FAU

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Editorial

Dear readers,

Innovation, diversity and passion: Those are the three guiding principles of our FAU, as stated in our mission statement. But what use are guiding principles that are just written down in a strategic document but are of no significance in real life? At FAU, we live these guiding principles every day in all that we do – in research, in teaching and when it comes to sharing the knowledge created at our University with society, whether in partnership with companies, in start-ups or in dialog with people from the region.

This, the second issue of our FAU magazine, underlines all of the above: It shows researchers who tirelessly keep pushing the boundaries of what has been believed to be possible, whether this involves developing an entirely new type of prosthetic or the hunt for neutrinos in perpetual ice. It introduces students who work together to achieve outstanding results for their FAU – like the Formula Student team, whose electric racing car is their pride and joy. It talks about teaching staff who pass on their knowledge with infectious enthusiasm and creativity, for instance the winners of our teaching awards. And it reports back on members of staff with foresight and a talent for getting to the crux of the matter who are dedicated to improving the (research) infrastructure at FAU.

Of particular importance to the success of our FAU are people who are there for their University and who campaign tirelessly for our research location. Read the interview with the chair of our University Council Roland Busch, Siemens CEO and FAU alumnus, to discover the fascination FAU has for him. Follow a conversation between Humboldt professor Michaela Mahlberg and Bavaria's Science Minister Markus Blume to discover what Bavaria needs to thrive as a research location. And find out what Andrea Bréard's plans are as the new Vice President Education of FAU.

As you can see, it is always the people who make a place come to life. Once again this year, we would like to dedicate the following pages to them and their achievements.

I hope you enjoy reading,

Joachim Hornegger
President of FAU

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Spotlight

GERMAN DESIGN AWARD 2025

Cover Photo: Members of High Voltage Motorsports e.V. in their workshop in Erlangen-Tennenlohe.

Innovation

Near enough **to grasp**

Alessandro Del Vecchio develops neuro-orthoses aimed at allowing paralyzed people to grasp objects. Sensors are used to detect the person's intention for movement and act on it using a wearable exoskeleton.

Alessandro Del Vecchio uses the 3-finger grip to check whether the sensors in the armband are measuring the muscle activity correctly. Gloria Kohnle and Yannick Finck are two members of his research team.

Alessandro Del Vecchio remembers well the day he was meant to travel to Rome for the training camp of the Italian elite school for fighter pilots. He came down with a severe infection in his left ear and had to cancel the examination – and abandon his dream. However, the son of a teacher and a businessman who was born in Eboli in the province of Salerno in the south of Italy did not let this setback discourage him. Now a father of two small children himself, he has always been motivated to "make the world a better place than when I found it." Del Vecchio studied Biomechanics and Physiology in Parma, and completed a Master's degree in both subjects. After completing his doctoral thesis and several years as a postdoctoral researcher at the Department of Bioengineering at Imperial College London, he moved to Erlangen.

"To be perfectly honest, I'm glad that I didn't become a Top Gun pilot. I have the best job in the world and I am happy to go to work every day. Maybe my ear infection actually saved my career," says the head of the Neuromuscular Physiology and Neural Interfacing Laboratory (N-squared Lab) at FAU.

Sensors recognize intended movements

Today, Del Vecchio is in charge of a working group with twelve members that focuses on topics including fundamental research into neuroscience. The team is interested in how the brain controls muscles, for example in rapid movements involving joints or for grasping and manipulating objects. According to the 36 year old, his translational approach is based on the fact that "we want to understand the underlying physiological mechanisms, in order for us to be able to transfer our findings to neurotechnological applications such as human-machine interfaces and protheses."

Specifically, the neuroscientist wants to help people who have suffered a spinal injury or who are no longer able to move their hand after suffering from a stroke. "In our experiments, we noticed that there is still some electrical activity in their muscles. That is fantastic, as it means we can circumvent the brain but can still integrate all the calculations of the spinal cord. In the project NeurOne, Del Vecchio's team is working to develop what they call a neuro-orthosis. This involves an electrical sensor that is attached to muscles and can "read" the person's intended movements. Using a 3D printer, the researchers produced extremely thin sensors that register the weak activity of the still functioning motor nerve cell bundles. A brain-computer interface supported by AI decodes the received signals to determine the person's intended movement. Del Vecchio explains the innovative invention developed in his laboratory as follows: "It is the combination of flexible sensors, advanced signal processing and AI algorithms that allow an exact interpretation of muscle activity and intuitive control of the neuro-orthosis."

Glove helps with grasping

In its project GraspAgain, the research group has created a prototype to show what a neuro-orthosis may look like. It is a wearable exoskeleton shaped like a glove. The fingers and the thumb of the hand should move forcibly and independently of each other. "We have just demonstrated this in our latest study. Eight participants whose hands were completely paralyzed were able to open and close their

"I hope that in the next five to ten years all people with paralyzed hands will be able to grasp everyday objects again."

Prof. Dr. Alessandro Del Vecchio

Alessandro Del Vecchio demonstrates the neuro-orthosis developed in the GraspAgain project. It executes a 2-finger pinch without him having to actively make a grasping movement himself. The object in his hands is a fine needle electrode that is implanted in the muscle in order to measure electrical signals.

hands using their own nerve impulses," Del Vecchio reports.
The researchers hope that the neuro-orthosis will allow those affected to carry out more than 90 percent of their everyday tasks independently. "We have already made great progress in neurorehabilitation. And I hope that in the next five to ten years all people with paralyzed hands will be able to grasp everyday objects again," explains Del Vecchio.
The advantage of this innovation: The electrodes and circuit boards are extremely thin and can be printed on conventional textiles or integrated into clothing. Nevertheless, the researcher still believes that there is need for research and development in the area of fine motor skills for moving individual fingers of a paralyzed hand. Above all, better hardware and software is required in order to process the weak electrical nerve signals. "However, those are engineering problems we can find a solution to. I believe in the Latin motto 'sic parvis magna': We can reach our goals if we keep solving small problems. In this way, great things are achieved from small beginnings." ■ **et**

A comparison of Neuralink and neuro-orthoses

The technology used by Neuralink, co-founded in 2016 by Elon Musk, is based on implanting microelectrodes into the brain that record and stimulate neural activity. The system includes a chip that communicates wirelessly with external devices. The method focuses on direct brain-computer communication. In the short term, in order to treat brain diseases, in the long term to boost people's mental abilities. It requires invasive surgery that has the potential for severe risks, including infections, immune reactions by the body and unknown long-term consequences. There are also ethical concerns relating to brain manipulation and data protection. That apart, it is difficult to predict the entire three dimensional dynamics of the human hand in natural movements. Spinal interfaces, on the other hand, integrate all calculations from the brain and the neural circuits in the spinal cord. The activity of the spinal motor neurons that control the muscles can be translated directly into the three dimensional movements of the hand. Neuro-orthoses aim to reinstate patients' ability to move by using external sensors on the skin and implanted electromyographic sensors (fine needle electrodes) in the muscle. The low risk method measures and amplifies the electrical impulses in the muscles to derive neural signals. One possible development in future would be a chip that is implanted directly into the muscle and interprets what the paralyzed person would like to do.

These highly sensitive lattices of electrodes measure the electrical activity of the muscles. They can be attached to skin, worn as a cuff or integrated into textiles.

Making **material speak**

Karl Mandel has received an ERC Consolidator Grant worth two million euros. With the funding, the chemist hopes to develop supraparticles that will give information about the state of materials.

1 Prof. Mandel, what are you currently researching?
We are researching supraparticles. These are small particles of only a few micrometers in size made up of much smaller nano components or molecules. We want to try and make the particles as "intelligent" as possible. One of our aims is for the particles to be able to communicate what happened to them, for instance if they were subjected to a certain temperature, humidity or other stress.

2 Why are you interested in this topic?
Particle synthesis is really exciting, as you can discover highly unusual properties by exploring new combinations of nano or molecular components. I hope that the "communicating particles" will allow materials "to speak", thereby enabling us to transform material into a source of information, thereby raising the topic of "information" to a new level, not only in the digital but also in the material world.

