Carl von Ossietzky
Universität
Oldenburg

2025/26 ISSUE

THE UNIVERSITY OF OLDENBURG'S RESEARCH MAGAZINE

EINBLICKE 70

Early brain development
How thinking begins

Dear Reader,

The Excellence Strategy, launched by the German government and federal states, aims to promote cutting-edge research and increase its international visibility. This spring, the University of Oldenburg celebrated a sensational success in this highly competitive arena, gaining approval for all three research projects that had applied for funding as Clusters of Excellence. This achievement places the University of Oldenburg in a league of its own among Germany's younger universities. Of the 21 universities founded since 1960 (known as Neugründungen), it is the only one to host three of these top-level research projects.

As a result, the university now has a unique opportunity to apply to be designated as one of up to 15 Universities of Excellence. In this next phase of the Excellence competition, the University of Oldenburg will be competing alongside the University of Bremen. Although the two universities – founded just over 50 years ago – were viewed critically for a long time, they are now regarded as young, unconventional and forward-looking universities with a remarkable track record, particularly in research. This is reflected in the fact that they have a total of four Clusters of Excellence between them, including one joint Cluster. The topics of the three Oldenburg Clusters – hearing research, marine research and animal navigation research – already have a long and fruitful tradition at the University. EINBLICKE provides regular updates on the fascinating findings emerging in these fields. In the current issue we outline the direction that the Excellence projects will be taking over the next seven years.

We also portray an impressive young researcher from the Ocean Floor Cluster of Excellence: geoscientist Sinikka Lennartz, one of the principal investigators of the Cluster whose work has overturned a paradigm that had been in place for decades and has earned her several prestigious awards. She investigates how microscopic processes in the ocean impact the global climate.

The University is also breaking new ground in medical research – for example, into how the brains of newborns develop. At the premature baby unit of Klinikum Oldenburg, neonatologist Axel Heep battles every day to give the babies in his care the best possible start in life. He also works with an interdisciplinary team at the university, researching factors that are crucial for brain development – from the molecular level to potential therapies for cognitive impairments.

Special needs education researcher Teresa Sansour is investigating ways to ensure that people with complex disabilities can participate as fully as possible in everyday life. In our interview she discusses how to reduce barriers and foster true inclusion.

Among other exciting topics covered in this issue, we explore the link between AlphaGo, the AI that defeated the champions of the board game Go for the first time, and the management of energy networks. We also examine new methods of restoring sensitive ecosystems, ranging from seagrass beds to mangroves, in tidal zones around the world. Finally, we take a journey through art history, exploring how artists have dealt with crises in the financial system in their work over the centuries.

We wish you an inspiring read!

Yours, the EINBLICKE editorial team

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Between Land and Sea

Tidal flats around the world are home to unique ecosystems. How can they be protected and restored?

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Where is society headed? Four researchers at the university shed light on the latest trends in their fields.

THE NUMBER

183.176

... is the number of data points obtained from a variety of audiometry and speech audiometry tests, cognitive tests and questionnaires of 581 test subjects that researchers from the Hearing4all Cluster of Excellence have made available on the Zenodo platform under the title Oldenburg Hearing Health Record (OHHR). The data was collected between 2013 and 2015 in collaboration with Cluster partner Hörzentrum Oldenburg. It has been structured and processed and is now available to researchers from all over the world to use for their work.

Making research data publicly available is a prerequisite of the research data policy to which the Cluster has committed itself. But it will also play a critical role in the upcoming funding period, in which Cluster participants from Oldenburg and Hannover aim to establish globally applicable standards for data collection and structuring in hearing research.

Common data standards hold enormous potential, particularly for large-scale data-driven analyses. These AI based analyses are key to detecting hearing impairments at an early stage and predicting their progression. Moreover, AI is increasingly used to enhance signal processing in hearing aids, and researchers and developers rely on large amounts of standardised data to train these systems.

The ocean in equations

Geoscientist Sinikka Lennartz translates microscopic biological and chemical processes in the marine environment into mathematical equations – and incorporates them into global Earth System Models. The German Research Foundation has now awarded her its prestigious Heinz Maier-Leibnitz Prize.

By Ute Kehse

Sinikka Lennartz is researching carbon decomposition in the ocean – a much-overlooked factor in the global carbon balance. Her earth system models run on the university's high-performance computing clusters.

It was by no means a given that Sinikka Lennartz would one day become a marine researcher. "I come from Hesse," she replies with a smile when asked whether she has a special connection to the sea. Hesse is a landlocked state in the middle of Germany, so it was more of a coincidence than anything else that the marine environment became the focus of her research. She applied to work on a three-month project at the renowned Woods Hole Oceanographic Institution in the US when she was still a Master's student in geoecology at the Technische Universität Braunschweig – and got accepted. "I had no idea this was such a famous marine research institute," she recalls. Yet her stay at Woods Hole, on the US east coast, marked a turning point in her career. It was there, in a group led by marine researcher Scott Doney – a leading expert on the role of the oceans in climate change – that she first encountered mathematical modeling of biological processes in the sea.

Lennartz is now a junior professor in biogeochemical ocean modelling at the University of Oldenburg, and has already won numerous awards for her research, including prestigious prizes from the German Research Foundation (DFG) and the Helmholtz Association. But the highlight came this year when Lennartz received Germany's top award for early-career researchers: the DFG's Heinz Maier-Leibnitz Prize. It comes with 200,000 euros for further research and went to a University of Oldenburg scientist for the first time. She was also awarded the Georg Wüst Prize by the German Society for Marine Research and the Lower Saxony Science Prize.

To understand what makes Lennartz's research so important and relevant, it's worth taking a closer look at carbon, the chemical element which in its key compound form, carbon dioxide, is driving global warming. In its multiple chemical forms, carbon is exchanged between living organisms and the abiotic environment in an endless cycle – a highly complex machinery consisting of carbon sources, carbon sinks and intermediate storage sites on which ultimately our planet Earth's temperature depends. Researchers generate simulations of the carbon cycle with all its pathways and deviations to predict how human CO_2 emissions will affect the climate, and then use Earth System Models (ESMs) to predict temperatures and other variables. However, not all the processes in the cycle have been sufficiently studied to be incorporated into global models. For example, one of the largest carbon transfer processes in the ocean, the conversion of organic biomass into inorganic CO_2 – also known as remineralisation – is currently represented with far less precision in ESMs than the reverse process, the build-up of organic substances from CO_2 via photosynthesis. These gaps create uncertainties in climate projections.

However, in recent years Lennartz has made significant progress towards understanding and quantifying two little-researched processes by which the ocean affects the climate system. First, she studied the climate-active trace gas carbonyl sulphide and how it is exchanged between the ocean and the atmosphere. Published in 2017, her global model of this process continues to set the standard in the field, and she plans to use it as a starting point for clarifying open questions in a new project with researchers from the US and Israel. Secondly, she is researching carbon compounds in the sea and their bacterial breakdown. "I find it fascinating that these diverse chemical and microbial processes which take place at the microscopic level have such global relevance," she explains.

Lennartz recently demonstrated just how relevant they are in her model of the dynamics of organic carbon compounds dissolved in the sea (also known as DOC). She led an initiative to incorporate DOC into an Earth System Model, resulting in the first model to explicitly represent bacterial DOC degradation while remaining consistent with observational data. Prior to this, global models either aligned with DOC measurements or included bacterial mechanisms, but not both. She then demonstrated that this reservoir, which consists of millions of different substances and forms one of the largest organic carbon reservoirs in the Earth system, reacts far more strongly to environmental changes than previously assumed. According to her calculations, the oceans will probably be able to store more carbon than was thought. "But that won't save us from climate change," she hastens to clarify. On the basis of her predictions, the additional carbon absorbed by the oceans over the next 200 years is equivalent to the amount generated by humans within just three to four years – which highlights the huge impact of human activities on global material cycles. Thanks to her results, degradation processes in the oceans can now be better incorporated into the climate models that feature in the reports of the Intergovernmental Panel on Climate Change.

"Sinikka Lennartz's discovery that dissolved organic carbon does not remain stable over thousands of years, but behaves dynamically, has challenged a paradigm that existed for decades and has revolutionised our understanding of biogeochemical processes in the sea," emphasises Prof. Dr Thorsten Dittmar, the head of the Marine Geochemistry research group in which Lennartz was a postdoc researcher from 2019 to 2021. "Her great strength lies in her unconventional way of questioning established doctrines and tackling unsolved scientific problems."

Oceans could store more carbon in the future

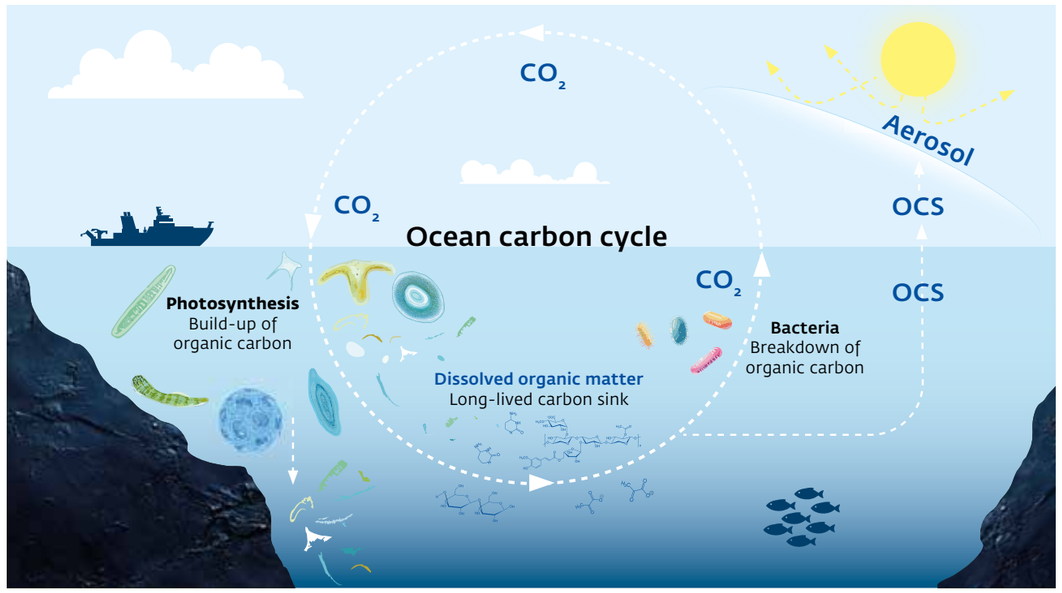
Lennartz herself sees interdisciplinary dialogue as a key inspiration: "What I enjoy most is working and having discussions with people from many different disciplines – that's when I

come up with the best ideas." This is also one of the things she appreciates most about her current research group: new trains of thought to follow and a shared passion for spontaneity. She says she learned how to steer discussions in a productive direction during her time at the Massachusetts Institute of Technology (MIT) in the US – but according to colleagues she was already good at the art of discussion before that. She worked at MIT on a DFG Walter Benjamin Fellowship in 2021 and 2022 before taking up the junior professorship in Oldenburg three years ago.

Curiosity, frustration tolerance and perseverance are other key prerequisites for scientific success, she says: "It's rarely the case that everything works out straight away." Her own career pathway has been enviable so far, including positions at ETH Zurich, the GEOMAR Helmholtz Centre for Ocean Research Kiel and MIT. She has also started a family and now has two children, one seven years old and one eighteen months. But there have been times when not everything has gone to plan: last year, despite a positive assessment, a research proposal for a large collaborative project under her co-leadership was rejected – to her great disappointment. "That was quite a setback," she admits. "I was really keen on that project. We had a great team for tackling the question of carbon storage in dissolved organic compounds from different angles." She even had fun writing the proposal – a task many researchers find unpleasant. "Thinking about the next important steps to get closer to solving long-standing research questions, and how to put those ideas into practice – it was all very exciting," she says.

But her enthusiasm for solving the mysteries of marine material cycles is as keen as ever. As a member of the Cluster of Excellence "The Ocean Floor", which is based at the Universities of Oldenburg and Bremen, she will now turn her attention to other exciting questions. Lennartz, who at 37 is among the youngest on the team, is among its leading scientists. One of the fifteen doctoral candidate positions to be filled in the cluster from the beginning of 2026 will be in her research group. The focus here will be on carbon in its particle form rather than the degradation of dissolved organic carbon in the sea.

Lennartz already has her sights on certain data sets that she can tap into to learn more about the fate of carbon in the sea. Thanks to new technologies, scientists now have access to far more data about marine microbiological processes. "This is a treasure trove that cannot be ignored," Lennartz stresses. An entirely new picture of the geographic distribution of different microbes and the functions they perform will emerge, she says. Her aim is to use it to provide an even more comprehensive description of the dynamics of carbon degradation in her Earth System Model.



