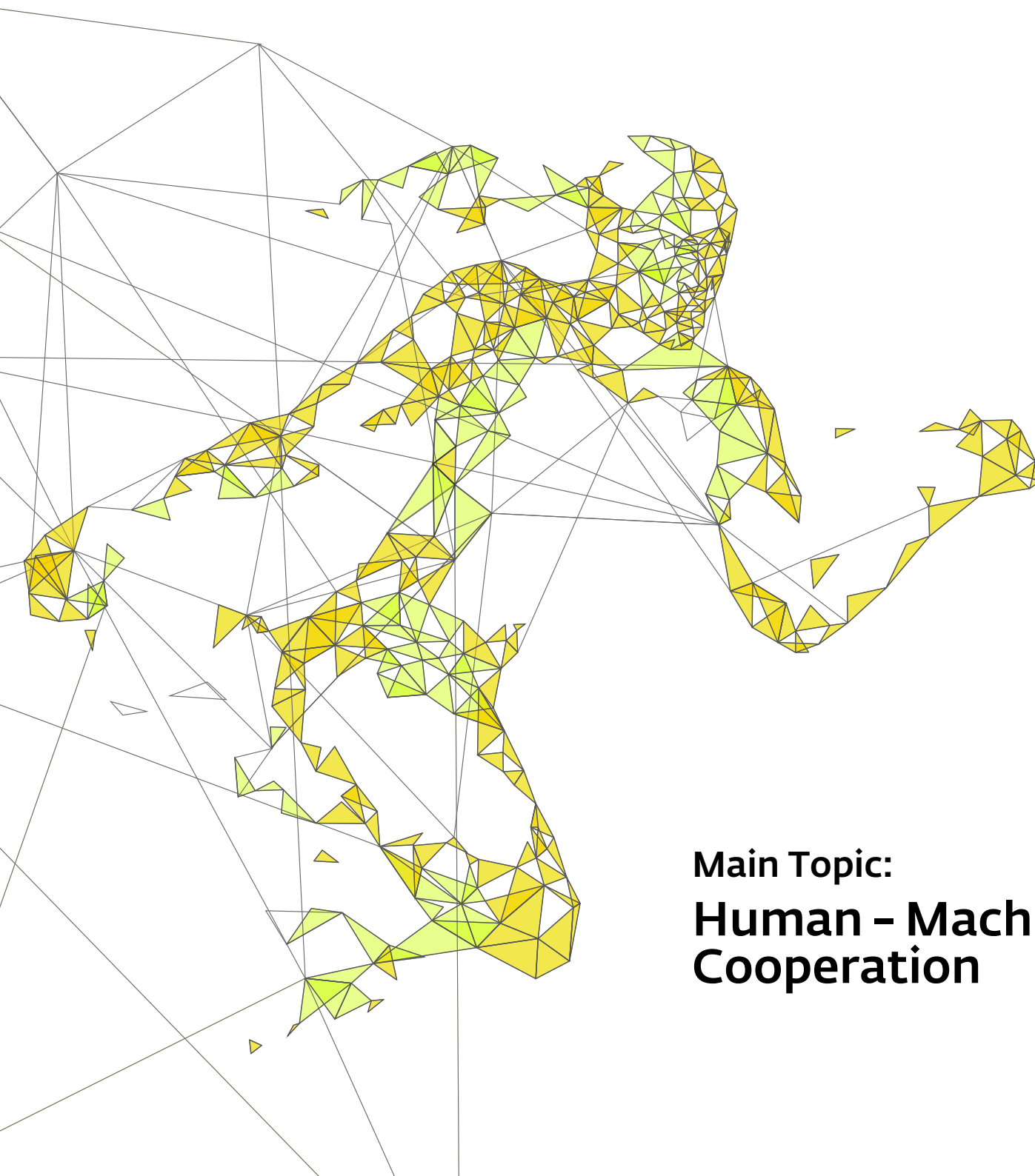


2017/18 ISSUE

RESEARCH MAGAZINE

# EINBLICKE 62



**Main Topic:**  
**Human - Machine  
Cooperation**

[Anzeige]

# Editorial

Dear Readers,

Watching a video, going through your emails or taking a nap while your self-driving car brings you safely to your next appointment – this futuristic vision is already becoming manifest. The first autonomous buses are now driving on German roads and the automation of society in general is advancing in leaps and bounds: from refrigerators that restock themselves to digital factories and networked diagnostics for saving more lives.

Oldenburg scientists are studying this trend intensely – from both technological and ethical perspectives, looking, for example, at the question of how to programme machines to make the right decisions. This new issue of Einblicke offers exciting insights: in an interview the two computer scientists Werner Damm and Martin Fränzle talk about current challenges and goals; philosopher Mark Siebel and neuropsychologist Jochem Rieger discuss basic

moral and ethical standards; legal expert Jürgen Taeger and political scientist Markus Tepe examine gaps in the current legal provisions; and computer scientist Susanne Boll and social scientist Gesa Lindemann explain how to optimise cooperation between human and machines.

Another major topic of our times is religion. We spoke to Joachim Willems to find out why the educationalist sees interreligious competence as a “key qualification in the 21st century”.

We also introduce you to economist Stephanie Birkner. She holds Germany’s first and only “Female Entrepreneurship” junior professorship and is researching how female entrepreneurship can strengthen the economy and society.

Our reportage takes a closer look at relationship between the surface of the

sea and the climate. Marine researcher Oliver Wurl and his working group are studying the exchange of gases between the atmosphere and the water.

The world of the outer surface of human beings – i.e. the skin, our largest sensory organ – is something Ulrike Raap knows plenty about. For the dermatologist the diversity of her field is “a dream come true”.

Last but not least, Oldenburg sports scientists are researching “feigned throws” in handball. In a series of photos we show how players’ movements are represented in a 3D model that reveals the patterns of a deceptive manoeuvre.

We wish you a most enjoyable read!

Yours,  
the EINBLICKE editors.



# List of Contents



Staying flexible: Professor of religious education Joachim Willems



On human-machine coexistence



Complex processes on the sea surface



Sport in the 3D lab: How variable are movements?

3	<b>Editorial</b>
7	<b>The Number</b> Clothes as time's witness: the "Everyday Textile Culture" collection
8	<b>Innovation Sets the Pace</b> In the world of work and start-ups female skills are in growing demand. Stephanie Birkner on "female entrepreneurship"
10	<b>Research Update</b>
14	<b>Letting Your Views be Challenged</b> Professor of religious education Joachim Willems on interreligious competence in daily life

## Main Topic

16	<b>When Machines Decide</b> As automation forges ahead, what opportunities and risks does it bring? And how far on is the research? An interview with Werner Damm and Martin Fränze
21	<b>Moral Dilemma</b> Mark Siebel and Jochem Rieger discuss ethical standards for autonomous systems
24	<b>For the Good of Humankind</b> Who shoulders the responsibility as computers encroach on our lives? Jürgen Taeger and Markus Tepe are looking for legal and political answers

27	<b>Understanding Each Other</b> Susanne Boll and Gesa Lindemann are exploring how to improve human-machine communication
30	<b>Living Labs</b> Oldenburg computer scientists are testing reality in six "living labs"
32	<b>A Fascinating Surface</b> The sea's surface has been ignored by climate research until now. Oliver Wurl is studying how important the "skin" of the oceans really is
36	<b>In Pictures</b> The "feigned throw" in sport

40	<b>Layer by Layer, Cell by Cell</b> For Ulrike Raap the skin is an architectural masterpiece
44	<b>UGO News, Imprint</b>
46	<b>New Appointments</b>
50	<b>Doctorates, Habilitations</b>

[Anzeige]



The Number

Ober- &  
Unterbekleidung  
Kombinationen  
Arbeitsbekleidung

2,596

The “Everyday Textile Culture” collection at the Institute of Material Culture comprises articles of clothing and textile objects.

**I**t also features around 4,800 documents, 400 fabric samples and 50 historical natural dyes.

The collection has steadily grown since it was first set up 38 years ago. Students and staff can use items from the collection as work materials and for study and research projects.

The collection has plenty of oddities and rare items to offer: from designer clothes by the experimental label Comme de Garçons to a Klepper raincoat from the 1920s that testifies to the development of the first rubber-coated waterproof clothing and a 1990s jersey from German football team Borussia Dortmund with high levels of harmful chemicals. It also features articles of normal, everyday clothing. The collection’s „Clothing and Stories” concept is unique in Germany. All the articles

of clothing have been worn and some show clear traces of usage. Whenever new items are donated to the collection, in addition to the objects themselves the institute also documents the stories and memories attached to them because they reveal many things about a certain era and its cultural and social context. What gender and body images prevailed at the time? How was clothing cared for and stored? What social function did clothing fulfil at the time?

In addition, the students and staff at the institute are conducting research into materials development and sustainability discourses, the history of costume and design, changes in gender and body perception and textile practices, from the ways in which clothes are cared for to the culture of remembrance and dressing habits.



Is there a feminine approach to founding start-ups? Stephanie Birkner hopes to find out.

# Innovation Sets the Pace

Stephanie Birkner holds Germany's only junior professorship for "Female Entrepreneurship". Her research looks at how female entrepreneurs can inspire business and society – beyond women's quotas and STEM funding

It's Pippi Longstocking. If you ask Professor Dr Stephanie Birkner, Junior Professor for Female Entrepreneurship about a role model for a female entrepreneur, she will tell you it's the cheeky little girl in Astrid Lindren's children's books. "She is the most entrepreneur-

rial girl I know," Birkner says. In her view Pippi stands for everything that defines entrepreneurial thinking and acting: openness, considering things out of the box and having the will to develop ideas of one's own when problems arise.

When the economist talks about herself it soon becomes clear that she herself has plenty of Pippi Longstocking's traits. The 36-year-old has two children, a husband who works in the Netherlands – and a junior professorship in a new research field. On the side

she also teaches at Regensburg University, coaches entrepreneurs and is involved in numerous projects and committees. Her packed daily schedule calls for highly developed improvisational skills. But Birkner takes it all in her stride. "I mean, what would be the point of being a junior professor for female entrepreneurship if I didn't have a creative approach to challenges?" Still, she emphasizes that there is plenty of room for improvement when it comes to supporting young women in science and the start-up world.

## Linking two established areas of research

Her journey into academia began with a degree in Business Consulting at Emden. After completing her doctorate at the University of Oldenburg she took up an acting professorship for Business Economics at the Jade University of Applied Sciences. In October 2014 Birkner became Germany's first Junior Professor for Female Entrepreneurship at Oldenburg University's Department of Business Administration, Economics and Law. "I like the agile environment of an Entrepreneurial University," she says, referring to the EXIST 2011 competition in which the University made it to the top three alongside the Technical University of Berlin and the Munich University of Applied Sciences. This is why Birkner works closely with University's start-up and innovation centre (GIZ). She also attaches particular importance to international exchange.

At the beginning of her junior professorship Birkner faced the challenge of having to combine two established research fields – entrepreneurship and gender studies. "I did a form of pioneering work, looking for paths between both worlds," she explains. Gradually a research design began to emerge that was deliberately application-oriented. "My research field is all about transfer and practical application. Multi-methodical, transdiscipli-

nary science is the only approach that makes sense to me."

Birkner explains that her junior professorship is designed around two central concepts: entrepreneurship and "female". But in her understanding entrepreneurship means more than just starting up a business in order to develop and pursue new business models. Entrepreneurs, she believes, are people who identify a problem and have the confidence to develop and implement solutions to it – whether this involves pursuing the economic objective of building up a company (entrepreneurship), making an established company more innovative (intrapreneurship), or aiming at changing society to the better. Her approach to the word "female" is similar: for Birkner it goes far beyond the biological sex. "In my definition 'female' applies to anybody with a female attitude to things. I am interested in whether there is such thing as a female entrepreneurial spirit, regardless of biological sex," the academic explains.

In order to find answers here, Birkner and her team prioritize explorative research designs. For example, in interview studies the research focus is on finding out more about the context that triggered the intention to launch a start-up, as well as the challenges taken on and experienced in this process. The first result: entrepreneurs who fit the "female" profile are more interested in finding meaning in what they do. "They measure success according to whether they can change something qualitatively, whereas characteristically male entrepreneurs measure success according to quantitative growth factors such as money. This applies particularly to patriarchy-dominated sectors such as the tech industry," Birkner explains.

In addition to the tech industry Birkner's research currently focuses on the health industry and digital transformation. "Here I let myself be guided by the question of where I can make the most changes through entrepreneurship education, in

other words in promoting intention and competence in entrepreneurial thinking and acting," Birkner says. The health sector is ideal for this because the majority of its workers are women, which means there are plenty of potential beneficiaries of entrepreneurial support, she explains. What's more, the health industry is becoming more and more economically relevant. "Experts predict that the key innovations of the twenty-first century will be in the field of psychosocial health," Birkner says. "The still male dominated start-up world needs to discover the more female-dominated health industry as a key innovation field. I would like to find out how to best foster these processes."

## Upgrading "typically female" skills

Innovations on the labour market inform her third field of research: digital transformation. "As I see it, it looks increasingly likely that as 'typically female' considered abilities such as communication and social skills are going to increase in value," Birkner says. As she points out, in nearly all branches digitalization is ushering in cultural change; it is strengthening the principle of globally linked labour network – the focus is increasingly on collaboration, and "egotistical movers and shakers" are no longer in lead. Female entrepreneurship, with its focus on qualitative success measures, can position itself perfectly here.

Three research fields with very different demands – Birkner's junior professorship is in itself an exercise in entrepreneurial thinking and action. She meets the challenges with female entrepreneurial spirit – just as Pippi Longstocking would: "I have never done this before so I am absolutely sure I can do it!" Accordingly, Birkner would like to see a culture that is more open to mistakes not only in the academic world, but also in the start-up world. (bb)

## Agriculture and horticulture south of the Sahara

How can small-scale ecological agriculture succeed in the increasingly urbanized regions south of the Sahara? In the new project ECOSOLA, scientists from the University of Oldenburg together with African partner universities and other partners from the field are studying the existing conditions and future options for urban agriculture in Tanzania and South Africa. ECOSOLA stands for Ecosystem-based Solutions for Resilient Urban Agriculture in Africa. The German Federal Ministry of Education and Research and the German Academic Exchange Service will provide around 800,000 euros in funding over the next three years for

the project, which is coordinated by Oldenburg economist Professor Dr. Bernd Siebenhüner. The rapid advance of urbanization in many areas of Sub-Saharan Africa poses serious problems for its societies. African cities like Nairobi (Kenya), Kinshasa (Democratic Republic of Congo) and Dar es Salaam (Tanzania) are growing at breakneck speed and displacing the rural-agricultural economic systems that surround them. At the same time, small-scale farms and horticultural businesses have established themselves in Africa's cities and are making an important contribution to feeding their populations. The farmers, however, are struggling with

problems such as insecure or unclear land-use rights, lacking political acceptance, soil, water and air pollution, inadequate water supplies and major damage caused by flooding. The scientists working on the ECOSOLA project plan to focus on a number of ecological business models and develop concrete solutions for urban farming in Africa. Siebenhüner's working group "Ecological Economy" and the "Landscape Ecology" working group led by Oldenburg ecologist Professor Dr. Michael Kleyer are collaborating closely with the University of Dar es Salaam and the Nelson Mandela Metropolitan University (Port Elizabeth, South Africa) in the project.



Urban farming: Bat guano is used as fertilizer for mushrooms growing at an organic farm on the outskirts of the Tanzanian metropolis Dar es Salaam. On the basis of ecosystem-based business models like this one, the ECOSOLA project aims to provide concrete solutions for urban agriculture in Africa.

## Longitude – no problem for migratory birds

Migratory birds are able to orientate with astounding accuracy, using the position of the sun, the stars and the Earth's magnetic field. Until now this is how scientists have explained birds' ability to determine their north-south position, but how they are able to determine their east-west position has remained one of the biggest mysteries in the field of migratory bird research for decades. Now Prof. Dr. Henrik Mouritsen of the University of Oldenburg and an international team

of scientists have shown through experiments with reed warblers (*Acrocephalus scirpaceus*) that the birds can detect magnetic declination. In other words, the birds identify the angle between magnetic north and true north. The researchers presented the results in the online edition of the prestigious science journal *Current Biology*. According to Mouritsen the results shed a whole new light on scientists' ideas about how birds navigate.

## Music builds bridges

Music activates the brain and produces happiness hormones, has therapeutic effects, lowers aggression and promotes mental and social development in the young. The latter aspect is the focus of the three-year joint project "Musical Interventions for the Sustained Integration and Cultural Participation of Children and Youths with Refugee Backgrounds" (MINUTE), which will receive a total of 250,000 euros in funding from the Federal Ministry of Education and Research until the end of 2019.

This joint project between the Goethe University Frankfurt and Oldenburg University examines for the first time the potential of musical interven-

tions such as singing or playing music for promoting cultural integration. The study also aims to provide guidance for the development of specific educational initiatives promoting the cultural integration of refugees. While the Frankfurt researchers are focussing on young men still living in refugee centres, the Oldenburg researchers led by musicologist Professor Dr. Gunter Kreutz are concentrating on primary school children from refugee families. These children are taught in the same class as local children and children who have settled permanently in Oldenburg. Two hundred third-grade children from four Oldenburg primary schools are taking part in the study.

## Success in the Hyperloop competition

The goal of the innovative "Hyperloop" transportation system is to transport passengers at speeds of up to 1,200 kilometres per hour. Students at Oldenburg University and the University of Applied Sciences Emden/Leer sent their prototype to compete in the Hyperloop Pod Competition II initiated by SpaceX founder and Tesla boss Elon Musk. Although they narrowly missed making it into the final

round at the SpaceX headquarters in Hawthorne, California, the competition's organiser SpaceX awarded the team its innovation prize, one of four prizes in total, for the sophisticated braking system it designed for its prototype electromagnetic levitating pod. During the competition, the Oldenburg and Emden students experienced technical difficulties on the test track.

## So that new knowledge benefits all

To intensify exchange with businesses, society, public authorities and cultural institutions and thus boost innovation in the region – this is the stated aim of the knowledge transfer project „Innovative Hochschule Jade-Oldenburg!“ run by Oldenburg University and the Jade University of Applied Sciences. This is Lower Saxony's only approved project in the „Innovative Hochschule“ funding initiative, and the researchers on the project have applied to receive approximately 11 million euros in funding from federal and regional governments until 2022. The project aims to systematically harness new target groups, partnerships, pathways and spaces for the transfer of knowledge.

The ambitious transfer project is divided into seven sub-projects: „SchülerWissen“ aims to inspire young people to tackle scientific research problems. „KarriereWege“ focuses on the transition from university to the professional world. The „Innovation(s) Werkstatt“ offers start-ups and established business professionals a space to develop innovative ideas, while the „Innovation(s)Management“ project is about systematically analysing and mobilising innovation potential in the region. The sub-project „Innovation(s)Labor digital“ aims to develop practical applications to meet the challenges of the digital age. Behind the „Innovation(s)Mobil“ are a bus and a ship, both equipped with innovative engine systems, which as a „Showroom“, mobile communications platform and experimental workshop aim to boost innovation in the region. A comprehensive „ScienceBlog“ will make the research activities, results and innovations from the project accessible to wider audiences and encourage feedback and discussion. Finally, there is a „Lab-on-the-Web“ in the pipeline where web-based data from scientific studies can be collected.