3 Which opportunities does your ERC Consolidator Grant offer?
The ERC gives me the financing to work together with my team over the long term, focusing on one particular topic. That would not be possible in smaller, shorter term projects. A complex topic requires a lot of time and resources, and this is what the ERC Consolidator Grant can give us. ■ **sh**

Prof. Dr. Karl Mandel

studied earth science and materials science in Munich, Salzburg, Ulm and Oxford. He completed his doctoral degree in chemistry in 2013 at JMU Würzburg. From 2014 until 2024 he was the head of the Particle Technology Group at the Fraunhofer Institute of Silicate Research ISC in Würzburg. In 2018, he received 1.8 million euros in funding from the Federal Ministry of Education and Research as part of the NanoMatFutur competition in order to establish a junior research group in the area of material research. In 2020, Mandel was appointed Professor of Inorganic Chemistry at FAU. Since 2024, he has also belonged to the board of directors at the Fraunhofer ISC in Würzburg.

Attack of **the killer cells**

From the very beginning of his career, Andreas Mackensen has focused on how to manipulate the immune system to make it attack cancer cells. He is now also using genetically engineered immune cells to fight autoimmune diseases.

Andreas Mackensen doesn't really believe in miracles. At least he didn't until 2021, when together with Georg Schett, Director of Department of Medicine 3, he was the first to use CAR-T cells to treat a patient with the autoimmune disease lupus erythematosus. In mouse models, the treatment had already appeared to be successful in regulating the hyperactive immune system. "At the beginning, I was skeptical, and later overwhelmed: All disease parameters disappeared, the young woman has now been disease-free for three and a half years," says Mackensen. "It really is a miracle."

The Director of Department of Medicine 5 – Hematology and Oncology carries out research into chimeric antigen receptors, or CAR-T cells for short. They are already used as a standard treatment option for relapses of certain types of cancer of the blood or lymphatic system. T-cells are taken from the patient's own body and genetically engineered to recognize features found on the surface of cancer cells known as antigens and eliminate the cancer cells.

Now that this cell treatment has also proven so successful for severe autoimmune diseases, the immunologists Mackensen and Schett and their team are being inundated with requests. A few months ago, a 15 year old girl with lupus was successfully treated with CAR-T cells. Mackensen: "The ultimate goal of my research has always been to develop treatments that benefit patients." From an early stage, he spoke out in favor of producing CAR-T cells directly at Uniklinikum Erlangen. In 2019, Mackensen and his team had their application approved for the first time by the government of Upper Franconia. Since then, Erlangen is one of the few academic centers in Europe permitted to produce CAR-T cells for clinical applications.

Focus on cancer research

Of course, the researcher is still continuing his research on CAR-T cells for treating cancer, particularly in the area of solid tumors. These are malignant masses of tissue that can originate in any organ and form metastases anywhere in the body. "The challenge here is finding an antigen that is exclusively located on the cancer cells," explains Mackensen. "In addition, solid tumors can encapsulate themselves and try to avoid detection from the immune system." A study funded by the Federal Ministry of Research is currently underway in collaboration with working groups in Münster,

Prof. Dr. Andreas Mackensen

began his clinical training in 1988 at the university hospital of Albert-Ludwigs-Universität Freiburg in the Department of Hematology/Oncology and moved in 1991 to Institut Gustave Roussy, Villejuif/Paris on a scholarship from the DFG. In 1993, he returned to Freiburg and completed his habilitation there in internal medicine in 1998. In 1999, he was appointed full Professor of Cellular Immune Therapy at the Department of Hematology and Oncology at the University of Regensburg. In 2007, he was appointed Chair of Hematology and Oncology at FAU and Director of the Department of Medicine 5 – Hematology and Oncology at Universitätsklinikum Erlangen. Since 2012, Andreas Mackensen has been a member of the supervisory board of Uniklinikum Erlangen and since 2019, a founding director of the Bavarian Cancer Research Center and speaker for Erlangen of CRC transregio TRR221.

Regensburg and Hannover focused on CAR-T cells aimed at targeting tumors predominantly occurring in childhood – sarcomas and neuroblastomas – as well as breast cancer.
The CAR-T cells recognize the antigen GD2 on these tumor cells, and can confidently home in on their target. The researchers have also incorporated a booster by ensuring that the CAR-T cells produce the hormone interleukin 18. "When the CAR-T cells attach to the tumor cells, they are already quite exhausted," Mackensen explains. This is when the hormone is released. It stimulates the CAR-T cells. They get the push they need to attack the tumor cells."

Stem cell transplants for leukemia

As speaker for Erlangen for the collaborative research center (CRC) transregio 221, Andreas Mackensen is also conducting research into making allogeneic stem cell transplantation, the only hope for a cure for certain types of leukemia, safer and more successful. After being treated with chemotherapy or radiation therapy targeting the leukemia but also intended to prepare the patient's immune system for the transplant, patients receive stem cells from a healthy donor. "This is also a type of cellular immunotherapy in which the donor's immune cells have a decisive role to play," explains Mackensen. "In order to cure the disease, the tissue from the donor and the recipient must differ in their characteristics to a certain extent. Scientists discovered that this was the case after realizing that bone marrow transplants between identical twins led to the highest relapse rate for leukemia."
The immune cells from the donor recognize leukemia cells as being foreign and eliminate them. This is known as the graft-versus-leukemia (GvL) effect. On the other side of the coin, however, the donor's immune cells may also attack healthy tissue, with this being known as graft-versus-host disease or GvHD for short.
The CRC hopes to specifically boost the GvL reaction and at the same time control GvHD better using new therapeutic approaches. This is another area where CAR-T cells come into play. In a bid to improve the GvL effect, donor lymphocytes are fitted with a CAR, a chimeric antigen receptor, that allows them to fight leukemia in a more targeted way. ■ **sh**

Rocky path towards CAR-T cell production

Erlangen is one of the few academic centers permitted to produce CAR-T cells in Europe. It took nearly five years until the authorities responsible, the government of Upper Franconia, granted permission in 2019. Andreas Mackensen and his team supporting the head of production PD Dr. Michael Aigner had to meet numerous bureaucratic requirements and set up a laboratory classed as security level S2 with clean rooms before they were permitted to conduct work involving genetic engineering. In addition, qualified staff are required, with approximately a dozen people working in the laboratory. The cells are produced in a closed system (prodigy system), a type of bioreactor, developed by the company Miltenyi Biotec. All clinical studies with CAR-T cells require the permission of the department at the Paul-Ehrlich-Institut responsible for cellular therapies.

Anything other than **bone idle**

Aline Bozec is the speaker of the new Collaborative Research Center/ Transregio 369, "DIONE – Degeneration of Bone due to Inflammation". The CRC investigates why and how inflammatory diseases affect bones.

1 What are you currently researching?
I am currently researching the molecular and cellular mechanisms involved in the biology of bones and rheumatoid arthritis. I am particularly interested in which role immune cells and their interactions with bone cells play in autoimmune diseases. Our aim is to gain an understanding of the underlying processes that lead to bone destruction in diseases such as these.

2 Why are you interested in this topic?
Autoimmune diseases such as rheumatoid arthritis significantly reduce patients' quality of life. If we understand the complicated mechanisms behind the interactions between bones and the immune system, we will be able to develop treatments that prevent the loss of bone mass and improve patient care.

3 What is the aim pursued by CRC Dione?
The CRC combines expertise from immunology, bone biology and clinical research. We hope to gain a comprehensive understanding of the molecular network at various levels: ranging from the systemic level to the micro-environment of the bone to cellular factors regulating the loss of bone mass. This tiered approach should contribute to the development of innovative treatment methods and improve the understanding of complex molecular mechanisms underlying inflammatory loss of bone mass. ■ sh

Prof. Dr. Aline Bozec

completed her doctoral degree in biochemistry at Université Claude Bernard Lyon in 2004. She has been employed at the Department of Medicine 3 – Rheumatology and Immunology in Erlangen since 2012, initially as an assistant professor (Emmy Noether scholarship) for osteoimmunology, and since 2019 as a full professor for experimental immunotherapy. Her working group focuses in particular on the interaction between metabolism, bone homeostasis and inflammation.
The research focus of the Bozec lab is to gain an understanding of the cellular and molecular mechanisms that lead to changes in bone marrow in diseases such as rheumatoid arthritis, osteoporosis and metastatic cancer.