The element carbon takes different pathways in the sea: as carbon dioxide it dissolves from the atmosphere into the water, where it is converted into organic compounds by algae. Once the algae have died, some of their remains sink to the sea floor in particle form, while other constituents dissolve in the seawater, where they are further decomposed by bacteria and converted into CO_2. One by-product of this process is carbonyl sulphide (OCS), which rises into the atmosphere as an aerosol and reflects solar radiation.

Outlooks

How will religion be taught in schools in the future?

Prof. Dr Joachim Willems

Religious Education

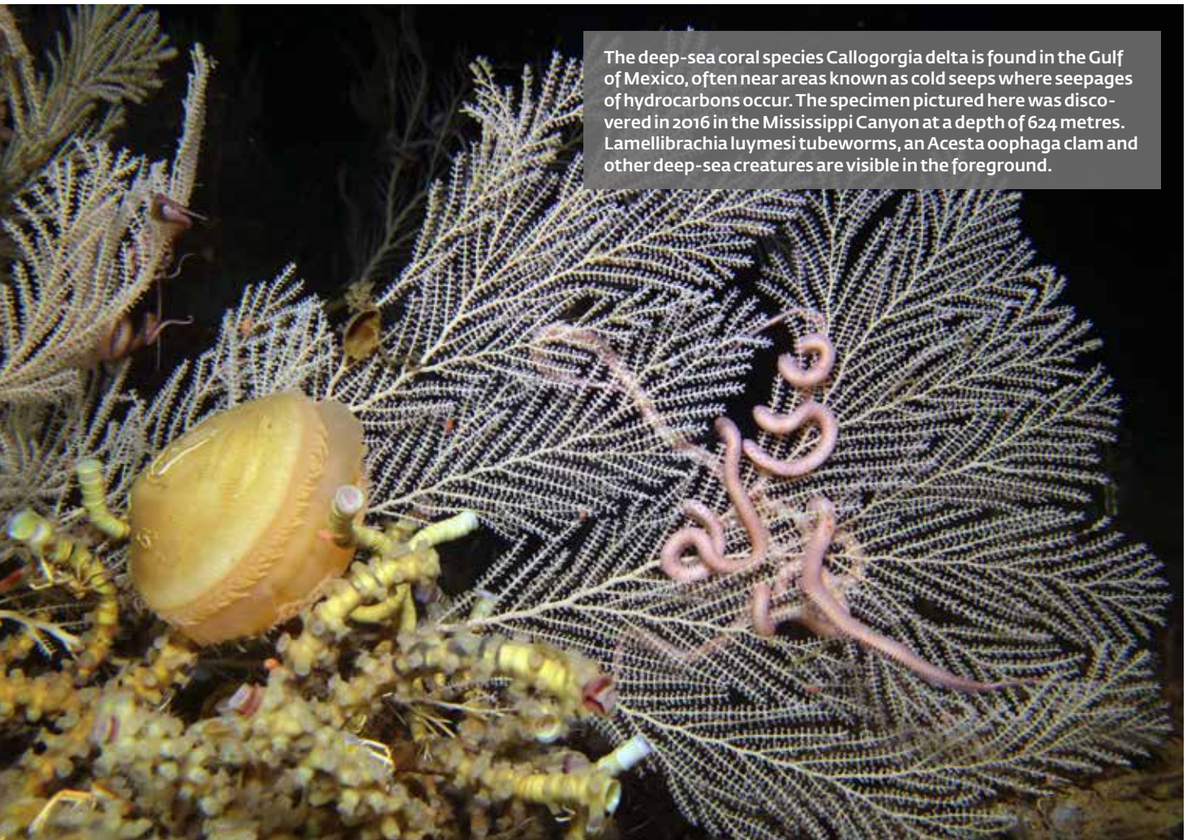
There is a fundamental upheaval underway in Germany's religious landscape. While in 1950, more than 95 percent of the population were members of one of the two largest Christian Churches, in 2024 it was just 45 percent. In addition to this secularisation, there has been a growing religious pluralisation of society, evidenced for instance by the increasing proportion of Muslims. There has also been a clear trend towards individualisation. Against this background, it is becoming increasingly difficult to organise and justify teaching Religious Education, separated by denomination, as enshrined in the constitution.

In Lower Saxony, Evangelical and Catholic Religious Education have been merged under the working title "Christian Religious Education" (CRU). But it is unlikely to stay that way. For quite some time now, Religious Education is de facto often taught not separated by denomination, which does not correspond to the model provided for in the constitution, and CRU won't change this. In the longer term I see three more likely alternatives. The first – and most radical – would be to get rid of Religious Education altogether to make way for new topics that appear more relevant. The second option would be a subject in which all pupils engage with different religions using a more descriptive and comparative approach, similar to that of religious studies. As a third alternative, I can imagine interfaith education that also allows space for normative questions, so that students can decide for themselves which beliefs they consider appropriate. Different religious communities and academic theologies could cooperate with the state to provide these lessons, leaning also on religious studies as a key reference discipline.

The result would be lessons in which pupils learn about different religions, but can also discuss faith and existential questions. Because I am convinced that religion still provides a relevant way of understanding the world alongside other approaches such as the natural sciences and economics. And schools should continue to offer this perspective in the future.

Deep-sea bacteria with minimal genome

A German-American research team led by Prof. Dr Iliana Baums from the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) and Dr Samuel Vohsen from Lehigh University in the US has discovered two highly unusual bacterial species in the tissue of two deep-sea corals from the Gulf of Mexico. The two coral symbionts lack even the ability to obtain energy from carbohydrates – an impressive example of how few genes are required to create a functioning organism. The team's findings were published in the scientific journal Nature Communications.
For their study, the researchers were investigating several colonies of the two soft coral species Callogorgia delta and Callogorgia americana, which live in total darkness at depths of around 300 to 900 metres, when in the course of their analyses they discovered the two closely related and previously unknown bacterial species from the Mollicutes class of bacteria. These microbes often live as parasites on or in the cells of plants, animals and humans, and can be the cause of disease. On the basis of genetic analyses, the researchers have proposed that the newly discovered bacterial species be assigned to a new family called Oceanoplasmataceae.
Further research revealed that the bacteria live in a gelatinous tissue layer that forms part of the coral's immune defence system and also transports nutrients. One of the two species (Oceanoplasma callogorgiae) has only 359 genes to encode proteins for various metabolic functions, while the other (Thalassoplasma callogorgiae) has 385. For comparison, the intestinal bacterium Escherichia coli has more than 4,000 protein-encoding genes and humans have around 21,000.
How the metabolism of the two newly discovered microbes can function with such a reduced genome is a mystery to the researchers: "These bacteria don't even carry genes for normal carbohydrate metabolism, in other words, for converting carbohydrates into energy – a function that every living organism was thought to have," Baums explains. According to the research to date, their only source of energy is the amino acid arginine, which is provided by the host coral. "However, the breakdown of this amino acid generates only tiny amounts of energy. It's truly astonishing that the bacteria can live on so little," Baums stresses. It remains unclear whether the microbes are entirely parasitic or whether the corals benefit in some way from their symbionts.



The deep-sea coral species Callogorgia delta is found in the Gulf of Mexico, often near areas known as cold seeps where seepages of hydrocarbons occur. The specimen pictured here was discovered in 2016 in the Mississippi Canyon at a depth of 624 metres. Lamellibrachia luymesi tubeworms, an Acesta oophaga clam and other deep-sea creatures are visible in the foreground.

How time influences medical decisions

Terminal illnesses, an unfulfilled wish to have children or advancing age: in different phases of life people focus on different aspects of time. The temporal structure of life influences how we assess medical options, or take advantage of them. This is a key finding of the interdisciplinary research group Medicine and the Time Structure of the Good Life, which has been investigating the interactions between medicine and lifetime since 2021.
The German Research Foundation has now approved a further four years of funding for the project, which involves the Universities of Oldenburg, Göttingen, Frankfurt am Main and the Humboldt-Universität zu Berlin. Prof. Dr Mark Schweda from the Department of Health Services Research has been appointed as the group's spokesperson. The research group applied for just under 3.4 million euros in funding. In this second funding phase, the focus will be on the importance of intergenerational aspects for medicine.

Obstacles to growing microorganisms in the lab

Microbial ecosystems such as those found in seawater, soil or the human gut are amazingly diverse. Yet many of these microorganisms die when grown in the lab. Now a new study by biodiversity researchers Dr Tom Clegg and Prof. Dr Thilo Gross from the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) has found a potential explanation for this phenomenon. The microbes' survival depends not only on their individual needs, but also on a hidden network of relationships which can collapse as a result of even minor structural changes. The findings were published in the scientific journal PNAS.

The unique properties of ultra-thin materials

A novel class of ultra-thin materials – also known as two-dimensional materials (2D materials) – is the focus of a newly approved research project. These solids are often less than a nanometer (a billionth of a metre) thick and consist of just a few atomic layers. In the "Dual Twist" project, physicist Prof. Dr Christian Schneider and his team from the Institute of Physics will develop experimental set-ups to explore the unique properties of 2D materials using a special method that involves "twisting light", paving the way for their application in innovative quantum technologies.
The European Research Council has awarded Schneider approximately two million euros in funding over a five-year period for his project. Schneider and his team were able to induce 2D materials to emit coherent laser light at both extremely low temperatures and room temperature in 2021 – a breakthrough that could serve as a basis for the development of highly versatile nanolasers.

How desert ants navigate

Like songbirds or monarch butterflies, desert ants of the species Cataglyphis nodus use the Earth's magnetic field for orientation. Yet, according to the research of a team led by Dr Pauline Fleischmann of the Institute for Biology and Environmental Sciences in the journal Current Biology, the mechanism through which they sense the field is different. The researchers suspect that the desert ants' magnetic sense is based on tiny particles of magnetite, a mineral whose main component is iron oxide. The finding opens up new avenues for research into the evolution of this sensory perception process in animals.

Research on high-energy beaches continues

The north-facing beach of the island of Spiekeroog is home to a unique observatory that delivers a continuous stream of data on what happens when freshwater and salt water converge deep below the sandy surface. Thanks to its complex and innovative infrastructure researchers are able to conduct a detailed analysis of the dynamic subsurface processes in this transition zone between land and sea for the first time.
"The conversion of elements such as carbon or nitrogen in the subsurface of sandy beaches has not yet been incorporated into global models of material cycles," explains Oldenburg hydrogeologist Prof. Dr Gudrun Massmann, who leads the DynaDeep research group. Launched at the beginning of 2021, the team now aims to determine whether sandy beaches should be integrated into future global material cycle models.
The German Research Foundation has extended the project's funding by a further four years, with an additional 4.8 million euros. In the next project phase, the team is conducting similar investigations on beaches in Belgium and France in order to determine the extent to which the findings on Spiekeroog can be extrapolated to other coasts.

The changing Wadden Sea

Biodiversity in the Wadden Sea off the coast of the Netherlands, Germany and Denmark is changing dramatically. This was the finding of a study published by a German-Dutch research team in the journal Global Change Biology, in which a group led by Oldenburg biologist Prof. Dr Helmut Hillebrand of the Institute of Chemistry and Biology of the Marine Environment (ICBM) played a key role. Several fish species, including Atlantic cod and various species of flatfish, were among those worst affected by population decline. However, there was also a downwards trend for many mussels, snails and bristle worms, as well as for phytoplankton and plants such as seagrass and the vegetation in the salt marshes.
For the majority of seabird species, by contrast, the data pointed to an increase in population sizes over an extended period of time. Yet for many wader and gull species this overall positive trend reversed in the late 1990s and early 2000s, and their numbers have been in decline ever since. The study's findings could potentially be used to improve nature conservation strategies.

Interdisciplinarity boosts results

Unusual research approaches in which seemingly unrelated disciplines converge are the hallmark of Oldenburg University's new "booster units". The eight units develop creative solutions at the interface of different research fields. In one team, scientists from the fields of education, musicology and computer science are working together to design a playful musical environment for learning to use artificial intelligence. In another, biologists and religious studies experts have joined forces to search ancient records for references to early human and animal navigation movements.
The goal is to use interdisciplinarity to gain new perspectives on questions such as what digital information we trust and why, the impact of hearing loss on social interactions, and how colonialism affects the carbon cycle. Other projects focus on resilience in premature babies, AI analysis of genetic data and diversity-sensitive healthcare in rural areas.
The booster units are funded by the Strategic Development of Potential funding line as part of the "zukunft.niedersachsen" programme, which is jointly run by the state of Lower Saxony and the Volkswagen Foundation. The university applied for the funding with its "Programme for Excellence" and has been awarded a total of 22.5 million euros. Besides funding numerous other projects, the sum will finance two full-time doctoral candidate or postdoc positions for each booster unit for an initial four-year period.