## Junior research group “RightSeeds”

Is the agricultural industry producing the right seeds for sustainable agriculture? Can commons-based ownership rights to plant species trigger an ecological and social revolution in crop production? These are the questions addressed by the junior research group “RightSeeds” headed by Professor Dr. Stefanie Sievers-Glotzbach at the Institute for Ecological Economics Research. The collaborative project with the Department of Agricultural Ecology at the University of Göttingen, the Institute for Ecological Economics Research Berlin and other partners from the field will be funded for five years by the German Federal Ministry for Education and Research (BMBF) as

part of its Social Ecological Research funding line. Crop cultivation has developed into a commercial system over the past 100 years, putting seed ownership in the hands of a handful of private corporations. For ecological agriculture in particular, the commons approach represents a viable alternative. The scientists are examining initiatives, networks and companies that offer predominantly sustainable seed types, forego private patents and keep the cultivation process transparent. They are also supporting a South-North exchange between a commons-oriented collective in the Philippines and German initiatives and businesses.

## Molecular fingerprint created

A single altered gene in the human genome can have a major impact. Macular dystrophy, a disease which affects the area of the retina where vision is sharpest, can be traced back to precisely this type of point mutation. Researchers led by biochemists Professor Dr. Karl-Wilhelm Koch and Farina Vocke and working together with human geneticists from Tübingen, Verona (Italy) and Philadelphia (USA) have now succeeded in identifying and studying a key gene in the genome of macular dystrophy patients. The gene contains the blueprint for a protein that controls important neurotransmitters in the cells of the retina. Here, the researchers found clues about how the defective protein disrupts cell functions. Based on these findings they hope to be able draw conclusions about other types of retinal disease. The results were published in the journal “Human Molecular Genetics.”

## Data from tidal flats

The measuring station of the Institute for Chemistry and Biology of the Marine Environment (ICBM) has been in operation almost continuously for the past 15 years. Equipped with several different types of sensors and situated in the straits between the islands of Spiekeroog and Langeoog, the station measures salinity levels, temperature and the speed of sea currents among other things. It operates around the clock and in all weathers. Researchers from a variety of disciplines are currently using the station for different research projects. These include the BEFmate project, in which researchers are studying the biodiversity and function of ecosystems, and the Citizen Science project “Macroplastics”. The station was built for the DFG research group “Biogeochemistry of the Tidal Flats” in 2002 and was the first of its kind.

## Research training group

Combinations of hydrocarbons – such as crude oil or natural gas – are the basis for countless products made by the chemical industry, from painkillers to plastic packaging. How can direct reactions that otherwise occur only circuitously be induced in carbon-hydrogen bonds? This question is the main focus of the new research training group “Chemical bond activation” at the University, which will receive around 3.5 million euros in funding from the German Research Foundation (DFG) for an initial period of four-and-a-half years. Answers to this question could potentially save the chemical industry material, energy and time, pave the way to new materials and drugs and help to combat disastrous oil spills more effectively. Twelve PhD candidates have been conducting research in this future-oriented field since March, and as many as twelve more doctoral students from the participating research groups at the Institute of Chemistry and the Institute for Chemistry and Biology of the Marine Environment (ICBM) will join them on the project. Under the aegis of at least eleven professors the young scientists will study the activation of these otherwise relatively inert carbon-hydrogen bonds from different perspectives – for example under the influence of specific catalysts or bacteria that break down crude oil. The aim is to develop and analyse new methods. Research training groups support young scientists at universities. The aim of the DFG is to qualify doctoral students, foster independent research and prepare them for the complexities of “science” as a professional career. “Activating chemical bonds” is one of a total of seven DFG research training groups currently underway at the University of Oldenburg.

## Hearing researchers continue along their successful path

The University has cleared the first hurdle in the Excellence Strategy programme, the follow-up to the Excellence Initiative of the German Federal Ministry of Education and Research and the German Research Foundation. Its draft proposal for a Cluster of Excellence titled “Hearing4all: Research for personalized treatment of hearing deficits” has been selected to proceed to the full proposal stage. The Oldenburg researchers developed their proposal together with hearing researchers from Hannover based on the results of the previous Cluster of Excellence. The full proposal must be submitted to the German Research Foundation by February 2018, and the final decision will be reached in September of next year. Building on the findings of the former Cluster of Excellence the researchers want to develop solutions specifically

tailored to the individual needs of patients across the spectrum of hearing deficits. To this end they plan to bundle their work into four research strands reflecting on the one hand the chain of development from basic research to hearing technology and on the other the severity of the hearing impairment. The first strand aims to use the latest neuroscientific methods to gain a deeper understanding of the complex interaction between hearing, perceiving and processing in the brain over the course of a person’s lifetime. The second comprises IT-based research aimed at constructing a virtual multilingual hearing clinic. In the third strand the researchers plan to develop individually tailored diagnostics and treatments for patients with medium to severe hearing impairment and full deafness. The objective of the fourth

strand is to develop an entirely innovative systems technology for the hearing aids of the future, based on the Cluster’s scientific and technological findings. A total of 25 neuroscientists, medics, psychologists, linguists, physicists and engineers from the universities of Oldenburg and Hannover are involved in the planned project. The Jade University of Applied Sciences, the Hör-Tech GmbH company, the Hearing Centres in Oldenburg and Hannover, the Fraunhofer Project Group Hearing, Speech and Audio Technology and the Fraunhofer ITEM institute are also project partners. The coordinator for the planned Cluster is Oldenburg physicist and physician Professor Dr. Dr. Birger Kollmeier. “Hearing4all” is one of the world’s leading centres for medical engineering, hearing research, audiology, medical diagnostics and therapy.



Virtual simulation of complex hearing environments: researchers use high-tech laboratories to develop customized hearing aids for the full spectrum of hearing impairments.



Be open-minded in a religiously plural world: "In addition to knowledge about religions we also need to acknowledge and understand each other," says Joachim Willems.

# Letting Your Views be Challenged

Religion has become a huge social topic once more since the start of the millennium. How can we coexist peacefully in a religiously diverse world? Religion educationalist Joachim Willems is looking for answers

He was young and in love – these thoughts were the last thing he wanted in his life at that point. Joachim Willems was studying Buddhism, hardly an unusual activity for a student of theology, but for Willems it became a defining experience. What if he decided to pursue this philosophy? Wouldn't that mean calling into question his whole worldview and way of life? And by logical extension withdrawing from that life in the quest for serenity; separating from his girlfriend,

entering a monastery and learning to meditate?

Instead of going to live in a Buddhist monastery, Prof. Dr. Dr. Joachim Willems, professor at the University's Institute of Lutheran Theology and Religious Education since spring 2016, kept to his chosen path. But he has never abandoned his intensive study of different religions, and the topic of "interreligious competence" has become the main focus of his research and teaching.

Interreligious competence: for the doctor of theology and education research this is a basic cultural skill that everyone needs in today's religiously pluralistic world. It goes beyond knowledge about different religions to encompass mutual awareness and, ideally, mutual understanding, he explains. It also means questioning whether religion really is behind all those things people suspect, he adds. After all, each individual has their own character and background: "Cultures are not homo-

genous, and nor are religions," stresses Willems, who has made extended visits to Russia throughout his career, where he also carried out the research for both of his dissertations.

## A key qualification in the 21st century

Whether the issue is the construction of a mosque in a Christian neighbourhood or the debate about school exams during Ramadan, "interreligious competence is about being able to analyse religious phenomena from different perspectives," says Willems. "This way I can adapt to situations involving interreligious encounters – without the way I react in such situations being predetermined."

This skill has become increasingly important since the start of the new millennium: "Religion disappeared from the radar for a long time, when the focus was on breaking with tradition and secularisation. But around 2001 – as a result of the 9/11 attacks among other factors – it became a big topic once more." Willems explains: "When you watch the news or read a newspaper today, religion is the big issue. But often the focus is not our religion but the religion practised by others. And you realize that this needs to be examined more in depth – be it in sociology, educational science or religious studies." On the back cover of his book on the theory of interreligious competence, he goes so far as to describe it as a "key qualification in the 21st century".

How do young people deal with religious plurality? This is a question Willems is examining in a project funded by the German Research Foundation called "Religious Diversity: Experiencing it, Interpreting it, Evaluating it" (abbreviated as REVIER). Through qualitative analysis of interviews with Christian, Muslim, and non-religious teenagers aged 14 to 19 he is trying to gain insights into their attitudes and worldviews. These views may not be representative, he explains, but simi-

larities allow him to draw conclusions beyond individual cases – which taken on their own as case studies also highlight successes and shortcomings in interreligious coexistence and can serve to increase awareness.

Willems cites the case of a 17-year-old Muslim boy who recalled an incident when his class was singing a Christmas carol during a music lesson. As the boy tells it in the interview, a fellow pupil said to him: "Jesus Christ is born" in a provocative manner, as if to say: "Jesus Christ is in Christianity, see!" The response must have come as a surprise. The Muslim boy said: "Well sure, I actually think it's great that we're singing about it! He was a prophet and did many good things. The Bible itself is one of God's books, so it's part of Islam."

This scenario inspired Willems to develop a concept for an RE lesson – including role playing on potential outcomes before the unexpected ending is revealed – and points to develop in further lessons on Christianity, Islam and interreligious encounters. The father of two put this concept into practice at a school complex in Berlin where he taught during and after his Habilitation.

The insights Willems gained from the 30 interviews he analysed are multifaceted. Talking of his Muslim interviewees, he observes: "Every one of them is aware of the stereotypes prevalent in the non-Islamic majority society and is able to constantly change perspective." For example a schoolgirl wearing a headscarf who told him about a conversation with a teacher. The interesting aspect here, he says, was that the "supposedly pre-modern" and undemocratic schoolgirl defended her right to wear a headscarf citing individual freedoms, while the teacher, who sees herself as a representative of the legal, social and cultural system based on those very freedoms, denied the girl these rights". While the schoolgirl was aware of the other point of view, Willems explains, the teacher was convinced that only her view counted

and represented how the world works. Willems has come across similar cases involving discussions about being allowed to pray during school breaks.

During the REVIER project Willems also observed "how quickly Islam tends to come up when people talk about religion". With Islam, he notes, religious practice becomes visible, and some people only become aware of religion in this context, so only then does it become a topic of discussion. He also sees this with his students, whose interest in interreligious learning is particularly strong when it comes to Islam. Willems has employed an Islam scholar on his team. "Her seminars are full," he says.

## Encouraging students to adopt their own positions

For 43-year-old Willems the subject of his professorship, religious education, goes beyond teaching religion to describe specific religious communication processes in different social contexts – not just in schools, but also for example within a church community. Nonetheless, he sees schools as a key location for teaching religious and interreligious competence, "because there is no other place where you can really reach everyone".

He finds subjective points of view particularly important, comparing a religious education lesson that doesn't encourage pupils to develop their own position to "music lessons without the experience of hearing, where the music is only considered abstractly on the basis of sheet music, lines and symbols". He appeals to teachers as well as pupils to allow themselves to be moved, and even challenged – for instance by the partly radical messages contained in biblical stories – to clarify their own position on existential questions. In the same way that he once allowed himself to be challenged by Buddhism. "Something happens with me as an individual when I try to understand the world, when I interact in the world – that's what education is all about." (ds)



# When Machines Decide

Cyber-physical systems will change the world in the same way that the Internet has changed it, the two computer scientists Werner Damm and Martin Fränze are convinced. Through this technology both everyday objects like refrigerators and complex systems like medical equipment and cars will be connected to intelligent control systems, communicate with one another and make their own decisions. The Oldenburg scientists are conducting research on the foundations of this technology and also working on an ethical concept for the machines to ensure that humanity is well served



Werner Damm (left) and Martin Fränze: "These systems have to be programmed to comply with ethical norms."

**Automation is advancing inexorably. Your work deals with the technological foundations of this process. Where is this journey going - and is mankind making itself redundant in the world of work?**

**Fränze:** That is a controversial issue in professional circles. Some experts are convinced that this is indeed the case and are therefore calling for a universal basic income. Others argue that historical evidence speaks against it. They point to previous industrial revolutions, which instead created radically new professional fields.

**Damm:** One way or another, big changes are imminent. In the field of transport, for example, where in the short or medium-term entire professions

such as taxi, bus and truck driver will disappear.

**Artificial intelligence seems to be only a matter of time. Where would you draw the line?**

**Fränze:** The most important thing is to have clear guidelines. It's fantastic if a computer can learn on its own in order to assist us more and more in difficult situations. But the system's behaviour has to remain predictable and oriented towards responsible actions based on social consensus. Otherwise we will have little use for the system.

**In what areas do you expect to see most progress?**

**Damm:** At the university we are research-

ing how to technically optimize medical care and aftercare. Take intensive care units, for example, where staff is confronted with a flood of information. In addition to the heartbeat there are countless other vital parameters that indicate critical situations, but which often go "under the radar". Indeed we know that 30 percent of deaths in post-operative phases could be avoided if personnel were in a position to create a meaningful overall picture from the vast amount of individual signals and the profound medical knowledge residing in large databases - with the help, say, of intuitive interfaces. This is a fantastic example of a meaningful way to collate information using cyber-physical systems.

**Fränze:** A further research focus is the design of energy supplies. The fluctuations in the demand and supply of electricity are constantly controlled and balanced out already. But this task is becoming increasingly complex due to the rise in the supply of energy from renewable sources. What we need is systems that allow energy producers, storage systems and consumers to communicate with one another intelligently. The merging of the physical and virtual worlds can create entirely new possibilities for influencing this incredibly complex system. Electric cars as intermediate buffers for surplus energy or washing machines that turn on when power becomes available are just the beginning.



## Prof. Dr. Werner Damm

A lecturer with Oldenburg University's Department of Computing Science since 1987, Werner Damm is head of the Safety Critical Embedded Systems division and Director of the Research Centre for Critical Systems Engineering. Damm established the Transportation Research and Development Division at the University-affiliated OFFIS Computer Science Institute and is also a member of its board. His work focuses on methods for the mathematically exact verification and analysis of safety critical embedded systems.

**Damm:** The third major area is autonomous driving with the aim of reducing the number of accidents, using resources more efficiently and minimizing emissions.

### That is your focus. What exactly are you researching?

**Damm:** To name just one example: in Germany we are involved in a project funded by the Federal Ministry of Economics and Technology called Pegasus. It's about developing test standards, in other words generally accepted methods and tools for testing highly-automated vehicle functions. The focus is on systems that can take control for certain periods of time in specific situations. The idea is that the driver shouldn't have to monitor the technology the whole time and is therefore free to temporarily focus on certain other activities and side tasks.

**Fränzle:** That's the first step. At some stage the driving will be left entirely to the vehicle.

### But surely not without the aforementioned test standards which the industry needs if it is to put such autonomous systems onto the streets?

**Fränzle:** The testing methods are indeed a colossal challenge and they are also one of our focus areas. We want to know how we can design software architectures and validation methods that meet the very high safety targets automation requires and prove that they have been met.

### What does that mean exactly?

**Damm:** Take our just completed trans-regional collaborative research project AVACS. Here we proved the safety of traffic applications in all three areas – cars, airplanes and trains – using mathematical methods. So, in other

words, we know how automated systems need to be built in order to remain controllable. Apart from that we are currently involved in ENABLES3 ...

### An EU-funded project ...

**Damm:** Exactly. Focussed on the testing of highly automated systems. In this project we set up virtual test rigs in order to determine how an autonomous vehicle behaves in all conceivable scenarios. How well, for example, does the assessment of the situation operate, or the object identification? This means that even without test kilometres on the road we can examine whether and when a vehicle's reactions are adequate.

### “Technology only makes sense if it serves people”

Werner Damm

### Automation will ultimately turn car driving into a mobility service. Are people ready for this yet?

**Fränzle:** It depends. Are we talking about a situational autonomous driving system that only takes care of motorway manoeuvres from after entering via the slip road to just before the exit? With such a system I maintain my own driving skills, I can tray and test the system and build trust. Or does the car drive in fully automated mode? Then I could put my children into the car and tell it to drive them to music school. Here, people's reservations will be significantly higher.

**Damm:** On the whole, acceptance levels depend heavily on the extent to which a person can learn to trust the vehicle's autonomous driving function by selectively remaining 'in the loop'. It's important to remember that

technology only makes sense if it serves people and is accepted by them.

### One way or another, the vehicle takes on a huge amount of responsibility. Will automation really make roads safer?

**Damm:** This is a controversial issue. Let's just look at one statistic: around 3,500 people die on German roads every year. Due to human error – we get distracted or nod off, for example. So of course automation is superior to humans in this respect. Sensor systems are always active, and situation assessment is carried out on a permanent basis. Already today we can see around corners using so-called virtual horizons. On this basis we can safely assume that the number of accidental road deaths will drop significantly.

### Mr. Damm, as a member of a working group for the ethics commission of the Ministry of Transport, you have been involved in drafting guidelines on automated driving. What was the objective here?

**Damm:** The challenge with highly automated driving is that everything that is otherwise decided by a human being is taken over by a vehicle, and this also goes for critical situations. The behaviour of the system has to be programmed accordingly. Two of the central questions that we discussed in the working group were therefore: How can we design decision-making so that it is clearly comprehensible and transparent for people? And how can we be sure that the decisions comply with society's values?

### What results did the commission arrive at?

**Damm:** First of all, that people's lives are in principle more worthy of pro-



Scientists at Oldenburg University can test assistance functions for self-driving cars in the University's driving simulator.

tection than things. Point two refers to the much-cited dilemma in which an automated car has to decide between two evils: does it drive into a group of two people or of five? In other words, can human lives be weighed against one another? The working group rejected this outright, in line with a decision by the Federal Constitutional Court on airplane hijacking and a discussion about whether or not to issue a warrant to shoot it down. In such cases the life of the passengers on board cannot be sacrificed to save the lives of a larger group of people on the ground.

### These are highly complex questions that certainly cannot be answered by computer scientists alone.

**Fränzle:** We are indeed in the midst of a paradigm shift. Before, as engineers we were used to building and analysing systems models that represented

perfect blueprints of our software and hardware products. But when it comes to semi-autonomous driving, our models can no longer be perfect because the systems have to take into account human beings and their characteristics. Representing these is a necessary prerequisite to analysis of the dynamic interactions between people and machines.

### “Making machines comply with the rules that govern human actions”

Martin Fränzle

### So you also need input from others fields, and the social sciences in particular?

**Fränzle:** That's right, yes. Lessons learned from psychology, philosophy, sociology, and political and legal science.

These systems have to be programmed to comply with ethical norms, for example.

### So that might be a question for philosophy ...

**Fränzle:** Exactly, because it's about making machines comply with the rules that govern human actions. In connection with the question about the conditions under which certain actions are required or forbidden.

**Damm:** Psychology, on the other hand, provides us with important approaches for explaining human behaviour, such as how can the technical system find out what a person intends to do? How can its attention be directed to a certain problem? And how can a system explain its decisions to people?

### What about the liability of autonomous systems?



### Prof. Dr. Martin Fränze

Martin Fränze has been a lecturer at Oldenburg University's Department of Computing Science since 2004 and is the head of the Hybrid Systems Division there. The computer scientist is also a head of division and scientific director at the Transportation Research and Development Division of the University-affiliated OFFIS Computer Science Institute. His main areas of research include mathematical models and the design, synthesis and verification of safe embedded computer systems.

