be misleading, because at this point in their careers they are already highly qualified and have accomplished a great deal. We have numerous outstanding examples of academics of this level at our university – reason enough to take a closer look at the valuable and exciting work of some of these aspiring scientists.

Along the way we will lead you into the world of sounds and noise, which is where hearing researchers Martin Bleichner and Kai Siedenburg spend most of their time. Bleichner measures the perception of noise in everyday life with mobile EEG devices he has developed himself; Siedenburg is interested in beautiful sounds and aims to optimize the music listening experience for people with impaired hearing.

Silke Laakman works with fascinating new methods for measuring marine biodiversity. Using only water samples and the genetic material they contain – known as environ-

mental DNA –, she and her team are able to measure the biodiversity of marine communities, identifying species from psyllids to porpoises.

Interdisciplinarity is at the heart of Leena Karrasch's work. A committed sustainability researcher, her studies on adaptation to the consequences of climate change combines theories and practices from the natural and social sciences and delivers results that are incorporated into local planning.

Also in this year's issue: what hidden information resides in the smallest building blocks of language; how can digital assistants help the elderly retain their independence; the influence of the military on prisons; and the often overlooked connections between Christianity and racism.

We wish you a stimulating read!

The EINBLICKE editorial team



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On hearing and noise

Hearing researcher Kai Siedenburg focuses on pleasant sounds whereas his colleague Martin Bleichner is more interested in noise, but soon they will be working together.



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huge wedges* line the walls of the Anechoic Room Wechloy Campus. These 1.5 metre-long sound absorbers are covered in a special fabric and ensure that almost all sounds in the room are absorbed. The Anechoic Lab is one of the quietest rooms in Oldenburg. The background noise level in the recently renovated acoustics laboratory is well below the absolute threshold of human hearing for all frequencies. When the door is closed you hear absolutely nothing – a state that can feel strange or even unpleasant. “Some people experience a sense of pressure in their ears because we are not used to our eardrums not vibrating,” explains acoustician Dr Stephan Töpken, who oversees the lab together with technician Christoph Scheicht (photo). Anyone who spends any time in the eight-meter-high anechoic chamber begins to hear their own heartbeat, digestive sounds or the blood coursing through their veins. The lab is a key research facility for the scientists in the Hearing4all Cluster of Excellence, the Collaborative Research Centre Hearing Acoustics and other research projects. They use it to measure as pre-

cisely as possible the acoustic properties of the devices required for their research, such as loudspeakers and microphones. But the lab is also used for listening experiments with test subjects, particularly experiments on spatial hearing. In order to achieve the greatest possible precision for measurements, no background noise whatsoever should penetrate the room from outside, and any sound waves generated inside the room should not be reflected. For this reason, the cuboid laboratory is a “room-in-room” construction, with the inner room resting on metal springs, which isolate it from the outer environment. There is a one-metre gap between all walls and the outer shell of the building, and the ventilation and lighting systems can be operated almost silently. The sound-absorbing wedges on all six walls are key to ensuring that there are no noticeable echoes whatsoever. The result is an acoustic “free-field condition” – similar to those experienced on the top of a mountain when there is not wind.

**plus or minus 10 to 15 – depending on how you count some of the foam absorbers which are divided into sections*

6.7 decibels

or more precisely: 6.7 dB(A) – this is the background noise level in the renovated acoustics lab according to official measurements. The noise sources include ventilation and the railway line behind the campus. The sound is so quiet that it can only be measured with special microphones.

50 hertz

The sound absorption system in the anechoic chamber soaks up sounds all the way down to this frequency – a very low hum. This is due to the huge size of the absorbers, whose geometry ensures that even very long-wave sound waves cannot propagate.

916 cubic metres

The anechoic chamber has the volume of a large family house. Two-thirds of it is filled with sound absorbers.



At the interface

Rising sea levels, groundwater salinisation and drier summers: the consequences of climate change affect the coastal areas of northern Germany. Leena Karrasch is investigating how society can adapt to these changes. Her research combines the natural and social sciences – and establishes a direct transfer between science and society.

A

quiet but constant crackling is in the air. It sounds like bubbles in a fizzy drink and accompanies anyone who walks along the wooden footbridge that crosses the Langwarder Groden, between the main dyke line and the summer dyke. "That's the sound of thousands of tiny mud scuds bursting air bubbles in the mudflats," says coastal protection expert Dr Leena Karrasch. She recommends that anyone who wants to see what a desirable future for Germany's North Sea coast might look like should visit this wetland area on the northern tip of the Butjadingen peninsula between the Jade Bay and the Weser estuary.

Since the summer dyke was reopened a few years ago, this has become a place where nature can freely unfold again under the influence of the tides. The salt marshes can act as natural buffer zones, providing protection from waves during storms, and are partly used as extensive pastures. A nature trail meanders across them. For Karrasch, a walk in the Langwarder Groden raises precisely the questions at the heart of her research: How can coastal and inland areas be prepared for the consequences of climate change – whether that means rising sea levels or extended periods of drought and heavy rain? How do nature and society interact? How to shape decision-making processes so that they reconcile apparently conflicting interests and use synergies in the fields of water and coastal management, nature conservation and biodiversity, agriculture, policy, but also recreation and tourism?

These are questions that bring together natural and social sciences, just as Karrasch herself combines various disciplines in her own work. Her rather unusual academic pathway began with a degree in biology, after which she earned two Master's degrees at the Universities of Groningen and Oldenburg in the newly launched "Water and Coastal Management" double-degree programme. After completing her

doctoral degree in natural sciences at the University of Oldenburg, she moved to the university's Department of Business Administration, Economics and Law, where she has been a post-doctoral researcher in the Ecological Economics working group led by Prof. Dr Bernd Siebenhüner ever since. The 37-year-old has also conducted research at the university's Centre for Environmental and Sustainability Research (COAST) for over a decade.

Karrasch realized early on that strategies for regional climate adaptation were what really interested her. She wanted to develop her research together with the people who decide which measures to deploy or are affected by them, so that society benefits directly from the results. The principle behind this, transdisciplinarity, combines scientific findings with their practical application, and is what makes her work at the university special. Karrasch is currently involved in the large-scale transdisciplinary project "Gute Küste" ("Good Coast"), funded by the Ministry for Science and Culture of Lower Saxony and the Volkswagen Foundation. She also works in two other projects, has already completed five more, and has several others in the pipeline. All these collaborative projects deal with water and coastal management and the consequences of climate change – and Karrasch's task is always the same: to build bridges between research and practice.

At the once lowest point in Germany, there will soon be a lake again.

The fact that she has a background in both natural and social sciences has proven invaluable for this intermediary role. "In the mutual exchange with regional experts, for example, I can draw on models from the natural

sciences and additionally mediate internally between the disciplinary cultures – or work out a common thread for joint research proposals," she says.

The geographical focus of Karrasch's work is her home region – the North German coastal zone. "When I was doing my Master's degree, many of the students were studying the impact of climate change in distant parts of the world – mangrove forests in the tropics or Pacific islands under threat, for example," recalls Karrasch, who grew up in the town of Wilhelmshaven on Germany's northwest coast. "But East Frisia is also affected," she reflected. However, efforts to adapt to the changing climate in the northwest region were largely limited to building and reinforcing dykes, she explains. "But there are other approaches, and I want to be part of it."

Take Krummhörn, a municipality with 54 kilometres of coastline situated near the estuary of the river Ems. In a project launched in 2011, Karrasch spent four years working with local experts in water management, nature conservation, agriculture, tourism and community politics to develop a strategy for sustainable land use. Not only did the Intergovernmental Panel on Climate Change in 2019 cite the findings in a special report on the state of the world's oceans. The strategy was also directly incorporated into the county's regional planning programme in 2018. "That kind of thing usually takes a long time. I was quite surprised and enthusiastic to see our participatory research make an impact so quickly," says Karrasch recalling the project titled COMTESS, which was funded by Germany's Federal Ministry of Education and Research.

In the first stage of the project Karrasch, together with Oldenburg landscape ecologists Prof. Dr Michael Kleyer and Dr Martin Maier and COAST coordinator Dr Thomas Klenke, had developed several future scenarios for the municipality of Krummhörn, of which one third lies up to 2.5 metres below sea level. At present, its marshland is drained by a network of

ditches and canals and is mainly used for agriculture and dairy farming. Karrasch then used maps to show where it would make more sense to focus on creating water storage areas – also considering the increasing frequency of droughts –, and identified areas where waters with reed could be used for carbon capture and storage. She then presented strategies that were deemed practicable to the team of experts for discussion.

This approach of developing future scenarios and strategies on the basis of workshops, interviews and focus groups of interested parties is a key feature of Karrasch's work. By the end of the four-year planning process in the Krummhörn region, a concept designed together with the experts had been agreed on. It involves the creation of additional polders – retention areas that can be flooded in the event of heavy rain. One example is the "Freepsumer Meer", which has been drained and used for agriculture since the 18th century. As the county Aurich stipulated shortly afterwards in its 2018 regional spatial plan, in the long term this could result in the creation of a new lake at the site that was long deemed the lowest point in Germany.

The value of this two-way transfer – in which scientists benefit from societal perspectives and local expertise and

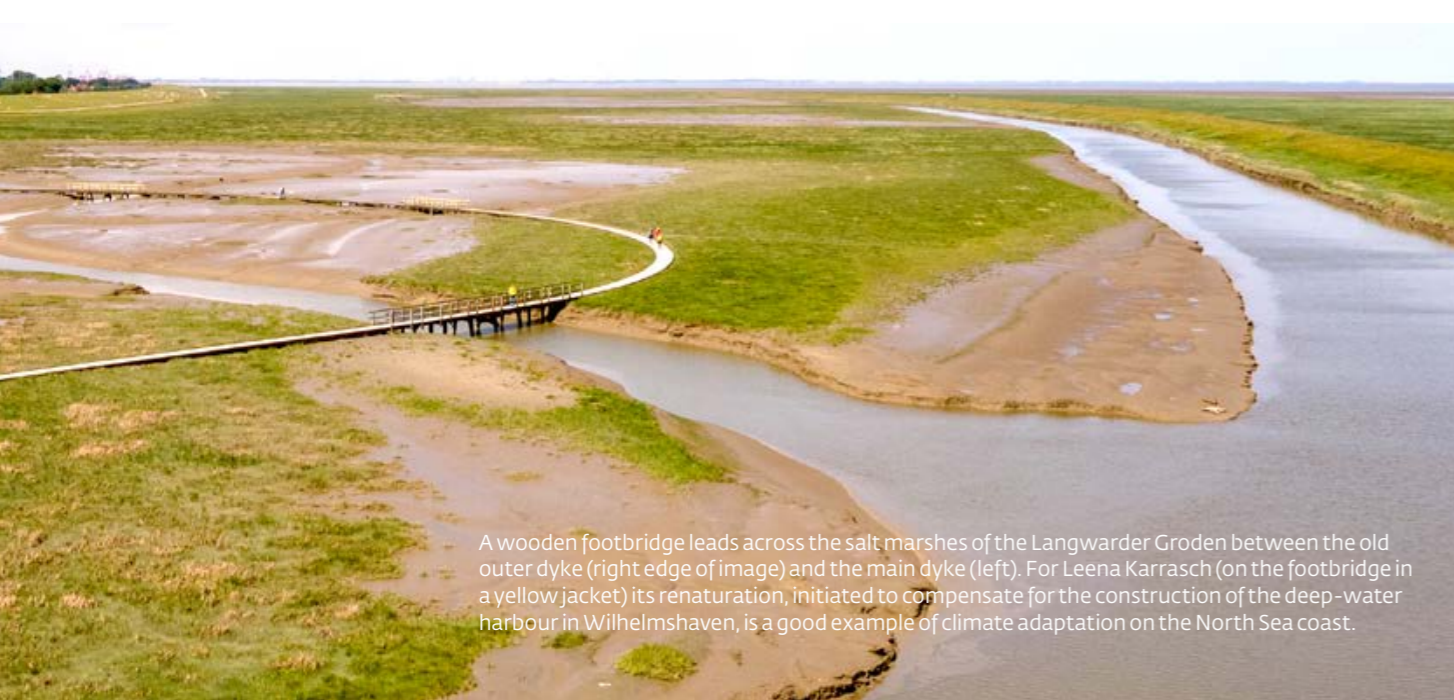
the region from scientific findings – is also apparent in another project in which Leena Karrasch was involved: the SALTSA project. Funded by the German Research Foundation, a team co-led by Oldenburg hydrogeologist Prof. Dr. Gudrun Massmann and Siebenhüner analysed the increasing salinisation of groundwater associated with rising sea levels. Once again, Karrasch was in charge of facilitating the exchange of information with experts from the region.

"Waterworks, drainage associations, the Water Association Council of Lower Saxony – I talked to everyone who was involved with water in the northwest." When the project started in 2016, even these circles were not aware of the fact that groundwater can become saline even in a rainy region, Karrasch recalls. "At first I felt really disheartened because hardly anyone was willing to discuss the issue." However, she documented perceptions, knowledge and learning processes of the stakeholders and found that over the five-year project period – and in particular after the unusual dry years from 2017 to 2019 – awareness of the problem increased.

The modelling performed in the SALTSA project made researchers and practitioners alike realise – to their own surprise – that drainage

ditches are one of the main causes of groundwater salinisation: the deeper the ditches, the greater the risk. In the past, the focus had been on increased groundwater extraction. "This was one of those moments that shows how science can also disprove widely held assumptions," says Karrasch. Thus, the project "brought to the fore a completely new factor that had not been considered before" – and put the issue of salinisation firmly on the agenda of the region's water management authorities, as well as Lower Saxony's recently published water supply concept.

Karrasch's goal in both coastal protection and water management is a holistic perspective. "In general, we need to think less in terms of technical adaptation and work more with natural processes," says Karrasch, as she walks across the Langwarder Groden. Is the international community's goal of limiting the rise in global temperatures to 1.5 degrees Celsius at all achievable? Karrasch has serious doubts, but is nevertheless optimistic that her two children will be able to "live good lives in the future – although no doubt differently from the way we live today". With the right approaches and strategies, regions can adapt to the changing climate, she stresses. "We humans will always find a way to deal with new situations." (ds)



A wooden footbridge leads across the salt marshes of the Langwarder Groden between the old outer dyke (right edge of image) and the main dyke (left). For Leena Karrasch (on the footbridge in a yellow jacket) its renaturation, initiated to compensate for the construction of the deep-water harbour in Wilhelmshaven, is a good example of climate adaptation on the North Sea coast.