Parental attitudes to environmental issues

The birth of a child has little impact on how its parents feel about environmental and climate issues, according to a representative study by Prof. Dr Gundula Zoch from the Institute of Social Sciences and Dr Nicole Kapelle from Trinity College Dublin (Ireland). The research team's findings were based on an analysis of longitudinal data from the German Socio-Economic Panel (SOEP) survey carried out between 1984 and 2020.
The widespread assumption that parents become more concerned about the environment and climate issues after the birth of a child cannot be confirmed across the board, said Zoch. The results show a tendency among parents to be less concerned about the environment and climate issues around the time of childbirth, simply because for many people daily life with a newborn sets other, more immediate priorities that push environmental and climate protection into the background. By the time the children reach school age, however, their parents' concerns again correspond with those expressed before the birth.

Outlooks

When will AI make your diagnosis?

Prof. Dr Nils Strodthoff

AI4Health Division

When used correctly, artificial intelligence (AI) already sees more than humans do: one model, for example, detects signs of liver disease or diabetes in electrocardiograms – diseases that at first glance have nothing to do with the heart. This is possible because AI recognises patterns across thousands of data sets that remain hidden to the human eye.

Researchers are now looking into what happens when multimodal AI models combine different data sources, such as ECGs, blood values and X-ray images. The hope is that this broader perspective will make it possible to detect new disease patterns and facilitate predictions. This is also the aim of the highly contentious “foundation models” that form the backbone of generative AI. These are designed not only to perform a specific task – such as detecting a particular disease – but also to respond flexibly to questions posed by physicians. Yet they are still a long way off. Strict regulatory requirements are holding things back for one thing, and transferring research findings into clinical practice is fraught with difficulties: just because AI delivers good results based on curated research data sets does not necessarily mean it will do the same when dealing with real-world patient data. The danger is that it will make incorrect diagnoses. Systems therefore need to be very robust – and standards for measuring this are still very much in their infancy.

That said, initial applications have been in use for years and are running in the background. AI programmes are already detecting abnormalities in X-ray and MRI images as reliably as specialists – without ever getting tired or needing breaks. For patients, however, visiting the doctor remains a familiar experience: the diagnosis is still made by a fellow human being.

Putting smart agents through their paces

Our power grids could soon be operated by smart and explainable AI systems. A junior research group led by Eric Veith and funded by the Federal Ministry of Research, Technology and Space is investigating how to provide the best possible training to ensure an optimal response in critical situations.

By Ute Kehse

The 28 April 2025 is a date that people in Spain and Portugal will remember for many years to come. It was on that Monday at 12:33 pm that the Iberian Peninsula experienced a complete power blackout, with some places being left without electricity until the next day. The blackout was caused by a chain reaction of overvoltage disconnections: one power station after the next shut down until a critical point was reached and electricity generation in both countries collapsed completely within a matter of seconds. The Spanish government later published a report detailing the events that led to the outage. For Oldenburg computer scientist Dr Eric Veith, it's easy to see why human grid operators in control rooms would be stretched beyond their limits in a situation like that – despite the support of automated systems. "When a massive disruption occurs, the control room is flooded with notifications. Suddenly, all the screens light up like a Christmas tree." With so many decisions to take and only seconds to respond, it's virtually impossible for humans to develop a strategy to stop the fatal cascade.

The German power grid might have a reputation for being one of the world's most secure and stable, but the energy transition, with the increased fluctuations in electricity generation and consumption it entails, is intensifying the challenges for grid control, and cyber attacks are another risk. Veith's research is focused on creating modern AI systems to support the professionals at grid control centres in their daily work and thus help to make critical infrastructure more resilient in the face of unforeseen events. This would be difficult to achieve with conventional software, he explains. "There are so many incalculable factors in modern power grids, so many influences that people were unaware of when they were built, that it is simply no longer possible to develop software components that are prepared for every eventuality." Which is why his junior research group Adversarial Resilience Learning, funded by the Federal Ministry of Research, Technology and Space (BMFTR), is focusing on creating an AI-supported software system that can learn, is reliable, and whose decision-making is transparent.

To explain how this works, Veith starts by talking about the board game Go – and another memorable day, at least in the world of computer science. On 13 March 2016, the AI software AlphaGo achieved something that was thought to be impossible at that point: it won a game against the reigning world Go champion, Lee Sedol. "Go is the most complex board game ever invented, and the sheer multiplicity of options makes it extremely difficult for a software to develop a good strategy," Veith explains. It was ultimately a trick that enabled the AlphaGo programming team to beat the best human players: they first fed the AI software with moves used by Go champions and then had it play against a copy of itself countless times. Eventually, the programme learned the weak spots of its human opponents and was even able to develop hitherto unknown strategies.

An "evil twin" challenges the operator agent

Pitching two identical software programmes against one another to produce increasingly sophisticated tactics – Veith is employing the same strategy as the AlphaGo team in his own research project. In a method known as Autocurricular Deep Reinforcement Learning, he and his five-person team feed the computer programme – which the researchers refer to as "the agent" – with information about a system via various sensors. "The system could be a playing field or it could be a power grid," Veith explains. The agent also includes a training algorithm which is based on a neuronal network, i.e., an AI programme modelled on the biological neuronal architecture. This structure allows the neural network to make decisions in a similar way to the human brain. It doesn't follow a pre-programmed pattern, but to a certain extent programmes itself, learns from experience and is able to deal with new situations.

Veith's agent is given a so-called reward function that describes, in mathematical terms, a desired state of the system. In the case of the power grid, this reward could be used to ensure that the power frequency and voltage levels remain within certain parameters. "But the strategy is not laid out in advance", the computer scientist emphasises. The agent detects something, reacts and then calculates a feedback signal in order to determine whether it has fulfilled the task at hand. To achieve the objective – for instance, stabilising the grid frequency – the agent has several options: it can switch on power stations, disconnect consumers from the grid or adjust controller settings, to name a few. It can also shift reactive power, which is necessary for voltage stabilisation, or activate protective devices. With the help of the training algorithm it learns how to best achieve its goal. "These agent systems are proactive rather than simply reactive. And we don't have to prescribe how this system should achieve something; we just have to tell it what the desired state is," Veith adds.

To train their agents, the researchers first had to develop an appropriate simulation environment. Creating a realistic replica of a power grid was one of the most complex parts of the project. "Our idea, inspired by AlphaGo, was to set up not just one agent to stabilise the grid but to use a second one too, a sort of evil twin which would work to achieve the opposite effect, then let them battle it out", Veith explains. This would effectively confront the operator agent with a constant stream of new problems and make it learn faster. Depending on how the researchers configure the second "challenger" agent, it could try to outwit its opponent and destabilise the power

grid by simulating cyber attacks, extreme weather situations, or a surge in demand for electricity precipitated by thousands of smart home devices being switched on simultaneously.

"Using this basic idea, we started work in 2018 in Sebastian Lehnhoff's research group at the OFFIS Institute for Information Technology and made a lot of headway," Veith recalls. But like so many AI programmes, the team's original system of agents had one fundamental flaw: it provided no information about how its results were achieved. Yet explainability is essential if these agents are to be deployed in critical infrastructure, especially because in the course of their training AI programmes sometimes learn things that don't make much sense. "This is why we had to expand the original concept in a fundamental way, focusing on why an agent does what it does," Veith clarifies.

It is this objective that the researcher has been pursuing since 2022 – both in his junior research group at the University of Oldenburg and also in two EU-funded joint projects in collaboration with the University-affiliated OFFIS Institute. Industry partners such as Austrian energy provider Wiener Netze and Stuttgart-based Netze BW were also involved.

To guarantee transparency, the team developed an algorithm that converts the agent's strategy into an "equivalent decision tree". This enabled the researchers to map out, step by step, the rules that the programme follows when making its decisions. "We can see exactly which threshold values for which sensors lead to a particular decision so we can determine whether it makes sense in the real world or whether the agent has been fooled by a statistical anomaly during learning," explains Veith.

"Our 'evil' agent soon learned how to attack the power grid"

The next step for the team is to optimise the agent's training. "Training it from scratch is extremely resource-intensive, as several million simulation steps are needed for it to learn a meaningful, transferable strategy," the researcher explains. To speed up the process, the team developed a method for incorporating the industry partners' know-how into the agent's training. One example was a street in Vienna where many of the residents drive electric cars. "If they all come home from work at more or less the same time and want to charge their cars, it's bad for the grid," Veith explains. The team was able to put this negative pattern to good use in the challenger agent. "It quickly learned how to apply this information to attack the power grid," says Veith. The operator agent, in turn, was forced to develop a counter-strategy, to which the challenger agent then responded – a game that the researchers continued for a while. "In the end, we had a decision tree and could see that the strategy indeed made sense."

It was also the decision tree that helped the team solve another typical AI software problem – that of "catastrophic forgetting". When an AI is being trained with new data, previously learned patterns occasionally get overwritten. As a countermeasure, Veith and his doctoral students programmed their agent to compare decisions made by its own training algorithm with rules listed earlier in the decision trees. If discrepancies arise, it can then initiate retraining with the old data. "We call this rehearsal. The neural network then has to go through the old cases again, because it has clearly forgotten them", Veith explains. This combination enables the agent to learn much faster and achieve reliable results.

It will probably be a while before the programme can actually be used in a grid control centre, the researcher notes: "It's hardly feasible to conduct field tests with a real power grid at this point in time, so we're currently discussing other possible applications for our system, for example in crisis prevention." Nevertheless, the stated goal is to create a system that can be deployed in real-life situations – reliable software that makes the right decision when it really matters.

Eric Veith and his team have developed an AI that can operate power grids and deal effectively with unexpected problems.

Outlooks

Who creates the future?

Prof. Dr Martin Butler
Director of the research centre "Genealogy of the Present"

The future is not yet set. This is what makes it uncertain. In times of multiple crises, when wars and other catastrophes dominate the headlines, uncertainty, for many, becomes a real "crisis of assurance". People deal with this in very different ways: some trust the reliability of scientific prediction; others believe in the visions of political decision-makers or in religious promises of salvation. At the interdisciplinary and interdepartmental research centre "Genealogy of the Present", we look at the different narratives that are emerging about the future, how they compete for authority, and how they shape present-day thinking and action.

For example, in the discourse on the future of Western industrialised nations, one side regards migration as critical to addressing the problem of ageing populations and shortages of skilled laborers, whereas the other side sees it as a danger that must be averted. These two narratives about the future compete with one another, informing the opinions and decisions of today.

Alarmingly, in this battle for attention, the impact of a narrative is not necessarily tied to its factual accuracy. So a tweet by the US president, posted while he is on the golf course, may have more societal influence than a scientific study. Therefore, how and why a specific vision of the future prevails, depends on who is involved in creating it, or in what context and with what reach it is disseminated, among other things.

Our research looks at all these aspects: our aim is to uncover the mechanisms that create and popularise visions of the future, and in so doing, shed light on the relationship between future narratives and present-day action. At a time when the institution of science and the authority of its prognoses are being questioned more than ever before, this perspective is of particular significance.

1,000 days that are crucial

Complications during pregnancy or birth can cause lasting damage to a child's brain function. In the quest to identify risk factors and new treatments, basic research at the university and everyday clinical practice in the neonatal intensive care unit at the Oldenburg University Clinic for Paediatric and Adolescent Medicine are growing ever closer.

By Sonja Niemann

In addition to his research on early brain development, as director of the University Clinic for Pediatrics and Adolescent Medicine Axel Heep (left) works with premature babies on a daily basis.

For parents, a premature birth is always a harrowing and traumatic experience. "First they worry about whether their child will survive, then they start wondering whether the complications during birth might have caused permanent damage, especially to the brain," says Prof. Dr Axel Heep, a specialist in paediatric and adolescent medicine and director of the University Clinic for Paediatrics and Adolescent Medicine.

For the doctors working in the neonatal intensive care unit, answering this question is virtually impossible at such an early stage – which is precisely what motivates Heep. Brain development in early childhood is at the centre of his research. "The fundamental processes take place in the first 1,000 days, so during pregnancy and the first two years of life," he explains.

How the brain develops

Nerve cells converge to create the brain, form networks, react to external stimuli and constantly build new connections. Heep wants to understand the influencing factors and effects of this process in as much detail as possible. "I design research projects based on clinical practice – but in their implementation I find it important to incorporate expertise from other research areas," says Heep. As a result, a network is forming around him that is bringing everyday clinical practice in the neonatology unit ever closer to the basic research at the university.

Research at the University of Oldenburg begins by looking at how the brain develops. The group led by anatomist and neurobiologist Prof. Dr Anja Bräuer is studying the molecular basis of brain development, which begins around the third week of pregnancy when the neural tube – the embryonic precursor to the central nervous system consisting of the spinal cord and brain – develops. Millions of nerve cells form here and then migrate to very specific, designated locations where they develop from stem cells into highly specialised nerve cells and create networks. Neurobiologist Dr Nicola Brandt, a member of Bräuer's team, is investigating how cell migration functions during the formation phase of the brain's outermost layer, the cortex. The cortex itself consists of six layers that develop from the inside out in a highly complex process. If errors occur at this stage because nerve cells end up in the wrong position, brain damage can occur and can in some cases be severe.