**Damm:** This is an important aspect – and the situation is complex. After all, safety-related driving decisions are not based solely on information that comes from the vehicle itself, and for which the manufacturer shares responsibility. Information is also transferred from other vehicles via wireless communication. But what happens when the car in front of you perceives the world differently and delivers false information? Or if communication lines are hacked? Another point is that the autonomous system needs up-to-the-second map updates – and these come from the Cloud. Who checks that these maps have not been tampered with?

**Fränze:** Another aspect is that globally implemented cyber-physical systems have to comply with all country-specific contexts. Regulations for the private sphere in Europe, for example, are very different from those in the United States. How can we design these systems so that their parameters adapt

to comply with the framework of each individual society?

#### Is the necessary legal framework already in place here? Is automated driving legal?

**Fränze:** Road traffic regulations have recently been updated to make it possible to authorize self-driving vehicles. But only on the condition that a legally traceable transfer of control between driver and technical system takes place and the human driver remains in the loop. The timing is good because this type of vehicle is already in the development phase.

**Damm:** The other good news is that the European parliament has passed an important resolution stipulating that whenever an autonomous system makes a decision that has safety implications, it has to explain why it took this or that action and also state the underlying principles. This guarantees the necessary transparency and prevents potential manipulations.

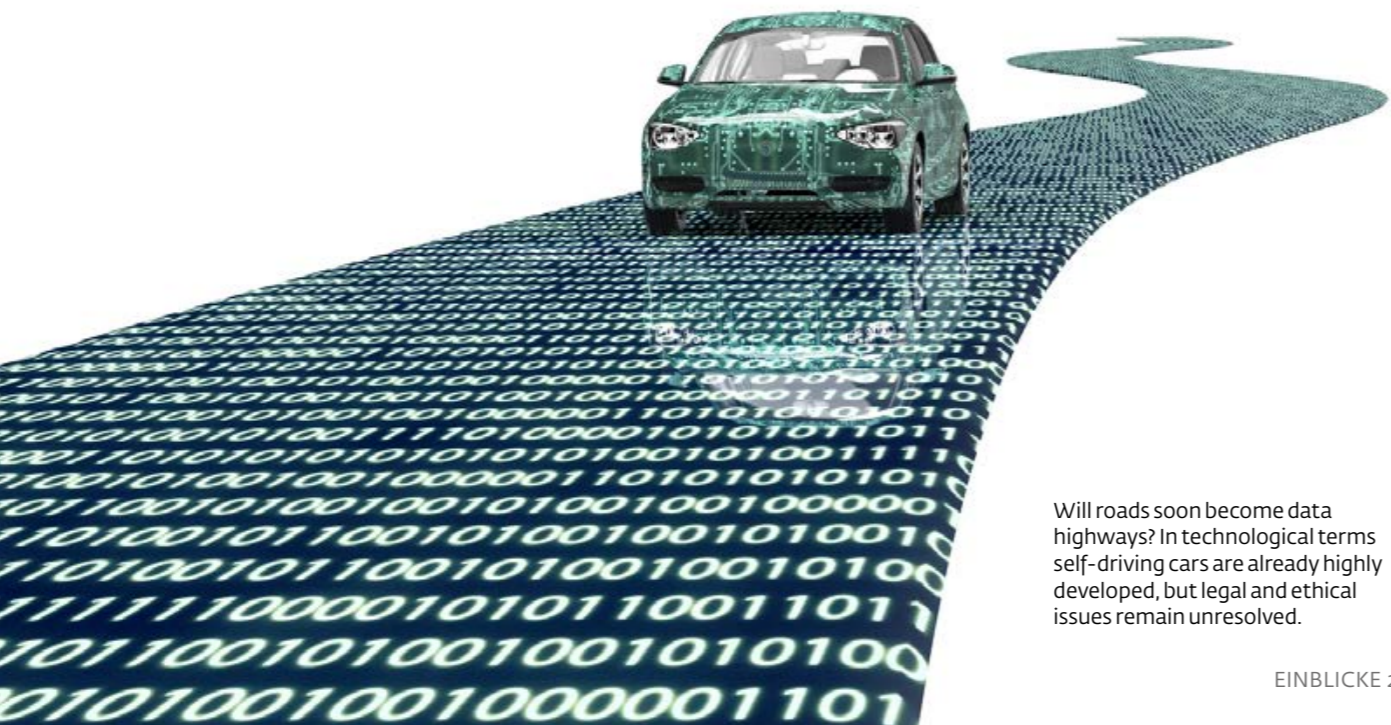
#### So the challenges are immense ...

**Damm:** Yes. That's why we're working together with lots of partners – not only in research, but also from industry. Fortunately in Germany the climate for this is very constructive. Ultimately we all ask ourselves similar questions, such as what it means to use humane technology. Or how to integrate not only artificial intelligence into computer architecture, but also a social conscience.

#### So when will the first automated cars start driving on German roads?

**Fränze:** For situationally autonomous vehicles, we should be ready in three to five years. But for safe, fully-automated driving everywhere we need a lot more time – and here even the most optimistic predictions from manufacturers vary in the extreme.

*Interview: Corinna Dahm-Brey, Volker Sandmann*



Will roads soon become data highways? In technological terms self-driving cars are already highly developed, but legal and ethical issues remain unresolved.



Autonomous systems such as self-driving cars take over important decisions for humans. But what if it's a matter of life or death? Is it at all possible to establish norms and programme systems to deal with such events?

# Moral Dilemma

Autonomous systems capable of independent decision making are about to take over our world. But on what basis? What underlying ethical rules are they following? Is it this human-machine interface that drives the research of philosopher Mark Siebel and neuropsychologist Jochem Rieger

We live in a world in which decision-making is being increasingly surrendered to technical systems. When you park your car nowadays, your assistant system guides you into the space. When you embark on a car journey, you allow yourself to be led by your navigation system, trusting that it will find the right route. In the operating room robots assist surgeons, achieving a degree of accuracy to a tenth of a millimetre. Technological development – ridiculed

for decades as science fiction – has long been firmly anchored in the present.

#### New questions impact society as a whole

For some the development of these cyber-physical systems represents a huge opportunity while others fear that automation will soon take over entire professional fields. Who needs

lorry drivers when the lorries can drive themselves? Or surgeons when robots can operate much more precisely?

Whether we like it or not, the advance of technology gives rise to questions that impact society as a whole. If machines are increasingly able to make decisions for us and are learning how to react to unforeseen events, does this not pose the threat of society losing control? Is it possible to ever truly understand why a machine has made

a decision? And to what extent do we want to surrender decision-making to technical systems? Researchers from different disciplines at the University of Oldenburg are looking for answers to these questions. "Because one thing is clear: if research and politics do not address the issue, industry will ultimately dictate the development," Prof. Dr. Jochem Rieger firmly believes. And if this happens, the cognitive neuropsychologist who researches human-machine cooperation doubts that society will be able to reconstruct and understand how and why technical systems take certain decisions. His research focus is the "perception, information processing-cognition-action" cycle. "It is through this cycle that humans interact with their environment. We want to find out what exactly goes on in the brain here. Moreover, in this process decisions are a prerequisite for interaction with the world." His team measures brain activity to try to predict mental states: whether a person behind the wheel is exhausted, stressed or cognitively overloaded. "If we are able to measure this status and make predictions, we can provide the

cyber-physical system with additional information about the human and whether he or she will be 'amenable' to reaching a joint decision," Rieger explains. It might also be possible to determine which of the five senses the machine should best engage in order to communicate effectively with its partner at a given moment: "If the auditory channel is occupied because the person is in a conversation, the system would try to make contact via the visual channel," the scientist says. For human-cyber-physical-system cooperation to function, researchers must find a way to integrate humans and machines in goal tracking and actions in a way that they will compensate for each other's weaknesses and combine their strengths. "Potentially people will then be able to solve problems that are too complex for them at the moment," Rieger says. Someone creating a production plan, for example, gains a better overview of the production machines through interaction with a technical system, thus improving the working and production processes and saving resources. "This is an abstract example that illustrates how human-machine

systems can expand the capacities and objectives within our reach as humans. "Society should stop being so pessimistic and seize the opportunity to make the most of human-machine cooperation," Rieger believes.

This sounds plausible but would require broad social acceptance, more precise system specifications and that ethical standards are taken also into account. "To put it simply, someone has to tell the system in advance which decisions are good or bad in different situations," Prof. Dr. Mark Siebel from the Institute of Philosophy explains. This is the area where Rieger and Siebel's interests intersect and where they can profit from each other's knowledge. "We neuroscientists are mostly interested in the technical side. We take a system, put it into action and ask the humans who interact with the system which actions they like and which ones they don't. But we won't be able to extract any ethical guidelines from the results. That's where the philosophers come in, because they are experts in ethical reflection," Rieger explains. "We, in turn, profit from the data provided by the neuroscientists," Siebel adds.

### Will algorithms decide over life and death?

Siebel is mostly interested in the ethical standpoint here: what constitutes morally good and bad decisions? "Autonomous systems and how they learn to make good decisions are a perfect case in point," Siebel says. However, whether something is morally good or bad in a specific situation is often a matter for debate. "It's something even philosophers argue over," Siebel points out. In this context the "trolley problem" is frequently cited, a classic thought experiment revolving around the question of whether or not to pull a lever to divert a tram from one track where it would kill a group of people to another track where it would kill only one person. This situation raises an

old philosophical question involving a moral dilemma. The person who has to make the decision is placed in an inextricable double bind. Is it acceptable to divert the tram onto another track where it would kill one person rather than killing several? This is the sort of dilemma an autonomous vehicle could find itself facing. How is an algorithm supposed to decide whether the car it is steering should kill an 80-year-old in order to save the lives of five children?

If you follow the reasoning of utilitarianism, one of the three main schools in ethics, the "net saving" of five lives would justify the ending of one. "This is difficult because it involves weighing up one life against another. On the other hand, what alternatives do you have? The decision can hardly be left to a random number generator," Siebel says. No wonder then that the "Ethics Commission on Automated and Connected Driving" set up by the German Transport Minister Alexander Dobrindt came to the conclusion that the "computer colleague" behind the wheel cannot solve difficult moral dilemmas. "Genuine dilemmatic decisions, such as a decision between one human life and another, depend on the actual specific situation, incorporating 'unpredictable' behaviour by parties affected. They therefore cannot be clearly standardized, nor can they be programmed to be ethically incontestable." The explanation shows how automation forces people to confront ethical grey areas that have been left to philosophers and chance in the past. After all, is any driver in an extreme situation really able to reach a rational and ethical decision within a millisecond? Humans remain unpredictable here.

### Culturally adaptive systems needed

Another factor that is relevant for decision-making in future autonomous systems is the cultural background of their field of application.



Mark Siebel: "Someone has to tell the system in advance which decisions are good or bad in different situations."

"Cultural adaptation is something we should not forget," Siebel says. He explains that although in Germany priority is given to a child's wellbeing, other cultures are more protective of old people, cows are holy, or goats are valued over dogs – all details that must be taken into account when programming. Rieger goes one step further: "Autonomous driving systems like the ones we are discussing here in Germany would simply not function in a city like New Delhi!" Very few norms govern traffic there, and the few that exist differ considerably from our own due to cultural differences. Any autonomous vehicle equipped with "western European algorithms" would have huge problems there. So what kind of algorithm would be capable of making the right decisions there?

### Decision-making processes must be transparent

Both academics agree that autonomous systems must function in a way that ensures that their decision-making processes are transparent. "We know from legal practice that the motivation for an action always plays a role when evaluating the consequences of that action," Rieger explains. If someone dies, it makes a difference whether

the person was killed intentionally, whether it was planned or committed with malice aforethought, or whether it happened due to unfortunate circumstances. "The underlying reason plays a major role for the evaluation, so it must also play a role in evaluating the consequences of the actions of autonomous systems," Rieger states. But he gives one more reason why the decision-making process must be factored in: In test situations a self-learning machine delivers results conforming with the decisions that people have made. "But when you look inside the system you may find that the reasons it gives for its actions are completely unexpected, for instance the motives may be racist. But this is not apparent in the result." Will it be possible to trace an algorithm's motives in real situations? Rieger and Siebel are agreed: "This is a question for our colleagues from machine learning." At any rate the example shows that the aim is not to achieve the optimal decision, but one that is well founded.

For Rieger and Siebel alike, autonomous systems offer a multitude of opportunities for overcoming societal and economic challenges. They want to accompany and give direction to this process with their research. "We are a long way off being able to provide answers, first of all we have to ask the right questions." (kl)



Jochem Rieger: "Society should stop being so pessimistic and seize the opportunities."



What will be the social and legal consequences of advancing automation? Jürgen Taeger (left) and Markus Tepe believe that as scientists they bear responsibility.

# For the Good of Humankind

When the real world and the virtual world merge, everyday life can be a lot easier. But who bears responsibility for the computer systems that are becoming an ever more integral part of our lives? Jürgen Taeger and Markus Tepe are seeking answers, both legislative and political

An autonomous car avoids an obstacle. So far, so good. But what if the evasive manoeuvre was triggered by faulty data? What if there was no obstacle and the car's sudden swerve endangers other road users? "If we give computers more and more responsibility, we need to keep the consequences in mind – for each individual and for

society as a whole," says Prof. Dr. Jürgen Taeger, a jurist. His research partner Prof. Dr. Markus Tepe, a political scientist, elaborates: "Making continuous technological progress is only one side of the coin. We must not lose sight of human beings in the process. This is the contribution we want to make with our research." The jurist and the

political scientist are working in close collaboration with computer scientists, philosophers, psychologists and sociologists. Their objective: to analyse the social, legal and ethical implications of cyber-physical systems (CPS) – with an eye to ensuring that humans are always able to intervene in time. CPS is a neologism that describes

the integration of the physical world of machines, systems and devices with the virtual world of the Internet and cyberspace to create an autonomous and intelligent, self-organizing network. The first applications are already in operation today, for example in navigation devices that analyse traffic data as well as the movement profiles of road users in order to suggest alternative routes. The cyber-physical systems of the future will go far beyond this and lead for example to highly efficient "smart factories". As part of an intelligent power grid, a CPS can control energy networks or connect doctors and patients to enable remote diagnoses and home medical care.

## A brave new world

For Taeger and Tepe these are fundamentally positive advances because of the huge potential of automation and networking processes to increase social prosperity. This sounds like a brave new world. "But as scientists," Taeger points out, "we can't simply let things happen. Someone has to deal with the question of responsibility." He notes that the first signs that this is being taken seriously are beginning to emerge, for example the Federal Government has set up various panels of experts – including a "high-tech forum" where representatives from business, science and social groups discuss the issue, as well as an ethics committee appointed by the Federal Ministry of Transport. However, so far, Taeger says, the reports of these committees have been very vague about the social consequences and legal implications of the new technologies.

For jurist Taeger the main question is whether our legal system is ready for CPS in everyday use. "The legislators may have to adjust existing laws and create new regulations." The traffic laws have been adapted for the semi-autonomous driving that is already possible (see the interview on p.16). But

this was merely a first step and hasn't been successful, says Taeger. He sees advancing automation affecting several legal areas – liability, data protection, civil law and even constitutional law. For one thing is clear: with the advance of self-learning Artificial Intelligence Systems, human decisions will play less of a role. "This will have a crucial consequence for liability questions, namely that drivers can no longer be held responsible as they are today. Because there is no driver behind the wheel who could be at fault," Taeger explains. Potentially, he says, the insured owner of the car who puts such a risky vehicle on the road could be liable, or in the case of faulty algorithms, the manufacturer and its supplier. "There is an open question as to who pays damages. We need to clarify who bears responsibility and can be held liable for damage in this interaction between humans and technology."

Another challenge in the field of liability law arises when autonomous vehicles communicate with each other. As Taeger explains, this can result in one vehicle influencing the behaviour of another, for example by warning it about a dangerous situation and causing it to apply the brakes: "If this leads to an accident it will be difficult to pinpoint the cause." Telecommunications companies could potentially come into play if the data proves to be faulty or lacking, says Taeger. "After all, these networks are critical systems in which IT security against attacks must be guaranteed," he adds, concluding: "We will conduct an intensive discussion about these liability issues in the coming years."

Another question that arises when cars exchange data is how this information should be handled – the keywords here being privacy and data protection. According to Taeger the legislators have already taken action here, and the Road Transport Law now stipulates which data can be sent to whom, and for what purpose.

More problematic for the jurists are the challenges that arise in the area of

civil law. "When we talk about autonomous systems we're talking about computer systems that act independently," Taeger explains, taking as an example the robots used in manufacturing that can detect when one of their parts is worn out: "These robots could then issue tenders on their own, and even decide who gets the contract. So it's no longer people who are concluding contracts, but autonomous cyber-physical systems." This is why in legal circles the idea of creating a third legal entity – an electronic person (ePerson) – in addition to the natural person and the legal person (a joint-stock company for example) is under consideration, he says. This "ePerson" would then logically have to be able to conclude legal transactions and be endowed with liable capital.

## Who should be allowed to create the algorithms?

"This is where things also get interesting for me as a political scientist," Tepe continues. "Because naturally a society in which robots act independently will be very different to today's society. So the time has come to start thinking about how the state can make sensible regulations here. The key questions are: Who is allowed to create algorithms that are able to make decisions, and on what basis?" Here Tepe's focus is more on ethical issues than the conclusion of maintenance agreements. In this context researchers on decision-making typically bring up the "dilemma situation": a car has to swerve suddenly – on its right is a mother pushing a pram, on its left an old man walking down the street. Which person should it swerve to avoid if it means hitting the other? "A human being behind the wheel would react instinctively in such a situation," Taeger continues. Allowing a computer programme in advance to weigh up the legal interests in such a situation would be inadmissible under the rulings of Germany's Federal Constitution

nal Court. “Weighing up human lives against one another would be incompatible with our legal system,” he says.

So how should the algorithms be designed? In Tepe’s view, technology poses a challenge here that requires a normative decision – making this above all a task for the politicians. But so far, he says, they have been very slow to react. “There is no broad political discourse on this issue at

the moment,” the researcher says. He adds that the Pirate Party tried to put the topic of how to deal with artificial intelligence on the political agenda, but the discussion, like the Pirate Party itself, has disappeared almost entirely from public debate. “So far this is just not an issue you can win elections with,” Tepe observes.

According to Taeger the situation becomes particularly tricky once autonomous robots start evolving on their own, as self-learning systems. Could these systems one day become so independent that we no longer understand how they work?

Algorithms are generally anything but transparent, he notes, and if in doubt are even treated as trade secrets. “In my opinion,” he says, “we need independent institutions to scientifically assess whether or not these algorithms comply with ethical principles or are potentially anti-democratic.”

Tepe has similar fears. He explains that if on the one hand technological advances radically change society, but on the other many people no longer understand them, the result could be a kind of “expert democracy” – in other words a political system in which a large part of the population is excluded from decision-making processes. At the same time, however, cyber-physical systems is a highly complex field, and this, he explains, poses the question of how to generate a meaningful discussion among the general public about the critical issues at stake. “It’s a balancing act,” says the scientist, “and I would like to analyse how the political parties and public interest representatives position themselves here.”

Tepe also wants to find out more about the public’s views on the new technologies and their social repercussions. He cites the example of ride-sharing service Uber: “In terms of creating a shared economy this is a sensible idea because it puts unused resources – like the empty passenger seat of a car on its way to the city – at the public’s disposal.” But what a first glance appears to fulfil a social purpose is currently undermining working standards in the taxi sector, Tepe points out. Do users see it this way, too? Or are they just happy to get a cheap ride? He plans to examine these aspects more closely with the help of surveys and decision-making experiments.