Mission: **Cybercrime**

Most people are familiar with classic forensics from TV thrillers. Felix Freiling is an expert for IT forensics and helps stop criminals in the digital world.

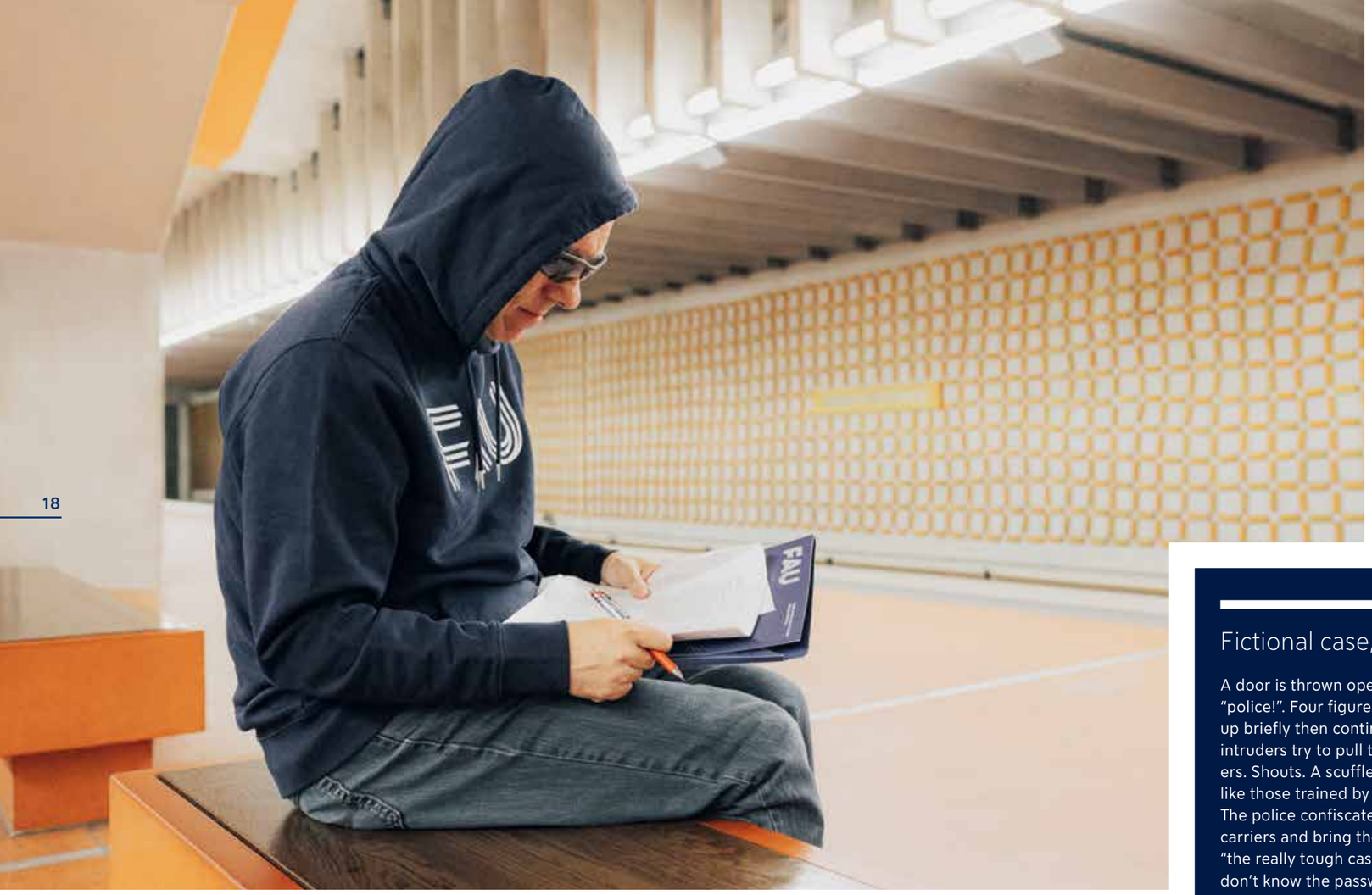
Nowadays, everything we know from the analog world has its counterpart on the internet. Like crime. Illegal arms trading is found there, as is theft, espionage, blackmail or child pornography. FAU professor Felix Freiling investigates how to track down criminals in the digital world.

One of his focal areas is IT forensics. Instead of bloody knives, Felix Freiling analyzes data. Nearly all public prosecutor investigations nowadays involve data taken from hard disks, cellphones or smartwatches. “Our task is to find methods that can document potential crimes in a way that stands up to scrutiny in court,” Freiling explains.

Stands up to scrutiny in court. That is the crux of the matter – and the challenge. “As computer scientists, the first thing we have to understand is what the lawyers actually need from us.” For example, when it comes to investigating whether someone owns child pornography. “It is relatively easy to prove the existence of files – that would constitute the physical elements of the crime. However, this in itself does not have much legal clout. It must be proven that the defendant knew that there were images on their data carrier, in other words that they acted with criminal intent. The public prosecutor then asks us: Is there any indication of how the images got on to the data carrier? Or that the images were accessed, renamed or used in any other way by the user?” Timestamps can be a good indication in this instance. At least three or four of them are attached to each file, giving information about when the files were created or processed.

Helping in genuine detective work

Sometimes the FAU IT forensics team is also called on to assist with particularly tricky cases where the experts at the authorities cannot proceed any further using their traditional methods. In one case, Freiling remembers, they found incriminating preview pictures on a computer, but not the actual image files themselves. The question was: Are these preview images only created if you open the images in the image viewer? Does this count as criminal intent? “In such cases, we reconstruct the setting as an experiment, similar to an on-site inspection in traditional police work. We set up a computer with the same parameters and try it out.”



Felix Freiling teaches IT forensics at FAU.

As a rule, however, IT forensic experts such as Freiling and his colleagues focus on developing methods and tools in order to answer questions the courts may have. For example in the DFG research training group "Cyber crime and forensic computing", headed by Professor Freiling. "In our work, we rely on our understanding of computer systems, of how hardware and software work, and the nature of the various tools available."
In spite of strict data protection laws and even without data preservation: The IT expert from Erlangen is convinced that criminal prosecution in Germany is, in principal, extremely effective. "The authorities have a fairly free reign. It could be made even easier for them, but the danger of abuse would be high." In his opinion, exploiting current capacities to the full and training good staff for this purpose is more important.
That is where Freiling sees his responsibility. "Many of our students are highly motivated and come to us because they explicitly want to pursue IT forensics – Erlangen is the only place in Germany to offer a university-level course," he explains.

Staging a criminal procedure

A trademark of education in IT forensics at FAU is the close collaboration with the School of Law. "There, my colleagues work through a whole criminal procedure with their students: from the initial suspicion, to the investigations, to the trial that is held under realistic conditions in Erlangen district court. "Our IT students accompany the process and act as expert witnesses," reports Freiling, for example in the fictional case of a television chef accused of tax avoidance. In his opinion, this close collaboration with future legal experts creates mutual understanding and a better appreciation of what one side requires and the other side can provide.
However, a little bit of criminal energy on the part of the prospective IT experts is no bad thing. Felix Freiling is sure: "You can only defend well if you are also good at attacking."
A hacker internship is now an integral part of the degree program. "Ten years ago, this was still looked down on by the scientific community." Nowadays, student research projects on attacking techniques are also standard. It goes without saying that these exercises are not an end in themselves, but rather serve the purpose of discussing legal and ethical frameworks.
By the way, the fictional TV chef was convicted and sentenced – not least thanks to Felix Freiling's students. ■ **sk**

"Many of our students are highly motivated and come to us because they explicitly want to pursue IT forensics – Erlangen is the only place in Germany to offer a university-level course."