The fat molecule lysophosphatidic acid (LPA) and the proteins that regulate LPA play an important role in cell migration. Using a special method which involves manipulating an LPA-regulating protein in the brains of mice embryos during pregnancy, Brandt and doctoral candidate Marie Koop were able to demonstrate the effects of imbalances in LPA concentrations.

Under the microscope, the researchers were then able to track how far the manipulated cells migrated at different points in time before and after the birth. Their experiments revealed that many of the nerve cells that had been manipulated only migrated to an inner or middle brain layer, whereas those in a control group migrated all the way to the outer brain layers, as would be expected. "In this way we were able to demonstrate that LPA regulation is crucial for the migration of nerve cells," explains Koop.

Cell development: the devil is in the detail

Learning, thinking, remembering – for all these cognitive functions to work, not only must nerve cells migrate to the right location in the brain but they must also network correctly once they are there. Bräuer's group is also researching this particular process. The team is investigating how nerve cells develop their typical shape. The focus is on the treetop-like dendrites and the "spines" (tiny protrusions) that cover their surface and are crucial for transmitting signals to and from other nerve cells.

"We are investigating what conditions are required for optimal development of the branched dendrites and their spines," says Bräuer. A protein called plasticity-related Gene 5, or PRG5 for short, plays a key role in nerve cell development. Franziska Köper, who is doing her doctorate under the supervision of both Bräuer and Heep, has now been able to decipher precisely how and where this happens.
She was able to demonstrate that

1+2 Nicola Brandt (left) and Anja Bräuer are researching the fundamentals of brain development. They use nerve cells from the brains of mice for their experiments.

3+4 Under the microscope, the scientists can observe how individual cells react to their manipulations.

PRG5 proteins form teams known as "multimers" along the dendrites. "The fact that the PRG5 proteins cluster at the sites where the spines also form is a clear indication that they play an important role in this process," Köper explains.

Understanding how proteins like PRG5 or signalling substances like LPA influence brain development at the molecular level could pave the way for new therapeutic approaches – also for premature babies, for example. "Finding the mechanism which allows us to steer brain development from the outside, so to speak, would be a dream come true," says Bräuer.

From brain function to behaviour

However, errors in brain development only become a problem if they lead to restrictions in people's everyday lives. Psychologist Prof. Dr Andrea Hildebrandt and her team are therefore investigating brain-behaviour associations and in recent years they have focused on premature babies and their distinctive cognitive characteristics.

"Attention deficit hyperactivity disorder (ADHD), which is more common in premature babies, is an example of how a neurodevelopmental disorder can manifest in everyday life," Hildebrandt explains. Hildebrandt, Heep and their joint doctoral student Merle Marek investigated a crucial human trait called "self-regulation", which is closely linked to ADHD and refers to the ability to focus the attention and block out distractions.

In her doctoral thesis, Marek investigated the connection between the brain functioning of premature babies and their self-regulation abilities. For this, she drew on data from the Bavarian Longitudinal Study, a longitudinal study that examined premature babies born in the 1980s and continues to monitor them as adults today in various follow-up studies. Based on the results of cognitive tests and clinical ratings conducted as part of this study, Marek was able to conclude that babies born more than eight weeks pre-term still have more difficulties with self-regulation in adulthood than those who were full-term babies. "They find it more difficult to tune out irrelevant stimuli than other people do," Marek explains.

She then analysed MRI brain scans of these individuals to identify potential links between the observed deficits and brain structure and was able to show that the connectivity of brain areas that are important for self-regulation was weaker than in those born full term. One possible explanation is that a fatty layer that speeds up the transfer of information forms around the nerve bundles in the womb, but birth inhibits this process, and in pre-term babies this inhibition occurs at an earlier stage. "Although the cognitive control of participants in the longitudinal study continued to improve with age, our study shows that the initial difficulties never disappear entirely," says Heep. The good news: "Self-regulation is a relatively malleable function which can be learned with appropriate training," says Marek.

The collaboration between Heep and Hildebrandt also extends to other areas: the psychologist is currently recruiting babies born pre-term at Heep's clinic for a study in which she plans to investigate how well they link audio and visual stimuli compared to full-term babies. The paediatrician and the psychologist are also working together to find indications of cognitive anomalies in the brain scans of pre-term babies – and hope to develop new personalised treatment options based on their findings in the long term.

Although Bräuer and Hildebrandt conduct basic research with their respective teams, they also work in close collaboration with Heep's Perinatal Neurobiology research group. Their common goal is that the research results will produce findings that can help to improve treatment options for premature babies.

Heep, his research partners and his team at the clinic reached an important milestone this year: having completed an intensive preparation phase, a study group led by neonatologist Prof. Dr Anne Hilgendorff is now gathering large amounts of research data on the topic of "high-risk births".

Bringing together interdisciplinary expertise

The team includes both scientists and clinicians and combines the interdisciplinary expertise of research groups from the fields of gynaecology, obstetrics, paediatrics and adolescent medicine, child and adolescent psychiatry and psychotherapy, radiology, immunology, genetics, psychological methodology and statistics. "Together, we want to find out why some children are incredibly strong after a difficult start in life while others need more support," says Hilgendorff.

In her previous position at the Helmholtz-Zentrum München, Hilgendorff set up a cohort of premature babies and is very familiar with the particularities of this vulnerable group as test subjects. On ethical grounds, it is not permitted to carry out examinations or take blood samples solely for research purposes. After all, it is imperative that newborn babies experience as little stress as possible in their first days of life. As a result, researchers must often rely on samples and data that are collected for other medical reasons. The study team obtains the first samples in the delivery room, after receiving the parents' consent.

"We have an in-depth approach: we try to obtain as much information as possible about the individual premature baby and also examine the placenta, which provides information about immunological processes during pregnancy, as well as the genetic characteristics of the parents," says Hilgendorff. Biosamples such as saliva, blood, faeces or urine enable the team to identify specific indications of disease processes. MRI and X-ray images from medical examinations are also included in the database, as are neurological, psychological and sociological data collected during examinations and interviews. Based on all this information, the researchers hope to pinpoint factors that increase the risk of abnormal development during pregnancy – and thus identify starting points for preventing high-risk births.

Another key development will soon improve the research opportunities: thanks to funding from the Federal Ministry of Research, the University Clinic will be able to commission a new MRI machine specially designed for premature babies. Developed by a company based in Magdeburg, the system is the first ever to use a 1.5 Tesla magnetic field to produce radiological images of babies and infants – and Oldenburg is one of the first locations where it will be used. Its technical specifications mean that it can be used directly in the paediatric clinic, which will accelerate the diagnostics process and facilitate data gathering on the risk cohort.

"All these developments make it possi-

UMO researchers are investigating how premature babies respond to audiovisual stimuli. The tests take place six months after the calculated date of birth. Light-emitting diodes and light detectors are built into the cap. This safe near-infrared spectroscopy procedure is used to measure brain activity.

In order to recruit families of at-risk newborns for the ongoing study, Anne Hilgendorff provides detailed information about the data and biological samples required by the research team.

ble for us to delve deep into the clinical research and link it with our findings from basic research," says Heep. This is now happening in several parallel initiatives. In the Intersectoral Care of Vulnerable Groups project, which is funded by the Federal Ministry of Research, Heep and his research partners are developing methods to better predict and prevent high-risk births and care for high-risk babies. Setting up the risk cohort is an important part of this project. The University Clinic for Paediatrics and Adolescent Medicine is taking part in the university's Programme for Excellence with an interdisciplinary Booster Unit, which is investigating the effect of music therapy programmes on primary school children who were born prematurely.

Last but not least, the School of Medicine and Health Sciences is supporting research into the early development of children as one of two profile initiatives. The three-year start-up funding for this initiative is intended to lay the foundation for one of the first university medical centres in Oldenburg. This status would further strengthen the link between neonatological research and teaching and patient care. The initiative sets out a clearly defined concept that describes how patients can benefit more immediately from research results and also guarantees members of the medical centre the freedom to conduct research and teach.

While Heep's role is to coordinate the various projects, he also acts as the main link between research and patient care. "No matter what approaches we pursue – they are always based on questions raised by our tiny patients," he emphasises. Heep will continue to seek answers in close collaboration with disciplines beyond his own speciality, with the common goal of giving children who have an imperfect start the best possible chance of leading a self-determined life.

300 premature births per year

Prof. Dr Eduard Malik's University Clinic for Obstetrics and Gynaecology and the University Clinic for Paediatrics and Adolescent Medicine together constitute the Perinatal Centre at Klinikum Oldenburg. Perinatal centres must meet special criteria for the care of pregnant women, premature babies, and newborns. As a Level 1 centre, the clinic's perinatal unit specialises in the care of premature babies born at or after the 24th week of pregnancy and critically ill newborns. It is also a contact point for expectant mothers from across Germany's north-west region who have pre-existing conditions or other risk factors. Around 2,000 babies are born at the clinic every year, approximately 300 of whom are pre-term, which means they are born more than three weeks before the due date, and 100 of whom are extremely premature, generally weighing less than 1,500 grams at birth.

Outlooks

How can we save coral reefs?

Prof. Dr Iliana Baums

Marine Conservation

Coral reef ecosystems are threatened by increasing sea temperatures. When the water gets too warm, the symbiotic relationship between the corals and their single-celled algal symbionts breaks down. This process is known as coral bleaching. As these events become increasingly frequent, more and more corals are dying. Even those that survive may be weakened. They don't have much energy left to defend themselves against infectious diseases or produce offspring. This is a serious issue because coral reefs are particularly species-rich habitats that protect coasts during storms.

So, what can we do? Clearly, the most critical thing is to limit global warming. We also need to help corals survive these rapid changes. As coral researchers, our approach is to preserve as much genetic diversity as possible, for example by building biobanks or by cryopreserving some of the eggs and sperm. We can make reproduction possible between coral colonies that are too far apart for it to occur naturally. This will help the corals to undergo natural adaptive processes, maintain diversity and continue reproducing.

One of the major obstacles we face in this are cumbersome permitting processes. We need urgent regulatory reforms to help us in our mission to preserve coral diversity.

What gives me hope is the incredible innovation and energy that so many people are contributing to tackling the crisis. Significant technological progress has been made over the last ten years, such as reproducing corals in captivity. However, given the vast size of the Caribbean and the Great Barrier Reef alone, it is a real challenge to restore reefs globally to their current state.

THREE TIMES EXCELLENCE

Three major research projects at the University of Oldenburg will receive funding as Clusters of Excellence over the next seven years. The NaviSense project is the only one in Lower Saxony to have gained Cluster status in the latest round of approvals, and aims to create a deep, interdisciplinary understanding of the senses, mechanisms and behaviours that animals use for navigation. The hearing researchers of the Hearing4all Cluster celebrated their third success in the Excellence Strategy competition. In the field of marine research, the University of Bremen and the University of Oldenburg scored a joint victory with the Ocean Floor Cluster of Excellence. We take a closer look at the projects.

Animal navigation: NaviSense

The mission of the NaviSense team is to gain a thorough understanding of how animals navigate over long distances. Its findings will be incorporated into nature conservation strategies and technological innovations such as quantum technologies and autonomous navigation systems. The team's research is divided into four research foci: in the first, the underlying mechanisms of magnetoreception and other senses that animals use to navigate are investigated. The magnetic and celestial compass as well as the processing of sensory information in the brain are also studied in detail. As the magnetic sense of birds seems to be based on a quantum effect, the second research focus is on quantum physical phenomena – in particular phenomena which occur at ambient temperature, like magnetoreception. Most of today's quantum technologies can only be implemented at extremely low temperatures. Therefore, it would be a major step forward if we can understand how quantum physical processes can be controlled at higher temperatures. In the third research focus, the team aims to use the findings from navigation biology research in nature conservation. Migratory animal species are particularly affected by climate change and habitat loss, however, efforts to rewild endangered species in new and suitable locations often fail. The goal is to develop better, science-based conservation strategies. In the fourth research focus, the NaviSense scientists will develop and test models and algorithms for virtual and real-world robotic systems that are inspired by animal navigation, for instance sensors or autonomous navigation systems.

Applicant university: University of Oldenburg
Spokesperson: Prof. Dr Henrik Mouritsen

Hearing research: Hearing4all

The Cluster aims to improve the prediction, diagnosis, and treatment of hearing loss. Hearing4all (H4a) has already achieved significant results over the course of two previous funding periods since 2012. Now, under the new guiding theme Hearing4all.connects, the research alliance encompassing the University of Oldenburg, Hannover Medical School, and Leibniz University Hannover will expand to include additional disciplines, enabling an even more comprehensive investigation of hearing loss. In the coming years, researchers will pursue new genetic approaches to predicting, diagnosing, and treating hearing loss. They will also explore how artificial intelligence can enable hearing aids and cochlear implants to distinguish more effectively between important and irrelevant sound sources.