Even if Markus Tepe and Jürgen Taeger cannot yet predict how the rapid technological advances will change the laws and society over the next few years, they are confident that their research can help to make the process of automation more socially compatible. Technology that truly benefits mankind – based on scientific research. (bb)

And now, Lady Justice? Cyber-physical systems raise new questions – from liability issues to data protection and challenges in civil and constitutional law.



Main Topic

Whether at hospitals, at factories or on the roads, the points of contact between humans and machines are ever more frequent. Effective communication is vital to avoid misunderstandings with serious consequences.

## Understanding Each Other

Technical systems are performing more and more tasks autonomously. But cooperation with humans will always be necessary. Computer scientist Susanne Boll and sociologist Gesa Lindemann are therefore researching how people and machines can communicate with each other

Humans talking to machines is nothing really new. When we call the hotline of a phone company we generally end up talking to an automated answering system first. For many, the question-and-answer game with robots like the iPhone’s virtual assistant Siri has become routine. But the discussion about autonomous cars has

given the topic of communication between man and machine new impetus. Technical systems in general are becoming more intelligent and even making their own decisions: warehouse systems, for instance, can now automatically place orders for spare parts when supplies are running short. But no matter how independent the

technology becomes – humans will remain an integral part of the equation. The future interaction of humans and machines is the subject of interdisciplinary research at Oldenburg in which computer science, psychology, philosophy, jurisprudence and social science all intersect. Computer scientist Prof. Dr. Susanne Boll and sociologist

Prof. Dr. Gesa Lindemann of the University of Oldenburg are focusing on how to harmonize communication between humans and machines.

### Not human error

Computer scientist Susanne Boll is studying how to make this interaction as smooth as possible; how humans and machines can learn to work together as a team. This is by no means always the case, and misunderstandings can cause damage and even lead to disasters. “People often talk of human failure when this happens,” says Boll. “Humans are seen as the error in the system. I see it differently: basically it’s the system that has failed because it didn’t cooperate properly with humans.” When there is an emergency in an intensive care unit and all kinds of devices and warning lights start blinking and beeping, it can be extremely difficult for the doctor to correctly assess the situation. This can lead to mistakes. “It’s therefore particularly crucial in communication between humans and machines that the transfer of control goes smoothly,” Boll explains. “This can succeed if the technical system explains what it is doing in a way that is immediately comprehensible to the human in a given situation.” A sliding door doesn’t need to announce that it is about to open. An autonomous vehicle, on the other hand, should inform the driver well in advance that there are road works 500 metres ahead where the person will need to take back control of the vehicle.

### A human model

Whether such a message gets across will depend among other things on what state the person is in at that moment. Susanne Boll and her colleagues are therefore trying to develop a form of human model that can help autonomous systems to determine what frame of mind a person is in and how to respond accordingly.

If a person is extremely irritated by the voice commands of the on-board computer, it doesn’t make sense for it to keep trying to communicate in that way. The system could switch to clear optical signals instead. Boll is investigating which sensory channels are best suited for conveying information in different situations. The scientists also hope that the human model will teach vehicles and other autonomous systems to assess the chances of a human understanding a message in a given situation – in order to avoid misunderstandings. Boll is working closely with psychologists to develop this model.

Once an autonomous system has determined a person’s mental state, it needs to find the right way to communicate with them. With cars in particular, two aspects need to be taken into account: task engagement, in other words how engaged a person is in an activity, and task duration, i.e. how long the driver has been engaged in a side-line activity. “Both have a strong influence on the driver’s state,” Boll explains. “A scientific rule of thumb is emerging that it takes around seven seconds before a person is ready to switch from autopilot to taking the wheel. In our view that interval varies considerably depending on state of mind and situation.” Consequently, she wants to study the length of these intervals more closely – and which sensory channels the computer should use to communicate with the driver, depending on the situation.

### Correctly packaging the information

Another interesting question concerns the information that the system should pass on to the human when handing over control. Should it simply instruct the person to take the wheel? Or would it be better to announce that there are road works 500 metres ahead at the same time? Or would it perhaps make even more sense to tell the per-

son what direction to drive in once he or she has taken the wheel – to make it easier to merge with the traffic ahead of the road works, for example. To this end Boll’s co-workers have developed a steering wheel with an arrow that lights up and points left or right. Task engagement and task duration also determine whether a person will respond better to acoustic or optical signals, or other types of signal like vibrations.

### Orientation for emergency medics

Cars and the correct transfer of control from autopilot to human is just one of many aspects Susanne Boll’s working group is researching. Another field of research is the hospital environment, where the requirements for communication can be very different. Here the researchers are working on a system that provides doctors with swift guidance when an emergency occurs and the medical technical equipment starts blinking and beeping. The idea is for the system to analyse the current data and extract the relevant information so that the doctor is informed about the patient’s condition. The information can then for example be fed into a pair of Augmented Reality Glasses (AR Glasses). “In this way the doctor is shown the relevant information while he is on his way to the patient’s room,” says Boll. It would also be conceivable that a symbol appears on the AR glasses showing which body part is affected. “This sort of aggregated picture of the overall situation that points the doctor to the relevant part of the body could be a great help when things get stressful,” she adds.

### Discussions with machines?

At the heart of automated technology are cyber-physical systems, the control systems that are built into the devices. The term refers to the merging

of artificial intelligence and the real world. At the University of Oldenburg and among experts in the field everywhere, there is a discussion about the extent to which humans will be able to conduct genuine dialogue with such systems in the future. It is conceivable that at some point we will be able to debate with intelligent navigation systems about why they selected a certain route. The question is when and whether such a dialogue is desirable. Sociologist Gesa Lindemann wants to find out how dialogue between humans and increasingly intelligent cyber-physical systems could influence the way we communicate, and is working with IT experts at the University to do this. “The interesting thing about communication between two people is that the meaning of the communication develops during the dialogue,” says the scientist. “A question like: ‘Do you know what time it is?’ could elicit the response: ‘Yes, I’m nearly ready!’ for example. So the conversation moves to a new level. The meaning of the dialogue develops in a particular direction.”

Social researchers call this “indexical communication”, where the meaning of a dialogue depends on the context in which it takes place. The opposite of this today is technical communication, which follows clear rules and predefined patterns. “We call this mathematized communication,” says Gesa Lindemann. “For us social scientists the question is how communication as a whole will change as people start communicating more and more with intelligent technical systems, even though indexical communication is inherent to humans.” Lindemann considers it important that such aspects are taken into account in the development of communicative technical systems.

While humans are generally good at interpreting the intention of their dialogue partners, it is not possible to know why a technical system gives a certain response to a certain question. “When I ask Google a question, I

don’t know where the answer comes from or what data it is based on,” says Lindemann. “The system might give a particular answer because it knows my preferences or has gathered other information about me,” she explains. “This can be an advantage, but it also touches on key human aspects like dignity or my right not to have a machine or an algorithm know everything about me.”

### Machines that “read the air”

From their research Lindemann and her colleagues know that communication with machines is handled or experienced very differently from one culture to another – for example in the way people deal with service robots. “In Japan people expect machines to be smoothly integrated into daily life, to be invisible, as it were – they don’t want to communicate with the device,” says Lindemann. She notes that the Japanese have a saying that a person can “read the air”, which

means that they can perceive a mood and adapt to it to create a harmonious work environment. The Japanese expect the same of an intelligent machine like a service robot. “A machine that requires a dialogue is therefore basically an affront,” says Lindemann. In Germany the situation is completely different. There, she explains, people consider conducting a dialogue with a machine – or even a discussion in times to come – to be useful. “I see it as crucial that the developers of intelligent and communication-enabled technical systems are aware that their culture defines them – and develop the technology accordingly.” Gesa Lindemann talks here of a “reflexive loop” that needs to be taken into account in the design process. Developers need to be aware of which ideas about communication they are using as a basis to design a system – and critically review those ideas, she says. And Susanne Boll adds: “In this process we are pursuing the common goal of designing technology that enables humans and machines to really understand each other better in future.” (ts)



Computer scientist Susanne Boll is researching ways to improve communication between humans and machines. To this end she also works with experts from other disciplines, including social scientist Gesa Lindemann.

# Living Labs

What decisions should cyber-physical systems be allowed to make and how do we deal with the consequences? These are just two of the questions that Oldenburg computer scientists are researching together with psychologists, philosophers, sociologists, political scientists and jurists at the University. Their work covers the full spectrum from basic research to strongly application-oriented solutions. To assist them in their research the experts have recourse to an infrastructure that is unique in northern Germany, the so-called "Living Labs" which were set up by the Oldenburg OFFIS Institute for Information Technology and the German Aerospace Center (DLR) in Oldenburg and Braunschweig. New technologies – for use in the home, on the roads, on ship's bridges or in patient simulators – are tested here at the early stages of development under real-life conditions. An overview:



Institut für Informatik



Institut für Vernetzte Energiesysteme



Institut für Verkehrssystemtechnik



The colour code indicates which partners are involved in the Living Labs

## German Bight



Living Lab

### eMIR

Continuous co-simulation environment and test field installations on land and water in the German Bight for developing maritime navigation and assistance systems



Living Lab

### Smart City

Demonstrator and test field for multiple applications in urban environments integrating energy supply, healthcare and traffic systems (under construction)



Living Lab

### Health

Simulators and test environments for "Ambient Assisted Living" for the elderly as well as the emergency care and operating theatres of the future



Living Lab

### SESA

Simulation and analysis environments as well as tools for studying large-scale, intelligent power grids under real-life conditions



Living Lab

### RTP

Methods and toolkits for the cost-effective development of safe cyber-physical systems, primarily with applications in transport, energy and healthcare

## Oldenburg

## Braunschweig



Living Lab

### AIM

Virtual test environments, special test labs, driving simulators, analytic technology, test tracks in real-traffic situations and server systems for research into intelligent mobility solutions are at the core of the DLR's Living Lab in Braunschweig. The test and simulation environments at the University of Oldenburg were designed to harmonise with it.





The scientists make regular field trips to gain a better understanding of the complex processes taking place at the sea surface.

# A Fascinating Surface

The layer between the sea and the air is extremely thin. Yet, it influences the way gases enter the water from the atmosphere and vice versa and thus has an impact on the climate. Oldenburg researchers are studying the role of the sea's "skin" across the globe

It's a sunny day in the Jade Bight off Wilhelmshaven and two devices are floating on the water: a bowl, which is hung up within a square metal frame and is kept afloat by a life ring. The shiny red buoys attached to each corner of the frame are clearly visible across the bight. A second device, a remote-controlled catamaran some four metres in length, carries aluminium crates and a round metal barrel with a blinking light on top. At its bow end several glass plates are rotating slowly in the water. A rhythmic squeaking punctures the silence of the late summer's day

as the devices drift imperceptibly with the tidal current. On board the Otzum research boat Dr. Oliver Wurl looks satisfied: "The measurements are all going well," the marine researcher says, gazing out over the water.

The device with the red buoy, known as the Sniffle, and the catamaran are the main pieces of equipment used by the "Sea Surfaces" research group of the Institute for Chemistry and Biology of the Institute for Marine Environment (ICBM). They help the scientists to study a part of the ocean that has barely been explored so far: the film on

its surface that is no more than a few thousandths of a millimetre thick. It is host to all kinds of different molecules, from proteins and polysaccharides to fatty acids. A number of bacteria and microscopic algae can also be found here. For Wurl the fascinating thing about this fine layer is that "everything that is exchanged between the ocean and the atmosphere – from heat to carbon dioxide and oxygen – has to pass through this thin layer on the surface."

This layer's surface area alone makes it immensely important. The seas cover around 70 percent of the earth's

surface. They store heat and greenhouse gases like carbon dioxide (CO<sub>2</sub>) and therefore play a key role in climate events. Marine microorganisms produce at least half of the oxygen that is so essential to life on our planet. But scientists still know very little about how the skin of the sea influences the interaction between the ocean and the atmosphere. Indeed, as an international consortium of scientists (SOLAS-Surface Ocean – Lower Atmosphere Study) wrote in a report published in 2015, more knowledge about the surface films is urgently needed.

This is precisely what Wurl set out

## Wind isn't the only factor

to achieve with his project PassMe (Air-Sea Gas Exchange: Parameterization of the Sea-Surface Microlayer), for which he received a much coveted starting grant from the European Research Council (ERC). "Our principal

aim is to better describe the gas exchange between the ocean and the atmosphere," he says. Until now most of the mathematical models used by climate scientists, for instance, calculate gas exchange – experts use the term parameterization – primarily in relation to wind speed."

"The influence of the wind is crucial but by no means everything. It's a complex process," Wurl explains. The PassMe researchers therefore measure the gas exchange and describe the surface of the sea. What substances and organisms does it contain? Under what conditions do they collect here? "We are trying to understand the relationship between these factors in order to either confirm or correct the literature on parameterization," Wurl adds. For this research the ERC awarded the marine chemist 1.5 million euros over five years. Before choosing the ICBM as his research location in 2014 Wurl had conducted research in Singapore, Canada and the United States. It is the interdisciplinary cooperation that he

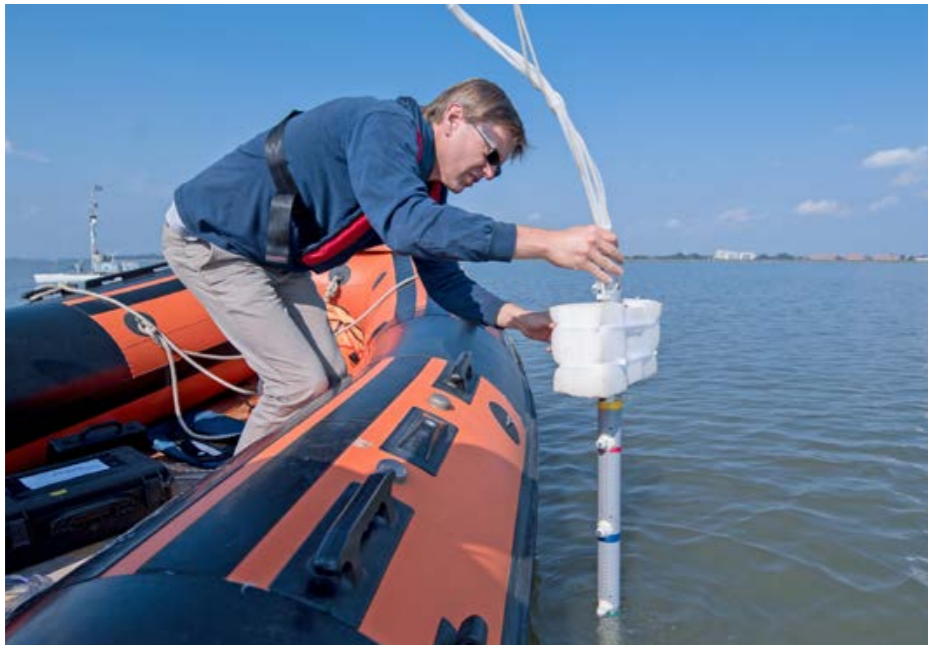
cherishes most about the Oldenburg institute.

In the meantime the marine chemist has brought together a small but international team. One postdoctoral researcher comes from Spain, one of the PhD-students from Malaysia and another from the US. In order to work towards their research goal the team now needs to collect data from different areas of the world's oceans. Wurl has just returned from a research cruise to the North Atlantic and the Norwegian fjords. He has also been to the Baltic Sea and the Pacific. Next year he will return to the Baltic and expeditions to the Arctic regions are in the pipeline for 2019.

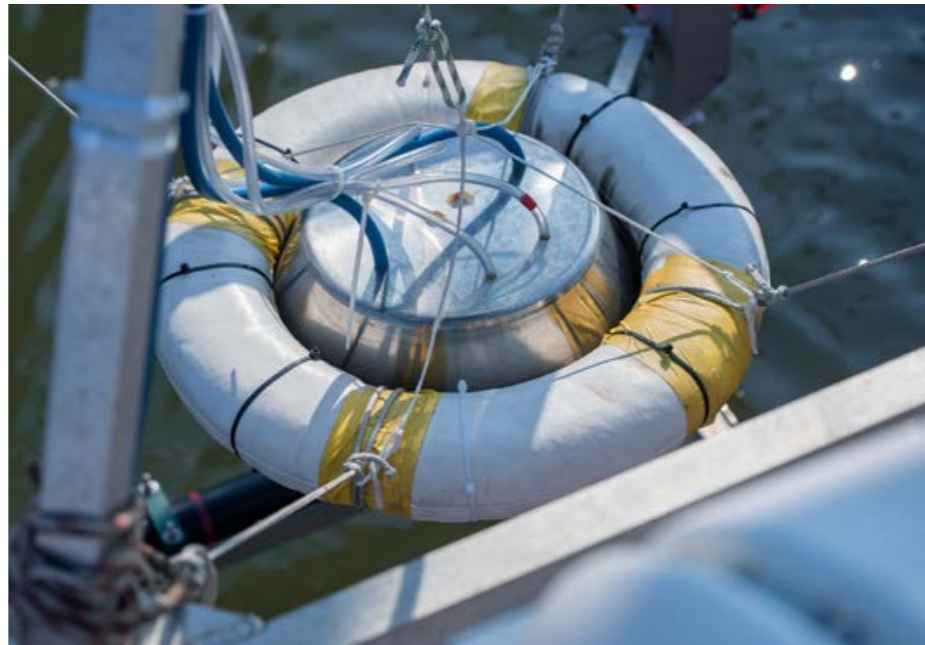
On this late summer afternoon, however, Wurl's team is in the Jade Bight – their open-air laboratory – testing their devices and conducting measurements to supplement their data from more distant sea journeys. Before setting off everything has to be in its proper place. On the narrow jetty the workshop manager Helmo Nicolai



The sensors on the measuring buoy and the catamaran gather important field data over periods of several hours.



Not just automatic: Wurl operates some of the devices manually.



The heart of the device: a sensor below the bowl detects changes in CO<sub>2</sub> content.



A sophisticated system: the rotating blades on the catamaran collect the surface film.

is manoeuvring the trailer carrying the Sniffle. He lines it up alongside the boat on the quay wall with the utmost precision so that the measuring buoy can be placed on board without being damaged. When it is finally secured safely to the stern of the boat, everyone breathes a sigh of relief. “Helmo tailor-made that mounting bracket. There was just not enough room on board the Otzum,” Wurl says. Many more similar structures have been developed over time to meet specific needs. The catamaran, which is also too big for the Otzum, sits safely moored behind a dinghy. At any moment the Otzum and the dinghy will set off to carry the devices out to sea.

For Wurl the project began with a technical challenge. “Whenever I sail across water in a boat, which might also rotate once we are in situ, everything gets churned up,” he explains. This motivated him to develop new instruments in order to collect useful data from the sea’s thin surface layer. “And also not to work exclusively in the lab,” he points out. Wurl and his colleagues, especially the postdoctoral researcher Mariana Ribas-Ribas, then spent a whole year constructing devices with the help of the university’s workshop team.

The catamaran’s six rotating glass plates, which are one-third submerged in the water, gather samples from the

surface film. The thin film clings to the plates thanks to surface tension and is then transferred by wipers into a sample jar. After that the water is pumped through a series of sensors which record data at ten-second intervals to provide the scientists with high-resolution data on factors like pH value, water temperature, the amount of oxygen dissolved in the water and certain dissolved organic substances. The researchers use another method to measure the effectiveness of photosynthesis, in other words how well the microscopically small algae, or phytoplankton, are faring in the water. These data are all important pieces of the puzzle when it comes to understanding what is happening in the surface film. Wurl is particularly proud that this glass panel system allows the researchers to analyse at least 20 litres of sample water from the thin surface layer per hour.