Prof. Dr. Felix Freiling

Fictional case, genuine adrenaline

A door is thrown open with a bang, someone calls "police!". Four figures huddled over computers look up briefly then continue typing hectically. The intruders try to pull them away from their computers. Shouts. A scuffle.... Usually, IT forensic experts like those trained by Felix Freiling work in the lab. The police confiscate suspicious devices and data carriers and bring them to the IT experts. However, "the really tough cases encrypt their data," Freiling explains. "You cannot access them if you don't know the password. That is why IT investigators have to take the criminals by surprise in critical situations and take over the computers while they are up and running, particularly when it comes to cybercrime." This is the situation students are practicing during the simulation initiated by Freiling's former doctoral candidate Janine Schneider. Students take on the roles of the police and the criminals. But the adrenalin is real. The question is, what do I do first? "One wrong press of the button, then the computer crashes and all evidence is lost."

Got you! Realistic crime scenes in the cybercrime seminar.

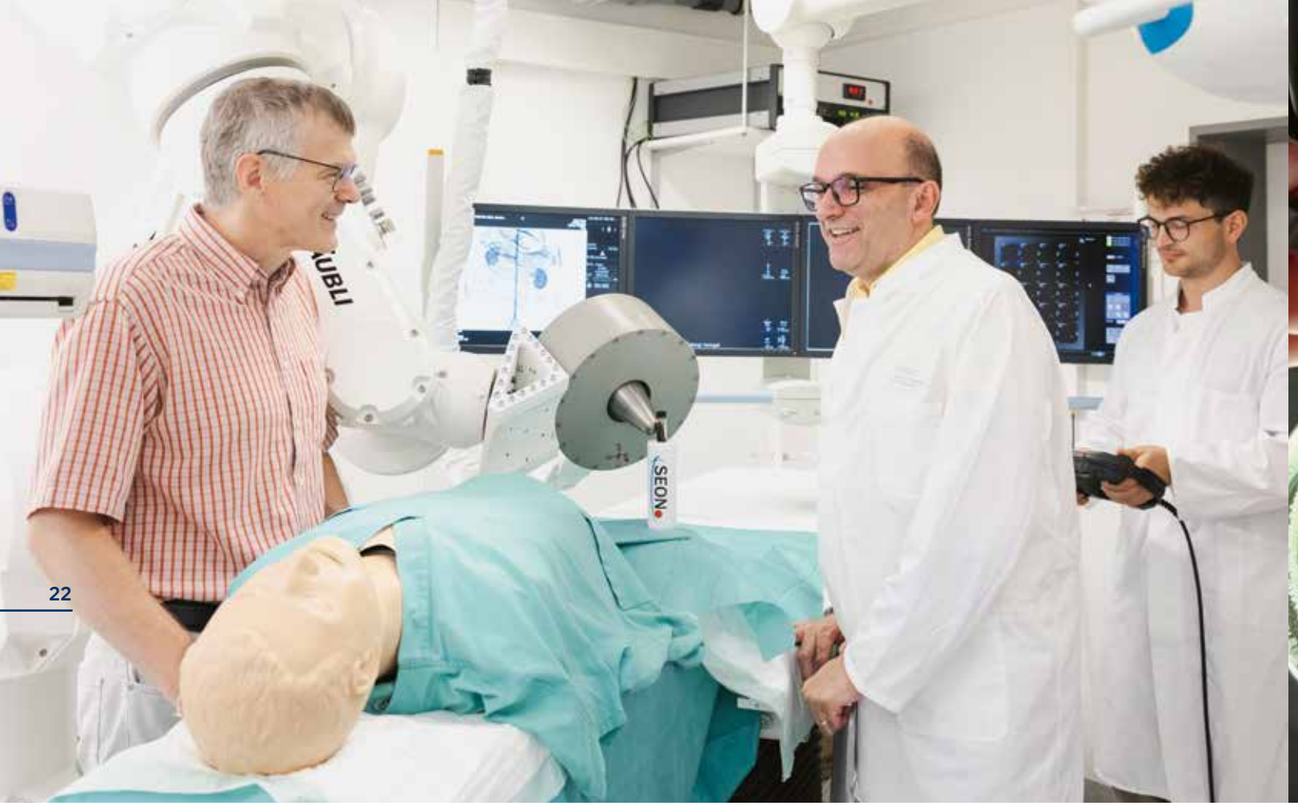
Molecular communications

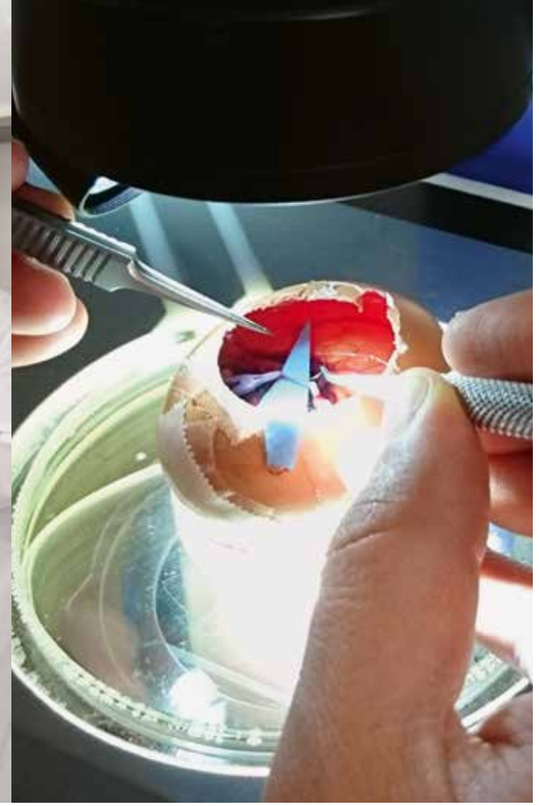
Nature uses messenger substances to transfer information. Engineer Robert Schober and a number of research groups are investigating from a number of different perspectives how this can be put to good use for medical treatments and in engineering.

In modern communications engineering or for example in medical diagnosis using computer and magnetic resonance tomography, information is generally transferred using electromagnetic waves. “Electromagnetic waves, however, rapidly reach their limits in the tissue of humans and animals,” explains Robert Schober. “We would like to overcome these barriers using biological signaling pathways.” The engineer is holder of the Chair of Digital Communications at FAU and speaker of the research training group “Synthetic molecular communications across different scales” (SyMoCADS). This project funded by the German Research Foundation (DFG) intends to expand technical transmission of information into living organisms based on the considerably smarter methods that evolution has developed over the course of millions of years: “In biology, information is often transferred via molecules,” Schober explains. “Following this model, we would like to use biological mechanisms, hormones and pheromones, signaling molecules and odorants for purposes such as fighting cancer more effectively.”

Hens’ eggs for tumor research

Cancer research and the extremely difficult treatment of these insidious diseases clearly indicates how important and even life-saving biological communication is. The cause and basis for malignant tumors are cells from the affected person’s own organism. Often, cancer is not detected in time. Surgery can remove a significant part, but more often than not it fails to remove all the dangerous tumor cells. Targeting these for elimination is always similar to walking a tight rope: As they function just like normal cells in many areas in the body, measures taken against tumor cells can also easily damage healthy tissue.
One way of avoiding the dilemma between promising cancer treatments and dangerous side effects are measures that are specifically targeted to attack the remaining tumor cells. “This is particularly effective if you understand how the cancer cells communicate with the rest of the organism,” explains Robert Schober. “Until now, research in this area has only been possible using animal testing.” In order to change that, a project from the Federal Ministry of Education and Research (BMBF) set to run





Top: Robert Schober, Christoph Alexiou, Professor of Nanomedicine at Uniklinikum Erlangen, and doctoral candidate Christian Huber (from left to right) experiment with an electromagnet that precisely maneuvers nanoparticles through the organism.