Another key area of research involves the development of shared data standards. These standards will enable the training of AI-based systems that can predict an individual's probability of hearing loss. Researchers also aim to transform hearing aids into comprehensive hearing health systems, using sensor data collected at the ear to provide long-term health data and early indicators for declining health.

Hearing4all also seeks to better understand the real-life challenges people with hearing loss face. Researchers will investigate the role of multilingualism in hearing, conduct studies outside the lab in real-world environments, and explore the importance of hearing in social interactions. Close collaboration with non-university partners remains a central component of the cluster's work, supporting the rapid transfer of research findings into practical applications.

Applicant Universities: University of Oldenburg (Managing University), Hannover Medical School (MHH), Leibniz University Hannover
Spokespersons: Prof. Dr Christiane Thiel (University of Oldenburg), Prof. Dr Andrej Kral (Hannover Medical School), Prof. Dr Holger Blume (Leibniz University Hannover)

Marine research: Ocean Floor

Oldenburg researchers have been involved as a partner in the University of Bremen's Ocean Floor Cluster of Excellence ("The Ocean Floor – Earth's Uncharted Interface") since 2019. The Universities of Oldenburg and Bremen jointly submitted the current application for renewal of funding. In the Cluster, they will pool their expertise with the aim of further advancing our understanding of the role of the ocean floor in biogeochemical cycles and biodiversity under changing climatic conditions. With its research, the Cluster will contribute to a scientific basis for the protection and sustainable use of the oceans.

The ocean floor acts as a dynamic interface and fulfils wide-ranging functions for the entire Earth system. The researchers in the Cluster investigate the processes that control global matter fluxes towards, above and in the ocean floor. This involves deciphering the processes that regulate the transport of biogenic particles to the ocean floor and their transformation under changing environmental conditions, analysing the transfer of carbon and other elements between the ocean floor and seawater, and understanding how ecosystems on the ocean floor react to environmental changes. In view of the scientific and technological complexities, these objectives can only be achieved in the context of an interdisciplinary research network.

The Ocean Floor Cluster of Excellence has been based at the University of Bremen's MARUM – Center for Marine Environmental Sciences since 2019. While Bremen focuses on the geology and paleoecology of the ocean floor, including a strong focus on technology development for investigating these environments, the University of Oldenburg primarily contributes expertise in the areas of biodiversity research, biogeochemistry, modelling and microbiology.

Applicant universities: University of Bremen (Managing University), University of Oldenburg
Spokespersons: Prof. Dr Heiko Pälike (University of Bremen), Prof. Dr Helmut Hillebrand (University of Oldenburg), Prof. Dr Gesine Mollenhauer (Alfred Wegener Institute)

Making participation a reality

Germany wants to become an inclusive society, but progress has been rather slow when it comes to increasing the participation of people with disabilities. In this interview, Teresa Sansour, an expert in the field of special needs education, explains which groups need more attention and how her research can help to boost participation.

Interview: Henning Kulbarsch

Kevin Zinke is one of the individuals whom Teresa Sansour and her team followed in their daily lives for their study. The young man lives with his family in Oldenburg.

Terms such as "inclusion" and "participation" are on everyone's lips nowadays. Yet many people with disabilities still work in sheltered workshops or live in special accommodation. Does this add up?

Sansour: Facilities such as workshops for people with disabilities deserve our recognition. They're an important achievement, especially compared to the situation in other countries, because we support the people who work there rather than leaving them sitting alone at home. It's more a question of not resting on our laurels but restructuring this system to gear it more towards systematic inclusion. German society has embarked on this path, but progress is slow. There are many individual projects and institutions that are doing wonderful and innovative work and that show that this is possible. But inclusion has yet to become the norm.

What does the word "inclusion" mean to you?

Sansour: True inclusion means people with and without disabilities living together as a matter of course; people with disabilities being seen as relevant to the community and empowered to contribute rather than just receiving support. In the US, for example, there are more opportunities for people with intellectual disabilities to study at university. That underlines that this group of people are being given the opportunity to continue their academic education in adulthood. I would like to see the same for Germany.

Is inclusion made more difficult by the fact that the group of people with disabilities is so heterogeneous?

Sansour: Without doubt. My work focuses on people with intellectual disabilities, and in this area more than any other inclusion is rarely the norm today – particularly in the case of people with profound intellectual and multiple disabilities (PIMD). These people are seldom able to live their daily lives in a way that could be considered inclusive. As a society we still have a lot of work to do here.

What falls under the term "profound intellectual and multiple disabilities"?

Sansour: In special needs education, this term refers to a severe intellectual disability associated with other impairments such as motor, verbal or cognitive impairments. A severe intellectual disability rarely occurs in isolation. People with PIMD often have difficulties communicating verbally, or their ability to make intentional movements may be limited. They are therefore deemed unable to perform a "minimum level of economically utilisable work" within the meaning of the German Social Code, which is why they are generally not allowed to work in workshops. However, a person's environment also plays a significant role in making a disability "complex", as we say in German. Their environment may create additional barriers, for example because other people are not prepared to engage with them. In such cases, those affected often feel excluded and ignored. If, on the other hand, the people around these individuals have been properly sensitised and have learned, for example, to deal with people with limited verbal skills, communication will be easier for everyone involved. In other words, it is above all the opportunities to participate in activities that determine whether a person experiences themselves as disabled.

Why did the participation of this group receive so little attention for so long?

Sansour: It's a very small group, and our society tends to overlook small groups. Then there's the fact that people with this kind of disability were exempt from compulsory education until the 1970s, which meant that they were unable to build up an educational biography and were excluded from the labour market as they moved into adulthood. You might say that they fell through the cracks. The UN Convention on the Rights of Persons with Disabilities, which Germany ratified in 2009, was a step forward – but more in theory. It sets inclusion and also the right to work as goals, but in practice German governments initially focused on people with less severe disabilities because they're easier to integrate in schools and in the labour market. Only recently have people with PIMD finally started to receive more attention.

Discussions about inclusion generally revolve around schoolchildren. What role does inclusion play in the daily lives of adults?

Sansour: Adults with PIMD in particular are unlikely to experience much inclusivity in their everyday lives. Inclusive forms of housing, for example, are still quite rare. Relatives of people with disabilities frequently point out that although the journey to inclusion is possible, it demands a great deal of time, knowledge and money. The effort this entails must be reduced for everyone if we want to be an inclusive society.

What motivates your research, and what is your main focus?

Sansour: With the studies I conduct, I can make a concrete contribution to developing better solutions for an inclusive society. I find this hugely motivating. My research focuses on issues with high practical relevance – both in and outside of schools. One thing I have noticed is a general tendency to underestimate people with intellectual disabilities. For instance, one of my projects deals with literary learning. When it comes to improving reading skills of people with intellectual disabilities, the focus tends to be on pragmatic text types such as shopping lists or cooking recipes, usually written in plain language. However, we have observed that at least the listening comprehension of many people with intellectual disabilities is sufficiently well developed for them to benefit considerably from engaging with literary texts that have not been simplified, and discussing them with others. This demonstrates once again that we must avoid general-

isations and instead treat each person as an individual. Another focus of my current research is facilities that have already adopted a highly participation-oriented approach and which can serve as a model for others.

You're referring to the study "Lighthouses of participation for people with PIMD", which received funding from the Federal Ministry of Labour and Social Affairs. What was your approach here?

Sansour: First of all, we had to identify these facilities. In collaboration with Dr Caren Keeley from the University of Cologne, we developed an innovative questionnaire on participation informed by the latest research and distributed it nationwide. Based on the responses we got, we selected four facilities for a larger field study. During visits to these facilities, we then conducted numerous interviews with staff and made our own observations.

Were there any methods that produced particularly interesting results?

Sansour: Yes, the shadowing method really stood out. We "shadowed" people with PIMD, following them around in their daily lives in order to experience their perspective as closely as possible. We also encouraged them to use the photovoice method with their support staff, which involves taking and discussing photos, to help them bring about change for themselves or their group. The photos they took were images of successful moments of participation, to which we added audio commentary. At the end of the field studies we showed participants the photos and video and audio recordings in combination with other materials, and – as far as possible – discussed everything with them. This was a very enjoyable experience for both the participants and us researchers.

Which "lighthouses" were you able to identify?

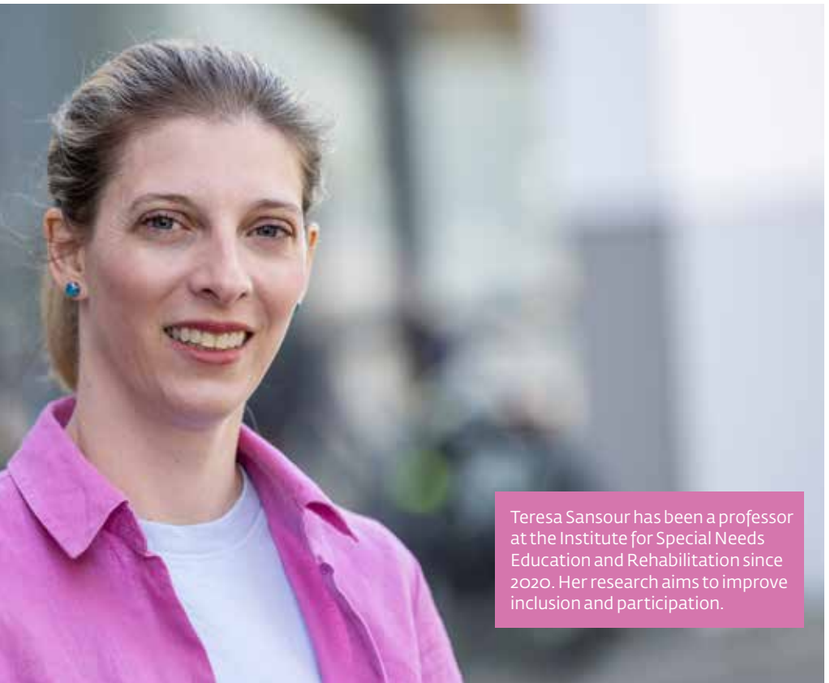
Sansour: I prefer to talk about "lighthouse moments", because we're less interested in specific facilities than in individual moments in which people experience participation. We witnessed such a moment in a facility in Berlin, where people with PIMD and their support staff rescue food products that are past their expiry date from supermarkets, reprocess them and then pass them on to a charity for the homeless. For us, this has lighthouse qualities because it allows people with disabilities to experience genuine self-efficacy: to do something for others, to contribute rather than being trapped in the traditional role of receiving help.

What is the role of specialist support staff here?

Sansour: Their attitude is crucial. They need to facilitate participation at an early stage, for example in the joint preparation of meals, and engage with disabled people's skills, wishes and requirements. At the same time, there should be plenty of flexibility in the implementation of such projects so that staff can react spontaneously to an individual's signals. Participation is an interactive process in which a purely paternalistic attitude is inappropriate. Of course, their help is needed, but they must avoid being overbearing and making all the decisions for those they are assisting, and instead focus on empathy and attentiveness. Ideally, support persons will also create opportunities for peer contact, so that people with PIMD can meet each other as well as people without disabilities within their own social environment on a regular basis.

What is happening with the results of the lighthouse study?

Sansour: For one thing, they are being incorporated into a guide on an online platform for professionals in this field, such as facility managers and staff. The guide explains "lighthouse moments" and offers advice on how to introduce practices that encourage participation, including on a small scale in individual households or residential groups. We want to provide inspiration for ways to enable people with PIMD to live as independently as possible, to pursue their favourite activities and to interact with others.



Teresa Sansour has been a professor at the Institute for Special Needs Education and Rehabilitation since 2020. Her research aims to improve inclusion and participation.

UGO awards for dementia research, art education, smart medicine and doctoral supervision

Every year, the Universitätsgesellschaft Oldenburg e.V. (UGO) presents several awards for outstanding academic achievements. This year the two Awards for Excellent Research, each endowed with 5,000 euros in prize money, went to psychologist Mandy Roheger and art educator Michaela Kaiser. The Outstanding Doctoral Thesis Award, which includes a cash prize of 2,000 euros, went to Antonia Wallbraun from the Didactics of Chemistry group. Biologist Maren Striebel received the Award for Outstanding Doctoral supervision (2,000 euros).

Research initiatives in art education

Prof. Dr Michaela Kaiser has been Professor of Art Education and Art Mediation at the Institute of Art and Visual Culture since 2022. She conducts research at the interface of art and education, with a special focus on exclusion and inclusion in relation to basic (art) education concepts such as institutions, profession, performance and post-digitality. The UGO prize is a recognition of her research initiatives: six years after completing her doctorate she designed two collaborative research projects for which she secured large sums of third-party funding. Kaiser studied art education and therapy in the Netherlands and applied social sciences in Bielefeld before earning her doctorate in Münster in 2019. She moved to the University of Potsdam in 2021 and joined Oldenburg in 2022.