Hansa

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Commons-based varieties – clear advantages

Agricultural approaches in which plant varieties are jointly developed by many different breeders and then made freely available for cultivation promote biodiversity and reduce farmers' dependence on international markets. The practice of "commons-based" plant breeding and seed production can thus help to make the agricultural sector more resilient, as demonstrated by Prof. Dr Stefanie Sievers-Glotzbach from the university's Department of Business Administration, Economics and Law and Lea Kliem from the Berlin-based Institute for Ecological Economy Research (IÖW) in a study published in the *International Journal of Agricultural Sustainability*. The researchers investigated the impact of industrial seed production on agricultural resilience – defined as the

ability of agroecosystems to adapt to changes such as climate change or disease – and compared it with that of commons-based seed production. To measure this impact, they identified 14 indicators including supply chain variability, the availability of regionally adapted varieties and the cost-effectiveness of seed production. The two economists then analysed the sustainability reports and brochures of conventional seed producers in German-speaking countries and compared them with the publications of a selection of companies and initiatives producing seeds on a commons basis. The comparison led to the conclusion that the commons-based approach to plant varieties has clear advantages over the standard practices of large seed companies, reports Sievers-Glotzbach,

who heads the Junior Research Group RightSeeds, which is funded by the Federal Ministry of Education and Research (BMBF). Rather than focusing on just a few high-yielding varieties that thrive only under optimal cultivation conditions, plant breeders and seed producers who use a commons-based approach work with a wide range of varieties that can adapt to regional particularities and climate-related changes. However, the analysis also showed that commons-based initiatives have not yet developed a funding model that can cover the costs of the labour-intensive breeding of new, adapted varieties in the medium term. Kliem and Sievers-Glotzbach therefore recommend the creation of long-term funding programmes and an improved political framework for such initiatives.



Commons-based seed production focuses on breeding diverse varieties that can adapt to regional conditions and changing climate. Until the beginning of the 20th century, farmers took it for granted that they could freely use different plant varieties, exchange seeds and develop new varieties in their fields.

Faster wind energy expansion

Where is there enough space and support among the population to successfully expand wind energy projects? This is the key question for the social scientists working on the WindGISKI research project, which has secured two million euros in funding from the Federal Ministry for the Environment within the framework of the AI light-houses funding programme. The aim of the collaborative project, which is led by the Leibniz University Hannover, is to use a geographic information system (GIS) in combination with artificial intelligence (AI) to identify promising areas for future wind energy projects. In a sub-project led by Prof. Dr Jannika Mattes, the Oldenburg working group Organisation & Innovation examines sociological factors that influence change and social obstacles to expansion. The ultimate goal of the scientists' work is to help accelerate the expansion of wind energy in Germany.

The future of gas supplies in Lower Saxony

The aim of Oldenburg management scholars Prof. Dr Christian Busse and Julien Minnemann is to launch a discussion about gas supplies in the transition to a sustainable heating sector with stakeholders in Lower Saxony's gas industry and also involve the public in the debate. In their project, the two scientists are creating a platform for discussions about alternatives to natural gas, affordability, the security of supplies and implications for business models. The scheme is part of the Ministry for Science and Culture of Lower Saxony's "Future Discourses" funding programme and will receive just under 120,000 euros in funding over 15 months starting January 2023.

Sustainable protection for the sea

Making the interaction between humans and the sea as sustainable as possible is the goal of the CREATE collaborative project led by Oldenburg biodiversity expert Prof. Dr Helmut Hillebrand. CREATE is one of seven projects in the German Marine Research Alliance's second research mission. The Federal Ministry of Education and Research is funding the project with an initial grant of around four million euros over a three-year funding period. Experts from the natural and social sciences, economics, engineering and society at large are working together in the project and will set up three living labs in the North Sea and the Baltic Sea. The goal is to work with all stakeholders to develop measures to make human use of the oceans more sustainable and effective – and to jointly implement these measures in specific regions. The living labs will be located in the conservation areas Borkum Riffgrund, Sylt Outer Reef and Eckernförder Bucht.

Making dark semiconductors glow

Whether or not a solid can emit light depends on the energy levels of the electrons it contains. An international team led by Oldenburg physicists Dr Hangyon Shan and Prof. Dr Christian Schneider was able to rearrange the energy levels in an ultra-thin sample of the semiconductor tungsten diselenide in such a way that this material, which normally has a low luminescence yield, began to glow. The team reported its results in an article published in the journal *Nature Communications*. The light effect could be used to optimize the optical properties of semiconductors and thus contribute among other things to the development of innovative LEDs and solar cells.

AI for smart hearing aids

The German Research Foundation has extended its funding for the Oldenburg-based Hearing Acoustics Collaborative Research Centre (CRC). Led by hearing researcher Prof. Dr Volker Hohmann, the CRC will receive up to 8.1 million euros in its second funding period from 2022 to 2026. Under the official project title "Hearing Acoustics: Perceptive Principles, Algorithms and Applications" (HAPPAA), the scientists in the collaborative project are developing hearing aids and assistive listening devices that use artificial intelligence methods to automatically adapt to different acoustic environments. In this second funding period, the CRC team aims to improve and integrate the models, algorithms and applications it has developed so far. One goal is to develop algorithms for active noise control which automatically adjust to different acoustic environments. The long-term goal is for each hearing aid to learn continuously so that it can better predict which setting is optimal for the individual user in any given situation.

The thin skin of the oceans

The surface layer of the oceans is the focus of a new research group led by oceanographer Prof. Dr Oliver Wurl from the Institute for Chemistry and Biology of the Marine Environment (ICBM). The project, entitled "Biogeochemical Processes and Air-Sea exchange in the Sea-Surface Microlayer" (BASS), investigates the complex biological, chemical and physical relationships in the surface microlayer, which in many places is less than a millimetre

thick and regulates the exchange of gases, energy and momentum between water and atmosphere. The German Research Foundation (DFG) and the Austrian Science Fund (FWF) are funding the project for the next four years. The researchers applied for 4.1 million euros in total.

To gain a better understanding of the processes in this paper-thin layer, the team is conducting field investigations as well as experiments in the lab, in

the wind-wave tank of the Universität Hamburg and at the Sea Surface Facility of the Wilhelmshaven campus of the ICBM. A three-week measurement campaign is planned for the summer of 2024, with members from all participating project groups on two research vessels in the North Sea near Helgoland. The team will use various measurement techniques on different platforms, such as ICBM's new autonomous research catamaran "Halobates".

Face masks: obstacles to lip-reading

The fact that it is more difficult to understand what a person is saying when they are wearing a face mask is mostly due to their mouth being hidden, experiments conducted by hearing researchers at the university's medical faculty revealed. This leads to the conclusion that everyone, not just people with impaired hearing, uses lip-reading

to some extent to understand speech. The interdisciplinary team of researchers from the Department of Medical Physics and Acoustics and the University Clinic for Otorhinolaryngology presented their results in the science journal *Otology & Neurotology*. To find out how face masks impact speech comprehension, the researchers

played sentences to test subjects in various scenarios. They found that even if the sound quality remained constant, when the speaker's mouth was hidden behind a virtual mask, speech comprehension decreased by more than a fourth – just as much as when participants couldn't see the speaker at all.

How neuromodulation works

Neuromodulation can help to improve memory, mobility and speech in people with neurological diseases. The scientists in the Research Training Group Neuromodulation of Motor and Cognitive Function in Brain Health and Disease are investigating the effects of electrical, magnetic or pharmacological stimulation on the brain, as well as the effects these treatment methods have on patients' daily lives. The German Research Foundation

(DFG) is providing a five-year grant for the group, which is based at the Department of Psychology at the School of Medicine and Health Sciences. The researchers applied for 6.5 million euros in funding, which will enable 13 doctoral students to conduct research in this area. They will be supervised by eleven Oldenburg scientists and one scientist from the University of Cologne. The spokespersons of the new research training group are Prof. Dr Christiane

Thiel, head of the Biological Psychology Lab, and neuropsychologist Dr Cornelia Kranczioch. The researchers are focusing on how and why different methods of neuromodulation can be effective in treating neurological disorders such as stroke or Parkinson's disease. Their research makes use of cutting-edge technologies such as magnetic resonance imaging, magnetoencephalography and electroencephalography.



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Maintaining our independence in old age

Old people and modern technology don't work well together? Nutritionist Rebecca Diekmann disagrees. She and her team design an app-based system to help this demographic live healthier lives and remain independent.

Three metres. That's the distance between the chair and the mark on the floor. As soon as the person sitting in the chair grips the armrests with their hands and pushes their body up from the seat, the timer starts running – and it doesn't stop until they have crossed the mark, turned around and walked back to resume their original sitting position. The amount of time this procedure takes provides information about the individual's mobility levels. If it takes less than ten seconds, there's no need to worry. Anyone who needs longer than 20 seconds should get their physical function, muscle strength, and balance checked.

With its strict emphasis on performance and times, the Timed Up and Go Test (TUG test) exercise is reminiscent of physical education at school, with the difference that it is generally performed by elderly people rather than schoolchildren. This geriatric mobility test reveals how steady and agile a person is on their feet and how their mobility levels progress over time. "To stay fit and live independently in our own homes is something we probably all wish for," Dr Rebecca Diekmann says.

It is this independence that the nutritionist wants to help senior citizens preserve. Diekmann heads the junior research group Nutrition and Physical Function in Older Adults at the University of Oldenburg's Department of Health Services Research. The team brings together eight researchers from computer science, medical engineering, nutritional science, medicine, and physiotherapy to develop technical tools to help older people stay healthy. One of the projects it is currently working on is a tablet-based app that helps older people to eat a healthy diet and maintain mobility. The group is also planning to develop measuring and training stations where test subjects can do physiotherapeutic exercises and

document their progress without help from others. The assistance system that the researchers will be developing over the next few years will integrate the complementary concepts of a mobile tablet app and permanently installed training stations in public areas.

They won't start from scratch, but build on previous projects. As part of their Prediction for Maintaining Independence in Old Age project, for example, the researchers already developed and used technology to get older people moving and measure their performance. Instead of relying on medical personnel to check that they stick to the rules and to keep a record of times in exercises such as the TUG test, cameras and various types of sensors monitored these tasks.

Reduced appetite and decreasing energy requirements can lead to poor nutrition.

But exercise and training alone don't guarantee success. One commonly overlooked prerequisite for retaining mobility into old age is the knowledge on right diet. "For example, it's impossible to build muscles if your protein intake is too low," Diekmann explains. Malnutrition is a common problem among the elderly. As they grow older their total energy requirements and appetite decrease. As a result, they eat about 20 percent less on average, which means that the supply of essential nutrients also falls short – but this often goes unnoticed.

The app-based assistance system is designed to make older adults aware of how to maintain a balanced diet.

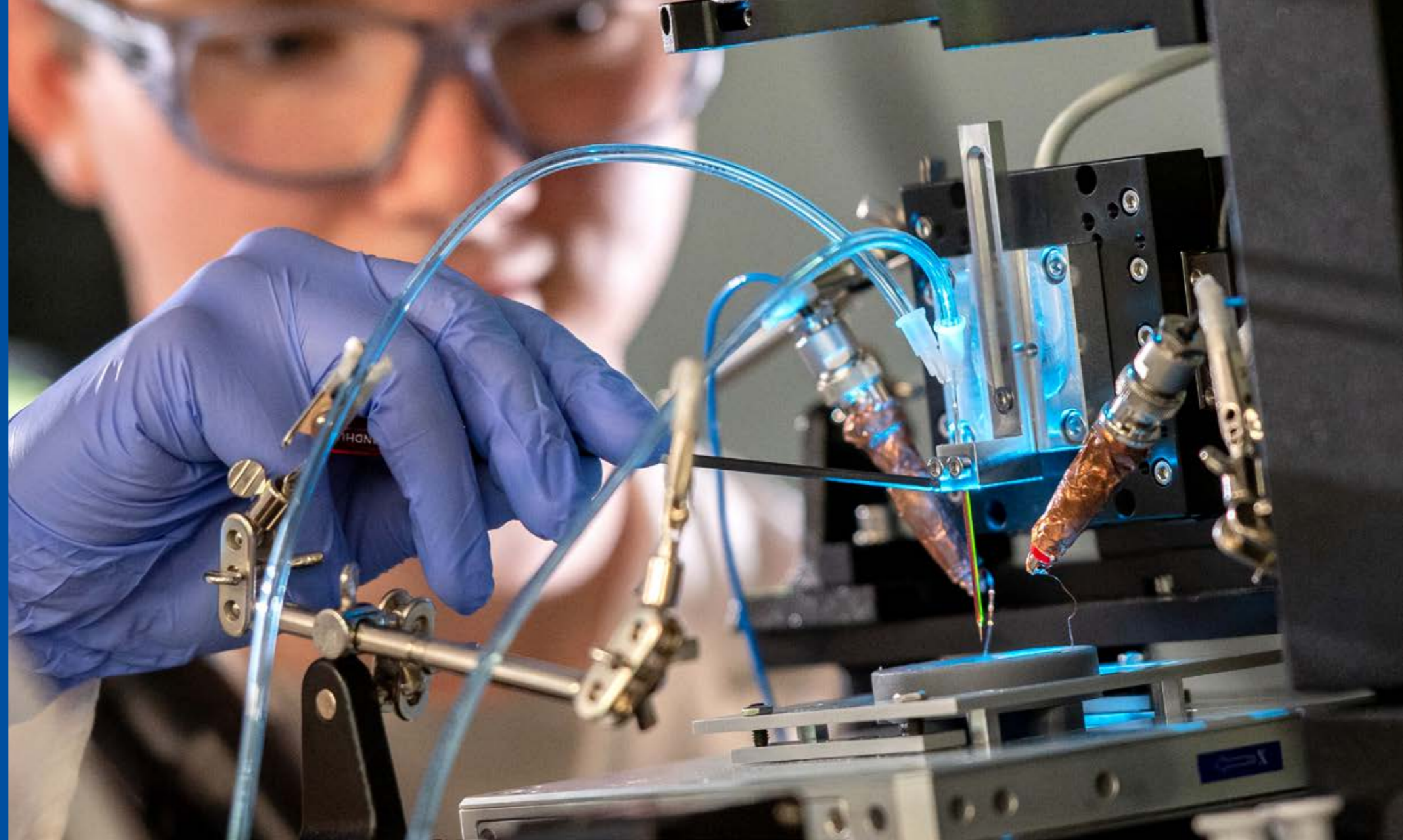
They provide all the key data themselves, entering all the meals and snacks they eat over the day on a tablet computer. "We're not interested in every last detail; it's more about a rough assessment of whether nutritional requirements are met," Diekmann explains. The app calculates how much of the nutrient requirements are already covered and informs the user. Diekmann's team has been steadily expanding the app's functions over the years, and it now includes videos of simple mobility exercises, to-do lists for sports activities and general information dispelling common myths about nutrition.

Diekmann recently got the green light for her AS-Tra project. A five-year grant from the Federal Ministry of Education and Research will allow the scientist and her team to further improve the system and put it to the evaluation. "This is our big chance to conduct a randomised controlled trial and evaluate the effectiveness of the assistance system," Diekmann says. Before this step she and her team plan to integrate a psychological model into the system to help keep users motivated. The Transtheoretical Model of Behaviour Change describes the various phases involved in changing a behaviour permanently. The app will use this model to adjust content according to factors such as whether the user has never shown any interest in nutrition or exercise before, whether they are starting to think about adopting a healthier lifestyle or whether they have already undertaken initial steps in this direction. "It makes no sense to suggest exercises to someone who still has no idea why this is good for them," Diekmann explains.

Yet in old age in particular, adopting a healthier lifestyle pays off and can lead to quantifiable improvements, for example in the TUG test. But instead of getting good grades at school one gets a better chance to live independently for longer. (sn)

Printing atom by atom

A research team led by chemist Dmitry Momotenko has developed a new 3D printing technique for manufacturing ultrasmall metallic objects. Using this technique, the researchers aim to substantially increase the surface area of battery electrodes to drastically reduce charging times. A lab visit allows to take a look.