In addition to the catamaran, the

### Not just a fair-weather team

measuring buoy Sniffle provides critical data about the gas exchange itself: inside the bowl which rests on the surface of the water is a sensor measuring the CO<sub>2</sub> content of the air enclosed inside it. “We observe over intervals

of 15 to 20 minutes whether the CO<sub>2</sub> content inside the bowl is rising or dropping,” Wurl explains. In this way the scientists can determine whether gas from the water is entering the air or the other way round. “If I know how much CO<sub>2</sub> is collecting or being lost I can also determine the speed of the exchange,” the marine chemist adds. At regular intervals the sensor also measures CO<sub>2</sub> content in the atmosphere and at one meter below sea level for the calculations.

This method is not uncontroversial, Wurl admits, because of course the chamber shields against the effects of the wind. But wind always causes turbulence under the surface of the water, the researcher explains, “and that brings fresh, CO<sub>2</sub> enriched water to the surface.” In order to counteract the problem the researchers use an acoustic method to measure turbulence both directly below the bowl and one-and-a-half metres away from it. “This allow us to compare turbulence levels and correct the data accordingly,” Wurl says.

But there’s no sign of any turbulence on board the Otzum on this windless afternoon. After a short ride the captain and the doctoral student have lowered the Sniffle into the Jade Bight’s tidal current. Wurl and the skipper have also tugged the catamaran alongside the buoy with the dinghy. The devices

will now remain in the water collecting data for four to five hours. “On a calm day like today it’s no problem to bring out the devices,” PhD-student Nur Ili Hamizah Mustaffa says. But things look very different on windy days.

Not that the researchers are a fair-weather brigade. “We love rain,” Mustaffa laughs. This is because it changes the composition of the sea-surface layer and impacts the gas exchange. It is precisely such effects that the researchers want to measure. The young woman from Malaysia has almost completed her PhD. She is using the data from the catamaran and analysing additional water samples to test for other substances, such as so-called natural surfactants. These surfactants originate from phytoplankton, for example, or are produced during the breakdown of organic substances. Since they reduce the surface tension of the water they can have a major effect on the gas exchange.

Mustaffa’s colleague Tiera-Brenda Robinson investigates other substances in the water, such as gel-like particles. These so-called transparent exopolymer particles or TEPs also come from phytoplankton. Since the particles are very sticky they cling to other substances in the water and in so doing alter the structure of the surface film. Waves breaking out at sea can carry the film deep under water or propel it into

the air as aerosols (liquid particles). The impact this has on exchange processes through the sea surface is being studied by the Oldenburg scientists in the MarParCloud research network as well as other projects.

But for the research group there is

### Chemical reactions influence the gas exchange

one more important aspect to consider. If particularly large amounts of organic material accumulate at the surface of the ocean in wind-protected coastal waters, say, “then the surface becomes streaky with what we call slicks,” Wurl explains. This effect is visible to the naked eye. The marine chemist points out a few areas in the Jade Bight where the water is as smooth as glass. The accumulation of substances on the surface absorbs even the tiniest ripples, so-called capillary waves, which otherwise form on the surface of the water when the wind is low. This densely compacted film causes gases to diffuse through the surface much more slowly. “We have shown that in such areas the gas exchange can be reduced by up to 15 percent,” Wurl says. And slicks in coastal waters can cover as much as 20 percent of the surface area.

“We also know now that chemical reactions in the sea-surface microlayer

influence the gas exchange,” says the marine chemist. For example, one student is working to analyse the enzyme carbonic anhydrase in the surface layer. Phytoplankton utilises this molecule to transform the hydrogen carbonate dissolved in the water – in other words the salt of the carbon dioxide – into gaseous CO<sub>2</sub> in order to transfer this into the cell. This enzyme also collects in the sea-surface microlayer, Wurl explains. The researchers estimate that this can affect the exchange of gases by up to ten percent. For the researchers the effects of slicks and carbonic anhydrase are an important indicator that the sea-surface microlayers need to be factored into future climate research models.

Wurl is reluctant to make any definitive statements, however. In this respect he is very much the critical scientist who wants to underpin his conclusions with as much data as possible. But the measurements are finished for today. Between now and the next field trip the researchers will evaluate their data and conduct further experiments. The wind on the Jade Bight is picking up now. “This often happens in the afternoon,” Wurl says. The researchers pack up their devices contentedly – everything has worked out well – and head back to the jetty in Wilhelmshaven at a leisurely pace. (cb)



# Deceptively Real



Deception is fundamental to many kinds of sports. Oldenburg researchers under the aegis of sports scientist Jörg Schorer are studying the many different movements people use to trick their opponents.

**1** In her dissertation Josefine Panten is analysing the movements handball players use in the seven-metre penalty throw. Her question: precisely how do the throwers go about disguising their intentions? She gathers the necessary video data using a motion capture system. The movements are visually represented in virtual images.

**2** Anatomical landmarks are labelled with reflectors attached to the bodies of test subjects.



**3** In the laboratory a total of 12 infrared cameras record the position of the markers – at a rate of up to 240 images per second. The doctoral student has to calibrate the cameras in advance.

**4** The two players take up their positions on the court. Before each throw, thrower and goalkeeper assume a starting position recognised by the system. This allows it to automatically map the anatomical landmarks.

**5** The experiment foresees a total of 160 penalty shots divided into four blocks of 40 throws each – with extended breaks in between. The repetitions are necessary in order to compensate for the variations in the throwing movements, which result from the multiple factors in a situation that can only be minimally controlled.

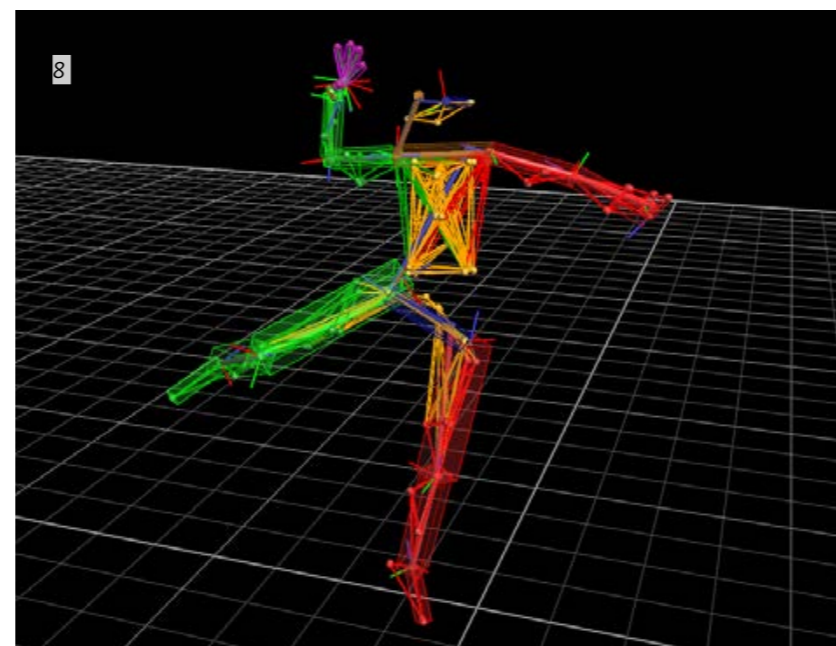


6 There are no rules beyond the normal rules of handball – meaning that the interaction can produce deliberate, spontaneous deceptive manoeuvres, as the experiment requires.

7 Josefine Panten's experimental design proposes an initial set of 10 pairings of test subjects with intermediate to advanced skill levels so that she can gather sufficient data for her cluster analysis. Experiments with other skill levels will follow.

8 "Feigned throw" in 3D. The analysis makes the trajectory of the movement, or the spatial progression of the lines of the (points of) movement, clearly visible – from small-scale pointing or grabbing movements to larger scale running and jumping movements.

9 Josefine Panten with her supervisor Prof. Dr. Jörg Schorer. Even during the experiment they are able to follow the individual movement patterns in real time on the screen and verify the quality of the recorded data.





With her research, dermatologist Ulrike Raap aims to gain a better understanding of the cellular processes in skin diseases and combat the causes.

# Layer by Layer, Cell by Cell

The skin, our largest sensory organ, is the subject of dermatologist Ulrike Raap's research and medical care. She describes it as an "architectural masterpiece" and hopes that by gaining a better understanding of its components she can pave the way for the development of novel treatment approaches

Shimmering soap bubbles float across the stage in the Experimental Auditorium on the University's Wechloy Campus, blown by the youngest members of the audience attending dermatologist Prof. Dr. Ulrike Raap's lecture "When the skin bubbles up" – her two sons. The 45-year-old has just held her inaugural lecture but she has long since settled in – in Oldenburg, at

the hospital where she is Director of the University Clinic for Dermatology and Allergology, and at the Medical Faculty with its international European Medical School Oldenburg-Groningen model degree programme.

The crowded auditorium was filled with new colleagues, students, and co-workers from the Medical Faculty and clinic as well as old friends and

colleagues. Raap, who moved to Oldenburg with her whole family just a month after accepting her post at the University, has been busy since she started here in autumn 2016. Her first joint publication with fellow dermatologist and head of the Groningen Department of Dermatology, Marcel Jonkman, has already been published and a joint project with Jonkman on

blistering skin diseases is due to begin in January. At her clinic, Raap has already changed several procedures and structures, had a bathroom converted into a patient reception area and switched to electronic patient records and chiefly paperless offices.

Hans Gerd Nothwang, Interim Dean of the School of Medicine and Health Sciences, describes Raap as a "power woman". "One can hardly imagine how much energy it takes for someone with two children to build a successful academic career in medicine and on top of that run marathons on the side," he comments. But Raap's main motivation, he concludes, has to be her fascination with the skin.

## Dynamics and dramatic events in the skin

Ulrike Raap discovered her palpable enthusiasm for our largest sensory organ – and the close contact with patients it entails – in the first year of her medical studies, which she began in Lübeck and completed in her home city of Hanover. To finance her studies she started working as a hospital assistant and was soon on duty at the Department of Dermatology in Lübeck on a regular basis. "Even as an assistant I was allowed to dress complex wounds, and I really enjoyed it and had fun," she recalls. The team she worked with was always very friendly and relaxed, and this made a lasting impression on her. When her clinical clerkship ended her colleagues at the Hanover Medical School's Dermatology Department convinced her to do her doctorate there. This was followed by specialist training in dermatology.

Ever since, Raap's research has dug deeper and deeper, exploring the skin layer by layer, cell type by cell type, and after a one-year stay as a postdoctoral researcher at the Neuroimmunology Department in Marburg she is now also a proven expert in immunology. Not only has she analysed the molecular and cellular processes that take

place in the body when it detects and defends itself against (real or perceived) disruptive factors, she is also able to explain these processes in a way that people without any medical training can understand. When she describes the skin, she talks about motorways, filling stations, about bubbling cells and weapon arsenals – using these images to illustrate the dynamic and sometimes dramatic events that unfold beneath the surface.

Raap's vivid descriptions revolve around topics like the eosinophil granulocytes which, because of their double nuclei, "always look like they're wearing sunglasses" and were the subject of her doctoral thesis at the Hanover Medical School (MHH) in 1999. Eosinophils are mobile cells that develop in the bone marrow and mainly play a role in fighting parasites. "The eosinophils migrate to sites of inflammation, which is exactly where they are needed," Raap explains. "So if a person has a parasite in their intestine, for example, these guys receive a signal, march in, and start firing oxygen radicals and cytokines (a group of proteins) at the parasites. In the end the parasite is eliminated from the body full of holes."

But these parasite-fighters also play a role in quite a few skin diseases. "When someone comes to you with neurodermatitis and you see that eosinophil granulocytes – along with their weapons arsenal – have accumulated in the skin, you know why their skin is so inflamed." The dermatologist and her team discovered that, in patients with neurodermatitis, eosinophils can produce and release a nerve growth factor called BDNF. According to their research, the resulting "hyperactive" nerve cells are one reason why neurodermatitis patients frequently suffer from itchy skin.

Itching is another topic in Ulrike Raap's research portfolio. She discovered that levels of a protein called interleukin-31 (IL-31), that is known to cause itching and was first discovered in 2004 by American scientists, correlate with the severity of the disease in neu-

rodermatitis patients. "Putting this to the test was actually a very simple idea I came up with when I was changing my son's nappies," she recalls. "At the time my technical assistant and I would never have guessed that we would end up publishing this project in one of the biggest immunological journals."

This research led to another outstanding publication – which also won a lucrative prize – in which Raap, together with a colleague from Lübeck, studied interleukin-31 concentrations in mastocytosis patients. Mastocytosis leads to the accumulation of mast cells (or mastocytes) normally present in human skin, which can release histamine that triggers itching. This is a serious disorder, Raap explains: "When mast cells accumulate in the intestines patients may suffer from diarrhoea; when they accumulate in the bone marrow this can lead to osteoporosis." She and her colleague discovered that increased levels of interleukin-31 are also released in mastocytosis patients and that this correlates with the progression of the disease.

## When the sticking power of chewing gum isn't enough

In the meantime, a direct link has also been established between the itch-producing protein IL-31 and eosinophil granulocytes – the blood cells that look like sunglasses under the microscope. This link is evident in bullous pemphigoid, an autoimmune blistering skin disorder. In this disease, the dermatologist explains, autoimmune antibodies "cause the skin cells that usually stick together like strips of chewing gum to separate, resulting in the formation of a blister." In such cases elevated levels of eosinophils are present not only in the skin and in the blood but also in extremely high concentrations in the blister fluid – "like little nuclear power plants". The eosinophils can release IL-31 and in turn be activated by it, resulting in a perpetual

motion machine. "It's all interconnected," Raap stresses.

Gaining a better understanding of the cellular processes in skin diseases in order to combat them more effectively is the main goal of Raap's research. Among other things, she leads a sub-project in a clinical research group funded by the German Research Foundation (DFG) on bullous pemphigoid. In this project, in addition to eosinophils, she is also studying basophil granulocytes, which play a role in allergic – and acute and potentially life-threatening – inflammation. She is also involved in a project led by a colleague in Münster on the topic of itching. And in January the project funded by the Oldenburg faculty of medicine begins in which Raap and her Groningen colleague Jonkman

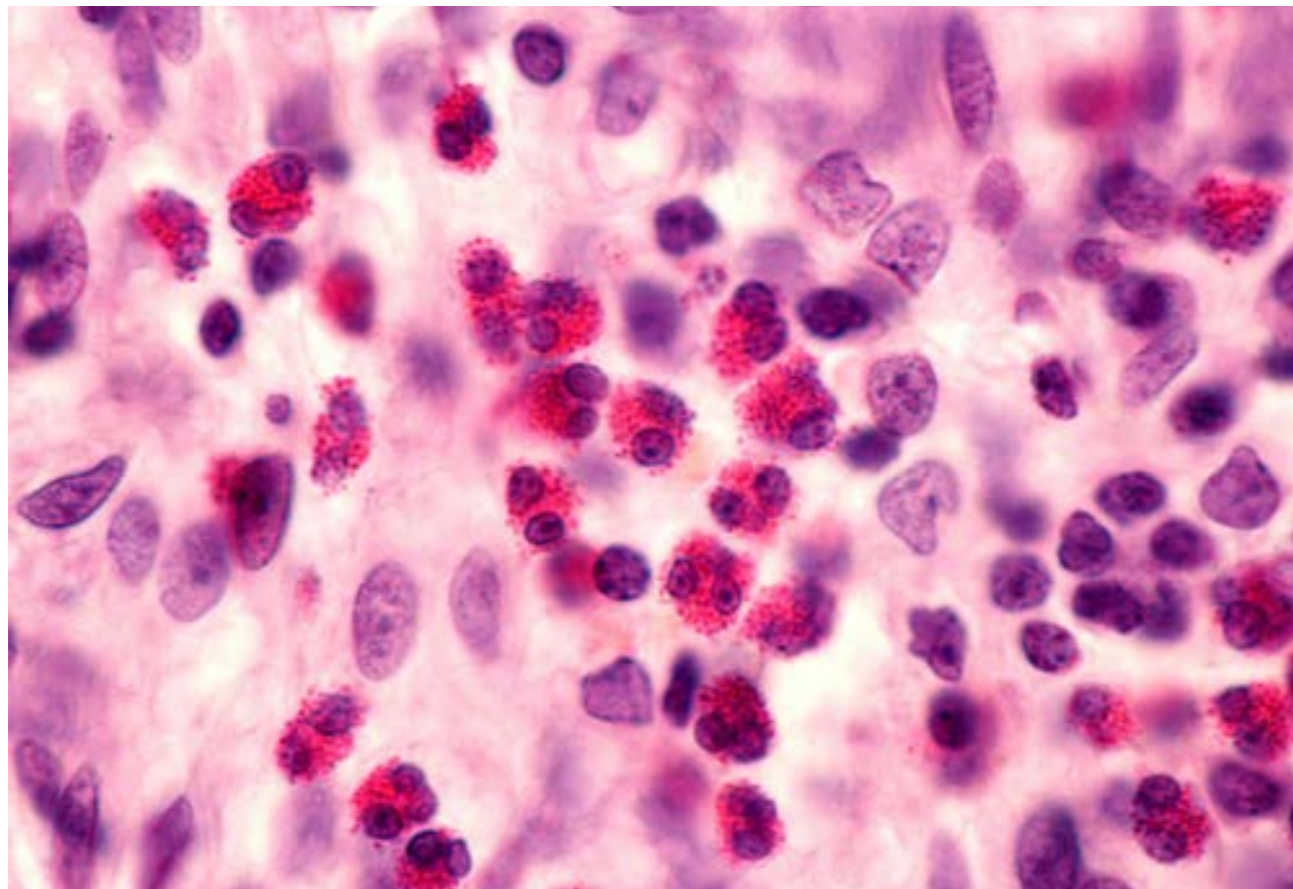
aim to establish a special skin model for blistering autoimmune disorders.

### **Detective work in cases of unexpected allergic reactions**

Raap not only combines her research, for example the weekly meetings with Bernhard Gibbs, her Head of Research at the Wechloy Campus, with her post as Director of the dermatology clinic and its private and outpatient services, she also teaches at the "European Medical School". She enjoys "showing young people all the great things we are doing in dermatology", she says. Treating sexually transmitted diseases

at the clinic, doing detective work in unexpected cases of contact dermatitis, dealing with serious autoimmune disorders or operating on sebaceous cysts or skin cancers: the broad spectrum of activities her field offers is "a dream come true" for Raap.

In her research and teaching as well as at the clinic, the patients' well-being is always her top priority. "We work on the patient and with the patient, and our goal here is to develop new treatment options for the patients," Raap stresses. To this end her team deals with the "full spectrum" of immunological research: "No cell is safe when we're around," she jokes. All with the goal of ensuring that – contrary to the title of her inaugural lecture – the skin doesn't "bubble up". (ds)



Eosinophile granulocytes: because of their double nuclei they "look like they're wearing sunglasses". Since Ulrike Raap earned her doctorate in 1999 her research has repeatedly focussed on these mobile cells that migrate to sites of inflammation and have been linked among other things to itching.