Early diagnosis

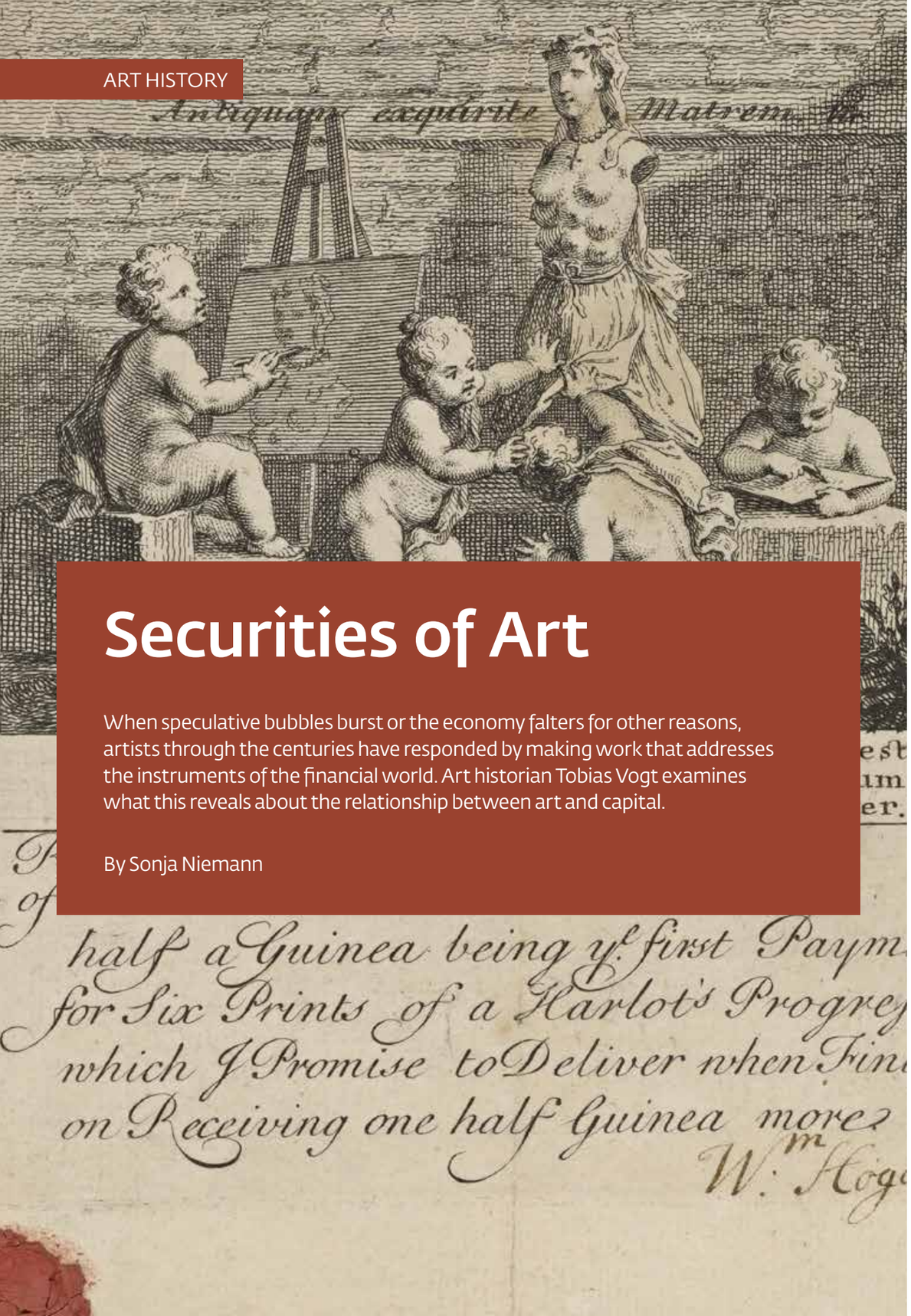
Prof. Dr Mandy Roheger is Professor of Outpatient Assessment in Psychology at the Department of Psychology. Her main areas of research are cognitive abilities and the prevention of dementia in older adults. She develops diagnostics for early-stage dementia with the aim of preserving cognitive faculties for as long as possible. The UGO award honours her innovative research approach and her significant contribution to solving one of the major social problems of our time. Roheger studied psychology with a focus on neuropsychology in Düsseldorf and Cologne. She completed her doctorate at the University of Cologne in 2019 and then conducted research in the neurology department at University Hospital Greifswald. She joined the University of Oldenburg in 2022.

Nanomedicine in the classroom

In her doctoral thesis, Dr Antonia Wallbraun looks at how complex research can be taught in school-level chemistry lessons. Modern nanomedicine involves the use of active substances which target specific infected organs rather than the whole body, an approach that reduces the risk of undesirable side effects. Wallbraun developed learning modules and experiments on this topic for secondary school students. The Outstanding Doctoral Thesis Award honours her interdisciplinary work, for which she has already received several awards, including the Julius Adolph Stöckhardt Prize. Wallbraun studied to become a secondary school teacher in chemistry and biology at Friedrich Schiller University Jena before moving to the University of Oldenburg, where she earned her doctorate in the Didactics of Chemistry research group.

Commitment to early-career scientists

Dr Maren Striebel has been conducting research at the Institute of Chemistry and Biology of the Marine Environment (ICBM) since 2012. Her special focus is plankton. She was given the Award for Outstanding Doctoral Supervision in recognition of her commitment to promoting early-career scientists. Her students praise her reliability, flexibility and creativity in all phases of their doctoral project: from finding research topics and conducting experiments to giving quick, constructive feedback on manuscripts and career planning. Striebel studied biology at the Universities of Ulm and Munich, where she also completed her doctorate. She did post-doctoral research at the Universities of Oslo and Vienna and won the UGO Award for Excellent Research in 2018.



Securities of Art

When speculative bubbles burst or the economy falters for other reasons, artists through the centuries have responded by making work that addresses the instruments of the financial world. Art historian Tobias Vogt examines what this reveals about the relationship between art and capital.

By Sonja Niemann

The engraver William Hogarth was just 23 years old and in the process of making a name for himself as both a craftsman and an independent artist when the South Sea Bubble burst in England. Within just a few months, South Sea Company shares first soared in value to 950 pounds and then plummeted to just 100. A scheme that had promised to deliver lucrative profits from overseas trade, and in which the government was also involved, turned out to be fraudulent.

The worlds of art and finance converged as early as the 18th century in the form of subscription tickets

The crisis spurred the aspiring British artist to find innovative ways to sell his work – and today Hogarth, who later became known as the father of satire, provides an interesting case study for Tobias Vogt, a professor of the history and theory of visual culture. "Hogarth was one of the first artists of his time to issue subscription tickets that deftly combined art and financial transactions," Vogt says. An early example of this is a slip of paper roughly the size of a page of a paperback book, dating from 1730, which served as a receipt for a sum of money paid for six engravings from the series A Harlot's Progress. What makes it so interesting to Vogt, however, is that the top half of the ticket features one of Hogarth's satirical etchings, meaning that it can be regarded as a work of art in its own right.

Hogarth's famous moral series, A Harlot's Progress, depicting a young woman who dies young after falling into prostitution and ending up in prison, sold well on a subscription basis. The etching on the ticket, titled Boys Peeping at Nature, later itself gained recognition among art connoisseurs. They regarded the satyr shown peeking under the skirt of the goddess Artemis as a symbol of the satirist seeing through society's pretences. However, when the image is viewed together with the contract spelled out below it, a new perspective opens up. "Only when perceived as a whole does the ticket reveal its dual function: it is at once proof of purchase and an artistic commentary on the situation of the day," Vogt explains. He sees it as a pointed critique by Hogarth of a society in economic crisis, a society of which he was a part, and which prompted him to adopt the unorthodox subscription model of payment.

Vogt has been exploring this unusual perspective on authentication in art for the past five years. He doesn't confine himself to signatures at the bottom of works, but extends his research to contracts, certificates and other securities that artists have integrated into their works as instruments of authentication. "It has become apparent that these issues pique interest in times of economic turmoil," he says. Vogt's project Securities of Art: Authentication as an Artistic Concept in Times of Financial Crisis, 1720 to 2020 has been funded by the German Research Foundation since 2023.

Artists influence the art market by commenting on, co-opting or counteracting financial instruments – for example, with new financing models such as the one used by Hogarth. "At the same time, the works that make use of these financial instruments inform the wider world about the mechanisms behind them. In this way, they open these cryptic economic processes to scrutiny and at the same time deliberately embroil them in contradictions," Vogt explains.

A particularly notable example of this is a work by conceptual artist Maria Eichhorn who, shortly after the dotcom bubble burst in 2002, founded an unusual public limited company at the documenta exhibition – named after herself. The company's aim was to preserve its own assets – to preserve them literally rather than to increase or invest them. The start-up capital – 50,000 euros in banknotes – was exhibited at documenta, as were the legal documents certifying the company's establishment. "Preserving value was intended literally. It was the purpose stated in the company's articles of association – and thereby contradicts everything that public limited companies stand for," Vogt explains. Stagnation was the founding principle, rather than growth and profit maximisation. But her public limited company contradicted basic capitalist principles in another way: unlike many works of art, the Maria Eichhorn Aktiengesellschaft cannot be fully owned – the original documents are held, as required by law, in the commercial register of the District Court of Berlin-Charlottenburg.

Dual role: art comments on capital, but art itself is often an object of speculation

"Such contradictions are typical of artistic intervention in the world of finance," Vogt explains. "Ultimately, the examples I cite are intended to highlight the incommensurability of artistic and economic production." Yet for all their supposed incomparability, spectacular art sales and auctions clearly demonstrate that there are parallels between the worlds of finance and art. Art itself can be an object of speculation – and an extremely lucrative one at that. "This lends the critique – offered by both Hogarth and Eichhorn – a tragicomic note," says Vogt.

Between land and sea

Geographer Thorsten Balke and his team are on a mission to protect intertidal zones and their dynamic ecosystems. The researchers have developed their own measuring devices to identify which areas are best suited as habitats for specific biotic communities. A visit to this unique landscape.

By Ute Kehse

Daniela Meißner (left) and Alejandra Vovides search for sensors in an oyster bed in the tidal flats near the coastal resort of Horumersiel.

If you trudge across the mudflats off Horumersiel on the west side of the Innenjade tidal channel at low tide on a calm day, the first thing you notice is the peace and quiet: no noise from traffic or building sites, not even the sound of waves or birdsong – just the occasional call of an oystercatcher. Everyday life on land seems very remote out here in the middle of this huge expanse of sand and mud .

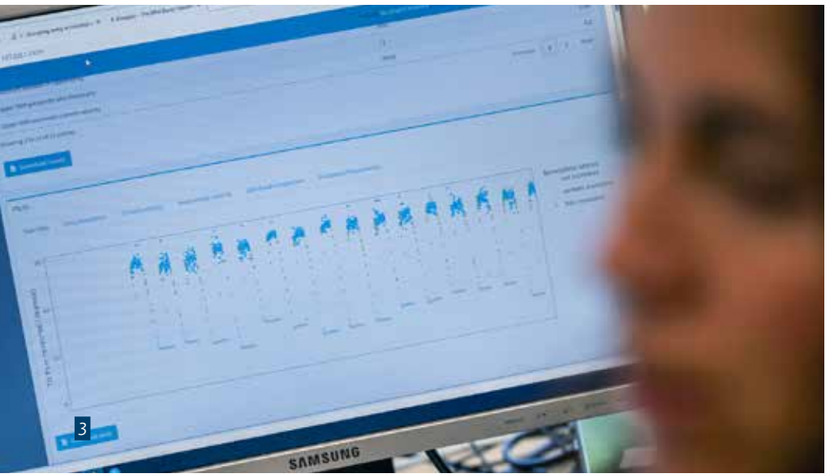
Further out, however, the scenery changes and an astonishingly diverse world emerges. Large, sharp-edged Pacific oyster shells protrude from the sludgy surface – just the odd one here and there at first, then in ever larger clusters that alternate with piles of mud and small pools of water for as far as the eye can see. The rough shells of the molluscs are covered with barnacles, tiny snails and even mussels. Fish larvae, transparent shrimp and small crabs dart across the puddles.

One wrong step here and you're ankle-deep in mud or scraping your shoes on sharp-edged oyster shells. "It's better to simply step directly onto the shells. Don't worry, the oysters won't mind," Dr Alejandra Vovides tells the two people accompanying her and technician Daniela Meißner on a field trip on this sunny day at the end of June. The ecologist moves effortlessly across the difficult terrain. "I've been working in intertidal zones for ten years now," she explains. From mangrove forests in tropical countries like Mexico or Indonesia to the salt marshes of the River Clyde in Scotland, she has studied tidal flats and their ecosystems all over the world.