A very special kind of 3D printer: Masters student Simon Sprengel makes some final adjustments to allow two metal solutions to flow simultaneously through the tiny printing nozzle.

It takes chemist Liaisan Khasanova less than a minute to turn an ordinary silica glass tube into a printing nozzle for a very special 3D printer. The chemist inserts the capillary tube – which is just one millimetre thick – into a blue device, closes the flap and presses a button. After a few seconds there is a loud bang and the nozzle is ready for use. "A laser beam inside the device heats up the tube and pulls it apart. Then we suddenly increase the tensile force so that the glass breaks in the middle and a very sharp tip forms," explains Khasanova, who is working on her PhD in chemistry in the Elec-

trochemical Nanotechnology Group. Khasanova and her colleagues need the minuscule nozzles to print incredibly tiny three-dimensional metallic structures. This means the nozzles' openings must be equally tiny – in some cases so small that only a single molecule can squeeze through. "We are trying to take 3D printing to its technological limits," says Dr Dmitry Momotenko, who leads the junior research group at the Institute of Chemistry. His goal: "We want to assemble objects atom by atom."

Nanoscale 3D printing – in other words 3D printing of objects that are a just few billionths of a metre in size –

opens up amazing opportunities, the chemist explains. For metal objects in particular, he can envisage numerous applications in areas such as microelectronics, nanorobotics, sensor and battery technology: "Electroconductive materials are needed for all kinds of applications in these areas, so metals are the perfect solution."

While 3D printing of plastics has already advanced into these nanoscale dimensions, manufacturing tiny metal objects using 3D technology has proven more difficult. With some techniques the printed structures are still a thousand times too large for many advanced applications, while with others

it is impossible to fabricate the objects with the necessary degree of purity.

Momotenko specializes in electroplating, a branch of electrochemistry where metal ions suspended in a salt solution are brought into contact with a negatively charged electrode. The positively charged ions combine with electrons to form neutral metal atoms which are deposited on the electrode, forming a solid layer. "A liquid salt solution becomes a solid metal – a process which we electrochemists can control very effectively," says Momotenko. This same process is used for chrome-plating car parts and gold-plating jewellery on a larger scale.

However, transferring it to the nanoscopic scale requires considerable ingenuity, effort and care, as a visit to the group's small laboratory on the Wechloy campus confirms. The lab contains three printers – all built and programmed by the team itself, as Momotenko points out. Like other 3D printers they consist of a print nozzle, tubes for feeding in the print material, a control mechanism and the mechanical components for moving the nozzle – but in these printers everything is a little smaller than usual. A coloured saline solution flows through delicate tubes into the thin capillary tube, which in turn contains a hair-thin

piece of wire – the anode. It closes the circuit with the negatively polarized cathode, a gold-plated silicon flake smaller than a fingernail, which is also the surface on which the printing takes place. Micromotors and special crystals that morph instantaneously when an electrical voltage is applied rapidly move the nozzle by fractions of a millimetre in all three spatial directions.

Since even the slightest vibrations can disrupt the printing process, two of the printers are housed in boxes covered in a thick layer of dark-coloured acoustic foam. Furthermore, they are resting on granite plates, each weighing 150 kilogrammes. Both measures



Dmitry Momotenko specializes in the 3D printing of metals. He wants to manufacture objects one atom at a time.



Liaisn Khasanova uses a micropipette puller to prepare the tiny printing nozzles made of special glass.



To close the circuit with the negatively polarized cathode, Karuna Kanes positions a hair-thin wire – the anode – inside the printing nozzle.



Tiny gold-coated silicon plates smaller than a fingernail are used as a printing surface.

are aimed at preventing unwanted vibrations. The lamps in the lab are also battery-powered because the electromagnetic fields produced by alternating current from a socket would interfere with the tiny electrical currents and voltages needed to control the nanoprinting process.

Meanwhile, Liaisn Khasanova has prepared everything for a test print: the print nozzle is in its starting position, the box is closed, a vial containing a light blue copper solution is connected to the tubes. She starts a programme which initiates the printing process. Measurement data appears on a screen as curves and dots. These show the variations in the current flow and register the nozzle briefly touching the substrate and then retracting again and again. What is the machine printing? "Just a few columns," she replies.

Columns are the simplest geometric forms generated in 3D printing, but the Oldenburg researchers can also print spirals, rings and all kinds of overhanging structures. The technique can currently be used to print with copper, silver and nickel, as well as nickel-manganese and nickel-cobalt alloys. In some of their experiments, they have already ventured deep into the nano-world. Momotenko and an international team of researchers reported in a study published in the journal *Nano Letters* in 2021 that they had produced copper columns with a diameter of

just 25 nanometres – taking 3D metal printing below the 100-nanometre limit for the first time.

One of the cornerstones for this success was a feedback mechanism that enables precision control of the print nozzle's movements. It was developed by Momotenko together with Julian Hengsteler, a PhD student he supervised at his previous place of work, ETH Zurich in Switzerland. "The continuous retraction of the print nozzle is enormously important, because otherwise it would quickly become clogged," explains the chemist.

"A liquid salt solution becomes a solid metal – a process which we electrochemists can control very effectively."

The team prints the tiny objects layer by layer at speeds of a few nanometres per second. Momotenko still finds it amazing that objects too small to be visible to the human eye are being created here. "You start with an object you can touch. Then a certain transformation takes place and you are able

to control these invisible things at an extremely small scale – it is almost unbelievable," says the chemist.

Momotenko's plans for his nanoprinting technique are also pretty mind-boggling: his goal is to lay the foundations for batteries that can be charged a thousand times faster than current models. "If that can be achieved, you could charge an e-car within seconds," he explains. The basic idea he is pursuing is already around 20 years old. The principle is to drastically shorten the pathways of the ions inside the battery during the charging process. To do this, the electrodes, which are currently flat, would have to have a three-dimensional surface structure. "With the current battery design, charging takes so long because the electrodes are relatively thick and far apart," Momotenko explains. The solution, he says, is to interlock the anodes and cathodes like fingers at the nanoscale and reduce the distance between them to just a few nanometres. This would allow the ions to move between anode and cathode at lightning speed. The problem: so far it has not been possible to produce battery structures with the required nano dimensions.

Momotenko has now taken on this challenge. In his NANO-3D-LION project, which is funded by a European Research Council Starting Grant awarded in March 2021, the goal is to develop and employ advanced nanoscale 3D printing techniques to fabricate ac-

tive battery materials with ultrasmall structural features. Having collaborated successfully with a research group led by Prof. Dr Gunther Wittstock at the Institute of Chemistry in an earlier project, Momotenko then decided to base the project at the University of Oldenburg. "The Department for Research and Transfer was very helpful with my grant application, so I moved here from Zurich at the beginning of 2021," he explains.

His research group now has four members: besides Khasanova, PhD student Karuna Kanes and Master's student Simon Sprengel have joined the team. Kanes focuses on a new method aimed at optimizing the precision of the print nozzle, while Sprengel investigates the possibility of printing combinations of two different metals – a process necessary to produce cathode and anode material simultaneously in one step.

Liaisn Khasanova will soon focus on lithium compounds. Her mission will be to find out how the electrode materials currently used in lithium batteries can be structured using 3D printing. The team is planning to investigate compounds such as lithium-iron or lithium-tin, and then to test how large the nano "fingers" on the electrode surfaces need to be, what spacing is feasible, and how the electrodes should be aligned. One major hurdle here is that lithium compounds are highly reactive and

can only be handled under controlled conditions. For this reason, the team recently acquired an extra-large version of a laboratory glove box, a gas-tight sealed chamber that can be filled with an inert gas such as argon. It has handling gloves built into one side with which the researchers can manipulate the objects inside. The chamber, which is about three metres long and weighs half a tonne, is not yet in operation, but the team plans to set up another printer inside it. "The chemical conversion of the material and all other tests will also have to be carried out inside the chamber," Momotenko explains.

The team will run up against some major questions in the course of the project: How do tiny impurities within the argon atmosphere affect the printed lithium nanostructures? How to dissipate the heat that is inevitably generated when batteries are charged within seconds? How to print not just tiny battery cells but also large batteries for powering a mobile phone or even a car – within a reasonable time? "On the one hand, we are working on the chemistry needed to produce active electrode materials at the nanoscale; on the other, we are trying to adapt the printing technology to these materials," says Momotenko, outlining the current challenges.

The problem of energy storage is extremely complex, and his team can only play a small part in solving it, the

researcher emphasises. Nonetheless, he sees his group in a good starting position: in his opinion, electrochemical 3D printing of metals is currently the only viable option for manufacturing nanostructured electrodes and testing the concept.

In addition to battery technology, the chemist is also working on other bold concepts. He wants to use his printing technique to produce metal structures that allow for a more targeted control of chemical reactions than possible so far. Such plans play a role in a relatively young field of research known as spintronics, which focuses on the manipulation of "spin" – a quantum mechanical property of electrons.

Another idea he hopes to put into practice is to manufacture sensors that are able to detect individual molecules. "That would be helpful in medicine, for detecting tumour markers or biomarkers for Alzheimer's at extremely low concentrations, for example," says Momotenko.

All these ideas are still very new approaches in chemistry. "It is not yet clear how it would all work," he admits. But that's how it is in science: "Every meaningful research project requires long thinking and planning, and in the end most ideas fail," he concludes with a smile. But sometimes they don't – and he and his team have already taken the first successful steps on their journey. (uk)

Christianity as a resource

What role does Christianity play in perpetuating racism? Theologian Dominik Gautier takes a critical look at the Christian faith and examines this and other pressing questions of our time, such as the relationship between humans and nature, from a theological perspective. In the following interview he talks about his research.



One of theologian Dominik Gautier's research interests is our relationship to nature. He believes a spiritual approach can encourage people to take nature's complexity seriously and develop a more caring attitude towards the natural world.

Mr Gautier, you are investigating racism and the American civil rights movement from a theological perspective. Why?

Gautier: When I was a student I studied the US civil rights movement and key figures like Martin Luther King, and asked myself: What does theology actually say about racism? According to the Christian faith, all people are equal before God. This means that theology should have positioned itself against racism. But it didn't. On the contrary, in my view it is entangled in the perpetuation of racist ideas, and there are very few theological discussions on the subject.

That basically stands in contradiction to theology's mandate to become far more critical?

Gautier: Yes. This is why in the 1960s James H. Cone, the Black theologian and founder of Black theology in the

US – which emerged from the Civil Rights movement and Black Power – criticized academic theology, which was mainly practised by whites. Cone maintained that theology makes itself complicit in racism by remaining silent on the issue. He pointed out that if a person who was killed by state violence, namely Jesus, is at the very centre of Christianity, then theology must find its voice for criticizing state violence – including police violence, for example. This also means that if Christianity takes itself seriously it must prove its sincerity by being critical of racism. My dissertation was therefore about developing a self-critical theology.

What exactly was your focus?

Gautier: I analysed how the German-American theologian Reinhold Niebuhr dealt with racism and the civil rights movement in the 1950s

and 1960s. Unlike many other white theologians, Niebuhr maintained that churches must come to see action against racism as one of the key tasks. However, as I demonstrated in my dissertation, he himself didn't always adhere to this, and he also downplayed racism. Niebuhr supported the cause of the civil rights movement. But he also said that those involved were too impatient in their push for change. He believed the movement should have adopted a more long-term perspective. This, of course, is problematic, because with his "not yet, later" attitude he reinforced a social problem – and he also did so by citing God.

So it was more about consolation...

Gautier: Yes. For me, as a white person, it was also important to study another white person and learn from their mistakes. Christianity is entangled in the notion of white supremacy. We

need to confront that – through nuanced research. In systematic theology we are concerned with explaining the Christian faith in the present day for the present day, and, in doing so, we also criticize the Christian faith, as well as showing that it has something to offer. The aim is not to proselytize, but to reflect and develop a different awareness of the problems of our time from a religious perspective.

You are currently involved in an interdisciplinary research network funded by the German Research Foundation. What is the focus there?

Gautier: In this network German and US researchers from the fields of American studies, history and theology have come together to study the civil rights movement from a transatlantic perspective. One of the objectives is to examine how the legacy of the civil rights movement continues to

have an impact and develop in the US and Germany today. The network started its work at the beginning of 2022. Within this context my interest is in the connection between racism, the environment and justice – from a theological perspective. The environmental justice movement emerged from the US Civil Rights movement in the 1980s – supported by the United Church of Christ. In 1987, this Reformed church published a groundbreaking, high-profile report showing that toxic waste was often dumped in places where mainly African Americans and people with Latin American ancestry lived. The report concluded that the consequences of the destruction of nature mainly impact People of Colour. In the future, I would like to address the question of how to develop a theology that is in dialogue with this movement – and that takes seriously the principle that Christianity should

be about justice for people affected by discrimination and justice for more-than-human nature.

You also research the relationship between humans and nature and examine the notion that Christianity is implicated in the destruction of nature.

Gautier: Yes, the sociologist Max Weber developed this idea implicitly at the beginning of the 20th century: he argued that the Reformed tradition of Calvinism, in particular, has promoted capitalism and thus – by extension – caused the destruction of Earth. In my view, however, this thesis requires a highly nuanced approach. After all, John Calvin, whose doctrine the Reformed tradition follows, also emphasized the strong connection between God and nature. So rather than elevating humans above nature, the Christian faith must emphasize solidarity with nature. I am

interested in how these sixteenth-century ideas were interpreted in fields such as landscape art and nature writing. Authors like Henry David Thoreau, known for his descriptions of nature and calls to protest against racism, are as much part of the Reformed tradition as John Muir, who founded the National Park movement in the US.

So in this respect, the ideas of Reformed theology have contributed to environmental protection.

Gautier: We have the national parks thanks to the conservation policy that emerged in the US in the nineteenth century. At the same time, the conservation of forests, of wilderness, was often linked to the eugenics movement, or preservation of the "white race". Muir himself disparaged indigenous people while exalting nature. The concept of nature was also glorified in National Socialist ideology, for example. We see this clearly in its narratives about the "German forest" and "blood and soil". The entanglement of nature conservation policies and nationalist, antisemitic thinking becomes apparent here. I believe that a theological discussion of nature must firmly reject such ideologies.

Would this lead to a less emotional way of looking at nature?

Gautier: From the Reformed theology perspective, nature is not an ethical guideline, nor "home" nor "Mother Earth", but first and foremost God's creation which, together with all humanity, is dependent on God. We can admire it in all its beauty. But we must also clearly name the dark sides of nature, for example the emergence of life-threatening viruses. What I aim

for is a sober and complex approach to nature that is rooted in solidarity. This is why in my research, I address the relationship between humans and nature, bringing the Reformed tradition into dialogue with cultural studies. Surprisingly, we see that both disciplines deal with similar topics.

Could you give an example?

Gautier: Both explore this exaltation of nature – but from different perspectives. For example, US law and cultural studies scholar Jedediah Purdy critically examines US environmental policy and the ideologization of nature in his book "After Nature. A Politics for the Anthropocene". He argues that in the Anthropocene – the age of humans as the dominant influence on the planet's climate and ecosystems – we must no longer make nature a screen for our own projections but take it seriously in all its complexity, something towards which Reformed theology also strives. This is where I believe Christian theology and cultural studies discourse on the Anthropocene intersect.

So your goal is to prompt a kind of religiously informed reflection on humanity and nature ...