[Anzeige]

## The UGO awards prizes and supports business founders

The Universitätsgesellschaft Oldenburg e.V. (UGO) has awarded its prize for excellent research 2017, endowed with 5,000 euros, to social scientist Professor Dr. Jannika Mattes. The 36-year-old is Junior Professor for the Sociology of European Societies and is studying the factors that drive innovation. This involves analysing how international companies bring together knowledge from different disciplines and locations to create new products. Mattes is also researching regional restructuring processes. She is examining the ways in which large entities with entrenched structures and high numbers of people involved change, for example, when an entire

region converts its energy production to wind energy.

Physicist Dr. Sebastian Wilken was awarded the UGO prize for an outstanding doctoral thesis. The 32-year-old earned his PhD in the working group led by Prof. Dr. Jürgen Parisi with a dissertation on organic photovoltaics. He studied elementary processes in solar cells that use conductive hydrocarbons, making them cheaper and more energy-efficient to manufacture. Their precise mode of operation is not yet completely understood. Wilken studied them using an innovative combination of microscopic and macroscopic measuring techniques. Both prizes were

awarded at the “Auftakt 17/18 event at which the University and the UGO inaugurated the new academic year on October 19th.

In 2017 the UGO also established a new event format for young and prospective start-up founders: the “Kellergespräche” (Basement Talks) aim to facilitate exchange within this group as well as with established figures from the corporate world. The talks will take place in the basement of advertising agency “von Mende Marketing”. The initiative was launched by UGO President Prof. Dr. Werner Brinker and his deputy, the head of the agency Swea von Mende.

[Anzeige]

## Imprint / Publication Data

Issue 62, 32st year of publication  
ISSN 0930/8253  
www.presse.uni-oldenburg.de/en/  
Press and Public Relations Office  
Ammerländer Heerstraße 114-118  
26129 Oldenburg  
Phone: 0441/798-5446, Fax: -5545  
presse@uni-oldenburg.de

**Publisher:**  
Presidential Chair of the Carl von Ossietzky  
University of Oldenburg

**Chief Editors:**  
Dr. Corinna Dahm-Brey (cdb)  
Volker Sandmann (vs)

**Editors:**  
Constanze Böttcher (cb),  
Birgit Bruns (bb),  
Nele Claus (nc, Trainee),  
Deike Stolz (ds)

**Freelance work:**  
Katja Lüers (kl)  
Tim Schröder (ts)

**Layout and Design:**  
Inka Schwarze

**Cover Design:**  
iStockphoto/liuzishan  
Graphic Editing: Per Ruppel

**Infographics:**  
Nele Claus: p. 7  
Per Ruppel: pp. 30/31

**Translations:**  
Lucy Powell, Alison Waldie

**Printed by:**  
Officina-Druck  
Posthalterweg 1b - 26129 Oldenburg  
Tel.: 0441/36144220 - info@officina.de

**Photos:**  
Peter Duddek: p. 3  
Fotolia/The Nightwriter: p. 20  
Fotolia/Edler von Rabenstein: p. 26  
Fotolia/Peshkova: p. 27  
Fotolia/JosLuis: p. 42  
Markus Hibbeler: p. 24, 29, 36 (2x), 37 (3x),  
38 (2x), 39 (2x)  
HörTech: p. 13  
iStockphoto/Chombosan: p. 21  
Kilian Köbrich: p. 10  
OFFIS/Institut für Informatik: p. 19  
Josefine Panten: p. 38/39  
Daniel Schmidt: p. 8, 14, 16/17, 18, 20, 22, 23,  
32, 33, 34, 34/35, 35, 40, 58/59

The articles may be reprinted only after consulting the editorial staff. The source must be cited.

Paper: PEFC certified (Programme for the Endorsement of Forest Certification Schemes)

## New Appointments



Anja U. Bräuer  
Anatomy

Prof. Dr. Anja U. Bräuer has been appointed Professor of Anatomy. Before coming to Oldenburg she was Deputy Director of the Institute of Anatomy and led the Molecular Neurobiology Working Group at the University Medicine Rostock. After completing her degree in Biotechnology at the Beuth University of Applied Sciences Berlin she earned a PhD at the Humboldt University of Berlin in 2002. Bräuer then took up a post as a research fellow at the Charité-Universitätsmedizin Berlin. A one-year research stay in Canada at the University of Alberta's Institute of Biochemistry followed. In 2004 Bräuer became a senior research fellow at the Charité's Institute for Cell and Neurobiology and was appointed Junior Professor of Molecular Neurobiology in 2006. In 2009 she became the institute's acting director. From 2006 until her move to Rostock in 2014 she led the Molecular Neurobiology Working Group there. Key areas of Bräuer's research are the factors that influence the growth of nerve fibres in the brain.



Christian Busse  
Sustainable  
Production Management

Prof. Dr. Christian Busse has been appointed Professor of Sustainable Production Management at the Institute for Business Administration and Business Education. Previously he was researching and teaching at the ETH in Zurich, where he completed his Habilitation in 2016. Busse earned a degree in Industrial Engineering and Management in 2002 at the Technical University of Berlin. After his graduation he worked as a management consultant in Dusseldorf before completing his PhD in 2010 at the Otto Beisheim School of Management in Vallendar on "Innovation Management and Logistic Service Providers". Until 2013 he coordinated a joint project funded by the Federal Ministry for Education and Research on the sustainable management of supply chains at the private EBS University of Business and Law in Wiesbaden. Alongside this particular focus Busse also conducts research on the intersection between firms and their environments as well as the research-practice gap.



Marcus C. Christiansen  
Applied  
Probability Theory

Prof. Dr. Marcus C. Christiansen has been appointed Professor of Mathematics with a focus on applied probability theory at the University's Institute for Mathematics. Previously he was Associate Professor of Actuarial and Financial Mathematics at the Heriot-Watt University in Edinburgh (Scotland). Christiansen studied Mathematics at the University of Magdeburg and completed his PhD in 2007 with an analysis of financial and biometric risks in life insurance. Following a deputy professorship at the Karlsruhe Institute of Technology, in 2010 he was made Junior Professor of Actuarial Mathematics at the University of Ulm. Research visits took him to the University of Leuven (Belgium) and the University of Copenhagen (Denmark). Christiansen's research deals with the applications of probability theory in actuarial mathematics, in particular the modelling of longterm insurance risks using stochastic processes.



Marion Dunkel  
Transcultural  
Music Mediation

Dr. Mario Dunkel has been appointed Junior Professor of Music Education with a focus on transcultural music mediation. Before coming to Oldenburg, Dunkel was a research assistant at the Institute of Music and Musicology at the Technical University of Dortmund. Alongside jazz and jazz historiography his other research focuses are transnational music diplomacy and teaching. Dunkel studied English and Music for Secondary Education I and II at the Technical University of Dortmund. During this time he spent two periods of study in the United States. On a scholarship from the German Academic Scholarship Foundation in 2014 he completed his American Studies doctoral thesis on "The Stories of Jazz: Performing America through Its Musical History", examining the construction and performance of jazz history between 1917 and 1956. Dunkel received the Berger-Carter Award from Rutgers University and the Cambridge University Press Award of the Society for American Music. He is the author of the book "Aesthetics of Resistance: Charles Mingus and the Civil Rights Movement".



Erkan Gören  
Quantitative Methods  
in Economics

Dr. Erkan Gören has been appointed Junior Professor of Quantitative Methods in Economics. Previously he was a postdoctoral researcher in the field of applied macroeconomics at the Institute of Economics at the University of Oldenburg. Gören studied economics at the University of Osnabrück. In 2015 he completed his PhD at the University of Oldenburg on the impact of ethnic and cultural diversity on economic growth and development. Research stays took him to Groningen (the Netherlands) and Aarhus (Denmark). In his research, Gören examines the socioeconomic effects in ethnically heterogeneous societies, in particular the impact of linguistic distance on economic growth. Further research areas include topics in evolutionary economics and the international technology diffusion based on the analysis of firm-level and macroeconomic data. Gören is also interested in the effectiveness of development aid schemes in combating global poverty.



Gerhard Hilt  
Organic Chemistry

Prof. Dr. Gerhard Hilt has been made Professor of Organic Chemistry at the University's Institute of Chemistry. Before coming to Oldenburg Hilt had held the position of Professor of Organic Chemistry at the University of Marburg since 2002. His research interests include transition metal catalysis, surface chemistry and organic electrochemistry. Hilt studied chemistry at the University of Bonn, where in 1996 he earned his doctorate with a thesis on the electrochemical regeneration of cofactors - molecules that are important for enzymatic reactions - in oxidation reactions. Thereafter, he spent two years at Princeton University, USA, on a BASF scholarship of the German Academic Scholarship Foundation. He then switched to the research group of the Chemistry Nobel laureate Prof. Dr. Ryoji Noyori at Nagoya University, Japan, in order to work in the field of asymmetric synthesis and catalysis. In 1999 Hilt received an Emmy-Noether scholarship and moved to the University of Munich, where he completed his Habilitation in 2002.



## New Appointments



**Oliver Kramer**  
Computational  
Intelligence

Prof. Dr. Oliver Kramer has accepted the Chair of Computational Intelligence, which he had held as a junior professor since 2011. Kramer studied computer science at the Universities of Bielefeld and Dortmund. After completing his degree in Dortmund he earned his PhD at the International Graduate School of Dynamic Intelligent Systems in Paderborn. He then conducted post-doctoral research at the Technical University of Dortmund. Research stays took him to the University of Stanford and the International Computer Science Institute Berkeley (USA). Before Kramer became junior professor at the University of Oldenburg's Department of Computer Science he was junior professor of Stochastics and Optimization at the Faculty of Civil Engineering of the University of Weimar. Kramer's research deals mainly with learning algorithms that can perform human-like cognitive tasks. He is investigating the question of how methods based on biological evolution can be used to enhance algorithm of artificial intelligence.



**Stefanie Sievers-Glotzbach**  
Economy  
of Commons

Dr. Stefanie Sievers-Glotzbach has been appointed Junior Professor for the Economy of Commons. Sievers-Glotzbach has been working at the University since 2012, and as a post-doctoral researcher she supervised the Master's degree programme "Sustainability Economics and Management". She studied Environmental Sciences at the Leuphana University of Lüneburg and the Kristianstad University in Sweden and obtained her degree in 2009. A doctorate in Economic and Social Sciences at the Research Centre Futures of Ecosystem Services of the Leuphana University of Lüneburg followed. Her key research areas are commons and their role in sustainable development as well as questions of fairness in human use of natural resources. As Junior Professor, Sievers-Glotzbach leads the junior researchers' programme "Right Seeds", a joint project funded by the Federal Ministry of Education and Research which analyses the potential of commons-based, non-profit plant cultivation and seed production for creating a sustainable food production.



**Boris Vertman**  
Analysis

Prof. Dr. Boris Vertman has been appointed Professor of Mathematics with a focus on analysis. Before coming to Oldenburg he taught and researched at the University of Munster in the Working Group Differential Geometry. Vertman studied Mathematics at the Universities of Cologne and Cambridge and then went on to complete his doctorate at the University of Bonn in 2008, where after two years as a Postdoctoral Fellow at Stanford University he also earned his Habilitation. He spent post-doctoral research periods at the University of California, Berkeley (USA), in Paris and in Sao Paolo, Brazil, before taking up his position at the University of Münster. His research focuses on spectral geometry, which deals with the correlation between an object's form and its vibrations – a significant area of research with applications in the construction industry in particular. Vertman is also studying Einstein metrics, which – based on Albert Einstein's Theory of Relativity – model our space-time structure and, depending on our assumptions on the universe, display varying geometrical properties.



**Friedhelm Wawroschek**  
Urology

Prof. Dr. Friedhelm Wawroschek has been appointed Professor of Urology at the University's Faculty of Medicine and Health Sciences in June 2017. Wawroschek has been Director of the University Clinic for Urology at the Klinikum Oldenburg since 2004, and had administered the professorship since 2013. Since 2009 he has been the director of the University Clinic's Prostate Carcinoma Centre. Before coming to Oldenburg he was a consultant at Augsburg Hospital. He earned his Habilitation with a paper on "Animal Experiments and Clinical Studies on Prostate Lymphoscintigraphy and Sentinel Lymph Node Identification in Prostate Carcinoma" at the Ludwig-Maximilian University of Munich. Born in Cologne, Wawroschek studied Medicine at RWTH Aachen University and was a junior doctor at the Department of Urology at the Krankenhaus Düren from 1991 to 1996. In 1992 he earned his doctorate and received his license as a specialist in Urology in 1995. Wawroschek is an expert in urological surgery and the treatment of tumours with medication. His research focuses on prostate carcinomas. He is also an examiner with the General Medical Council of Lower Saxony.



**Karsten Witt**  
Neurology

Prof. Dr. Karsten Witt has been appointed Professor of Neurology at the Faculty of Medicine and Health Sciences. Witt is also the new Director of the University Clinic for Neurology at the Evangelisches Krankenhaus Oldenburg. Previously he was the senior consultant at the Department of Neurology on the Kiel campus of the University Medical Center Schleswig-Holstein. Witt studied Human Medicine at the Free University of Berlin, where he obtained his doctoral degree with a thesis on the autoimmune disease lupus. He then took up a position as a junior doctor at the University Medical Center Schleswig-Holstein (UKSH). After completing his training as a specialist in neurology he earned his Habilitation with a paper on "Neuropsychological Disorders in Morbus Parkinson" and took up a post as consultant at the UKSH, becoming senior consultant in 2012. Witt has been teaching at the University of Kiel as an adjunct professor since 2010. His research interests are mobility disorders and cognitive skills in neurological diseases. He also investigates cognitive disorders and how they lead to dementia disorders.

**Heike Derwanz**  
Material Culture  
Mediation

Dr. Heike Derwanz has been made Junior Professor of Material Culture Mediation with a focus on transculturalism. Previously she was a deputy professor for Ethnology at the Institute of Ethnology and Cultural Sciences at the University of Bremen. Derwanz studied Cultural Studies, Art History and Philosophy at the University of Bremen and Sienna (Italy). Having won a scholarship for the Research Training Group "Automatisms. Cultural Techniques of Complexity Reduction", she earned her doctorate with a thesis on the careers of street artists on the art and design market. She went on to coordinate the research initiative "Low-Budget-Urbanität. Zur Transformation des Städtischen unter dem Primat des Sparsens" (Low Budget Urbanity. On the Transformation of the Urban Under the Primacy of Austerity) at the HafenCity University Hamburg, conducting research into the sustainable use of textiles. Other focuses of her research are economic ethnology, urban research, the art market, street art and outsider art. Derwanz also runs the DFG-funded project "Textile Minimalists. Pioneering Sustainable Action."

**Fakultät I - Bildungs- und Sozialwissenschaften**

**Bedia Akbas**, Thema: "Von Sprachdefiziten und anderen Mythen - Eine Studie zum (Nicht-)Verbleib von Fachkräften mit Migrationshintergrund in Einrichtungen der Elementarpädagogik." **Pädagogik**

**Bessy Albrecht-Ross**, Thema: "Der Wille zu leben - Eine qualitative Studie zum guten Leben von Menschen mit Dissoziativer Identitätsstörung." **Pädagogik**

**Renke Deckarm**, Thema: "European Commissioners, Their National Principals and the General Interest of the European Union." **Sozialwissenschaften**

**Mohammed El Hachimi**, Thema: "Berufliche Aufstiege von Menschen mit Migrationshintergrund - eine qualitativ-methodische Rekonstruktion ihrer Strategien, Barrieren und Aufstiegsverläufe." **Pädagogik**

**Christian Fritz-Hoffmann**, Thema: "Die Formen des Berührens. Zur Analyse des vermittelt-unmittelbaren Erfahrungsraums sozialer Praxis." **Sozialwissenschaften**

**Karen Geipel**, Thema: "Das werdende Subjekt. Geschlechtsbezogene Positionierungen junger Frauen im Sprechen über Zukunft." **Pädagogik**

**Carl-Conrad Hehmsoth**, Thema: "Vorstellungen von Grundschullehrer\_innen zu Grundlagen der Psychotraumatologie und dem Umgang mit traumatisierten Kindern in der Grundschule." **Sonderpädagogik**

**Gunda Holtmann**, Thema: "Ellen Ammann - Eine intellektuelle Biographie. Eine Untersuchung zur Geschichte der Sozialen Arbeit im Kontext der katholischen Frauenbewegung und des Katholischen Deutschen Frauenbundes zu Beginn des 20. Jahrhunderts." **Pädagogik**

**Sabine Israel**, Thema: "Essays on the political economy of health and living conditions in Europe." **Sozialwissenschaften**

**Birte Klingler**, Thema: "Hilfplangesprache über die Arbeit am Subjekt. Eine anerkennungstheoretische Perspektive auf die Positionierung von Kindern und Jugendlichen in Differenzordnungen." **Pädagogik**

**Michael Jankowski**, Thema: "Candidate Characteristics, Party Positions and Voter Heuristics: Analyzing the Political Supply- and Demand-Side of Politics." **Sozialwissenschaften**

**Carolina Käter**, Thema: "Die Förderung mathematischer Basiskompetenzen zu Beginn der Sekundarstufe I - Evaluation und Implementation eines Trainingsprogramms zur Förderung der mathematischen Basiskompetenzen im inklusiven Setting zu Beginn der Sekundarstufe I." **Sonderpädagogik**

**Steffen Kaiser**, Thema: "Heranwachsen im Spannungsfeld von Schule und Pflagetätigkeiten - Eine empirische Studie zur schulischen Situation von pflegenden Jugendlichen." **Sonderpädagogik**

**Ralf Martenstein**, Thema: "Förderung der Lern- und Behaltensleistung durch Aktivierung des Vorwissens - Eine quantitativ-empirische Feldstudie zur Überprüfung der Effektivität des Advance Organizers im Sachunterricht." **Sonderpädagogik**

**Anne Mertens**, Thema: "Hochschule und Arbeitsmarkt." **Pädagogik**

**Norbert Petzold**, Thema: "Individualisation as a way to exit long-term benefit receipt? The link between long-term beneficiaries appropriations of German minimum income scheme and their life planning." **Sozialwissenschaften**

**Bernadetha Gabriel Rushahu**, Thema: "Guidance and Counselling Services to Students with Disabilities in Higher Learning Institutions in Tanzania: Practices and Implications." **Pädagogik**

**Rudolf Schick**, Thema: "Grundlegung des Bildzeichenunterrichts im Förderschwerpunkt geistige Entwicklung." **Sonderpädagogik**

**Bettina Schmidt**, Thema: "Möglichkeits(t)räume diskriminierungskritischer Bildungsarbeit in Schulen - Erfahrungen und Reflexionen aus einer subjekt-wissenschaftlichen Praxisforschung." **Pädagogik**

**Michael Viertel**, Thema: "Mediatisierte Kindheit: Kontinuität und Wandel des Aufwachsens von Grundschulkindern im Spannungsfeld informeller und formeller Bildungskontexte." **Pädagogik**

**Laura Weiland**, Thema: "Kooperative Unterrichtsreflexion im Lehramtsstudium - eine Interventionsstudie." **Sonderpädagogik**

**Xuping Ye**, Thema: "Eine vergleichende Untersuchung zum Qualitätsverständnis von Unterricht in China und Deutschland." **Pädagogik**

**Katharina Zimmermann**, Thema: "The Europeanisation By Cohesion policy - The European Social Fund in local labour market policies." **Sozialwissenschaften**