Right: Hen's eggs are used to investigate how cancer drugs spread through blood vessels.

until 2026 is looking into an alternative approach: Together with Silke Härteis and her group from the University of Regensburg and a team from the Deggendorf Institute of Technology, a group at the FAU Chair of Digital Transmission is using hens' eggs to keep cancerous tissue alive in order to be able to examine it in greater detail.

"In this system, it is possible to observe how and in which ways substances reach the tumorous tissue," explains Robert Schober. In the first step, dyes are introduced into the blood vessel system in the hens' eggs, and the researchers plot how they spread. Once these connections are understood, it is easier to design substances that can later find their way independently to a cancer cell in a patient's body, causing as few side-effects as possible.

Directed to the target using magnets

The DFG research training group SyMoCADS is not only focusing on biological communication, however. They also hope that magnetic fields will be able to help direct cancer medicines to the required spot. For this purpose, the active agent is attached to super paramagnetic iron oxide nanoparticles. When this combination is injected into blood vessels, the Section of Experimental Oncology and Nanomedicine (SEON) at Uniklinikum Erlangen can then use a strong magnet attached to a mechanic arm to guide the substance to the cancer tumors. Experiments in animals have already demonstrated that this method works well with tumors located near the surface of the body.

The mechanical engineering laboratory at FAU may play an important role in improving this approach to treatment. That may sound rather surprising at first, but it actually does make sense: In order to fight a tumor as effectively as possible, the magnetic nanoparticles with the active substance must be able to travel through the blood vessels to their target. That is a real challenge in such a complex system with at times tiny capillaries. The SyMoCADS sub-project therefore examines such tumors in detail and then reproduces them in transparent plastic using 3D printers. These models show how the guiding algorithms developed by the Department of Electrical Engineering at FAU during another project can be put to use in practice.

If the tumor is located deeper inside the organism, it is important first of all to determine its exact position before commencing treatment. A SyMoCADS project group from the area of bioprocess engineering is using "vesicles" for this purpose, tiny biovessels that are already used in other areas as mini bioreactors. Thanks to a clever design and fitted out with suitable active substances, these biovessels are not only able to find a tumor, but can also communicate exactly where it is located. Using these vessels, substances for cancer treatment can then be accurately transported to their target before being released exactly where they are required.

Another project at the FAU Chair of Digital Transmission involves calculating the optimal design for these micro biovessels to ensure they work as effectively as possible. "Pooling resources from such different disciplines is an extremely promising approach, not only in cancer research, but also in a wide range of other scientific areas," explains Robert Schober. ■ **rk**

Several minds behind the research

Prof. Dr.-Ing. Robert Schober holds the FAU Chair of Digital Transmission and is speaker of the research training group "Synthetic molecular communications across different scales" (SyMoCADS).

Prof. Dr. Silke Härteis from the Institute for Molecular and Cellular Anatomy at the University of Regensburg is speaker of the BMBF project "Innovative test platform for molecular communication and microsurgical training – fluorescence systems, innovative protheses and technologies".

Dr.-Ing. Maximilian Schäfer from the Chair of Digital Transmission is in charge of the BMBF project for molecular communication at FAU.

Prof. Dr. med. Christoph Alexiou holds the endowed professorship from the Else-Kröner-Fresenius-Stiftung at Uniklinikum Erlangen. There he is in charge of the Section of Experimental Oncology and Nanomedicine (SEON) and is therefore also responsible for the super paramagnetic nanoparticles used for SyMoCADS.

Prof. Dr. rer. nat. Dr. habil. med. Stefan Lyer is FAU Professor of AI guided nanomaterials, is in charge of the Department of Oncology and Imaging at SEON and is responsible for some of the imaging for SyMoCADS.

Prof. Dr.-Ing. Dietmar Drummer holds the Chair of Polymer Technology in the Department of Mechanical Engineering at FAU and is in charge of SyMoCADS project 6, that develops plastic tumor models.

Prof. Dr. rer. nat. Dr. phil. Jens Kirchner is in charge of SyMoCADS project 5, that develops control algorithms used to guide magnetic nanoparticles to take the active substances to their target for fighting cancer. He has just moved from the FAU Institute of Electronics Engineering to the Dortmund University of Applied Sciences and Arts.

Prof. Dr. Kathrin Castiglione holds the FAU Chair of Bioprocess Engineering, is the speaker for SyMoCADS and is in charge of project 1, which develops bioreactors at the micro scale that are capable of carrying active substances to tumors.

Guide rails for research

Five instead of eight – FAU has redefined its key research priorities. Anja Boßerhoff and Georg Schett explain in an interview why the University has taken this step and the process behind it.

FAU has revised its key research priorities. Prof. Dr. Anja Boßerhoff, chair of the FAU Senate, and Prof. Dr. Georg Schett, Vice President Research, played a key role in the process.

Mr Schett, FAU has had five new key research priorities since 2024, it used to be eight. Does this mean FAU is carrying out less research than before?

Schett: Quite the opposite. We are one of the leading research universities in Germany and are searching for the answers to the most pressing issues of our times in a wide range of cooperations. This is exactly what is reflected in these new key research priorities and I am very grateful to Anja Boßerhoff for taking the initiative.

What prompted you to take this step, Ms Boßerhoff?

Boßerhoff: It was due to the Excellence Initiative at the beginning of 2023 where we participated with interdisciplinary clusters which bundled an incredibly wide range of expertise. FAU's Senate asked itself whether FAU, as a university which offers the entire spectrum of academic disciplines, was adequately represented in the previous key research priorities. A greater number of key research priorities doesn't automatically mean that everything is covered, especially because we have a very dynamic research landscape. The Senate's intention was to define interdisciplinary fields of research that incorporate all disciplines and cooperations, also future ones.

This requires a good overview of the research structures at FAU.

Boßerhoff: Correct. None of us knows all of the research being carried out at the University, which is why the CRIS system was very useful. We asked Marcus Walther and Bastian Melsheimer at the FAU Competence Center Research Data and Information to carry out a thorough search and evaluation of the CRIS platform and inform us about which research cooperations FAU currently has. In addition, the Competence Centers, Profile Centers and Research Centers at FAU had already been defined and also had to be reflected in the new key research priorities.

Such as in "Targeting environmental and economic challenges", to name one example...

Schett: This is where it becomes clear that we can only achieve this goal if all faculties work in close collaboration: science, engineering, medicine, economics and social sciences. In addition, it also becomes clear that the key research priorities do not each represent a faculty at FAU, even if there are also five of

The **five key research priorities** at FAU:

Exploring
the principles of nature

Targeting environmental and economic challenges

Understanding norms, cultural practices and social formations

Developing
future technologies

Engineering
transformative healthcare

fau.eu/research-profile

them. It was important to us to ensure that the new research priorities are visionary and inclusive, but detailed enough to include all the content that needs to be covered. I think we have succeeded in doing that.

In contrast to previous wording, the new priorities begin with the gerund form, i.e. "exploring", "targeting", "understanding", "developing" and "engineering". Is there a special reason for this?

Schett: This is not a coincidence and is in line with the development of FAU as a brand. In 2021, we changed our slogan from "Knowledge in motion" to "Moving knowledge". This reflects our desire to emphasize the active nature of research. Knowledge does not "move" by itself; it is the result of the hard work and the passion that researchers invest in order to push their projects forward. We wanted to focus more on this "doing" in our key research priorities.

Boßerhoff: What's interesting is that the verbs have taken on a life of their own and are used by FAU's Marketing department in the singular form in conjunction with the relevant symbol, so "Targeting" and the target symbol. In fact, this is exactly what researchers do: They focus on, explore, understand, develop and devise. We seem to have developed a viable concept, not only in terms of its content, but also in terms of the terminology we have chosen for it.

How does this development process work exactly – the Senate takes a vote and the result is binding for everyone?