Gautier: If I were talking to an environmental activist, we would probably agree that it is important to work towards environmental justice and to contain the climate crisis. But in my view, we should not conceive environmental protection merely as a technological problem that can only be solved politically – although that is of course crucial. We also need a spiritual approach: I believe that we can see Christianity as a resource for increasing our sensitivity to

the world and as a way to shift the focus a little away from ourselves – combined with a commitment to making life better for all living beings.

Does your faith play a role in your scientific work?

Gautier: Yes, I believe that faith can also be expressed by questioning one's own beliefs or traditional beliefs. On the other hand, traditional beliefs can also be surprisingly modern and relevant, and I can see them as a resource for ecological reflection, for example. For me, the two things go together – faith and academic reflection.

Interview: Constanze Böttcher

About Dominik Gautier

Dr Dominik Gautier has been a research associate at the university's Institute for Protestant Theology and Religious Education since 2012. He completed his doctoral thesis in 2020 with a dissertation entitled "The Ambivalence of Realism. Reinhold Niebuhr's theological ethics in a critical perspective on racism". Gautier studied at the University of Oldenburg and at the Union Theological Seminary in New York. In autumn 2022, he was a Visiting Scholar at the McAfee School of Theology, Mercer University in Atlanta, USA, where he was responsible for, amongst others, a seminar on "Reformed Theologies of Nature". He is also a member of the research network "Bridging the Black Freedom Struggle. German and U.S.-American Perspectives" funded by the German Research Foundation.

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On hearing and noise

Kai Siedenburg investigates how people with hearing problems can fully experience the joy of music again. Martin Bleichner is more interested in disturbing noises in everyday life. The two researchers nonetheless want to work together.



Kai Siedenburg (in the dark sweater) wants wearers of hearing aids to be able to fully enjoy concerts again. Martin Bleichner, by contrast, is more interested in annoying everyday noises like people loudly eating snacks in the cinema.

When Dr Martin Bleichner gives a talk he often holds a pen in his hand. Not to point at things or to take notes, but to make little “clicks” by pressing the end every now and then. “After a few minutes, when I eventually put the pen down, the reaction is almost always the same: half of the audience is visibly relieved; the other half will either have barely noticed the clicking or have chosen to ignore it,” the neuropsychologist explains. Since 2019 he has headed the Emmy Noether Group “Neurophysiology of Everyday Life” at the Department of Psychology, which studies how we perceive sounds in everyday life – in particular unwanted sounds, generally referred to as noise. “Many find it hard

to believe that different people perceive the same sensory impressions in entirely different ways,” says Bleichner. One example of this is synaesthesia, a phenomenon that produces non-separated sensory perceptions. Synaesthetes, as people with synaesthesia are called, might perceive letters or sounds as inherently coloured, or perceive touch simultaneously with sound or taste sensations. Bleichner’s research concentrates on auditory stimuli and his aim is to create a visual rendition of the effects they trigger in different people’s brains.

Were Bleichner to stand in front of an older audience, the number of people who feel irritated by the clicking would be lower. This is something his colleague Dr Kai Siedenburg knows

from his own research. Some of them would not hear the clicking at all, even if they tried. After all, one in two people over the age of 70 have some form of hearing impairment. But although this might come in handy with undesirable sounds, it can be especially annoying for music lovers. Concerts, recorded music and radio all sound very different to people with hearing problems. But there are plenty of answers to how they sound different. “The experience of listening to music with hearing impairments varies dramatically because types of hearing loss themselves vary so dramatically,” Siedenburg explains. He has been conducting research and teaching at the University of Oldenburg since 2016, and was awarded a Freigeist fellowship from the Volks-

wagen Foundation in 2019 to research music perception and processing. His “Music Perception and Processing Lab” is based at the Department of Medical Physics and Acoustics.

Both scientists are hearing researchers, although at first glance their key interests couldn’t be more different. While Bleichner’s main focus is unwanted noise and individual noise perception, Siedenburg pursues beautiful sounds – and ways to help people suffering from hearing problems enjoy them again. But perhaps the search for sounds perceived as noise is not so different from the search for the perfect sound after all?

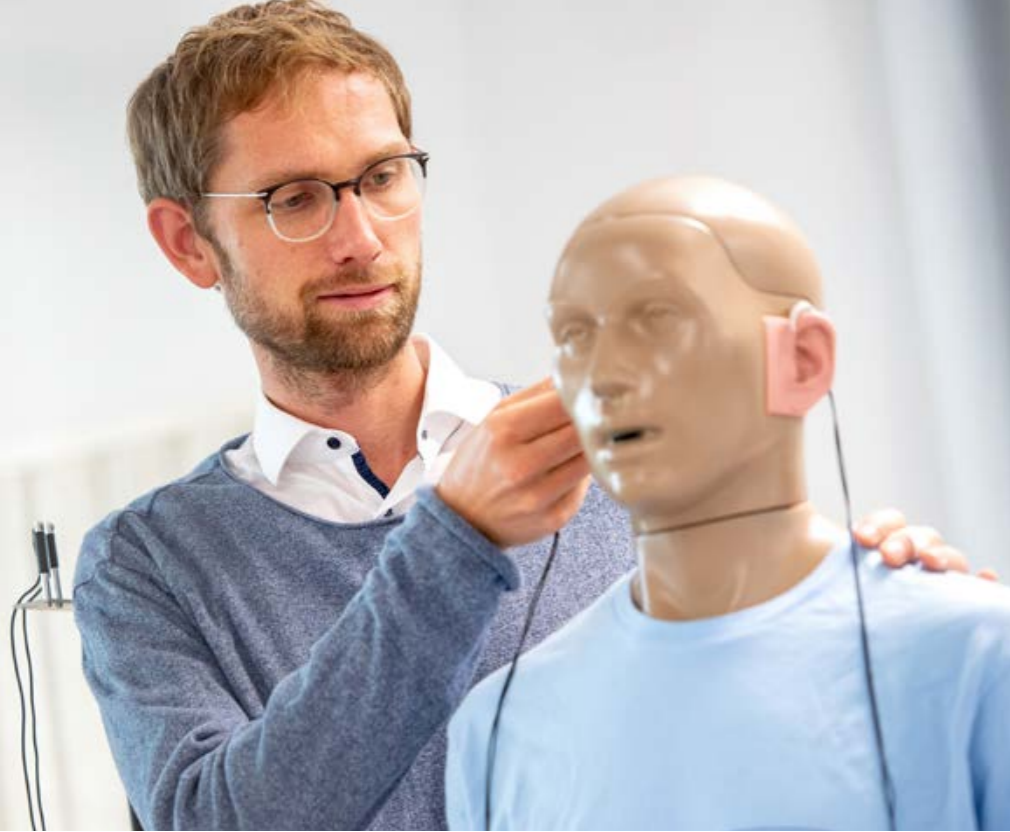
“People with hearing problems often complain that music sounds faded to them, that they are no longer able to

pick out individual instruments and that the sound quality in general is unpleasant,” Siedenburg says. Standard hearing aids seldom improve the situation, mainly because they tend to be optimized for helping people to follow conversations. “Hearing aids concentrate on the volume levels in normal speech,” Siedenburg explains. Music, on the other hand, especially in concerts, can be both very loud and very quiet and is thus outside this range – just one of the problems that hearing aids have yet to successfully address. Many functions in hearing aids today that help their wearers to understand speech actually make it more difficult to hear music.

This is something Siedenburg wants to change with his psychoacoustics

research. This discipline examines the connection between the physical auditory stimulus and its auditory perception. Siedenburg’s aim is to better understand these connections and find ways to transmit music so that, when technologically tweaked to the individual’s needs, even the hard of hearing can enjoy listening to it again. His central question here is: How to mix a musical signal – whether played live or from a recording – so that music fans with hearing aids can hear everything the composition has to offer?

To answer this question Siedenburg and his team, which includes three PhD students, want to pinpoint the critical factors in listening to music and find out which of these change with hearing loss. One experiment



Listening to music through a hearing aid is often far from pleasurable, as these devices are optimised for following conversations instead. This is something Kai Siedenburg hopes to change.



A piece of music has several different components. Our ability to distinguish them diminishes as our hearing deteriorates.



Keyboard, guitar, drums, vocals: Siedenburg and his team are investigating which elements of a piece of music remain most clearly in listeners' minds.

they conduct involves playing a short sequence of music featuring several instruments played simultaneously to younger people with normal hearing and older people with moderate hearing loss. The test persons then listen to two shorter sequences featuring a melody or a single instrument and are asked to identify those which they already heard in the first musical mixture. Siedenburg found that sequences had to be played at a much higher volume for the older participants to be able to perceive them at all, let alone match them with the musical sounds they had previously heard. This was not the case for the younger test subjects. Another interesting finding: How well a person performs in the experiment depends not only on their hearing ability, but also on their musical training. Anyone who has been deeply involved with music, making music themselves for example, will find the hearing exercise easier than someone in the same age group with no such experience.

To get a sense of which sequences in a piece of music are important enough to merit adapting their volume for hearing-impaired listeners, Siedenburg

and his PhD student Michael Bürgel studied the levels of interest that the various instruments in pop songs provoked in listeners. They found that participants in the experiment were less likely to remember the bass track than the vocal track, which they almost always remembered. The researchers were particularly surprised to observe that – compared with all other instruments in the experiment – it made little difference whether the test persons were told in advance to pay special attention to the voice, or whether they were only asked afterwards if they had perceived it: almost all of them remembered the vocal track correctly. These results show that when it comes to pop music, listeners pay much more attention to the human voice than anything else.

One reason for this bias could be that pop music as a genre often focuses on the singing voice, so this could mean that listeners have learned to concentrate more on that, Siedenburg explains. But this high level of attention could also result from imperfections in the human voice. “No matter how well and precisely someone sings:

singing is never perfect,” Siedenburg notes.

When small imprecisions become major mistakes – like when the child next door is practising the violin for the first time and manages to elicit the most piercing screeching sounds from the instrument – Bleichner’s interest as a neuropsychologist is piqued. The point at which a person experiences a sound as unpleasant differs from individual to individual. And the same person may also experience the same sound in very different ways. “Whether or not I am bothered by the sound of a motorbike depends on whether or not I am sitting on it,” Bleichner adds to prove his point.

He uses an electroencephalogram (EEG) to look into people’s heads and examine the effects that everyday sounds have on the brain. “A lot of what we know about how the brain functions has been learned by studying test persons for an hour or two in the lab,” he says. They have to sit as still as possible so that the researchers can record their brainwaves without disturbances caused by movement. External influences are eliminated as much as

possible. “This allows us to get a good look at the brain but has very little to do with daily life,” the researcher explains. Which is why he takes another path and measures the brainwaves of his test persons in everyday situations – working, eating or going for a walk. His team includes one postdoctoral researcher and five doctoral candidates.

What do people hear when you do not tell them what to focus on in advance?

Over the past few years he has been developing and continually improving a method for making these measurements, in collaboration with neuropsychologist Prof. Dr Stefan Debener, a fellow researcher in the Psychology Department. Their cEEGrid is a C-shaped piece of adhesive sticker that is placed

around the outer ear with the help of a small amount of sensor gels.” Unlike the clunky, traditional EEG caps, this one is almost invisible. Ten tiny electrodes attached to this ultra-thin piece of plastic measure brainwaves and the data is then transferred into a small amplifier, which in turn sends it to a smartphone for recording. “So you could even wear it to a family gathering without raising eyebrows,” Bleichner says.

In his experiments the researcher looks for certain waveforms in the EEG. These “event-related potentials”, or ERPs, are triggered by auditory stimuli. The same stimulus can cause different ERPs depending, for example, on whether the people in a test setup pay attention to a particular sound or have been instructed to ignore it. The neuroscientists then use a headpiece that looks like a swimming cap and has up to 96 electrodes attached to it to measure what happens in the brain.

Bleichner’s PhD student Arnd Meiser recently demonstrated the validity of working with ear-only EEGs in an experiment that, despite being lab-based, provides a number of key findings

for future studies in everyday life. In this experiment 20 test persons completed a number of hearing tests. They were wearing regular EEG caps with 96 measuring points so that the researchers could measure the typical potentials generated during assigned tasks. The scientists then compared the results with those that had been recorded using only electrodes located directly around the ears.

What they found was that, on average, the ear electrodes registered a similar level of intensity in audio-specific brain activity to conventional EEGs. However – as Meiser and Bleichner learned for their future research – there is no single way of placing the electrodes which is equally suited to all experiments. Instead they need to be fitted individually for each test person, and their placement needs to be adapted to the specific ERPs that the researchers want to observe.

Individuality underpins all Bleichner’s research. He is not interested in how noise affects people in general. “The link between chronic noise pollution and cardiovascular or other health issues is very well known,” he

says. The neuropsychologist is much more interested in how noise affects individuals. What do the brainwaves look like in a person who feels stressed by an everyday sound? And how do they differ from those of a person who might be able to block out Bleichner's pen-click-ing, for example? To better conduct research in everyday situations, Bleichner's mid-term goal is to record the brain activity of test subjects over extended periods of time, like in a long-term EEG. The researchers have developed a special app for this pur-

pose that registers changes in the audio environment without recording the sounds themselves or even conversations.

"What happens in a test subject's brain if you don't tell them beforehand what or what not to focus on?" asks Bleichner. The possibility of measuring brainwaves over an extended period in everyday situations, he hopes, will open a door on phenomena that no one yet knows about. "I'm sure this technology will advance our work, because it will allow us to research aspects that we have never looked at properly before," Bleichner says of the ear EEG.

Until recently, very little was known about the effects of hearing impairments on the perception of music. Musicologist Siedenburg has since shed some light on the situation. "When I came to Oldenburg as a postdoc researcher I wondered why no one had worked on this topic before," Siedenburg recalls. His own doctoral thesis in Montréal on musical timbres still informs his research today. In order to tailor music transmission to the needs of people with impaired hearing, he needs to find out what makes each tone in a piece of music distinctive. Timbre plays a critical role here. It is what allows us to distinguish between a violin and a piano, for example, even if both are playing the same tone at the same volume. "If a piece of music were a stew, then the timbre would be the taste of the individual ingredients. Sometimes, as with a juicy goulash that has been stewing for a long time, a piece of music that aims to blend the sounds of all the instruments makes it very hard to identify the various individual elements. With other pieces of music, the different timbres are very easy to distinguish from one another, like in a vegetable soup where the individual ingredients all taste very different," Siedenburg explains.

The timbre is one of the musical components that needs to be artificially modified to enable people with hearing difficulties to perceive it again. Here Siedenburg and his team let test subjects use the mixer themselves. In

an ongoing experiment, they are invited to adjust the levels on a simplified mixing interface to optimize how the music sounds to them. The researchers hope this will allow them to pinpoint the preferences that all people with hearing impairments may have in common when listening to music, despite their many differences.

One thing that people with hearing impairments all share is a strong desire for improvement. This is something Siedenburg encounters on a daily basis. He frequently gets calls from people suffering from hearing loss who have read about his work and want to know how far the scientist has got in finding a solution.