**Fakultät II - Informatik, Wirtschafts- und Rechtswissenschaften**

**Mohamed Abdelaal**, Thema: "Enabling Energy-Efficient Wireless Sensing with Improved Service Quality." **Informatik**

**Nazime Assly**, Thema: "Vertrauensbruch als Kündigungsvoraussetzung im deutschen und türkischen Arbeitsrecht am Beispiel der Bagatellkündigung." **Rechtswissenschaften**

**Abhishek Awasthi**, Thema: "Optimization of NP-hard Scheduling Problems by Developing Timing Algorithms and Parallelization." **Informatik**

**Lama Balloul**, Thema: "Interface Lifecycle Management on Enterprise Landscape Level." **Informatik**

**Sebastian Beer**, Thema: "Dynamic Coalition Formation in Electricity Markets." **Informatik**

**Alexander Bergfink**, Thema: "Videoüberwachung im ÖPNV." **Rechtswissenschaften**

**Linda Bergset**, Thema: "Challenges in Green Start-up Finance." **Betriebswirtschaftslehre**

**Philipp Biermann**, Thema: "Using Subjective Well-Being Data for Energy Policy Analysis." **Volkswirtschaftslehre**

**Michael Blaich**, Thema: "Path Planning and Collision Avoidance for Safe Autonomous Vessel Navigation in Dynamic Environments." **Informatik**

**Dirk Brunberg**, Thema: "Zur Wirkung von Sentiment in der Kapitalmarktkommunikation auf Finanzanalysten." **Betriebswirtschaftslehre**

**Frerich Buchholz**, Thema: "Essays on the Effects of Corporate Governance and CEO Narcissism on Firm Performance and Accounting Choices." **Betriebswirtschaftslehre**

**Felix Canitz**, Thema: "Corporate Social Responsibility and Financial Reporting - An Empirical Analysis with Emphasis on the Effects of Sustainability in Accounting." **Betriebswirtschaftslehre**

**Christian Denker**, Thema: "Assessing the Spatio-Temporal Fitness of Information Supply and Demand on Ship Bridges." **Informatik**

**Dennis Dexheimer**, Thema: "Führung und Fehlverhalten. Wirkungen, Einflussfaktoren und Interventionsmöglichkeiten." **Betriebswirtschaftslehre**

**Petra Dühnaupt**, Thema: "Financialization and Income Distribution - Empirical Evidence from OECD Countries." **Volkswirtschaftslehre**

**Reef Janes Eilers**, Thema: "Abstraction of Aging Models for High Level Degradation Prediction." **Informatik**

**Björn Engelmann**, Thema: "Techniques for the Verification of Dynamically Typed Programs." **Informatik**

**Sabrina Erkeling**, Thema: "Die rechtliche Zulässigkeit des Verbots des Handels mit virtuellen Gegenständen und Avataren durch die Betreiber von Online-Games." **Rechtswissenschaften**

**Maher Fakhri**, Thema: "State-Based Real-Time Analysis of Synchronous Data-flow (SDF) Applications on MPSoCs with Shared Communication Resources." **Informatik**

**Erik Flick**, Thema: "Proving correctness of graph programs relative to recursively nested conditions." **Informatik**

**Akem Noela Forkusam**, Thema: "Transnational Microfinance and Mission Drift: Evidence from Sub Saharan Africa." **Volkswirtschaftslehre**

**Jutta Fortmann**, Thema: "Wrist-Worn Light-Based Smart Digital Jewellery." **Informatik**

**Yang Gao**, Thema: "Verification of Stochastic Systems by Stochastic Satisfiability Modulo theories with Continuous Domain (CSSMT)." **Informatik**

**Birthe Gebhardt**, Thema: "Ein Analyse-Framework für zeitabhängige reaktive Ablaufplanung." **Informatik**

**Volker Gollücke**, Thema: "Bewertung von Simulationszuständen für eine gezielte Analyse risikoreicher Systeme." **Informatik**

**Christoph Gran**, Thema: "Perspektiven einer Wirtschaft ohne Wachstum. Adaption des kanadischen Modells LowGrow an die deutsche Volkswirtschaft." **Betriebswirtschaftslehre**

**Saskia Greiner**, Thema: "Risikointegriertes Prozess Engineering am Beispiel Offshore Windpark." **Informatik**

**Justin Philipp Heineremann**, Thema: "Wind Power Prediction with Machine Learning Ensembles." **Informatik**

**Sven Hildebrandt**, Thema: "Werbeerfolg von 2D- und 3D-Kinowerbung. Ein vergleichendes Laborexperiment am Beispiel des Spots 'Eco Break' der Volkswagen AG." **Betriebswirtschaftslehre**

**Lars Hochmann**, Thema: "Die Aufhebung der Leblösigkeit. Eine praxis- und naturtheoretische Dekonstruktion des Unternehmerischen." **Betriebswirtschaftslehre**

**Sascha Hornauer**, Thema: "Maritime Trajectory Generation for n-Vessel Collision Avoidance." **Informatik**

**Haoshen Hu**, Thema: "Essays on the Information Content and Spillover Effects of Credit Ratings." **Betriebswirtschaftslehre**

**Stefan Janacek**, Thema: "Identifikation von Freiheitsgraden und Wechselwirkungen in Rechenzentren unter Betrachtung elektrischer und thermischer Energie." **Informatik**

**Mirco Josefiok**, Thema: "MedRec - Entwicklung eines Cockpits für die Ausbildung in der Differenzialdiagnostik." **Informatik**

**Oday Jubran**, Thema: "Recurrence in Self-Stabilization - Theory, Verification, and Application." **Informatik**

**Leonhard Kähler**, Thema: "Environmental Agreements - Strategic Complements and Transnational Cooperation." **Volkswirtschaftslehre**

**Saifullah Khan**, Thema: "Recurrence in Self-Stabilization - Theory, Verification, and Application." **Informatik**

**Daniel Lückehe**, Thema: "Geometry-Predicting Communications Protocols for Car2X Applications." **Informatik**

**Judith Neugebauer**, Thema: "Abstract Flexibility Description for Virtual Power Plan Scheduling." **Informatik**

**Michael Neumann**, Thema: "Wie Start-ups scheitern. Betrachtung der Ursachen und Verläufe des Scheiterns junger Unternehmen aus einer attributionstheoretischen Perspektive." **Betriebswirtschaftslehre**

**Christian Neureiter**, Thema: "A Domain-Specific Model Driven Engineering Approach for Systems Engineering in the Smart Grid." **Informatik**

**Markus Oertel**, Thema: "A Linear Scaling Change Impact Analysis Based on a Formal Safety Model for Automotive Embedded System." **Informatik**

**Suren Pakhchanyan**, Thema: "Essays in operational risk and credit risk in financial institutions." **Betriebswirtschaftslehre**

**Kathrin Pappmeyer**, Thema: "Work-Life-Balance im Kontext von mitarbeiterunterstützenden Dienstleistungen." **Betriebswirtschaftslehre**

**Thomas Pieper**, Thema: "Organisationales und Nachhaltiges Lernen in der Wasserversorgungswirtschaft."

**Betriebswirtschaftslehre**

**Christina Pötzsch**, Thema: "The Economics and Econometrics of Trade-Related Technology Diffusion."

**Volkswirtschaftslehre**

**Serge Runge**, Thema: "Energiewirtschaftlich optimierende Batterieeinsatzplanung in geschlossenen Transportsystemen mit Batteriewechseln."

**Informatik**

**Johanna Schmidt-Bens**, Thema: "Auftragsdatenverarbeitung und globaler Datenschutz mit Fokus USA."

**Rechtswissenschaften**

**Charlotte Schuster**, Thema: "Managementmyopie - Eine empirische Studie zum Investitionsverhalten gründer- und managergeführter US-Unternehmen."

**Betriebswirtschaftslehre**

**Sören Schweigert**, Thema: "Simulative Überprüfung von Sensordatenverarbeitungssystemen."

**Informatik**

**Cornelius Steinbrink**, Thema: "A Non-Intrusive Uncertainty Quantification System for Modular Smart Grid Co-Simulation."

**Informatik**

**Simon Thomas**, Thema: "Die Positionierung von Markenallianzen in Szenen als Option der strategischen Markenführung."

**Betriebswirtschaftslehre**

**Janko Timmermann**, Thema: "Development of a User-adaptive Mobile System to Support Running Training for Beginners."

**Informatik**

**Marie Uebersalz**, Thema: "Rechtsprobleme bei der Förderung der Hochschultätigkeiten durch Leistungen Privater vor dem Hintergrund der Korruptionsprävention."

**Rechtswissenschaften**

**Daniel Vinke**, Thema: "Verfall von strategischen Wettbewerbsvorteilen auf internetbasierten Netzwerkmärkten."

**Betriebswirtschaftslehre**

**Lars Weber**, Thema: "Diver Modeling and Simulation of Lane Change Situations."

**Informatik**

**Björn Wolff**, Thema: "Support Vector Regression for Solar Power Prediction."

**Informatik**

**Sören Zimmermann**, Thema: "Dedicated Robotic Handling and Processing at the Submicrometer Scale: Feasibility Studies."

**Informatik**

### Fakultät III – Sprach- und Kulturwissenschaften

**Rami Chahin**, Thema: "Towards a Spectral Microtonal Composing: A Brigade between Arabic and Western Music"

**Musik**

**Dobrinka Genevska-Hanke**, Thema: "Subject realization in Bulgarian, Overt and Null subjects in Bulgarian-German Interlanguage."

**Anglistik**

**Marion Godau**, Thema: "Formgebung - Gestaltung - Industrial Design. Ein Beitrag zur Genealogie von ‚Design‘ anhand des ‚Gestaltungsdiskurses in der Bundesrepublik Deutschland der 1950er Jahre.'"

**Kunst und Medien**

**Katharina Hupe**, Thema: "Belgische Literatur vor Gericht. Über die Autonomie literarischer Texte in Gerichtsverfahren."

**Niederlandistik**

**Angela Jochmann**, Thema: "The effect of slowed speech on comprehension of German non-canonical sentences in aphasia with and without hearing impairment."

**Niederlandistik**

**Julia Munier**, Thema: "Von Nazi-Vamps und Nazi-Camp. Sexualisierte Deutungsmuster von Nationalsozialismus und italienischem Faschismus als erinnerungskulturelle Praktiken der Subjektivierung."

**Kunst und Medien**

**Lisbeth Suhrcke**, Thema: "Schriftstellerin/Wissenschaftlerin. Marie Lipsius (1837-1927) und ihr publizistisches Werk in der Gründungsphase der Musikwissenschaft. Ein Beitrag zur Wissenschaftsgeschichte."

**Musik**

**Jonas Traudes**, Thema: "Adoration & Observation. Musizierende ‚Wunderkinder‘ in der Öffentlichkeit um 1800."

**Musik**

**Christian Winter**, Thema: "In der Freiheit des freien Schriftstellers: Wolfgang Koeppen im literarischen Feld der Bundesrepublik Deutschland 1951-1996."

**Germanistik**

**Eugen Zentner**, Thema: "Der hybride Autor. Subjektbildung und die Praktik der autofiktionalen Selbstinszenierung in der deutschsprachigen Gegenwartsliteratur."

**Germanistik**

**Hendrikje Ziemann**, Thema: "The processing and comprehension of pronominal elements in Dutch as a second language."

**Niederlandistik**

### Fakultät IV – Human- und Gesellschaftswissenschaften

**Oliver Bruns**, Thema: "Antike Grundlagen der Entstehung moderner Menschenrechte."

**Philosophie**

**Lajos Fodor**, Thema: "Der Griff nach dem Absoluten."

**Philosophie**

**Viktoria Hartermann**, Thema: "Auch dies erkannte ich, dass es von Gottes Hand kommt (Koh 2, 24b) - Die Theologie des Buches Kohelet."

**Ev. Religion/Religionspädagogik**

**Christoph Kienemann**, Thema: "Der koloniale Blick gen Osten - Osteuropa im Diskurs des Deutschen Kaiserreiches von 1871."

**Geschichte**

**Jakob Koscholke**, Thema: "Synapses of amacrine cells and ceramide synthase deficiency in the mouse retina."

**Philosophie**

**Julia Kulbarsch-Wilke**, Thema: "James Bond und der Zeitgeist."

**Geschichte**

**Annika Raapke**, Thema: "The Realm Beyond the Line. European bodies and the perils and possibilities of the eighteenth century French Caribbean."

**Geschichte**

**Marlen Schapschröer**, Thema: "Exploring the Interaction of Physical Exercise Load and Perceptual - Cognitive Skills in (Elite) Athletes."

**Sportwissenschaft**

**Michael Schippers**, Thema: "Reassessing Probabilistic Measures of Coherence."

**Philosophie**

**Veronika Springmann**, Thema: "Gunst und Gewalt. Sport in nationalsozialistischen Konzentrationslagern."

**Sportwissenschaft**

**Christina Steingröver**, Thema: "Relative age effects in sport: An empirical investigation of micro- and macro-level developmental constraints."

**Sportwissenschaft**

**Klaas-Dieter Voß**, Thema: "Das Emdener Religionsgespräch von 1578. Zur Genese des gedruckten Protokolls sowie Beobachtungen zum theologischen Profil der flämischen Mennoniten."

**Ev. Religion/Religionspädagogik**

**Britta Wehen**, Thema: "Macht das (historischen) Sinn? Narrative Strukturen von Schülern vor und nach der Dekonstruktion eines geschichtlichen Spielfilms."

**Geschichte**

**Heinz Wübbena**, Thema: "Entwicklung eines feldtheoretischen Modells gruppenspezifischer Prozesse in Sportspielmannschaften."

**Sportwissenschaft**

### Fakultät V – Mathematik und Naturwissenschaften

**Rahma Suleiman Al-Nadhairi**, Thema: "Numerical modelling of the tidally influenced part of the Elbe River Estuary."

**Meereswissenschaften**

**Mehrnaz Anvari**, Thema: "Disentangling and characterisations of the stochastic behavior of complex time series, wind and solar power."

**Physik**

**Stefanie Arend**, Thema: "Verständnisorientierter Umgang von Mathematikstudierenden mit der  $\epsilon$ - $\delta$ -Definition von Stetigkeit - Perspektiven und Analysen."

**Mathematik**

**David Bastine**, Thema: "Stochastic Analysis and Modeling of Wind Turbine Wakes."

**Physik**

**Melanie Behrens**, Thema: "Controls on rare earth element and neodymium isotope distributions in the West Pacific: local imprint vs. lateral transport."

**Meereswissenschaften**

**Nadine Bernhardt**, Thema: "Analysis of phylogenetic relationship among diploid Triticeae grasses."

**Biologie/Umweltwissenschaften**

**Paul Georg Beyersmann**, Thema: "Ecological Significance and Regulation of Secondary Metabolite Production in Phaeobacter Species."

**Meereswissenschaften**

**Claudio Bierig**, Thema: "Approximation of Central Moments and Probability Density Functions by MLMC with Application to Stochastic Variational Inequalities."

**Mathematik**

**Sara Billerbeck**, Thema: "The pelagic clusters of the Roseobacter group: Global distribution, genome analysis and physiological characterization."

**Meereswissenschaften**

**Pamina Bohn**, Thema: "Kurzzeitige thermische Belastung von Lithium-Ionen Zellen während des Montageprozesses zu Hochvolt-Batteriesystemen."

**Chemie**

**Sven Breider**, Thema: "Genomic and taxonomic analyses of bacteria affiliated with the Leisingera - Phaeobacter cluster."

**Meereswissenschaften**

**Benjamin Burfeind**, Thema: "Zum Verhalten wässriger Aminlösungen in der absorptiven Gasaufbereitung."

**Chemie**

**Michaela Busch**, Thema: "EXTREME EVENTS IN THE MARINE ENVIRONMENT. The role of species-specific traits and adaptive strategies for harmful dinoflagellate bloom formation."

**Meereswissenschaften**

**Heinz Bültner**, Thema: "Electron Transport Through the Solid Electrolyte Interphase in Lithium-Ion Batteries."

**Chemie**

**Miguel Angel Cebrián-Piqueras**, Thema: "Trade-offs and synergies between forage production, species conservation and carbon stocks in temperate coastal wet grasslands."

**Biologie/Umweltwissenschaften**

**Kabritri Chattopadhyay**, Thema: "Optimization of spatial blancing and storage needs for large-scale power system integration of fluctuation solar energy."

**Physik**

**Anton Daitche**, Thema: "Memory Effects in the Motion of Inertial Particles."

**Meereswissenschaften**

**Pratik Ranjan Das**, Thema: "Conducting Polymers as Functional Binders for Lithium Ion Battery Positive Electrodes."

**Chemie**

**Sebastian Decker**, Thema: "Basische Aktivierung von Ethylenoxid und Diketen."

**Chemie**

**Özden Demircioğlu**, Thema: "Investigations of the optical properties of Cu<sub>2</sub>ZnSnSe<sub>4</sub> and detection of the secondary phases in Cu<sub>2</sub>ZnSnSe<sub>4</sub> solar cell absorbers by spectroscopic ellipsometry."

**Physik**

**Timo Dewenter**, Thema: "Analysis and Optimization of Power Grids in Connection with Virtual Synchronous Machines."

**Physik**

**Marvin Dörries**, Thema: "Proteogenomics of environmentally relevant, marine, sulfate-reducing bacteria."

**Meereswissenschaften**

**Marco Dogs**, Thema: "Ecological relevance of secondary metabolite production by marine surface-associated Rhodobacteraceae."

**Meereswissenschaften**

**Saustin Dongmo**, Thema: "Local electrochemical formation and selective detection of reactive oxygen species."

**Chemie**

**Jana-Katharina Dressler**, Thema: "Lernprozesse von Chemielehramtsstudierenden hinsichtlich des Experimentierens im Schulpraktikum."

**Physik**

**Helena Einzmann**, Thema: "Epiphytes in Human-Modified Landscapes."

**Biologie/Umweltwissenschaften**

**Martin Esmann**, Thema: "Probing single metal nanoparticles with a novel adiabatic- nanofocusing scanning near-field optical microscope."

**Physik**

**Hanna Fedderwitz**, Thema: "Preparation and Characterization of Cuprous Oxide Thin Films using Low-Temperature Scanning Tunneling Microscopy."