Boßerhoff: No, that's not how it works. We discussed everything in great detail in many meetings. The faculties are represented in the Senate and we also presented our concept to the University Governing Board to which all deans at FAU belong. This means our suggestions were communicated to the faculties and departments and we received constructive feedback that was incorporated into the final wording. I would say it was more of a bottom-up than a top-down process.

Which of your original suggestions were included in the final version?

Boßerhoff: There weren't that many changes. The Faculty of Humanities, Social Sciences, and Theology and the Faculty of Business, Economics, and Law suggested adding the term "norms" to "Understanding cultural practices and social formations". And Roland Busch, Chairperson of the University Council, suggested changing "Engineering transformative medicine" to "Engineering transformative healthcare", because health involves more than just medical care. To date, there has not been any feedback from anyone who cannot live with the wording at all.

What does this new focus mean specifically for day to day operations in research at FAU?

Schett: What's important is to remember that new research priorities aren't far-off galaxies drifting somewhere in the ether, but are actually put into practice. And we are doing that because they determine what we do – not only in research, but also in teaching and in our relationships with people and organizations outside the University. They are the guidelines for forming the strategic profile of our University and strengthen the FAU brand. And they are open for all the topics and challenges in research that are yet to come. ■ **mm**

They were the driving force behind the decision to revise the key research priorities: Georg Schett und Anja Boßerhoff.

Taking images with **a grain of salt**

Armin Nagel is developing a new MRI procedure: The biosignature imaging measures the salt content in tissue and can detect changes earlier than is the case to date.

When Armin Nagel looks at MRI images for medical diagnostic purposes, he looks for different details than usually is the case. He does not focus on the structure of pathogenic changes to organs or tissues depicted in cross-sectional images. Instead, the FAU scientist uses the MRI scanner to measure the salt content in tissues. Nagel, who has been Professor of Metabolic and Functional MR Imaging at FAU since 2016, explains, “these ion concentrations often change during the early stages of a disease, even before you can perceive any structural changes.”
Armin Nagel views ion imaging as a promising approach for diagnosing and treating illnesses, and that is his motivation behind adding this new procedure to the standard repertoire of imaging procedures. Together with his team, he

"Ideally, magnetic resonance biosignature imaging will allow changes in the progression of the disease to be detected at an earlier stage and will lead to more effective treatments for diseases."

Prof. Dr. Armin Nagel

is developing new measuring techniques and evaluation routines, as he explains, "we are trying to see whether we can obtain the images we want that will let us quantify the concentration of sodium or potassium." The measuring techniques invented by the team are tested on the MR system, initially with phantoms containing, for example, solutions with defined sodium or potassium concentrations. The next step involves testing the method on healthy people, before further investigations are conducted during clinical studies.

Additional data from biosignature imaging

Together with his colleagues Frederik Laun and Moritz Zaiss, Armin Nagel is pursuing the goal of establishing magnetic resonance biosignature imaging. This cutting-edge technological and clinical research focusing on the creation of different image contrasts in the MRI is hoped to provide additional data and new diagnostic findings. In three projects, the researchers are developing rapid MRI techniques capable of characterizing different tissues and their chemical composition and microstructures. While Armin Nagel concentrates on the sub-project ion imaging, Frederik Laun focuses on diffusion-weighted imaging and MRI susceptibility imaging. Moritz Zaiss conducts research into CEST imaging (see information box for further details).

The technological basis for all three projects is 7 tesla magnetic resonance imaging. "Thanks to its increased spectral resolution and the stronger signal, 7 tesla MRI often provides a greater contrast compared to imaging procedures used to date, allowing changes in tissue to be depicted at an earlier stage," explains Armin Nagel. In the last ten years, the search for clinical applications for 7 tesla MRI has concentrated predominantly on anatomic imaging. Nagel and his colleagues now hope to change that.

The DFG research group "Fast mapping of quantitative and metabolic MRI-fingerprints in ultra-high magnetic field" has received funding of approximately 3.6 million euros from the German Research Foundation to explore this area in greater depth. At FAU, research groups in the area of data science and machine learning led by Katharina Breininger, Florian Knoll and Andreas Maier are working closely together with researchers from Uniklinikum Erlangen. Armin Nagel is the speaker of the DFG research group.

Detect Alzheimer's or breast cancer at an earlier stage

MRI biosignature imaging will be used in several research areas in future: In neurodegenerative diseases such as Parkinson's or Alzheimer's or in chronic diseases such as chronic kidney disease. The procedure has also sparked interest among those working in oncology. It is hoped that biosignature imaging will lay the foundation for being able to assess individual risk for breast cancer more accurately in future. In all three clinical research fields, the three physicists collaborate with the medical specialists Arnd Dörfler, Jürgen Winkler, Anke Dahlmann, Sabine Ohlmeyer and Sebastian Bickelhaupt from Uniklinikum Erlangen.

"Frederik Laun, Moritz Zaiss and I have known each other for a long time already and we worked together at the German Cancer Research Center in Heidelberg before all three of us accepted a professorship at FAU," explains Armin Nagel, who before coming to Erlangen was Professor of Experimental Radiology at Universitätsklinikum Ulm and before that the head of a working group at the German Cancer Research Center in Heidelberg. "At FAU, we got together to brainstorm how to merge our research areas to create as much added value as possible in the field of imaging and its applications for diagnostic purposes."

The potential is huge. "Ideally, magnetic resonance biosignature imaging will allow changes in the progression of the disease to be detected at an earlier stage and will lead to more effective treatments for diseases," emphasizes Armin Nagel. That is also why the topic sparks his passion: "I find using methods from physics to tackle medical issues fascinating, particularly the diverse opportunities offered by being able to capture non-destructive MRI images from inside the human body."

■ **mk**

MRI biosignature imaging

Within the context of the DFG research group, the researchers Armin Nagel, Frederik Laun and Moritz Zaiss are developing rapid MRI techniques aimed at characterizing various types of tissue, their chemical composition and their microstructures. Armin Nagel focuses on ion imaging (see main text). Frederik Laun concentrates on diffusion-weighted imaging (analysis of water molecule mobility and tissue integrity) and MRI susceptibility imaging (changes in magnetic susceptibility indirectly give indications of the spatial distribution of iron, myelin or calcium levels in the brain, which may be altered in neurodegenerative diseases such as Parkinson's. Moritz Zaiss focuses on CEST imaging (chemical exchange saturation transfer). These molecular MRI techniques can depict information about proteins and metabolic products which has proven to be useful especially in relation to neurological issues. All three areas of specialization come under the umbrella of magnetic resonance biosignature imaging.

The **start-up factory**

FAU and ZOLLHOF have good chances of becoming one of the “Startup Factories” in the competition run by the German government. In our interview, Kathrin Möslein and Benjamin Bauer explain their concept and how they plan to make the leap from incubator to ZOHO Factory.

Mr. Bauer, can you tell us a little about the competition?

Bauer: The “Startup Factories” are a national initiative launched by the Federal Ministry for Economic Affairs aimed at establishing start-up hubs linked to universities yet managed in an entrepreneurial way. The competition is offered in addition to the Exist funding line, that has been supporting start-ups from academia for the last 25 years. With the Startup Factories, political stakeholders hope to establish entrepreneurial beacons in Germany, giving Germany a competitive edge over other start-up nations.

Ms. Möslein, as Vice President at FAU, you share responsibility for start-ups. Why is the University taking part in this competition together with ZOLLHOF?

Möslein: The answer is clear: We can and we must encourage more start-ups from academia. If we look at the start-up scene in the Nuremberg Metropolitan Region, there already is an impressive range of start-ups, but there is definitely potential for more. Especially deep-tech start-ups. There are huge opportunities in this area, especially as our FAU is regularly ranked among the most

Mission “ZOHO Factory”: Kathrin Möslein and Benjamin Bauer want to make the Zollhof a start-up factory.

innovative universities in the world. A Startup Factory for the whole of Northern Bavaria with close ties to the university offers enormous potential for the whole innovation ecosystem.

What exactly do you mean by an ecosystem in this context?