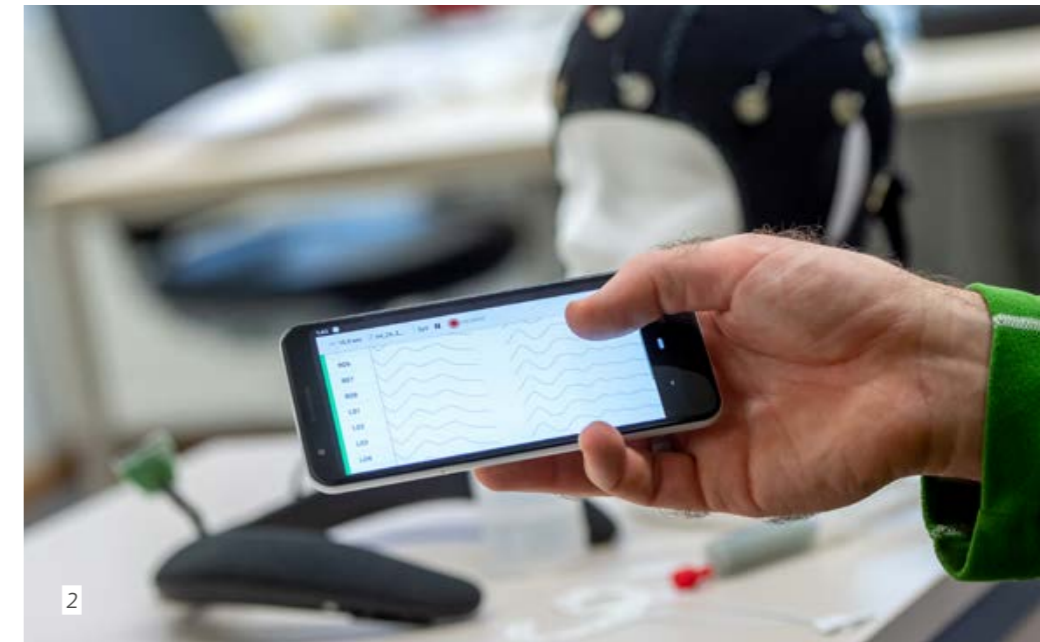
The desire to enjoy music as one did in the past is great among people with age-related hearing loss.

However, it will take some time before the people who call him are able to benefit from Oldenburg research at a concert and hear music almost as well as they once did. But they can at least dream about how Music Listening 2.0 might work for them in the future – when their hearing aids are connected to their smartphones, which receive all the relevant signals of the music being played at the concert via a microphone installed on the stage, for example. And since the app will know everything about their individual hearing impairments, it will be able to mix the incoming music so that when it is played via the hearing aid it sounds just like it used to – or even better.

To move one step closer to this dream, the two hearing researchers Siedenburg and Bleichner will soon start working together. Although one

may be mainly interested in noise and the other in music, there is one area in which their expertise is entirely complementary. "In the project with Martin Bleichner, we want to use EEG signals to decode, for example, whether someone is following the bass line or the vocals at a given moment," Siedenburg says. And this is why Bleichner will make an exception and actively seek out beautiful musical sounds for a change – so that in the future, even people for whom music is now just noise will be able to enjoy it once again. (sn)

In the lab, dummies help simulate the effect that hearing aids have on how a piece of music is perceived.



1 Not a hearing aid but a compact EEG: Martin Bleichner uses a small number of electrodes attached around the ear to monitor brain activity triggered by sounds.

2 EEG to go: To keep track of what is going on in the heads of his test persons in real-life situations outside the lab, Bleichner needs nothing more than a few electrodes attached around their ears, a small amplifier and a smartphone.

3 A special collar is used to play sounds to test persons in everyday life situations. The researchers use the cEEGrid to measure the reactions triggered by these acoustic stimulations and determine whether they are even perceived at all outside the lab.



Getting to the very core of language

Language is a door to human cognition, says Marijke De Belder. The linguist is investigating how words are structured and how we glean information from even the smallest linguistic building blocks. Her research not only provides theoretical fodder within academia, it also helps us understand how people actually acquire and process language.

When Dr Marijke De Belder hears the Dutch word *kreeftskeerkring* – which means Tropic of Cancer – it is not Henry Miller’s novel or geography that springs to mind. For her this word is associated above all with one thing: an analytical challenge.

De Belder is an expert in word structures. One of her main areas of expertise is morphology, a sub-discipline of linguistics. She investigates the patterns according to which words are structured and what the individual parts of a word reveal about its function. She also analyses how words and their grammatical forms interact with other linguistic levels, such as sentence structure. Her objective is to penetrate to the very core of language and find answers to the question of how it works at the most basic level.

“Language fascinates me because it is something deeply human,” says De Belder. “Although some animals also communicate using sounds, the way we humans speak and form sounds or sentences is unique,” explains the Belgian-born researcher, who studied linguistics and literature at the KU Leuven and then completed her doctorate at Utrecht University. The structured and empirical approach is what De Belder likes most about linguistic research. “We collect and analyse a lot of data; the research is very formal,” she stresses.

And De Belder knows exactly what she is talking about: she devoted a substantial part of her more than 300-page-long habilitation thesis to analysing Dutch compound words like *kreeftskeerkring*. Among other findings she was able to establish that the “s” in this and similar words makes the component *kreeft* identifiable as a proper noun. “I believe I am the first person to have recognized this,” she notes, not without a hint of pride.

In addition to these rather abstract

findings, De Belder, who since 2018 has been researching and teaching in a group led by Professor of Dutch Linguistics Esther Ruigendijk at the University of Oldenburg, is also seeking answers to applied linguistics questions with practical applications: Can structural differences between types of words be detected, and what role do they play in language comprehension? One goal here is to gain a better understanding of the problems that children with hearing impairments encounter in language acquisition – a topic that the researchers in the Oldenburg-based Cluster of Excellence Hearing4all, funded by the German Research Foundation, also investigate. The 39-year-old linguist’s collaboration with Ruigendijk’s team is fruitful for both sides because De Belder combines her research approach with the experimental methods of her colleagues from the field of psycholinguistics – the sub-discipline that deals with language acquisition, language processing and the relationship between language and thought. “Before coming to Oldenburg I mainly worked in theoretical linguistics as a ‘system linguist,’” De Belder explains.

“People intuitively know that different types of words are structured in different ways.”

Together with Ruigendijk and her colleague Dr Bénédicte Grandon she conducted experiments that demonstrated that in both Dutch and German, different word classes such as nouns or verbs have different syllable structures. And that people subconsciously associate the different struc-

tures with the various word classes. To arrive at this result, the team analysed long lists of words using artificial intelligence and then demonstrated a statistical correlation between structure and word class. Test persons were then asked to identify pseudowords – terms that follow the phonetic rules of a language but have no meaning. The tests showed that the participants were able to infer the function of a word based on its syllable structure alone, much as AI does. “People intuitively know that different word classes have their own particular structure,” explains De Belder.

Based on a study conducted with German-speaking test persons, the researchers also found that humans can detect cues from the sounds of a word which remain hidden to AI: “Words with nasal consonants, for example ‘n’, ‘m’ or ‘tj’ – as in ‘ng’ – are more likely to be identified as a noun than a verb in German,” De Belder points out. In her view, experts need to start paying more attention to these connections between sentence and phonetic structure.

These findings also have practical relevance, the linguist adds. Researchers suspect that babies already use sounds – or phonological cues – to analyse sentences, even though they do not know the words or their meaning. “Children with hearing impairments, for example, are probably lacking these cues,” De Belder explains. This opens up new pathways for research in the Cluster of Excellence.

In addition to their practical relevance these findings also reveal a certain fundamental truth, says the linguist: “Anyone who works with language is opening a door to human cognition.” To analyse her native Dutch in depth, she sometimes relies on a very human tool: intuition. “When it comes to Dutch, I sense certain things before I understand them. I am so deeply acquainted with the language – just as I understand my own sister better than any other person.” (cb)

Traces of diversity

Every litre of seawater is full of genetic material from all kinds of different organisms. Biologist Silke Laakmann and her team are pioneering techniques that use these DNA traces to determine the biodiversity of marine communities. This involves combining conventional methods of species identification with new genetic procedures.



Typical zooplankton found in the North Sea include copepods (top right), bristle worms (polychaetes, bottom right) and hydromedusae (left), a class of cnidaria. Many of the tiny organisms floating in the water are barely a millimetre long.

The marine protected area of Sylt Outer Reef has unusually high biodiversity levels for North Sea standards: fields of hard substrates alternate with areas of gravel and coarse sand, interspersed with flat sandbanks. The stones provide a solid base for colourful reef communities of organisms such as frilled anemones, mussels, bryozoans and sponges, while the sandbanks are home to various species of brittle stars and worms. Numerous fish species thrive in these waters, among them cod, sprats and herring, as well as flatfish and rare European river lamprey. This rich food supply in turn attracts marine mammals such as harbour porpoises and seals. So far, assessing biodiversity in marine protected areas such as Sylt Outer

Reef has been a very laborious process for environmental researchers: they cast nets of various mesh sizes to catch different sized marine species; use box corers to extract samples from the seafloor, and underwater cameras to take photos and make videos of the seabed.

But there are other ways to go about this: “All we need is a water sample,” says biologist Dr Silke Laakmann. The researcher and her team take advantage of the fact that a highly diluted collection of biological debris is just floating around in the sea: remnants of cells, mucous, scales, hairs, faeces and the remains of decaying organisms. However unappetising this might sound, the genetic material this debris contains, when analysed correctly, can provide astonishing insights into the

biodiversity of marine communities. The official term for this material is environmental DNA, or eDNA for short.

At the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) at the University of Oldenburg, Laakmann is working towards the major goal of achieving reliable assessment of marine biodiversity levels using nothing but water samples. The HIFMB was founded in 2017 as a cooperation between the University of Oldenburg and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research. “We study whether the eDNA results correspond with reality – in other words, whether we actually register as many organisms as possible present in a given region,” says the researcher, who has been running the Focus Group Marine Molecular Ecology

at the HIFMB since 2018. Two such focus groups are currently based at the institute. They are an instrument to provide targeted funding to promising mid career scientists and, at the same time, consolidate highly innovative research fields at the HIFMB.

The procedure at the heart of the work of Laakmann and her five-member team is also very much on trend. In recent years, eDNA analysis has become a powerful new tool in the environmental sciences. The method has huge potential as it allows analysing entire communities, however large, in one go, and provides all sorts of new insights into biodiversity. It also reduces environmental impact compared to traditional methods of sampling of marine organisms – an advantage which is particularly re-

levant in marine conservation areas. In the collaborative CREATE project, headed by Oldenburg biodiversity expert and HIFMB Director Prof. Dr Helmut Hillebrand, eDNA plays a central role to analyse the biodiversity of marine protected areas as well as the connections between them. The European oyster is the project’s key species. “One key question is whether oyster larvae from the Borkum Reef Ground protected area move with the currents into other marine areas where they had not previously been restored,” explains Laakmann. As part of the project, which is funded by the Federal Ministry of Education and Research in the framework of the German Marine Research Alliance, the biologist and her team currently compile an eDNA archive for the North Sea, aimed

at documenting the current status of biodiversity and the effects of future environmental changes. Environmental scientist Dr Kingsly Chuo Beng, a postdoctoral researcher in the focus group and an expert in eDNA research, manages the corresponding work package.

The researchers in Laakmann’s team have been laying the groundwork for this over the past four years: “Recently, a shift has taken place in biodiversity research, from what you might call the classical morphological methods of species identification to molecular ones,” the researcher explains. From microscope to genes, in other words. Her own training started in the conventional methods. “During my doctoral studies at the University of Bremen and my time as a postdoc at



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the Research Centre Senckenberg am Meer in Wilhelmshaven, I spent a lot of time in the sorting lab identifying organisms under the microscope according to their external form,” she recalls. Her speciality is zooplankton – aquatic organisms that are drifted along by currents in the oceans – in particular a diverse group of tiny crustaceans called copepods.

With the goal of establishing the novel genetic methods as a routine process for environmental monitoring, a comparison with conventional methods is currently underway. Laakmann and her team focus primarily on zooplankton in the North Sea and the Baltic, but also analyse material from Patagonia, the Arctic and South Africa. They have collected more than 3,000 samples which will be preserved for further studies at the HIFMB.

To obtain an overview of biodiversity levels, the scientists generally use three different methods. They still collect plankton in the traditional way using long, thin nets. This often brings on board a brownish, flaky mass of sea organisms which can range in size from the head of a pin to a few millimetres. “These samples are then split into two halves,” Laakmann says. One half goes to her and her team for conventional identification under a microscope or to semi-automated imaging analysis with Dr Astrid Cornils, a colleague at AWI. The other half is homogenised and then genetically analysed. The third method is eDNA analysis, whereby genetic material is extracted from water samples taken from various depths.

The molecular biology methods used for species identification are to some extent similar to those used for PCR tests in Covid test labs, in which characteristic areas of genes are amplified and sequenced for analysis.

The environmental sciences mostly concentrate on a gene segment that goes by the name of COI (cytochrome c oxidase subunit I). “The sequence of this special gene fragment is unique in every animal species,” Laakmann explains. In huge databases, researchers

from various international initiatives inventory species using the genetic code of their COI gene. Just as products in supermarkets are identified by barcodes on their packaging, every animal species ever registered in a database can be identified by its genetic code. As a PhD student and postdoc, Laakmann helped to expand this library of life by numerous species, among them organisms living in the water and on the seafloor of the North Sea, as well as copepods from the Arctic, the Antarctic and the deep sea.

“I think it is important to make a connection with the organisms I study.”

When the vast assemblage of genetic material in an environmental sample is analysed in parallel – a process that gives rise to thousands of different DNA sequences – this is known as “metabarcoding”. “In our samples we have millions of these gene snippets from all sorts of organisms. After sequencing we compare the gene sequences with the database entries, so that in the end we have a list of species or groups,” Laakmann explains. Over the past four years the researchers have developed a special toolkit for dealing with the eDNA. “We were interested in questions such as: How much water do we need in order to capture as many species as possible in one area? How often do we need to take samples? What should the filter look like? What databases should we use?” the biologist notes. The team also studied threshold values and computational algorithms. Laakmann is satisfied with the results: “We now know that eDNA metabarcoding is indeed able to identify all the various groups of invertebrates and fish that live in the North Sea. And now we

understand pretty good how best to apply the method to different questions.”

In order to examine whether or not particular species are present in large marine protected areas like Borkum Reef Ground or Sylt Outer Reef, it might make sense to take water samples from several different places, she says. In a study of bottom-dwelling organisms, the researchers are collaborating with a team from the AWI that carries out long-term observations in marine protected areas. Here, they combine DNA analyses with sediment samples and underwater photos. In particularly dynamic marine areas, on the other hand, it may be necessary to take water samples at the same location over and over again for several days on end in order to record all species present.

Laakmann stresses the importance of not relying solely on the genetic method, even in the future. “I would like to use integrative methods, which means combining conventional and new methods. That delivers the best of both worlds.” As a marine biologist, she wouldn’t want to miss out on identifying tiny amphipods, hydromedusae and opossum shrimps under the microscope. “I think it is important so I can make a connection with the organisms I study,” she emphasizes – a factor that would be absent were she to work exclusively with abstract gene sequences.

Moreover, interpreting eDNA metabarcoding results is often not entirely straightforward. So Laakmann controls all species lists to check that the results make sense. If, for example, a species of zooplankton appears unexpectedly on a list, the researchers

might need to check how trustworthy the database entries are. “In one case we worked out that a strange pattern in the data had been caused by a faulty identification using conventional methods,” she explains.