**Physik**

**Lena Freimuth**, Thema: "Studien zur Synthese von fluoreszierenden Diaminoterephthalsäurederivaten zur Anwendung in den Life Sciences und der Materials Science." **Chemie**

**Henning Fröllje**, Thema: "Rare Earth Element and Neodymium Isotope Tracing of Element Input and Past Ocean Circulation: Study From North and South Pacific Seawater and Sediments." **Meereswissenschaften**

**Andrea Fuchs**, Thema: "Auswirkungen von Klimaveränderungen auf Diversität und Aktivität von Mikroorganismen in Sedimenten." **Meereswissenschaften**

**Sindy Rocío Mojica Gómez**, Thema: "Astrophysical Signatures from Generalized Einstein Equations." **Physik**

**Thomas Greve**, Thema: "Hydrothermale Carbonisierung von Landschaftspflegematerial – Parameteranalyse und Methodenentwicklung in Richtung einer Prozessmodellierung." **Meereswissenschaften**

**Jan grosse Austing**, Thema: "Unitized Bidirectional Vanadium-Air Redox Flow Battery." **Chemie**

**Henning Großekappenberg**, Thema: "Eigenschaften und Reaktionen tertiärer und sekundärer Silylkationen sowie aluminiumbasierter Lewis-Säuren." **Chemie**

**Andrea Gruner**, Thema: "Signatures of bioactivity in petroleum reservoirs." **Meereswissenschaften**

**Nico Grüner**, Thema: "Fitness-based classification of phytoplankton species from the southern North Sea." **Meereswissenschaften**

**Luzie Haase**, Thema: "Kenntnisse, Einstellungen und Bewertungen von Jugendlichen bezüglich chemischer Berufe – Ergebnisse einer Fragebogenstudie in der Sekundarstufe I an allgemein bildenden Schulen." **Chemie**

**Matthias Heinrich**, Thema: "Diagnosebasierte Adaptionen von Mathematikunterricht durch angehende Lehrpersonen im fachbezogenen Schulpraktikum." **Mathematik**

**Iván Herráez Hernández**, Thema: "Numerical Analysis of Wind Turbine Aerodynamics." **Physik**

**Johannes Hoppenau**, Thema: "On the role of information and work in stochastic thermodynamics." **Physik**

**Rebecca Horeis**, Thema: "Nanohybridmaterialien für optoelektronische Anwendungen." **Chemie**

**Annika Janssen-Kaufeld**, Thema: "Biodiversität der benthischen Lebensgemeinschaft des Manganknollengürtels im äquatorialen NE-Pazifik." **Biologie/Umweltwissenschaften**

**René Jarling**, Thema: "Transformations of hydrocarbons in anaerobic bacteria." **Meereswissenschaften**

**Mirjam Kant**, Thema: "Eingrenzung der Schwellenwertkonzentration von 4-Hydroxyacetophenon bei ‚Aromatoleum aromaticum‘ Stamm EbN1." **Meereswissenschaften**

**Saranya Kanukollu**, Thema: "The metabolic potential and the distribution of the Roseobacter group in marine sediments." **Meereswissenschaften**

**Stefan Kapp**, Thema: "Lidar-based Reconstruction of Wind Fields and Application for Wind Turbine Control." **Physik**

**Leena Karrasch**, Thema: "Land management-based approach to assess ecosystem services embedded in participatory adaptive land use planning and assessment." **Biologie/Umweltwissenschaften**

**Alexander Kies**, Thema: "Modelling the Influence of Demand Side Management, Storage and Curtailment on a Highly Renewable European Power System." **Physik**

**Heiko Kollmann**, Thema: "Linear and nonlinear optics of helium-ion milled gold nanoantennas and Fourier-transform spatial modulation spectroscopy." **Physik**

**Sebastian Kofsmehl**, Thema: "Physiologische und subzelluläre Proteomik von Phaeobacter inhibens DSM 17395." **Meereswissenschaften**

**Jan Kühnert**, Thema: "Development of a photovoltaic power prediction system for forecast horizons of several hours." **Physik**

**Florian Loose**, Thema: "Imine in der Koordinationssphäre des Titans – Bindungsmodi und Reaktivität." **Chemie**

**Hannah Loranger**, Thema: "The Regeneration Niche of Trees at the Alpine Treeline – Constraints of Microclimate and the Alpine Grassland Vegetation on Germination and Seedling Establishment." **Biologie/Umweltwissenschaften**

**Lars Lühning**, Thema: "Neue Titan-katalysatoren für Hydroaminierungs- und Hydroaminoalkylierungsreaktionen zur Generierung pharmazeutisch relevanter Strukturmodule." **Chemie**

**Dennis Lutters**, Thema: "Synthese von neuen Silicium(II)-Verbindungen und Studien zu ihrer Reaktivität." **Chemie**

**Vera Mageney**, Thema: "Brassica oleracea var. sabellica L. – phytochemical variability, variety characterization & breeding perspectives." **Biologie/Umweltwissenschaften**

**Anna Rieke Mehrens**, Thema: "Characterization of Mesoscale Offshore Wind Speeds and their Variability." **Physik**

**Andreas Michalik**, Thema: "Star compass and magnetic compass in European Robins Erithacus rubecula." **Biologie/Umweltwissenschaften**

**Peter Michalowski**, Thema: "Entwicklung von Spinell-Dünnschicht-Kathoden für Lithium-Ionen-Batterien und deren Charakterisierung mittels Lock-In-Thermografie." **Physik**

**Nils Neugebohrn**, Thema: "Electronic Transport and Potential Barriers at the MoSe<sub>2</sub> Mo Back Contact in Cu(In,Ga)Se<sub>2</sub> Solar Cells." **Physik**

**Alex Neumüller**, Thema: "Argon and Hydrogen Plasma Treatment of Interfaces in Silicon Heterojunction and Silicon Thin Film Solar Cells." **Physik**

**Thi Thuy Hang Nham**, Thema: "Reactive transport modeling of organic trace compounds in groundwater." **Biologie/Umweltwissenschaften**

**Alexandra Ostmann**, Thema: "Meiofauna in Icelandic Waters – How Environmental Conditions Shape Distribution Patterns, Diversity, and Abundance." **Biologie/Umweltwissenschaften**

**Johannes Pein**, Thema: "The hydrodynamics of the Ems Estuary." **Meereswissenschaften**

**Maximilian Petzold**, Thema: "Land cover versus functional diversity based assessments of ecosystem properties in a heterogeneous landscape." **Biologie/Umweltwissenschaften**

**Simon Pfanztel**, Thema: "Plant evolution and biogeography in wetland ecosystems of the South American Andes." **Biologie/Umweltwissenschaften**

**Martin Pilarski**, Thema: "Heterogeneous Photocatalysis with Transition Metal Modified Layered Titanates for Solar Hydrogen Production." **Chemie**

**Anika Pohlabein**, Thema: "Marine dissolved organic sulfur – Sources, fate, and structural characteristics." **Meereswissenschaften**

**Franziska Preuß**, Thema: "The impact of viruses on the marine deep biosphere." **Meereswissenschaften**

**Siri Rackebandt**, Thema: "Modelling the Population Dynamics of Antarctic krill: The Timing of Reproduction and the Impact of Climate Change." **Meereswissenschaften**

**Crispin Reinhold**, Thema: "Sila- and Germacyclopentadienes: Radicals, Anions, and the New Type of Tetrylene." **Chemie**

**Nico Reinke**, Thema: "Application, Generation and Analysis of Turbulent Flows." **Physik**

**Jörg Robin**, Thema: "Time-Resolved Spectroscopy of Rydberg Electrons at a Gold Nanotip and Calcium Sensor Proteins." **Physik**

**Stanislav Rockel**, Thema: "Experimentelle Untersuchungen des Nachlaufverhaltens und der Dynamik einzelner schwimmender Windenergieanlagen sowie Anlagen im Parkverbund." **Physik**

**Birger Ruddigkeit**, Thema: "Enzym-katalysierte, kinetische Racematspaltung  $\alpha$ -quartärer  $\beta$ -Oxoester." **Chemie**

**Preeseela Satpathy**, Thema: "Influence of lactate in anaerobic digestion and in the Anaerobic Digestion Model No. 1 (ADM1)." **Meereswissenschaften**

**David Schellenberger Costa**, Thema: "Applying the effect-response framework in the tropics: Links between plant functional traits, the abiotic environment, and ecosystem functioning at Mount Kilimanjaro, Tanzania." **Biologie/Umweltwissenschaften**

**Dorothea Scheunemann**, Thema: "Studies on the Limiting Factors in Solar Cells Based on Colloidal CuInS<sub>2</sub> Nanocrystals." **Physik**

**Franz-Josef Schiel**, Thema: "Larvalökologie von Libellen astatischer Gewässer unter temperaten Klimabedingungen. Wie sind die Präimaginalstadien charakteristischer Libellenarten von Temporärgewässern an die besonderen Bedingungen ihres Lebensraumes angepasst?" **Biologie/Umweltwissenschaften**

**Torben Schlüter**, Thema: "Realisierung und Konzipierung von Syntheserouten zur diversitätsorientierten Darstellung diverser N-Heterocyclen durch Kombination von Multikomponentenreaktionen und anschließenden Cyclisierungen." **Chemie**

**Christina Schmidt**, Thema: "The influence of trenches on meiofauna communities in the deep sea with a separate view of the Vema Fracture Zone and a special focus on Harpacticoida (Crustacea, Copepoda)." **Biologie/Umweltwissenschaften**

**Christian Schubert**, Thema: "Study of energy yield influencing properties of Cu(In<sub>x-1</sub>Ga<sub>x</sub>)<sub>2</sub>(Se<sub>1-y</sub>S<sub>y</sub>)<sub>2</sub> solar cells by device simulation." **Physik**

**Patrick Schwager**, Thema: "Investigation of the Oxygen Reduction Reaction at Gas Diffusion Electrodes for Lithium-Oxygen Batteries by Scanning Electrochemical Microscopy." **Chemie**

**Nicole Schwartz**, Thema: "Why are aliens so successful? Explaining the invasion success of Sargassum muticum." **Meereswissenschaften**

**Susanne Schwarze**, Thema: "Behavioral and neuroanatomical studies of magnetoreception in migratory songbirds." **Biologie/Umweltwissenschaften**

**Christopher Seidler**, Thema: "Funktionalisierte poröse Additive für protonenleitende Membranen." **Chemie**

**Volker Steenhoff**, Thema: "Development of Amorphous Germanium Nanoabsorber Solar Cells." **Physik**

**Sonja Steinke**, Thema: "Studying the breeding ecology of Culicoides (Diptera: Ceratopogonidae) with focus on the Obsoletus Group." **Biologie/Umweltwissenschaften**

**Annemieke Strijkstra**, Thema: "Anaerobic degradation of para-alkylated aromatic compounds – a proteogenomic perspective." **Meereswissenschaften**

**Christiane Stroth**, Thema: "Phasenbildung und Phasenübergänge in Cu<sub>2</sub>ZnSnSe<sub>4</sub> – Dünnschichten für die Anwendung in Solarzellen." **Physik**

**Sebastian Ströh**, Thema: "Influence of glutamate receptor ablation in horizontal cells on retinal signaling." **Biologie/Umweltwissenschaften**

**James Taylor**, Thema: "Temporal and Spatial Variability of Epibenthic Megafaunal Communities from the Arctic Deep-Sea LTER Observatory HAUSGARTEN." **Biologie/Umweltwissenschaften**

**Nadine Tchamba Yimga**, Thema: "The role of molecular packing on carrier transport in liquid crystalline dyes." **Physik**

**Kristin Tietje**, Thema: "Neuronal and genetic basis of olfactory imprinting in zebrafish." **Biologie/Umweltwissenschaften**

**Yi-Ting Tsai**, Thema: "CPPI strategies and the problem of long-term guarantees." **Mathematik**

## Doctorates

**Laura Verbeek**, Thema: "Effects of Phytoplankton Diversity on the Stability of Freshwater Ecosystems."  
**Meereswissenschaften**

**Melanie Wallisch**, Thema: "Diaminoterephthalate – Neue Fluoreszenzsonden für Anwendungen in der Biochemie und Biologie."  
**Chemie**

**Stefan Weitemeyer**, Thema: "The Role of Storage for the Large-scale Integration of Fluctuating Renewable Energy Sources in Prospective Power Supply Systems."  
**Physik**

**Sebastian Wilken**, Thema: "Studies on the Generation, Extraction, and Recombination of Charge Carriers in Organic Solar Cells."  
**Physik**

**Thomas Winkler**, Thema: "Auswirkungen eines operativen Risikomanagements auf den Schadenverlauf von Kraftfahrzeug-Flotten."  
**Mathematik**

**Tanja Winter**, Thema: "Modellierung dynamischer Lasten auf Windkraftanlagen unter dem Einfluss turbulenter Anströmung."  
**Physik**

**Julia Witt**, Thema: "Nanopartikelgeprägte Matrizen: Aufbau von Grenzflächen mit hoher Selektivität für funktionalisierte Nanopartikel."  
**Chemie**

**Sarah Witte**, Thema: "Pedogenetic and biogeochemical processes in tidal deposits at the Southern North Sea coast."  
**Biologie/Umweltwissenschaften**

**Maren Zark**, Thema: "The impact of ocean acidification on marine dissolved organic matter."  
**Meereswissenschaften**

**Folker Zutz**, Thema: "Synthese und Charakterisierung von Cu<sub>2</sub>ZnS<sub>4</sub>Nanopartikeln und Untersuchung der Materialphasen an Pulverproben und Pulverpellets."  
**Physik**

### Fakultät VI – Medizin und Gesundheitswissenschaften

**Malte Ahlers**, Thema: "Thermische und nichtthermische Effekte von hochfrequenten elektromagnetischen Feldern der Mobilfunktechnologie auf Lichtantworten von retinalen Ganglienzellen."  
**Biologie/Umweltwissenschaften**

**Frerk Müller-von Aschwege**, Thema: "Konzept eines modellgestützten telemedizinisch-supervidierten Trainings am Beispiel von KHK-Patienten."  
**Informatik**

**Alina Baltus**, Thema: "The role of neuronal oscillations in auditory cortex for auditory temporal resolution in humans."  
**Psychologie**

**Regina Baumgärtel**, Thema: "Techniques for improving speech intelligibility and spatial perception in users of bilateral Cochlear Implants."  
**Physik**

**Derik Behrens**, Thema: "Assessment of auditory function in mice using prepulse inhibition and operant conditioning procedures."  
**Biologie/Umweltwissenschaften**

**Niclas Braun**, Thema: "Neurocognitive aspects and clinical relevance of bodily self-awareness."  
**Psychologie**

**Bianca Brüggemann**, Thema: "Synapses of amacrine cells and ceramide synthase deficiency in the mouse retina."  
**Naturwissenschaften**

**Sarah Janine Bütof**, Thema: "Organizational principles of spontaneously arising functional connectivity in the human brain."  
**Psychologie**

**Ling-Chia Chen**, Thema: "Cortical plasticity in cochlear implant users."  
**Psychologie**

**Lena Ebbers**, Thema: "Aktivitätsabhängige Prozesse im auditorischen System: Untersuchung morphologischer, physiologischer und molekularer Aspekte."  
**Biologie/Umweltwissenschaften**

**Nader El-Sourani**, Thema: "Routine use of contrast swallow after total gastrectomy and esophagectomy: is it justified?"  
**Humanmedizin**

**Georgios Exarchakis**, Thema: "Probabilistic Models for Invariant Representations and Transformations."  
**Physik**

**Stephanie Friepörtner**, Thema: "Intubationslarynx-tubus (iLTS) versus direkte Laryngoskopie (DL) bei Patienten mit simuliertem schwierigem Atemweg."  
**Humanmedizin**

**Helena Greb**, Thema: "Komplexität der Gap Junctions zwischen den Horizontalzellen der Fischretina."  
**Biologie/Umweltwissenschaften**

**Julian Grosse**, Thema: "Audio reproduction in non-optimal acoustical environments."  
**Physik**

**Katrin Hanken**, Thema: "Fatigue in multiple sclerosis – primary causes and treatment."  
**Psychologie**

**Henrike Janßen**, Thema: "Die durch perioperativen Stress erzeugte Zunahme von Plaquevolumen und Vulnerabilität in Apolipoprotein E-defizienten Mäusen ist einer Statintherapie und einer Interleukin-6 Inhibition zugänglich."  
**Humanmedizin**

**Angela Josupeit**, Thema: "Auditory Scene Analysis: Functional models of coding and classification of speech-related information from spatially distributed sound sources."  
**Physik**

**Steffen Kortlang**, Thema: "Characterization and model-based compensation of suprathreshold auditory processing deficits."  
**Physik**

**Ursula Kraneburg**, Thema: "Analyse von Beta-Defensinen im infizierten porzinen Wundheilungsmodell."  
**Humanmedizin**

**Janina Leyk**, Thema: "The role of HDAC6 in neurodegeneration."  
**Biologie/Umweltwissenschaften**

**Bojana Mirkovic**, Thema: "Decoding the attended speaker with electroencephalography: Towards real-life application."  
**Psychologie**

**Niko Moritz**, Thema: "Amplitude Modulation Analysis for Automatic Speech Recognition."  
**Physik**

**Julia Nannt**, Thema: "Age-related changes in multisensory integration mechanisms: A behavioral and event-related potential study."  
**Psychologie**

**Annika Notbohm**, Thema: "The role of Steady-State Visual Evoked Potentials in the study of brain oscillations."  
**Psychologie**

**Dirk Oetting**, Thema: "Loudness compensation for hearing-impaired listeners."  
**Physik**

**Paolo Ranzi**, Thema: "Advances in neuroimaging and pharmacology: an example using nicotine."  
**Psychologie**

**Tina Schlüter**, Thema: "Analysis of gene regulatory networks and their components in the auditory system."  
**Biologie/Umweltwissenschaften**

**Esther Schoenmaker**, Thema: "On the characterization of binaural contributions to speech intelligibility in multitaler situations."  
**Physik**

**Jens Schröder**, Thema: "Spectro-temporal Patterns for Acoustic Event Detection."  
**Physik**

**Maren Stropahl**, Thema: "The association between cross-modal reorganization and audio-visual processing in cochlear implant users."  
**Psychologie**

**Stefan Sulmann**, Thema: "The Guanylate Cyclase-GCAP System – a multi-protein complex in phototransduction."  
**Biologie/Umweltwissenschaften**

**Stephan Töpken**, Thema: "Sound Characteristics of Multi-Tone Sounds – Measurement Concepts and Model Approach."  
**Physik**

**Farina Vocke-Dörries**, Thema: "Fehlfunktion der Guanylatzyklase Aktivität im visuellen System."  
**Biologie/Umweltwissenschaften**

**Christoph Völker**, Thema: "Instrumental and Perceptual Evaluation of Hearing Devices – Methods and Applications."  
**Physik**

## Habilitations

### Fakultät I – Bildungs- und Sozialwissenschaften

**Dr. Annette Lohbeck**, Vortrag: "Schulleistungsstudien im Grundschulbereich." Schrift: "Selbstkonzepte von Grundschulkindern."  
**Pädagogik**

### Fakultät III – Sprach- und Kulturwissenschaften

**Dr. Mareile Oetken**, Vortrag: "Von Tüchtigen und Flüchtigen. Felicitas Hoppes literarische Bearbeitung des Iwein." Schrift: "Wie Bilderbücher erzählen. Analysen multimodaler Strukturen und bimedialen Erzählens im Bilderbuch."  
**Germanistik**

### Fakultät IV – Human- und Gesellschaftswissenschaften

**Priv.-Doz. Dr. Martina Roesner**, Vortrag: "Philosophie zwischen Wissenschaft und Lebensform. Zur Wirkungsgeschichte eines Leitmotivs spätantiker Philosophierens." Schrift: "Ich, Welt und Wissenschaft. Der ego-logische Ansatz der Ersten Philosophie bei Meister Eckhart und Edmund Husserl."  
**Philosophie**

**Priv.-Doz. Dr. Malte Thießen**, Vortrag: "Uneinige Zwillinge: Britisches ‚Town Twinning‘ als Aushandlung des Lokalen." Schrift: "Immunität als Ordnung des Sozialen. Eine Geschichte des Impfens im 19. und 20. Jahrhundert."  
**Geschichte**

### Fakultät VI – Medizin und Gesundheitswissenschaften

**Dr. Helge Bruns**, Vortrag: "Der Chirurg als Forscher. Was macht akademische Chirurgie aus? Schrift: "Experimentelle und klinische Untersuchungen zur Prävention, Diagnostik und Therapie von durch Ischämie/Reperfusion und Chemotherapie verursachten Leberparenchymschäden in Lebertransplantation und Leberresektion."  
**Humanmedizin**