Vovides is a member of the Vegetation Ecology and Conservation research team, which is led by Prof. Dr Thorsten Balke and focuses on coastal wetlands that emerge for several hours at low tide. Sand, rock or fine silt form the substrate of these unique transition zones between land and open sea. This is a world of extremes, characterised by changing tides, fluctuating temperatures and salinity levels, powerful currents and a plentiful supply of nutrient sources. Depending on the climate and tidal currents, a variety of ecosystems thrive in these intertidal zones: mussel beds, seagrass meadows and salt marshes in the Wadden Sea; coral reefs, seagrass meadows and mangrove forests in the tropics. One thing they all have in common is that they are endangered by a variety of factors, including pollution, fishing and climate change.

Balke's team aims to bolster efforts to conserve and restore these biotic communities by finding out which environmental conditions are most favourable for which ecosystems. This involves measuring variables such as how long a specific zone is flooded, how strong the current is at high and low tide, with what force the waves churn the water over the flats and how extreme conditions become during a storm. To gather all this data, in 2018 Balke began developing small, low-cost sensors similar to the accelerometers in smartphones for long-term monitoring on the tidal flats. In the meantime, the team has calibrated and tested three designs for different applications. "Because existing hydrological sensors are too expensive and too big for our purposes, we decided to take matters into our own hands and refine the technology ourselves," says Balke. In an article published in 2024 in the journal Limnology and Oceanography Methods, Balke, Vovides and other researchers presented an updated design for their "Mini Buoys", together with an open-source app that analyses the gathered data.

The sensors are now distributed across the tidal flats off the North Sea resort of Horumersiel – each well sealed in a black plastic tube around ten centimetres long. Today, Vovides and Meißner are on a mission to retrieve and replace four of the Mini Bouys out in the oyster beds and the shoreward mudflats. Their work is part of the German-Dutch SedWay project (Safeguarding the natural sediment processes in the Wadden Sea for biodiversity and people), which is led on the German side by Prof. Dr Bernd Siebenhüner, an environmental economist at the University of Oldenburg. The Lower Saxony Wadden Sea National Park Authority and the University of Groningen are also involved. "Our goal is to understand the hydrological landscape and create a fingerprint of the various habitats," Vovides explains as she makes her way across the oyster beds. The ecologist has positioned a total of 70 sensors at different locations



1 The sensors are enclosed in plastic tubes that are anchored to the ground and float to the surface at high tide. Barnacles have colonised the casing.

2 Where's the next sensor? Alejandra Vovides recorded the coordinates of all the sensors, but she still has a hard time locating the little tubes.

3 The raw data documents the changes that occur between high and low tide. This information can also be used to track tidal current velocities.

between the islands of Terschelling in the Netherlands and Sylt in Germany, each of which has to be replaced every few weeks.

"The first sensor should be here somewhere," she says after a 20-minute march across mud and shells. According to the GPS, she's in the right location now, but all she can see far and wide is oysters. Only after a long search does she finally discover the small tube. A closer look reveals why the sensor was so hard to find: the black plastic casing is covered with tiny, grey barnacles that make it barely distinguishable from the surrounding oyster shells – an unexpected problem which Vovides hadn't yet encountered on her deployments in the salt marshes. "Now we'll have to do tests in the lab to determine whether this growth affects the buoyancy," she says.

Seagrass meadows are biodiversity hotspots

The Mini Buoys are attached by two keychain rings to a metal stake which is firmly lodged in the mud. At high tide, the sensors float upright in the water; at low tide, they lie more or less horizontal on the ground. In their study, the researchers were able to demonstrate that the devices record the desired data on the duration of tidal inundation and tidal current velocity with a high degree of accuracy. Now, thanks to a design update, they can also measure the force of the waves as they roll over the tidal flats.

The data will be fed into a Decision Support System (DSS) – a key result of the SedWay project, designed to help identify potential threats to the Wadden Sea ecosystems and plan measures for restoring lost biotic communities. One main focus here is seagrass meadows – an ecosystem of grass-like aquatic plants that thrive in water up to ten metres deep. Today, little remains of these biodiversity hotspots, which were apparently once widespread in the Wadden Sea. Seagrass meadows filter the water, bind large amounts of carbon dioxide and contribute to coastal protection. "Before the 1930s, the East Frisian Wadden Sea was probably home to extensive seagrass meadows," Balke says. Since the 1970s, however, the remaining populations have experienced a sharp decline, mainly due to the large amounts of fertiliser carried by rivers into the North Sea. "Only near Sylt are there still a few larger patches," he adds.

Despite the fact that nutrient levels have dropped again in certain areas, attempts to reintroduce seagrass have had mixed results, possibly because they were carried out at the wrong time or at sites where this plant cannot thrive. "Our aim is therefore to gain a better understanding of what the dynamics in the system should be: what current velocities allow seedlings to colonise, how long can a certain area remain dry?" says Balke, who faces similar questions in his research on mangrove forests – the highly diverse ecosystems consisting of salt-tolerant trees and shrubs that are typical of tropical intertidal zones. "I find it fascinating that the processes in these two systems are actually very similar," says the researcher, who has studied mangroves in Indonesia, Vietnam, Thailand and New Zealand, while always taking account of social factors that determine the success or failure of nature conservation measures. His doctoral thesis already focused on the hydrodynamic conditions needed for mangrove seedlings to grow on mudflats. Mangrove seedlings face the same challenges as plants such as marsh samphire in the salt marshes of the Wadden Sea – they need to take root within a relatively short time window in which the water level is low, and develop sufficient anchorage strength to avoid having their roots exposed or dislodged by the next storm.

The researchers refer to the period in which a germinating seed can take root undisturbed by tides as a "window of opportunity". How long it lasts can vary considerably at any particular location, because the tidal range is affected by the phases of the moon and the changing seasons. "With pioneer species in particular, it's important to know how long they need to become established," Balke emphasises. In a recently published study, Balke together with Vovides and other researchers determined that two species of a globally widespread genus of mangrove trees have the best chances of thriving when the window of opportunity is at least three days long. In lab experiments, the seedlings developed branched roots up to twelve centimetres long within 21 days once the three-day period had elapsed. A high salinity in the substrate delayed growth, however. Field experiments in a natural environment in Sumatra confirmed these results.

Plans are underway to restore 600,000 hectares of mangroves in Indonesia in the coming years

The researchers believe their study could contribute to optimising the location and timing of mangrove regeneration projects in Indonesia,

The Mini Buoys were used for the first time in Sumatra (Indonesia) in 2019. The team led by Thorsten Balke (left) deployed 16 such devices in a former aquaculture basin that had been recolonised by mangroves.

where there are plans to restore a total of 600,000 hectares over the next few years. Natural seedling establishment would be considerably more cost-effective than the widespread – and frequently unsuccessful – practice of planting pre-grown seedlings. The team has identified the rainy season from November to February as the most propitious period for mangrove colonisation, as this is the time when water salinity levels are at their lowest and three-day windows of opportunity more frequent. "If the seeds are sown during this period, they have a better chance of thriving," Balke emphasises.

Whereas mangrove forests and seagrass meadows are endangered worldwide, oyster beds are now proliferating in the North Sea. These new arrivals to the mudflats have completely altered not just the ecosystem, but also the current patterns, because their textured nooks and crannies mean that they act as wave-breakers. The researchers plan to leave their Mini Buoys in the tidal flats off Horumersiel for a year in order to document several cycles of spring and neap tides, and perhaps even the odd storm. Meanwhile, Vovides and Meißner make their way to the next sensor, which is located a little closer to the shore, outside the oyster bed. "Let's see if it's still there," says Daniela Meißner. Mini Buoys can disappear, the two researchers explain: in areas that are more heavily frequented, curious holidaymakers sometimes make off with one of the devices. This time, however, the scientists are in luck, and after a few minutes they find what they're looking for – the small tube is lying half hidden in a puddle, buried under some algae.

Back in the lab a few days later, Alejandra Vovides takes a closer look at the contents of the recovered sensors. She prises open the first of the encrusted plastic tubes to reveal the data logger inside: an oval-shaped plastic tube containing a circuit board with sensors and memory chips attached. She then loosens a tiny screw and connects a cable to the computer – et voilà, the raw data appears on the screen: a pattern of dots representing the tilt angle of the sensor relative to the horizontal plane over the relevant time period. The dots form a curve that rises and falls between two extremes. Apparently, the sensor has consistently recorded the rhythm of the tides over a period of several weeks – the strenuous hike across the mudflats has paid off.

Julia Brennecke

Organization and Leadership

Prof. Dr Julia Brennecke has been appointed Professor of Organiztion and Leadership at the School of Computing Science, Business Administration, Economics, and Law. Previously, she was Professor of Innovation Management at both the University of Potsdam and at the University of Liverpool (United Kingdom). She will remain associated with the latter institution in the future.

Brennecke studied social sciences at the University of Göttingen, completing her doctorate in business administration there in 2012. She then worked as a research associate at the University of Freiburg, completing her habilitation in 2017. Several of her academic positions were abroad, including at Swinburne University of Technology in Melbourne (Australia) and at the University of Liverpool (United Kingdom). As a visiting researcher, she spent time at the Sciences Po in Paris (France) and the University of Toronto (Canada).

Brennecke's research focuses on networks within and between organisations, particularly in innovation-intensive companies. She studies collaboration and knowledge transfer in networks among leaders, among other things. One of her current research projects looks at entrepreneurial households in sub-Saharan Africa and the networks they form.

Martin Bleichner

Translational Psychology

Dr Martin Bleichner has been appointed to the Heisenberg Professorship of Translational Psychology at the Department of Psychology, where he has headed the Emmy Noether Group 'Neurophysiology of Everyday Life', funded by the German Research Foundation, since 2019. With his project 'The Everyday Brain: Towards Capturing Temporal Dynamics Beyond Lab', he successfully applied for admission to the DFG's renowned Heisenberg Programme. The programme will cover the costs for the first five years of the permanent professorship.

Bleichner studied Cognitive Science at the Universities of Osnabrück and Utrecht (Netherlands). He completed his doctorate at the University Medical Centre Utrecht and moved to Oldenburg in 2013. From 2016 to 2018, the neuroscientist was an Associate Junior Fellow at the Hanse-Wissenschaftskolleg.

A central focus of Bleichner's research is the development of portable electroencephalography (EEG) devices that can be used to measure brain waves in everyday life. He intends to use this data to analyse how people perceive the world around them, and the roles that concentration, mood and attention play in this process. One focus is on the soundscapes of everyday life and the question of how the brain processes background noise, speech or music, for example.

Chih-Hong Cheng

Safety and Explainability of Learning Systems

Prof Dr Chih-Hong Cheng has been appointed to the professorship for Safety and Explainability of Learning Systems at the Department of Computing Science. Previously, he held an associate professorship in Software Engineering and Interaction Design at Chalmers University of Technology in Gothenburg, Sweden, where he continues to be active as a visiting researcher.

Cheng studied at National Taiwan University, where he earned his master's degree in electrical engineering in 2008. In 2012, he received his doctorate in computer science from the Technical University of Munich. This was followed by positions in government and industrial research, including at the Research Institute of the Free State of Bavaria for software-intensive Systems (fortiss). At the same time, he took on interim professorships in Munich and Hildesheim before accepting the call to Gothenburg in 2024.

Cheng's research focuses on the development of safe, autonomous systems supported by machine learning. To this end, he designs processes, algorithms and tools to detect errors at an early state and ensure correct execution. In addition, Cheng has developed the open-source-tool ComOpT for testing autonomous driving systems. For this, he was awarded first place in the AI testing competition organised by the renowned Institute of Electrical and Electronics Engineers (IEEE).

Basil el Jundi

Navigation Biology

Prof. Dr Basil el Jundi has been appointed Professor of Navigation Biology at the Institute of Biology and Environmental Sciences. He was previously Associate Professor of Animal Physiology and head of the Animal Physiology section at the Norwegian University of Science and Technology in Trondheim.

El Jundi studied biology at the University of Marburg, where he completed his doctorate in animal physiology/neuroethology in 2011. He then worked as a research fellow at the University of Lund (Sweden). From 2017 to 2022, he led an Emmy Noether research group at the University of Würzburg before he was appointed as an associate professor in Trondheim in 2022.

His main research interests focus on the behavioral and neural mechanisms of spatial orientation and navigation in animals. The aim of his research is to reveal how the brain of animals integrates sensory cues and how it uses these cues to make robust navigational decisions. Insects such as the Monarch butterfly serve his research as model organisms, as they exhibit highly complex navigational behaviors despite being equipped with a brain the size of a grain of rice. His investigations range from behavioral studies in the field and in the laboratory to neuroanatomical techniques and electrophysiological approaches in actively navigating animals.