Möslein: We are all familiar with ecosystems in nature. A coral reef or your garden at home may spring to mind. Innovation ecosystems in which academia, the economy, society and politics work hand in hand to drive innovation follow the same concept. Such ecosystems are already extremely successful in Bavaria. Our region is known as the patent metropolis of Europe, and is well known for successful innovation ranging from inventions to world market leaders. The fact that people often think of clever minds fom Franconia in the context of innovation is not down to individual politicians, managers or researchers, but rather the interaction between many different team players. In this system, FAU acts as a driver of innovation. It is the source of great research results, it creates an innovation-friendly environment and takes the interests of many different stakeholders into account. In other words: FAU is great, but what makes it especially great is its cooperation with its partners.

From over four hundred prospective candidates, 15 applications successfully made it past the second last obstacle in the competition. FAU and ZOLLHOF included, the only finalists from Bavaria. How did you convince the jury?

Bauer: First of all, our reputation probably played a role. ZOLLHOF does not only exist on paper, it has been working very successfully as a start-up incubator for six years now. In this time, we have successfully accompanied more than one hundred start-ups, of which approximately 70 percent are still on the market – throughout Germany the quota is considerably less than 20 percent. Women are involved in half of all our start-ups, that is also a unique feature. The Financial Times currently ranks us as number four of the most successful German start-up hubs. Last but not least, it is certainly also due to the private capital that we have been able to acquire in the last six months. However, we have of course also scored with our concept for the competition that we drafted together at FAU.

Could you explain your concept to us?

Möslein: The concept covers three pillars: Firstly, we would like to support many more academics to become entrepreneurs. One way to do so involves awarding scholarships. Secondly, we want to give start-up teams the opportunity to use the technical structure of FAU and its partners for building prototypes. And thirdly, we are striving to establish a sustainable Franconian start-up fund to which successful entrepreneurs from Northern Franconia can contribute.

The German government is prepared to offer ten million euros for your project – provided you provide the same sum yourself as well. How do you intend to do that?

Bauer: We have proactively approached Franconian companies and their owners. And not only those who have been supporting us for years already, but also many with which we are not yet cooperating. Several of them have connections to FAU, either as they are alumni themselves or their children are studying here. I think we have brought good arguments and made a convincing case for the advantages of a financial contribution. We are currently aware of momentum gathering in the region – things are on the move.

What are the advantages of making a contribution?

Möslein: That takes me back to the ecosystem. Competition in academia and the economy does not mean that one takes something away from the other. Quite the contrary: This sparks innovations that benefit everyone. Why should start-ups not offer products or services from which established companies can benefit? And even “failure” can be an opportunity, although that is not a very widespread mindset in Germany. People who have received an academic education and obtained experience in entrepreneurship are highly sought after on the labor market, even if their first idea for a start-up may not have gone as successfully as they had hoped.

“We can and we must encourage more start-ups from academia. The potential is enormous.”

Prof. Dr. Kathrin Möslein

What are the plans for the future?

Bauer: We are continuing to campaign for private funds for this important initiative in Bavaria. We are also approaching foundations in the region. We have to present our final concept by February 2025. We are currently working very intensively on that. As the only competitor from Bavaria still left in the running, the initiative is linking institutes of higher education, associations, foundations, companies and innovators for the common goal: Together we want to become the start-up hub for Northern Bavaria.

And if it doesn’t work out?

Bauer: Even then, we will still need all the support we can get! The ZOHO Factory must go ahead, it is the entrepreneurial opportunity for Northern Bavaria. Strength in innovation, collaboration and stamina are the most important ingredients for success. ■ **mm**

Diagnosis without boundaries

MRI scanners have revolutionized the diagnosis of many diseases. Michael Uder, Director of the Institute of Radiology at Uniklinikum Erlangen would like to be able to use the technology in places it is currently not possible, for example in developing countries. In 2023, he was awarded the German Future Prize for his work.

Professor Uder, in conjunction with Siemens Healthineers, you have developed a new MRI scanner. What is the reason behind this new development?

The scanners that are currently available can only really be used in developed countries, and have very high requirements in terms of the buildings and infrastructure required to operate them. We wanted to build a scanner that can be used all over the world.

MRI images become clearer and more detailed the stronger the magnetic field is that is generated. Currently, scanners achieve up to seven tesla, your scanner achieves only 0.55 tesla. Isn't that much too low to produce good images?

It was clear to us that 0.5 tesla is not enough for every case. But we wanted to cover at least 80 to 90 percent of the scans required, so the "bread and butter" diagnoses. We achieved this with a wide range of innovations, including the use of AI. We trained machine learning algorithms with thousands of images and thus trained them to significantly improve the image quality.

One advantage your scanner provides is that it requires very small quantities of helium – only 0.7 liters instead of around 1000 liters.

This is a crucial point. The magnets in MRI scanners must be cooled in order for them to operate. This task is carried out by liquid helium as it is extremely cold. Electricity is required to cool the helium to these low temperatures. In the event of a power failure, the helium evaporates after a short time. It expands extremely and normally has to be released into the atmosphere so that the scanner is not damaged. The manufacturer then sends a truck filled with liquid helium and refills the scanner at a cost of around 50,000 euros. This simply does not work in several places around the world. Just 0.7 liters of liquid helium takes up so little space in its gaseous form that it can still be stored in the MRI scanner. The scanner can liquefy the gas once power is restored and it is ready to use again.

Prof. Dr. Michael Uder

studied Medicine at Universität des Saarlandes, Homburg. The radiologist completed his habilitation in 2002, focusing on the side effects of radiographic contrast agents on the kidneys. From 2003 to 2009, Uder was Professor of Radiology at the Institute of Radiology at Uniklinikum Erlangen, and has been the director of the Institute since 2009. His research focuses on diagnostics of the urogenital system, side effects of contrast agents and the reduction of radiation doses.

It took ten years to develop your scanner. Did you experience any setbacks during this time?

Quite a few. But all the hard work has been worth it, especially due to the fact that conventional MRI scanners can also benefit from these innovations. We recently put a 1.5 tesla scanner into operation that also only requires 0.7 liters of helium. And the AI software has now also been installed on our other MRI scanners.

Are you going to continue to develop the scanner?

We're already doing it. The scanner's successor should enable surgery to be carried out while patients are being scanned. This has not been previously possible due to the strong magnetic fields and the narrow dimensions of the tube. This technology opens up completely new applications for MRI.

■ **fl**

Light in, sound out

When children come to Uniklinikum Erlangen complaining of a sore stomach, the search for the cause can prove to be rather challenging. Funded with an ERC Starting Grant, Ferdinand Knieling is conducting research into a new, minimally invasive diagnostic method based on ultrasound. A flying visit to the Department of Pediatrics and Adolescent Medicine.

When Ferdinand Knieling strolls through the colorful corridors of the Department of Pediatrics and Adolescent Medicine, he often bumps into parents he's known for years. "Hello, how are doing?" the senior pediatric physician asks a young family who has come for a regular check-up appointment. "We're very well, thank you. Our son is really growing and thriving," the mother smiles, pointing to her son who is hopping along happily beside her. "As a pediatrician, you get so much back," the physician states later, and explains, "At Uniklinikum we usually deal with chronic and rare diseases that often persist over a long period of time."
Finding the cause of the diseases is always a challenge and vital for the correct treatment, which is why Knieling has decided to focus on diagnostic research. The fact that he himself is a father of four helps him deal with the children and their parents, who sometimes spend days or weeks at a time in the hospital – at their bedside, in special guest rooms or in the Ronald McDonald house. "The Department of Pediatrics and Adolescent Medicine houses all medical disciplines under one roof: from pediatric surgery and pediatric urology to neonatology, the Pediatric Kidney Center and the rheumatism outpatient clinic, all together between 80 and 100 doctors," Knieling explains. The patients range in age from premature babies to young adults. "If required, we will still treat a 19 year old if she has multiple pre-existing medical conditions from childhood."