The fact that land animals like chickens, cows, wild boar or mice keep turning up in the species lists is more of a curiosity. “Sometimes we can even work out why,” Laakmann adds. Genetic material from farmed animals like chickens and cows probably gets into the rivers, as do deposits from wild boar living in the estuaries, she explains. Ballast water is another potential source of exotic DNA: “But the mouse remains a mystery,” chuckles the biologist, who nonetheless intends to get to the bottom of the matter with Kingsly Chuo Beng.

“Now, for the first time, we can identify which larvae are floating in the water at what time of the year.”

Every now and then the researchers come across what are known as cryptic species – species that are genetically new but externally resemble other, already known species. Moreover, the genetic method increases the likelihood of finding rare or endangered species, including marine mammals. “We find more species than we

could previously identify,” Laakmann stresses. All of these factors show the huge potential of eDNA in opening up previously hidden areas of biodiversity.

When it comes to the larvae found in the zooplankton samples of benthic organisms and fish, a whole new world is revealed. With conventional methods these minuscule organisms can often only be roughly assigned to the different animal groups. Metabarcoding, however, allows researchers to pinpoint what species many of these larvae belong to – provided they are already inventoried in a database. “Now, for the first time, we can identify which larvae float in the water at what time of the year. This allows us to draw conclusions about their distribution and reproductive cycles,” Laakmann comments. Particularly in late spring and summer, when many organisms reproduce, eDNA analysis can detect up to four times as many species in zooplankton samples than conventional methods.

The larvae of the European oyster are also almost impossible to identify under the microscope. At the free-swimming stage, when they are less than a millimetre in size, they resemble round blobs that move using lobe-like extensions, much like all other bivalve larvae. Laakmann and her team are nevertheless confident that they will be able to uncover the drift of the mollusc offspring in the vast expanses of the North Sea. In preparatory studies for the CREATE project they have already successfully identified the genetic material of the oyster larvae in water samples. (uk)

1 Silke Laakmann and her team use environmental DNA to research marine biodiversity.

2 Conventional identification methods are important to allow for a comparison with genetic methods.

3 At sea (here with the research vessel Heincke in the North Sea), the team collects water samples containing environmental DNA.

4 Still on board, Kingsly Chuo Beng prepares the samples for further analysis.

Understanding prisons

According to human geographer Jennifer Turner, the military past of prison facilities and prison staff shapes the entire penal system. At the university's Institute for Social Sciences she explores the connections between prisons and the military.



The date is May 8, 2020. In West Yorkshire, England, a group of young men are taking part in celebrations marking the 75th anniversary of the end of the Second World War. These adolescents are offenders incarcerated in a former naval facility which is now a prison, supervised by prison staff who are ex-military personnel. "There are deep-rooted connections between prisons and the military, and not just in Britain but in many countries of the Global North – including Germany," Dr Jennifer Turner explains. This complex web of connections takes many forms: prisons are often located in former military buildings, a growing number of prison staff are former military personnel, and the proportion of military veterans among the inmates is relatively high – at least in the UK and the US. The British-born researcher refers to these connections, which have been little studied to date, as the "prison-military complex".

"There are deep-rooted connections between prisons and the military."

Turner took up her position at the Institute for Social Sciences in 2020 and has built up the Crime and Carcerality research group there. Her field of research belongs to a new and diverse sub-discipline of geography known as carceral geography. This field, in which Turner plays a prominent role, adds a spatial perspective to prison research, which has so far focused main-

ly on sociological aspects. The goal of carceral geography is to gain a better understanding of the functioning of prisons and other closed spaces such as refugee camps, psychiatric hospitals, retirement- and children's homes. With her research group, Turner aims to establish this relatively new field of prison research in Germany, where it has very little academic footing to date. She focuses primarily on prison staff and the role played by ex-military personnel as prison officers. "For our study in the UK, we asked former and current staff about their military experience, duties, and how long they had served in the military," Turner explains. She has also collected data in Canada, and now plans to conduct similar studies in Germany and Norway with the goal of comparing countries with different military histories and different approaches to the prison service.

"We hope this comparison will offer us insights into how the prison system can be improved," says Turner, who recently completed her habilitation in Oldenburg. The data could shed light on whether it makes sense for prisons, like those in the UK, to specifically recruit former military personnel. Turner suspects that due to their military experiences, former soldiers are better equipped than other prison staff to find common ground with incarcerated veterans.

In three studies published in 2021 and 2022, Turner showed that about 25 percent of prison staff in the UK have a military background – a figure that even she found surprisingly high. "Our research has demonstrated that this group already enjoys the training for the job more than others," says Turner. From these findings, the team concludes that individuals with a military background generally find it easier to adapt to structures which for them are more familiar, such as wearing uniforms and using formal language.

But how does a military background affect their professional skills? "We often hear the prejudiced view that prison staff with a military background are particularly strict and aloof, that they sometimes bully prisoners and resort to violence when deemed necessary," says Turner. However, her research shows that the opposite is more likely to be the case: 73 percent of prison staff with a military background see their workplace less as a place of punishment and more as a place for rehabilitation.

"We hope this comparison will offer us insights into how the prison system can be improved."

It also became clear that although former armed forces personnel often display typical military traits such as discipline, punctuality and respectful behaviour, they also exhibit many unexpected traits. "We were able to show that empathy, communication skills and an understanding of diversity go hand in hand with military experience," explains Turner.

Ex-military personnel are also often very alert and well trained in dealing with crisis situations. "If I were in prison, I would want the staff to have precisely these qualities," Turner notes. Whether prisoners take a similar view is a topic the geographer plans to investigate in the near future. As she says: "We will only be able to fully understand the military nature of prisons and the role of prison staff if we know and include the prisoners' perspective." (1s)

Prisons, assistance systems for the elderly and the transformation of agriculture

To mark the 50th anniversary of its founding, the Universitätsgesellschaft Oldenburg (UGO) awarded not just one but two Awards for Excellent Research in 2022. The UGO Award for Excellent Research in the humanities, social and cultural sciences went to human geographer Jennifer Turner, while nutrition scientist Rebecca Diekmann received the Award in the natural sciences, mathematics and medicine. Both awards are endowed with 5,000 euros in prize money. The Award for Outstanding Doctoral Thesis and 2,000 euros in prize money went to economist Julia Tschersich.



UGO Award for Excellent Research

Dr Jennifer Turner has been a lecturer and researcher at the university's Institute of Social Sciences since 2020. She heads the Crime and Carcerality research group. Her goal is to gain a deeper understanding of the functioning of systems of crime and carcerality and she is establishing a new branch of human geography in the process. Her work focuses primarily on spaces, practices and representations of incarceration. In addition to examining experiences of imprisonment she explores the "prison-military complex", focusing on the intricate connections between prisons and the military and the extent to which prisons are embedded in military infrastructures and staffed by former military personnel. Before coming to Oldenburg, Turner was a Senior Lecturer in human geography at the University of Liverpool in the UK.



UGO Award for Excellent Research

Dr Rebecca Diekmann has been teaching and conducting research at the Department of Health Services Research since 2013, initially in Geriatrics and since 2016 in the Assistance Systems and Medical Device Technology section. Here she heads the Nutrition and Functionality in older adults research group, which since 2022 is being funded by the Federal Ministry of Education and Research. Diekmann and her team are working on an assistance system to help older people live independently for as long as possible. The system consists of a tablet-based app and automated training stations and is designed to encourage older people to eat an age-appropriate diet and improve or maintain their fitness levels. Before moving to Oldenburg, the nutritional scientist conducted research at the University of Bonn and the University of Erlangen-Nuremberg, where she completed her doctorate in 2011.



UGO Award for Outstanding Doctoral Thesis

Dr Julia Tschersich's thesis focuses on initiatives that view seeds and plant varieties as commons. She examines how the activities of these initiatives in Germany, the Philippines and across the globe are influenced by factors such as intellectual property rights, seed laws, plant genetic resources and biodiversity. She also analyses how these seed initiatives, as "real utopias" within local communities, can contribute to the socio-ecological transformation of agricultural and food systems. Tschersich earned a Bachelor's degree in International Relations at the Technische Universität Dresden and a Master's degree in Sustainability Economics and Management at the University of Oldenburg. She is one of the founding members of the Oldenburg Food Council (Ernährungsrat Oldenburg) and Junior Assistant Professor of Environmental Governance and Transformations at Utrecht University in the Netherlands.



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Iliana Baums

Marine Conservation

Evolutionary ecologist and coral expert Prof. Dr Iliana Baums has been appointed to a joint professorship in "Marine Conservation" at the Institute for Chemistry and Biology of the Marine Environment (ICBM) and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven.

Within the framework of the joint professorship Baums will conduct research at the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) at the University of Oldenburg on how to increase the adaptive potential of marine ecosystems to changing environmental conditions. Before coming to Oldenburg, she was Professor of Marine Molecular Ecology and Evolution at Pennsylvania State University (USA).

Baums studied biology in Tübingen, Bremen and Miami (USA), where she completed her doctorate in 2004. She held post-doctoral positions at the University of Miami and the University of Hawaii (USA). In 2006, she moved to Pennsylvania State University, where she first conducted research and taught as an assistant professor and then became a full professor in 2019. Her main research focus is genetics and coral reef restoration. She combines findings and perspectives from genomics, ecology, evolutionary research and oceanography to gain a better understanding of the processes that shape marine life, with the goal of maintaining the diversity and productivity of marine ecosystems



A. Murat Eren

Ecosystem Data Science

Prof. Dr A. Murat Eren has been appointed to a joint professorship in "Ecosystem Data Science" at the Institute for the Chemistry and Biology of the Marine Environment (ICBM) and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven. Eren does research at the Helmholtz Institute for Functional Marine Biodiversity of the University of Oldenburg (HIFMB). Previously, he was assistant professor at the University of Chicago, USA.

Eren studied computer engineering at Canakkale Onsekiz Mart

University, Turkey. After his graduation, he worked as a software developer at the Turkish National Research Institute of Electronics and Cryptology. After he had finished his PhD at the University of New Orleans he joined the Marine Biological Laboratory (Woods Hole, USA) as a Postdoctoral Scientist. Eren and his colleagues developed anvi'o, an open-source software platform used by researchers around the globe for data-enabled microbiology. In 2015, Eren started working at the University of Chicago, where he studied the ecology and evolution of microbes with novel computational strategies.



Urte Helduser

Modern German Literature with a Special Emphasis on Literary Theory

Dr Urte Helduser has been appointed Professor of "Modern German Literature with a Special Emphasis on Literary Theory" at the Institute of German Studies. She was previously a senior lecturer at the Department of German Language and Literature I at the University of Cologne.

After studying German, history and philosophy in Marburg and Vienna, Helduser worked as a research assistant at the Centre for Cultural Research at the University of Kassel, where she also completed her PhD in 2003. She then worked as a post-doctoral researcher and senior lecturer at the Institute of Modern German Literature at Philipps-Universität Marburg, where she earned her habilitation in 2014, after which she held acting professor positions at the Leibniz University Hannover and in Marburg.

Helduser's research focuses on the relationship between literature and knowledge since the early modern period, with special emphasis on the exchange between medicine and literature as well as Disability Studies. She also conducts research in the areas of poetry, aesthetics, drama, theatre and feuilleton culture.



Benedikt Hensel

Hebrew Bible

PD Dr Benedikt Hensel has been appointed Professor of "Hebrew Bible" at the Institute of Protestant Theology and Religious Edu-

cation. He previously held various academic positions and interim professorships at the Universities of Mainz, Zurich (Switzerland) and Göttingen.

Hensel studied Protestant theology, Jewish studies and classical archaeology at the Universities of Heidelberg, Amsterdam and Utrecht (the Netherlands). He completed his doctorate and habilitation at the University of Mainz. From 2017 to 2021 he conducted research in Zurich on the origins of the Torah from an archaeological perspective, in a project with the Tel Aviv University (Israel).

Hensel's main research interests are the cultural and religious history of Israel and early Judaism, biblical archaeology and the literary history of the Hebrew bible. In Oldenburg, his research will focus - amongst others - on processes of identity formation in ancient Judaism. He is also conducting research on ancient Jordan and its influence on cultural and political developments in the Ancient Near East.



Marc-Phillip Hitz

Medical Genetics

Prof. Dr Marc-Phillip Hitz has been appointed Professor of "Medical Genetics" at the School of Medicine and Health Sciences. Hitz, a paediatrician and clinical geneticist by training, is also director of the University Institute of Medical Genetics at Oldenburg Hospital. Before coming to Oldenburg, he held a professorship for cardiogenetics of structural heart disease at Kiel University.

Marc-Phillip Hitz studied in Hamburg and Göttingen, where he earned his medical degree in 2004. He then moved to Hannover Medical School to take a position as a junior doctor in paediatrics. From 2008 to 2014 he was a research fellow in Montreal, Canada, and then in Cambridge, Great Britain, where he also received his PhD. In 2014 he moved to the Clinic for Congenital Heart Defects and Paediatric Cardiology at the University Medical Centre Schleswig-Holstein. In 2019 Hitz was awarded an endowed professorship at the German Centre for Cardiovascular Research in Kiel. His research focuses on the application of innovative technologies for improving the diagnosis and treatment of structural heart defects.



Michaela Kaiser

Art Education and Art Mediation

Dr Michaela Kaiser has been appointed Professor of "Art Education and Art Mediation" at the Institute of Art and Visual Culture. Before coming to Oldenburg, she held a teaching and research post at the University of Potsdam. Kaiser studied art education and art therapy in Nijmegen and Leeuwarden (the Netherlands) and applied social sciences in Bielefeld (Germany). She then worked as a research assistant at the universities of Paderborn and Münster and received her doctorate in 2019. She has held teaching positions at several universities and art colleges since 2017, including Osnabrück University and the University of Münster. In 2018 she took over as principal investigator of the research initiative Leistung macht Schule, which is funded by the Federal Ministry of Education and Research, at the University of Paderborn, and then moved to Potsdam in 2021. A key focus of Kaiser's research and teaching is ways to integrate inclusion in art education contexts. She also conducts research on talent and performance from an art education perspective, as well as on the professionalisation of art teachers in university-based teacher training.



Sinikka Lennartz

Biogeochemical Ocean Modelling

Dr Sinikka Lennartz has been appointed Junior Professor of "Biogeochemical Ocean Modelling" at the Institute for Chemistry and Biology of the Marine Environment (ICBM). Before taking this post, she conducted research at the Massachusetts Institute of Technology in Boston (USA) on a fellowship from the Walter Benjamin Programme of the German Research Foundation (DFG). Lennartz studied geoecology at the TU Braunschweig and the University of Tübingen and completed her doctorate at the University of Kiel/GEOMAR Helmholtz Centre for Ocean Research Kiel with a thesis on marine emissions of climate-relevant sulfur gases. In 2019 she moved to the University of Oldenburg as a postdoctoral researcher. Lennartz's research focuses on dissolved organic matter (DOM) – a mixture of various organic substances in seawater. She uses mathematical models to investigate the behaviour of this matter

on a global scale, and also applies numerical models to study the influence of microbes on DOM. Lennartz has received various awards for her work, including the DFG's Bernd Rendel Prize for early career geoscientists.



Daniel Neider

Safety and Explainability of Learning Systems

Dr Daniel Neider has been appointed Professor of "Safety and Explainability of Learning Systems" at the Department of Computing Science. Before coming to Oldenburg, he was head of the Logic and Learning research group at the Max Planck Institute for Software Systems in Kaiserslautern.