Mark Ellrichmann

Internal Medicine with Special Focus on Gastroenterology

Prof Dr Mark Ellrichmann has been appointed Professor of Internal Medicine with Special Focus on Gastroenterology at the Department of Human Medicine. He also takes over as Director of the University Clinic for Internal Medicine – Gastroenterology, Hepatology, Metabolic Medicine, Renal and Hypertensive Diseases at Klinikum Oldenburg.

Ellrichmann was previously Professor of Endoscopic Imaging at the University of Kiel and Deputy Director of the Department of Internal Medicine I at the University Hospital Schleswig-Holstein. He studied human medicine at the Universities of Bochum and Cape Town (South Africa). He received his doctorate in 2004 in Bochum, where he completed his specialist training and researched and practised until his move to Kiel in 2010. He held senior positions in the Schleswig-Holstein state capital, habilitated in 2016 and was appointed in 2021. He also completed a Master's degree in Hospital Management in Kiel in 2013.

Among other things, the gastroenterologist is researching how chronic inflammatory diseases of the gastrointestinal tract develop into cancer – and how it is possible to identify high-risk patients at an early stage. He is also investigating why neurodegenerative diseases such as Alzheimer's and Parkinson's are often associated with digestive problems. His research interests include innovations in endoscopy and artificial intelligence.

Peter Eppinger

International Economics

Dr Peter Eppinger has been appointed Professor of International Economics at the Department of Business Administration, Economics, and Law. Previously, he was a Postdoctoral Researcher at the University of Tübingen.

Peter Eppinger studied economics at the Universities of Tübingen and Munich and completed his doctorate at the University of Tübingen in 2018. For his dissertation, he was awarded the Roman Herzog Research Prize for the Social Market Economy by the Roman Herzog Institute. He undertook research visits to Harvard University and the Massachusetts Institute of Technology in Cambridge, the University of Michigan in Ann Arbor (all in the U.S.) and Tsinghua University in Beijing (China). He is a member of the CESifo Research Network of the ifo Institute for Economic Research in Munich.

Peter Eppinger's teaching and research activities lie in the field of international economics. His work focuses on foreign trade and investment issues, including the impact of international trade on workers, the organisation of multinational companies, and the impact of financial crises on world trade. In current research projects, he is investigating the resilience of global supply chains, the protection of intellectual property in emerging economies, and the economic effects of trade conflicts.

Sina Farzin

Sociological Theory

Prof. Dr Sina Farzin has been appointed Professor of Sociological Theory at the Institute of Social Sciences. She was previously Professor of General Sociology and Sociological Theory at the University of Federal Armed Forces in Munich.

Farzin studied European Culture and Economy and German Literature, Social Sciences and Art History at the Ruhr University Bochum. In 2009, she completed her doctorate at the University of Bremen, where she subsequently worked as a research fellow. In 2012, Farzin took up a junior professorship for sociological theory at the University of Hamburg, before being appointed professor in Munich in 2019.

Her main research interests focus on sociological theory, social theory, cultural and literary sociology and the sociology of knowledge. Farzin explores the question of how knowledge is created and made available in our complex and differentiated society. In the interdisciplinary network "Fiction meets Science", she researches the question of how novels, films or series represent science and how this knowledge is received. She is also interested in the role of aesthetic forms in science and how they shape knowledge production.

Christopher Gies

Statistical Physics

Dr Christopher Gies has been appointed Professor of Statistical Physics at the Institute of Physics. Gies studied physics at the Freie Universität Berlin and then moved to the University of Otago in New Zealand, where he completed his Master's degree in 2004. He received his doctorate at the University of Bremen in 2008 and then went on to earn his habilitation there.

As a research associate, Gies led his own independent research group at the University of Bremen's Institute for Theoretical Physics, and was appointed Acting Professor of Theoretical Solid State Physics in 2022. He also undertook several research visits to the University of Otago and to the Sandia National Laboratories in the US. His research focuses on quantum technologies such as the generation of quantum light and techniques for controlling the thermodynamic properties of quantum systems to generate multipartite entanglement. His research group is also working on quantum reservoir computing, a new branch of machine learning based on quantum architectures. Gies also conducts research into the material physics of atomically thin solids and semiconductor nanostructures. His work includes the development and derivation of analytical models as well as their numerical evaluation. He values close collaboration with partners in the field of experimental physics in the quest to jointly open up new perspectives for applications.

Johanna Heine

Inorganic Chemistry

Dr Johanna Heine has been appointed Professor of Inorganic Chemistry at the Institute of Chemistry. She previously researched and taught at the University of Marburg, where she also completed her chemistry degree, obtained her doctorate in 2011 and habilitated in 2021.

In Marburg, Heine led a junior research group and a sub-project in the Marburg Collaborative Research Centre 'Structure and Dynamics of Internal Interfaces' from 2013. From 2021 to 2022, she held an interim professorship at the University of Mainz. Since 2023, the German Research Foundation has been funding the chemist's research in the renowned Heisenberg Programme.

Heine is researching the synthesis and characterisation of semiconductor materials that can be used in solar cells or LEDs, for example. She is particularly interested in organic-inorganic hybrid materials that combine building blocks from organic and inorganic chemistry. This allows their characteristics to be combined in a unique way – not least with regard to sustainability.

Judith von der Heyde

Social Education with focus on Diversity Education

Prof. Dr Judith von der Heyde has been appointed Professor of Social Education with focus on Diversity Education at the Department of Educational Sciences. She previously held a professorship for Social Work and Diversity at the Fliedner University of Applied Sciences in Düsseldorf.

Von der Heyde studied educational science and philosophy at the University of Osnabrück, where she completed her doctorate in educational science in 2017. She then worked as a research assistant until 2023. During this time, she held deputy professorships in Osnabrück and at the University of Duisburg-Essen before she was appointed to Düsseldorf in 2023.

Her research focuses on diversity and aspects of inequality, particulary from a gender perspective. Specifically, she deals with the topic of sexuality as an educationally relevant variable: How, for example, can sexual education succeed in a diverse society? What role does materiality play in the form of human and non-human bodies, how do young people educate each other in this field and

how are the topics of sexuality and gender connected as categories of inequality? Von der Heyde's interests are bundled in concrete questions about professionalisation processes in social pedagogy with a focus on diversity education.

Torsten Jantsch

Protestant Theology with focus on New Testament

Prof. Dr Torsten Jantsch has been appointed Professor of Protestant Theology with focus on New Testament at the Institute for Protestant Theology and Religious Education. Previously, he conducted research on the cultural and religious significance of Jerusalem in ancient sources, which was funded by the Gerda Henkel Foundation.

Jantsch studied Protestant theology at the University of Leipzig and Humboldt University in Berlin, where he also completed his doctorate in 2009. He then worked as a research assistant at the Ludwig Maximilian University of Munich until 2017. Subsequently, he held various temporary academic positions, including a substitute lectureship at the University of Cologne. He served as substitute professor of New Testament for six semesters, including appointments at LMU Munich and Humboldt University of Berlin. His research explores how descriptions of God in the New Testament relate to ancient religious and philosophical contexts. He is also interested in cultural studies approaches to the New Testament, such as the formation of early Christian identities and the significance of cultural realms of memory such as Jerusalem. Jantsch also studies the ideological, religious, and philosophical backgrounds of New Testament authors, considering the Old Testament and the early Jewish traditions.

Dmitry Momotenko

Technical Chemistry of Smart Manufacturing

Dr Dmitry Momotenko has been appointed Professor of Technical Chemistry of Smart Manufacturing at the Institute of Chemistry. He studied chemistry at the Lomonosov University in Moscow (Russia) and graduated in 2009. In 2013, he completed his doctorate at the École Polytechnique Fédérale de Lausanne (Switzerland).

Momotenko then worked at the University of Warwick (United Kingdom) with a Marie Curie Fellowship from the European Union before he moved to the ETH Zurich (Switzerland) in 2017, where he obtained an Ambizione Grant. Since 2021, he has headed a junior research group at the University of Oldenburg for which he was awarded an ERC Starting Grant from the European Research Council. Momotenko's main research interests include additive manufacturing, nanomanipulation, scanning probe microscopy and chemical sensing. He is currently developing new electrochemical energy storage interfaces. For example, he is developing an innovative three-dimensional and electrochemical printing process to produce nanostructured electrodes for lithium-ion batteries. His aim is to develop a new concept for energy storage – for example for mobile electronic devices, electric vehicles or robotic systems – that will enable to drastically reduce charging times.

Anna-Verena Nosthoff

Ethics of Digitalisation

Dr Anna-Verena Nosthoff has been appointed Junior Professor of the Ethics of Digitalisation at the Institute of Philosophy. Nosthoff studied philosophy, sociology, economics and political theory at the Universities of Mannheim and Frankfurt am Main, as well as at the University of North Carolina at Chapel Hill (USA) and the University of London (UK). Nosthoff completed her studies with a Master's degree in Critical and Creative Analysis (Sociology) (2013) and a Master's degree in Political Theory (2016). She earned her PhD from the University of Freiburg in 2024.

From 2018 to 2021, she was a lecturer in Political Theory at the University of Vienna (Austria). This was followed by teaching assignments, for instance at the University of Basel (Switzerland) and the Free University of Berlin. In 2019, Nosthoff worked as Fellow at the Weizenbaum Institute in Berlin. She has undertaken research visits to the London School of Economics and Political Science (UK) and Princeton University (USA). From 2021 to 2022, she was co-director of the Data Politics Lab at the Humboldt University of Berlin. Since 2022, she has been co-director of the Critical Data Lab (Berlin/Oldenburg), which critically examines the power of digital data.

Nosthoff's main fields of research are the social influence of large technology companies, the platform economy and the digital transformation of the public sphere. In future, she will also be researching the ethics and politics of immersive technologies and new forms of technological authoritarianism.

Sonja Pyott

Cellular Communication in Neurosensory Systems

Prof. Dr Sonja Pyott has been appointed Professor of Cellular Communication in Neurosensory Systems at the Department of Neuroscience. Previously, the neuroscientist had been researching and teaching at the Rijksuniversiteit Groningen (Netherlands) since 2014, first as Assistant Professor and then as Associate Professor. She has also been teaching at King's College London (UK) since 2024.

After studying at Pennsylvania State University and Stanford University (both USA), Pyott came to Göttingen in 1999 as a Fulbright Scholar at the then Max-Planck-Institute for Biophysical Chemistry. This was followed by a doctorate at Stanford University and positions at the Johns Hopkins School of Medicine and the University of North Carolina at Wilmington (both USA) before she moved to the Department of Otorhinolaryngology at the University of Groningen in 2014. Pyott initially worked there as an assistant professor and has been an associate professor since 2021.

Her research focuses on the role of the inner ear in hearing and balance disorders. Using a variety of methods and models, Pyott investigates how sensory input from the inner ear shapes brain function. For example, she examines how the disruption of specific genes contributes to hearing loss. She also studies tinnitus and how ageing affects sensory processing.

Jan Rennies-Hochmuth

Hearing, Speech and Neurotechnology

Dr Jan Rennies-Hochmuth has been appointed professor of Hearing, Speech and Neurotechnology at the Department of Medical Physics and Acoustics as part of a joint process between the University of Oldenburg and the Fraunhofer Institute for Digital Media Technology (IDMT). The physicist and hearing researcher is also head of the Personalized Hearing Systems research group at the Oldenburg Branch for Hearing, Speech and Audio Technology (HSA) of Fraunhofer IDMT.

Interrupted by a research stay at Boston University (USA) in 2017/2018, Rennies-Hochmuth has headed the research group at Fraunhofer IDMT since 2012. He previously completed his Bachelor's and Master's degree in Engineering Physics at the University of Oldenburg, where he also gained his doctorate and habilitated in 2023. In his research, Rennies-Hochmuth investigates the relationships between sound waves, their perception by humans and technologies to improve speech and audio perception. Among other things, his work aims to help people with and without hearing impairments to hear better individually and to improve sound comfort in cars or when using audio devices. Rennies-Hochmuth received the Lothar Cremer Prize from the German Society for Acoustics for his work in 2016.

Mandy Roheger

Outpatient Assessment in Psychology

Prof. Dr Mandy Roheger has been appointed professor of Outpatient Assessment in Psychology at the Department of Psychology. She has been a junior professor in this field at the university since 2022.

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

Roheger is particularly interested in how the ageing process affects people's ability to learn, remember, think and perceive. She develops measures aimed at helping people to maintain or improve their cognitive abilities, especially those affected by dementia and Parkinson's disease. Together with Prof Dr Antje Wulff, she also heads the COVISION project, which is funded as part of Lower Saxony's COVID-19 research network. The aim of the project is to predict the course of neurocognitive symptoms after a COVID-19 infection.