Neider studied computer science and economics at RWTH Aachen University, completing his doctorate in 2014. Until 2016, he worked on a research project at the University of California, Los Angeles (USA) and the University of Illinois Urbana-Champaign (USA). He then returned to the Department of Computer Science at RWTH Aachen University as a postdoctoral researcher. He joined the Max Planck Institute in Kaiserslautern in 2017.

Neider's research focuses on reliability of artificial intelligence in safety-critical areas such as autonomous driving. The computer scientist is working on mathematical methods for proving the correctness of artificial intelligence and thus increasing trust in machine learning. Neider is also developing methods aimed at explaining artificial intelligence decision-making and recommendations in a transparent, easily understandable way.



Andreas Peter

Safety-Security-Interaction

Cybersecurity expert Prof. Dr Andreas Peter has been appointed to the newly created Chair of "Safety-Security-Interaction" at the Department of Computing Science. This is one of eight new professorships acquired by the University of Oldenburg and the Jade University of Applied Sciences as part of the state programme Digitalization Professorships for Lower Saxony. Before coming to Oldenburg, Peter was Professor of IT security at the University of Twente (the Netherlands).

Peter studied mathematics at the Universities of Oldenburg and Cambridge (Great Britain) and received his PhD in computer science from the Technical University of Darmstadt in 2013. He then moved to the University of Twente, where he was first a research fellow and then from 2014 to 2018 a junior professor at the Department of Computer Science.

Peter's research in Oldenburg will focus on the development of security solutions for IT systems in the context of safety-critical systems and the Internet of Things. He is studying the question of how to model security concepts and cyberattacks to improve detection and defence against such attacks. The goal is to develop and deploy customized security solutions that are based on the researched models but also take account of various types of user interaction as well as the functional safety of the systems to be protected.



Andreas Rauh

Computer Engineering – Distributed Control in Interconnected Systems

Dr Andreas Rauh has been appointed to the professorship of "Computer Engineering – Distributed Control in Interconnected Systems" at the Department of Computing Science. Before coming to Oldenburg, he spent a year as a visiting researcher at the École nationale supérieure de techniques avancées Bretagne (ENSTA Bretagne) in Brest, France.

Rauh studied electrical engineering and information technology at the Technical University of Munich and received his PhD from Ulm University in 2008. He then took up a post at the Chair of Mechatronics at the University of Rostock, where he completed his habilitation in 2017. From 2008 to 2015 he was a member of a working group which developed standards for interval arithmetic, a mathematical method for automatic error analysis, at the Institute of Electrical and Electronics Engineers (IEEE).

Rauh's research focuses on complex computer systems in which numerous independent software and hardware components interact. These systems are used in various contexts, for example to control the electrochemical properties and thermal state of solid oxide fuel cells.



Mandy Roheger

Outpatient Assessment in Psychology

Dr Mandy Roheger has been appointed Junior Professor of "Outpatient Assessment in Psychology" at the Department of Psychology. Roheger researches cognitive functions and states in humans in everyday situations. She is particularly interested in how the ageing process affects people's ability to learn, remember, think and perceive. Roheger develops measures aimed at helping people to maintain or improve their cognitive abilities, especially those affected by dementia and Parkinson's disease. The junior professorship is funded by the Joint Federal Government-Länder Funding Programme for young academics.

Roheger (29) studied psychology with a focus on neurology in Düsseldorf and Cologne, where she also completed her doctorate in 2019. She then moved to the Greifswald University Medicine, where she conducted research at the Department of Neurology in the working group Healthy Ageing and Prevention of Dementia. Since 2021 she has also been an associated researcher at the Karolinska Institute Stockholm (Sweden).



Heiko Schmaljohann

Migration Ecology

Dr Heiko Schmaljohann has been appointed Professor of "Migration Ecology" at the Institute of Biology and Environmental Sciences (IBU). An ornithologist, Schmaljohann has been a research associate at the University since 2017 and is also a visiting researcher at the Institute of Avian Research Vogelwarte Helgoland.

Schmaljohann studied biology in Kiel, York (UK) and Göttingen. After completing his doctorate at the University of Basel (Switzerland) and post-doctoral stays at the Swiss Ornithological Institute and the Institute of Avian Research in Wilhelmshaven, he earned his habilitation at the University of Oldenburg in 2013. He was then accepted into the German Research Foundation's renowned Heisenberg Programme. As part of his fellowship, which he carried out at the Institute of Avian Research and then at the University of Oldenburg, he spent two years researching migratory birds in Alaska as a Research Associate at the University of Alaska (USA).

Schmaljohann's work focuses on orientation and navigation skills in migratory birds and their innate migration programme.



Katharina Schuhmann

German as a Foreign Language

Dr Katharina Schuhmann has been appointed Junior Professor of "German as a Foreign Language" at the Institute of German Studies, funded by the Federal Government-Länder Programme. She was previously Assistant Professor of German and Linguistics at The Pennsylvania State University (USA).

Schuhmann studied English and Religious Education at the University of Erlangen-Nuremberg before obtaining two Master's degrees and a Ph.D. in Linguistics at Stony Brook University (NY, USA). Towards the end of her doctoral work, she served as a Visiting Assistant Professor at Bucknell University (PA, USA). Schuhmann subsequently conducted postdoctoral research at the Free University of Bozen-Bolzano (Italy) and taught at the University of Bonn. Schuhmann's research includes foreign and second language acquisition, theoretical linguistics, and psycholinguistics. She investigates across disciplines, including perceptual and lexical adaptation phenomena and processing of grammatical properties. Schuhmann's junior professorship is funded by the Joint Federal Government-Länder Tenure-Track Programme.



Nils Strodthoff

eHealth: Interpretable and Explainable Learning Algorithms

Dr Nils Strodthoff has been appointed to the Chair of "eHealth: Interpretable and Explainable Learning Algorithms" at the Department of Health Services Research. He previously led the Applied Machine Learning research group at the Fraunhofer Heinrich Hertz Institute in Berlin.

Strodthoff studied physics at the University of Göttingen and at Imperial College London. He completed his doctorate at TU Darmstadt in 2012, after which he conducted research at Heidelberg University and at the Lawrence Berkeley National Laboratory in California. His research focuses on machine learning and its applications in medicine. Strodthoff is particularly interested in self-supervised

learning, which uses raw data without supplementary labelling by humans. He also conducts research in the field of explainable artificial intelligence to gain a better understanding of artificial intelligence models in which the decision-making processes through which they arrive at their results are not yet known.



Kristin Tessmar-Raible

Marine Chronobiology

Prof. Dr Kristin Tessmar-Raible has been appointed to a joint professorship in "Marine Chronobiology" at the Institute for Chemistry and Biology of the Marine Environment (ICBM) and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven. Before coming to Oldenburg, she held a professorship in chronobiology at the University of Vienna.

Tessmar-Raible studied biology at Heidelberg University and earned her PhD at the University of Marburg. She then worked as a postdoctoral researcher at the European Molecular Biology Laboratory (EMBL) in Heidelberg, before moving to the University of Vienna in 2008 to take up a research group leadership position. In 2013 she received a Starting Grant from the European Research Council (ERC). She was appointed to a professorship at the University of Vienna in 2015. She was awarded a Consolidator Grant by the ERC in 2015, which will fund a project in which she aims to decipher the molecular basis of lunar rhythms until 2025. Tessmar-Raible's research focuses on a small marine annelid that is particularly well suited to molecular-level research in the laboratory.



Helmuth Thomas

Marine Alkalinity

Prof. Dr Helmuth Thomas has been appointed to a joint professorship for "Marine Alkalinity" of the Institute for Chemistry and Biology of the Marine Environment (ICBM) and the Helmholtz Centre Hereon in Geesthacht. He is also director of the Helmholtz Centre Hereon's Institute of Carbon Cycles.

Thomas studied chemistry in Düsseldorf and Kiel. While completing his PhD at the Leibniz Institute for Baltic Sea Research in Warnemünde he measured atmospheric carbon dioxide uptake

in the Baltic Sea for the first time. After a period of post-doctoral research at the University of Hamburg, he moved to the Royal Netherlands Institute for Sea Research on the island of Texel, where he conducted research from 1998 to 2004. He then took a post as an associate professor at Dalhousie University in Halifax (Canada), and was made a full professor there in 2012. In 2019, Thomas returned to Germany and established the Alkalinity working group at the Helmholtz Centre Hereon (formerly the Helmholtz-Zentrum Geesthacht). His research focuses on chemical processes such as marine carbon cycles, particularly in marginal seas such as the North Sea, the Baltic Sea or the Arctic Ocean.



Sebastian Vehlken

Knowledge Processes and Digital Media

Media theorist and -historian Prof. Dr Sebastian Vehlken has been appointed to the joint professorship of "Knowledge Processes and Digital Media" at the Institute of History and the German Maritime Museum (DSM) / Leibniz Institute of Maritime History in Bremerhaven. He previously taught and researched the history and culture of digital media at the Leuphana University Lüneburg.

Vehlken graduated in media studies and economics from the University of Bochum. He spent two years conducting research at the University of Weimar before taking a post as a research associate at the University of Vienna from 2007 to 2010. He completed his PhD thesis at the Humboldt-Universität zu Berlin in 2010, and then moved to Lüneburg, where he was first a research associate and then associate director of the German Research Foundation's Institute for Advanced Studies on "Media Cultures of Computer Simulation" (MECS), before becoming a professor in 2017.

Vehlken's main research interests include the history of digital media and computer simulation, digitality and material cultures, oceans as spaces of knowledge, as well as media and architecture.



Wolfram Wingerath

Data Science

Dr Wolfram Wingerath has been appointed Junior Professor of "Data Science" at Department of Computing Science. He was previously Head of Data Engineering & Research at Baqend GmbH, a research spin-off from the Universität Hamburg.

Wingerath studied computer science at the Universität Hamburg, where he also completed his doctorate in 2019. The main focus of his research is at the intersection between web technology and data management. The real-time database system InvalidB, which he developed as part of his doctorate, is now being used commercially. His work helps to improve website loading speed. Another subject of his research is the analysis and prediction of user behavior to make surfing the web a smoother experience.

The computer scientist is also an expert in hands-free coding – the use of speech recognition and eye tracking in software development. Wingerath not only uses and develops these methods himself, he also co-founded the Handsfree Coding initiative at the Gesellschaft für Informatik (GI).



Antje Wulff

Big Data in Medicine

Dr Antje Wulff has been appointed Junior Professor of "Big Data in Medicine" at the university's Department of Health Services Research. The junior professorship is funded by the Federal Ministry of Education and Research.

Wulff studied Business Information Systems at the Baden-Württemberg Cooperative State University in Stuttgart and Business Information Systems - Medicine and Health at the Technische Universität Braunschweig. She then took up a post at the Peter L. Reichertz Institute for Medical Informatics, which is jointly run by the TU Braunschweig and the Hannover Medical School.

Wulff's main research interests include computer systems that support medical staff in decision-making by providing diagnostic and predictive models for diseases based on health data. She also conducts research on medical data modelling and methods to facilitate standardized data flow between systems and institutions.



Julia Wurr

Postcolonial Studies

Dr Julia Wurr has been appointed Assistant Professor in "Postcolonial Studies" at the Institute for English and American Studies. Before coming to Oldenburg, she was a postdoctoral researcher at the University of Trier. Wurr studied English, French as well as International Relations and Translation Studies at the Universities of Trier (Germany), Liège (Belgium) and Oxford (UK). She completed her PhD in the International Research Training Group Diversity based at the Universities of Trier, Saarbrücken and Montreal (Canada) in 2019. Her thesis was an analysis of European and North American fiction on the "Arab Spring". Her work focuses on postcolonial studies, a transdisciplinary field of research that examines the consequences and legacies of the colonial era. Wurr's current research project "Birth and the Postcolonial" focuses on transnational commercial surrogacy and childlessness in Anglophone postcolonial literature. A future focus of her research will be the relationship between identity and social inequality as well as racism and classism.

School I – School of Educational and Social Sciences

TIJS BOLZ, Topic: „SchülerInnen-LehrerInnen-Beziehung aus bindungstheoretischer Perspektive im Förderschwerpunkt der emotionalen und sozialen Entwicklung“
Special Needs Education

HEIKE BÜHRING, Topic: „Zuschreibungen von Rückkehrer*innen aus dem Einsatz – Ein Beitrag zur Heimatdiskursforschung“
Social Sciences

SARAH MARIA BÜSING, Topic: „Die Erdeutung von Wille und Wohl bei medizinisch-ethischen Behandlungsentscheidungen in der Frühgeborenenintensivmedizin in Deutschland und der Schweiz“
Social Sciences

ANDREAS CHRISTOPH FILSER, Topic: „Social consequences of imbalanced sex ratios“
Social Sciences

ANTJE GANSEWIG, Topic: „Civic Education and Prevention with former Right-Wing Extremists in German School settings. An Evidence-Based Examination of Potentials and Challenges“
Social Sciences

MARIE HOPPE, Topic: „Subjektwerden unter Bedingungen von outsidersness. Subjektivierungstheoretische Lesarten kurdischer Schulbildungsbiographien in der Türkei“
Educational Sciences

SÜLEYMAN KANAT, Topic: „Diaspora-Biographien in der der Migrationsgesellschaft – Eine sozialwissenschaftliche Fallstudie über erzählte Biografien von Angehörigen der jesidischen Minderheit und deren Lebenswelt(en) in Deutschland“
Educational Sciences

NICOLAS NAUSE, Topic: „Arbeiten, Leben und Lernen an Bord von Segelschiffen“
Educational Sciences

NIKOLAS A. RATHERT, Topic: „Friedrich Fröbels dritte Gabe als Fördermaterial zur Verbesserung des räumlich-visuellen Vorstellungsvermögens. Eine empirische Studie im Rahmen des Förderunterrichts Mathematik im Übergangssystem an der beruflichen Förderschule“
Social Sciences

NEELE SCHIPPER, Topic: „Moralentwicklung im Jugendalter – Die moralische Identität als zentrales Element der moralischen Entwicklung von Jugendlichen“
Special Needs Education

MARCEL SCHÜTZ, Topic: „Projektierung und Informalität: Studien zur Organisationssoziologie temporärer Ordnungen“
Social Sciences

KAREN VOGELPOHL, Topic: „Fortbildung von Lehrkräften im Blended-Learning-Format: Eine Interviewstudie mit Fortbildungsteilnehmer:innen“
Educational Sciences

JEANNETTE WICK, Topic: „Prototypische Fördersituationen von Fachpersonen für Sonderpädagogik in der inklusiven Förderung – eine Videoanalyse“
Educational Sciences

School II – School of Computing Science, Business Administration, Economics, and Law

BERNHARD DANNEMANN, Topic: „Interaction of Economic Agents: An Application to Cognitive Skills and Competition“
Economics

MAREN INGRID KROPFELD, Topic: „Sufficiency-oriented Business Models and Sustainable Consumer Practices“
Economics

KERSTIN MOHR, Topic: „Between Chances and Challenges: Developing a Holistic Approach to Climate Governance and Gender. An Analysis of Columbia“
Economics

CONSTANZE TRAUTWEIN, Topic: „Sustainability impact of start-ups: Specifics, intentions and enabling factors“
Economics

JULIATSCHERSICH, Topic: „Seed Commons in the Multi-Level Governance Regime – Creating Empowering Institutions for a Social-Ecological Transformation of Agri-food Systems“
Economics

School III – School of Linguistics and Cultural Studies

SHARIF BITAR, Topic: „The Representation of Disability in Contemporary American Television Series“
English and American Studies

KATRIN HAMID, Topic: „Grenze – Gemeinschaft – Geschlecht. Repräsentationen von Weiblichkeit in künstlerischen Arbeiten zu Flucht und Migration nach und innerhalb von Europa“
Art Studies

ELLA MARGARETHA KARNATZ, Topic: „Autorschaft, Genres und digitale Medien. Michael Köhlmeier, Sibylle Berg, Cornelia Funke und Markus Heitz im deutschsprachigen literarischen Feld der Gegenwart (2010-2020)“
German Studies

CHRISTIAN KRAMER, Topic: „Der kollaborative Einsatz plurilingualer Techniken von fortgeschrittenen LernerInnen des Englischen als Fremdsprache – Gesprächsanalytische Zugänge an der Schnittstelle von englischer Fremdsprachendidaktik und Mehrsprachigkeitsdidaktik“
English and American Studies

MARION SCHERR, Topic: „The Invention of Outsider Art“
Material Culture: Textiles

HEIKE SCHOORMANN, Topic: „Akustische Eigenschaften der Vokale des Saterfriesischen und seiner Kontaktsprachen“
German Studies

BARBARA STREUBEL, Topic: „Ein graphematisches und schriftkulturelles Konzept für den Schriftspracherwerb bildungsbenachteiligter Kinder – Fall-Kontroll-Studie in Klasse 1 und 2“
German Studies

School IV – School of Humanities and Social Sciences

MAXIMILIAN KRÄMER, Topic: „Idealismus und Entfremdung. Zu Adornos Auseinandersetzung mit Kierkegaard“
Philosophy

MARKUS SACHS, Topic: „Betriebswirtschaftliches Denken und Handeln im antiken Rom“
History

School V – School of Mathematics and Science

HAMSA AHMED, Topic: „Performance Optimization of Cu(In_{1-x}Ga_x(Se_{1-y}Sy)₂ Thin-Film Solar Cells by Characterization and Modelling of Temperature and Low-Light Behavior“
Physics

LUKAS BELZ, Topic: „Continental Pans in Southern Africa and their Potential as Paleoclimatic and Paleoeological Geoarchives“
Marine Environmental Sciences

TORSTEN BLOHM, Topic: „Populationsökologische Untersuchungen am Abendsegler *Nyctalus noctula* (Schreber, 1774) in der Uckermark, Nordostbrandenburg“
Biology

JULIUS DEGENHARDT, Topic: „The impact of groundwater seepage on benthic microbial community structures“
Marine Environmental Sciences

EFTHIMIA DELIGIANNI, Topic: „Quasiperiodic oscillations from the accretion disk around compact objects“
Physics

ANGELIKA EINWICH, Topic: „Characterisation of mRNA and protein expression of the cryptochromes, the putative magnetosensors in the avian retina“
Biology

JAN FÄHRMANN, Topic: „Neue Anwendungen der Acyl-Nitroso-Diels-Alder-Reaktion und elektrochemische Schwefelaktivierung“
Chemistry

KERSTIN FITSCHEN, Topic: „Synthese und Charakterisierung kationischer Metall-ocenkomplexe des Titans und Zirconiums ausgehend von Pentafulvenmetallkomplexen“
Chemistry

GIUSEPPE GENTILE, Topic: „On the prescribed mean curvature flow of graphical hypersurfaces in certain globally hyperbolic Lorentzian manifolds with non-compact Cauchy hypersurfaces“
Mathematics

LUCA GERHARDS, Topic: „Quantum Chemical Investigation of the Photocatalytic Sulfoxidation of Hydrocarbons – A Potential New Reaction for Industry“
Chemistry

ALEXANDER GLOYSTEIN, Topic: „Exploring the structural, electronic and optical properties of cuprous oxide films and single crystals“
Physics

CLAUDIA GORR, Topic: „Klimawandel im Kontext des Klimasystems vermitteln: Cognitive-Development-Prozesse im Zuge der Verknüpfung schulischen und außerschulischen Lernens“
Physics

NELE GRÜNENBAUM, Topic: „Spatial and Temporal Variability of Submarine Groundwater Discharge on Barrier Islands“
Biology

MAURITS HALBACH, Topic: „Fate of microplastics within the riverine-marine transition: A polymer-specific mass-based approach on temporal and spatial scales“
Marine Environmental Sciences

ASHWIN HARIHARAN, Topic: „Numerical Analysis of Two-Defect Model Semiconductor for Time-resolved Photoluminescence Spectroscopy and Photovoltaic Device Performance“
Physics

SEYYEDHAMID MOUSAVI HASHEMI, Topic: „Non-Linear Variable Models for Inference and Learning from Non-Gaussian Data“
Physics

MATTES HEERWAGEN, Topic: „Arbeit in klassischen und quantenmechanischen Nichtgleichgewichtssystemen“
Physics

MARA ELENA HEINRICHS, Topic: „The impact of viruses on the composition of microbial communities and organic molecules in marine sediments“
Marine Environmental Sciences

NILS HENDRIK HINTZ, Topic: „Phytoplankton response to Fluctuating Light and Spectrum“
Marine Environmental Sciences

VINCENT HOEBER, Topic: „Epiphytic growth of vascular plants in temperate forests – an ecological perspective“
Biology

SARAH KAHLEN, Topic: „Quasinormal modes of spherically symmetric black holes in alternative theories of gravity“
Physics

CHRISTOPH KATHMANN, Topic: „Wärmestrahlung und -transport in Vielteilchensystemen“
Physics

NATALIE ANNETTE KELSEY, Topic: „Comparative analysis of the physiology, lipidome and genomic structure of migratory fattening“
Biology

BISHOY KHAIRALLA, Topic: „Spectroscopic and electrochemical studies of models of the cell membrane envelope of Gram-negative bacteria“
Chemistry

DAVID KIESLICH, Topic: „Untersuchungen zur asymmetrischen Michael-Reaktion und zur Cyanid-katalysierten Lactonisierung“
Chemistry

ANKE KORTE, Topic: „Spatially resolved spectroscopy of localized surface plasmon modes in gold nanostructures“
Physics

JESSICA KRÄUTER, Topic: „Defect Induced Reactions of Alcohols and Ketones on TiO₂ Rutile(110) Surfaces“
Chemistry

BASTIAN KRUEGER, Topic: „Analysis of Interphases in Lithium-Ion and Lithium Batteries during Cell Operation“
Chemistry

JANINA LEINBERGER, Topic: „Adaptations of bacteria from the family Rhodobacteraceae to diverse marine habitats“
Marine Environmental Sciences

LUOMOLI, Topic: „Developments of Transfer Hydrogenation Reactions Utilizing Dihydroaromatic Compounds as Dihydrogen Surrogate and their Applications in Synthesis“
Chemistry

MIENTJE LÜSSE, Topic: „Untersuchungen zum Einfluss eines experimentellen Citizen Science-Projektes auf die naturwissenschaftliche Allgemeinbildung“
Chemistry

ANNE MEHRTENS, Topic: „From Manure to Groundwater – The Fate of Veterinary Pharmaceuticals within the Aquatic Environment“
Biology

FELIX MILKE, Topic: „Biogeography of the Atlantic and Pacific Ocean microbiome“
Marine Environmental Sciences

NICO MITSCHKE, Topic: „Synthetic and Analytical Studies towards Metabolic Pathways and Enzyme Mechanisms Involved in Anaerobic Degradation and Transformation Processes in Bacteria“
Marine Environmental Sciences

MOZZAMIL MOHAMMED ABDALLA MOHAMMED, Topic: „Species coexistence, spatial distribution, and metacommunity diversity on spatial environmental gradients“
Environmental Science

JULIA MÜLLER-HÜLSTEDT, Topic: „Non-Precious Metal Catalysts Based on Activated Biochar for the Oxygen Reduction Reaction in High Temperature Proton Exchange Membrane Fuel Cell“
Chemistry

TIMO DI NARDO, Topic: „Entwicklung von Verfahren zur direkten Abscheidung von IrOx als Katalysator für die Anwendung in Elektrolyseuren“
Chemistry

ALEX RICARDO SILVA OLAYA, Topic: „Fundamentals of the Electrocatalytic Properties of Nanoporous Gold“
Chemistry

ANNIKA OTT, Topic: „Thermische Abstrahlung und Wärmeströme in Vielteilchensystemen magneto-optischer Nanoteilchen in einem externen Magnetfeld“
Physics

NILS OWSIANOWSKI, Topic: „A computational approach of locomotion, energy demand and dispersal of the common crinoid *Promachocrinus kerguelensis* (Echinodermata) and its circum-Antarctic success“
Biology

MARKUS SEBASTIAN PRINZ, Topic: „Invasive und potenziell invasive Neophyten der Ostfriesischen Inseln und angrenzender Gebiete“
Environmental Science

HARALD REINHOLD, Topic: „Oberflächenfunktionalisierung und Thermische Behandlung von CuInS₂ Nanopartikeln für Photovoltaische Anwendungen“
Physics

JAN HENNING ROSS, Topic: „Synthese neuer Titankomplexe mit chelatisierenden Indenyl-Amido-Liganden für die Hydroaminoalkylierung von Alkenen“
Chemistry

MARK-TILO SCHMITT, Topic: „Entwicklung und Evaluation einer digitalen Lerneinheit zur Einführung des differenzierten Atommodells. Ergebnisse einer explorativen quasi-experimentellen Studie in Sekundarstufe I“
Chemistry

THORBEN SIELING, Topic: „Ionic Liquids at Interfaces: Structure and Potential-driven Changes“
Chemistry

ROGER CARVALHO DA SILVA, Topic: „The processing of dissolved organic matter at the land-ocean interface: sources and organic carbon transformations in coastal oceans“
Environmental Science

VLADIMIR SMIRNOV, Topic: „Focusing of light on the nanoscale using metallic nanostructures: fabrication and characterization of plasmonic Bull’s eye resonators and Bowtie waveguides“

Physics

JULIA STREHL, Topic: „Entwicklung elektrochemischer Methoden für die Kohlenstoff-Element-Bindungsknüpfung und Oxidationsreaktionen“

Chemistry

MATHEUS DO CARMO TEODORO, Topic: „Accretion Processes around Compact Objects“

Physics

CHRISTOPH THOLEN, Topic: „Localisation and Investigation of Submarine Groundwater Discharge Sites by Unmanned Underwater Vehicles and Artificial Intelligence“

Marine Environmental Sciences

PATRICK THOMAS, Topic: „The importance of functional trait variation within and across phytoplankton species for the functioning of aquatic ecosystems“

Marine Environmental Sciences

DANIEL WACHTENDORF, Topic: „Synthese neuer Scaffolds aus β -Oxoestern“

Chemistry

ARNE RÜDIGER WEITEN, Topic: „Regulation und Ansprechempfindlichkeit des Kohlehydratabbaus und Transportes im marinen Bakterium *Phaeobacter inhibens* DSM 17395“

Marine Environmental Sciences

WIEBKE MARIE WOHLTMANN, Topic: „NHC-stabilisierte Carbenanaloge und Kationen der Elemente der Gruppe 14 für Bindungsaktivierungen“

Chemistry

School VI – School of Medicine and Health Sciences

STEFAN AHRENS, Topic: „Inter-Individual Variability of Nicotine Effects on Cognition – The Dopamine System as Possible Moderator“

Psychology

ANNA DAUBENBÜCHEL, Topic: „Oxytocin and eating behavior in childhood-onset craniopharyngioma patients“

Human Medicine

RAJESH DEVASSY, Topic: „The feasibility of myomatous tissue extraction in laparoscopic by contained in-bag morcellation: a retrospective single arm study“

Human Medicine

ALEXANDER DREYER, Topic: „Reach-and-grasp action specificity of the human mirror neuron system – Evidence from broadband high frequency activity in MEG and ECoG“

Psychology

JULES ERKENS, Topic: „The development of envelope-transcranial alternating current stimulation as a hearing aid“

Psychology

CONRAD FIFELSKI, Topic: „Ein immersiv ferngesteuertes Robotersystem zur Unterstützung von Patiententransfers in der Pflege“

Health Services Research

MAREIKE FRANKE, Topic: „Einfluss des hydrostatischen Druckes auf die funktionelle Schweregradbeurteilung von Koronarstenosen mittels „instantaneous wave-free ratio“ (iFR) und fraktioneller Flussreserve (FFR)“

Human Medicine

JOHANNES GRONE, Topic: „Der Einfluss der BRAFV600E-Mutation auf die Eigenschaften papillärer Schilddrüsenkarzinome“

Human Medicine

PHILIPP GEORG HEERMANN, Topic: „Bestimmung des kritischen Verschlussdrucks der systemischen Zirkulation mittels instantaner aortaler Druck-Flussgeschwindigkeits-Beziehungen unter intraoperativen Bedingungen“

Human Medicine

MANUELA JÄGER, Topic: „Dynamic properties of selective auditory attention using electroencephalography“

Psychology

YADWINDER KAUR, Topic: „Individual differences in brain signal complexity and their relationship with creativity“

Psychology

WIEBKE BRIT KLEINER, Topic: „Diagnostic accuracy of magnetometer-guided sentinel lymphadenectomy after intraprostatic injection of superparamagnetic iron oxide nanoparticles in intermediate- and high-risk prostate cancer using the magnetic activity of sentinel nodes“

Human Medicine

LINDA ANNA MARIA LECKER, Topic: „Translation, cross-cultural adaptation, validity and reliability of the German Diabetes Foot Self-Care Behavior Scale (DFSBS-D)“

Human Medicine

CHRISTIAN LINS, Topic: „Analyse und Klassifizierung von Körperhaltungen und -bewegungen mit Methoden des maschinellen Lernens“

Psychology

SONJA MEISER, Topic: „Cell Intrinsic Plasticity“

Neuroscience

THERESA NÜSSE, Topic: „Speech recognition in relation to hearing“

Medical Physics

HENNING OETJEN, Topic: „Temporal perception in the Mongolian gerbil: effects of aging and experimentally induced synaptopathy“

Psychology

JASPER OOSTER, Topic: „Self-conducted speech audiometry using automatic speech recognition“

Medical Physics

THERESA OTT, Topic: „Characterization of Large Fireballs using global monitoring methods“

Medical Physics

CHRISTIAN PHILIPP RAUSCH, Topic: „Prescribing medications of questionable benefit prior to death – a retrospective study on older nursing home residents with and without dementia in Germany“

Health Services Research

ULRIKE REHBEIN, Topic: „The complex life of MTOR“

Neuroscience

ENNO-EDZARD STEHEN, Topic: „Kontinuierliche Mobilitätsanalyse in der häuslichen Umgebung unter Einsatz ambienter Sensoren“

Health Services Research

SARINAH SUTOJO, Topic: „Auditory glimpses in machine listening“

Medical Physics

DUNJA THURN, Topic: „Experimentelle Untersuchung zur Parametrierung des Drehzahlreglers eines drucksensitiven Linksherzunterstützungssystems am Kreislaufsimulator“

Human Medicine

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