Ultrasound replaces endoscopy

Ferdinand Knieling's job involves working on the wards and holding lectures on pediatric medicine for medical students in the Department's own lecture hall. His third area of responsibility and a project that is close to his heart is research into the early detection of gastrointestinal diseases using special diagnostic ultrasound. "It is not always appendicitis when a child comes to us with a sore stomach," Knieling explains. "We also observe chronic intestinal diseases such as Morbus Crohn or ulcerative colitis in very young children." If left untreated, these diseases can trigger inflammation in the whole body and delay growth or the onset of puberty.
Usually, diagnosis requires an invasive gastroscopy or colonoscopy even in young children. However, doctors would prefer to avoid this as far as possible. "It is difficult to carry out an endoscopy on a two year old," explains the

doctor. Even just cleansing the intestines in preparation for the examination by drinking a special liquid can be a torture for the child, so they have to be admitted to the hospital in order to prepare for the endoscopy. That is both time-consuming and costly. Using imaging to make a diagnosis would be less complicated and only minimally invasive.
Ferdinand Knieling enters a room where the lights are dimmed and several ultrasound machines are located. The doctor points to a futuristic looking machine used for the procedure known as multi-spectral optoacoustic tomography (MSOT). MSOT is an innovative method that uses short-wave laser light to generate vibrations in the body. Highly sensitive detectors detect these vibrations and use them to create an image, similarly to standard ultrasound. "Light in, sound out: The different substances in the body such as lipids, hemoglobin or connective tissue absorb the light in different ways and become visible. The intestines become even more visible if the patient is given a harmless contrast dye that doesn't need to be injected and can be swallowed instead," he explains. "Using improved and more specific dyes in future may allow inflammation in the gut to be pinpointed even more accurately. This method would be particularly well suited to children, as the organs are located only a few centimeters below the surface of the skin and any alterations can be spotted well using the laser method."

Preliminary studies with moth larvae

Before the MSOT method can become the standard procedure for pediatric diagnostics, a number of preliminary studies are required. With this aim in mind, Ferdinand Knieling's team is conducting research together with Dr. Anton Windfelder from Uniklinikum Gießen on the larvae of the tobacco hornworm, a moth. The invertebrate is especially suited as a model organism for preclinical studies on chronic inflammatory bowel diseases, as up to 75 percent of the genes that can trigger a disease in humans are shared by these insects. Unlike the case with animal experiments on mice, there is no complicated approval procedure to comply with when it comes to larvae. Other advantages of using larvae rather than rats or mice are they reproduce more rapidly, are less expensive to keep and entail fewer ethical concerns. At the Department of Pediatrics and Adolescent Medicine, the caterpillars are prepared using a special chemical solution until they become transparent. In this way, researchers can then prove that the new dyes have indeed reached their target in the intestines.

Caterpillar as model of the intestines

The physician and his team have received a Starting Grant from the European Research Council amounting to 1.4 million euros in order to continue to develop the MSOT method over the coming five years. FAU is a worldwide pioneer for this diagnostic method. However, many obstacles have to be overcome before it can be used in regular pediatric practice. "The problem is that medical devices are only authorized for use in patients over the age of 18. The law focuses predominantly on patient safety," explains project coordinator Knieling. The MSOT method may only be used routinely on children after preliminary studies have been carried out and ethics committees and authorities have conducted the relevant checks.
For this reason, the Erlangen team of researchers are currently conducting experiments on a type of caterpillar. "We have no other choice, we have to be able to provide precise proof that the method is efficient," says Knieling en route to the laboratory on the third floor in the clinic. The caterpillars are dissected carefully and prepared for the laser ultrasound. The images are then analyzed in a computer room. "We are working with an interdisciplinary team of biologists, engineers and computer scientists." The pediatrician hopes that the minimally invasive ultrasound method will one day become the standard method for small patients, in order to be able to provide them the treatment they need quickly and accurately. ■ **stm**

PD Dr. Dr. Ferdinand Knieling

studied Medicine at the University of Göttingen and FAU, where he also completed his doctoral degree. During his degree, he took part in the Molecular Imaging Program at Stanford University. Since then, he has had a scientific and clinical role at the Department of Pediatrics and Adolescent Medicine at Universitätsklinikum Erlangen and has completed a co-operative degree program as a clinician scientist via the Interdisciplinary Center for Clinical Research in Erlangen. He has been head of his own research group since 2018. He completed his habilitation in 2021, and in 2023, he completed a doctoral degree in optoacoustic imaging methods.

The Renaissance of things

FAU Innovation Prize 24 25

In a complex digitalization project, Udo Andraschke hopes to contribute towards reverting academic collections in Germany to that what they used to be: a meeting point and a place where researchers from all disciplines can share and transfer knowledge.

The heart in the CT is more than 100 years old. The object from FAU's Anatomic Collection is scanned, and then cinematic rendering software transforms the data from the cross-sectional images into photo-realistic 3D images. "We use modern imaging procedures to digitalize selected historical specimens in this way," explains Udo Andraschke. The focus is not only on gaining new insights into organ and tissue structures that have been invisible to date, but also on other details: Which methods were used to prepare the specimens? Have they ever been restored? What might they be able to be tell us about their history?
This is the type of information that Andraschke, who has been the curator of the FAU collections since 2011, hopes to gather about objects from a wide variety of different collections, and make available online, one step at a time. The aim of the complex and long-winded process is to revert the collections that contain a total of one million objects back to what they used to be until well into the 20th century: places for academic research, exchange and knowledge transfer. "For many decades, the collections served as workshops in the various institutes, the objects were used for teaching and research," Andraschke explains. "Thanks to new media, but also changes in approaches, research interests and methods, interest in objects from certain subjects waned and they were often banished to the basement, attic, or wherever space could be found. Some artifacts were just got rid of, or if we were lucky at least passed on to other institutions."

Not only digital doubles

In 2017, FAU launched the project "Objekte im Netz" (Objects on the Net) together with the Germanische Nationalmuseum, focusing initially on six collections: the Collection of Prints and Drawings, the Medical Collection, the Paleontological Collection, the History of School Education Collection, the Pre- and Early History Collection and the Musical Instrument and Media Study Collection. "Before we started with digitalization, we sought intense dialog with experts – from the collections themselves, from the involved disciplines and from Digital Humanities," the curator explains. "We wanted to make a joint decision on which data to collect on which technical basis, and agree on the details of the virtual collection room and who would use it." In the end, a platform was created that not only delivered information about the objects themselves but also gave additional details such as the location where they were found, the material they are made of, their creator and information on related objects.

Moving Knowledge. FAU.

The digitalization project did not start entirely from scratch: In 1996, the FAU Antique Collection was presented online already, on one of FAU's very first websites. "That was a start," says Udo Andraschke, who studied Literary Studies, Philosophy and the History of Medicine in Regensburg and Erlangen. "However, the online presentation was really nothing more than a digital inventory with a photo and a little information about the object." It did make the objects more accessible to a wider public, but mainly to those people who already knew what they were looking for. According to Andraschke, "Presenting objects in this way tends to mean that the very thing that characterized academic collections gets lost: the joy of discovery, the possibility of finding things you weren't looking for, the potential of broadening research horizons."

"Digitalization should offer an opportunity to take a new look at objects."

Udo Andraschke

A question of ethics

In spite of all the potential offered by virtual collections, they also raise questions, for example regarding ethics. That is particularly, but not only, the case with the specimens from the Anatomic Collection. "On the one hand, we are providing fascinating images of unusual objects, but at the same time we also have to define who can access them and what happens to them," Andraschke explains. "For example, it is not in our interests for photos of deformities to be widely available online, where they could be taken in an inappropriate context, especially bearing in mind that our interests should always also be well justified."

Misuse apart, today's understanding of law and ethics may mean that we would have to treat sensitive objects in the collection differently than has been the case in the past, especially when you consider that they also include human specimens. What are our responsibilities vis-à-vis the people who have provided their organs? Would it possibly entail a violation of privacy rights? "Aspects of privacy and copyright law affect many areas and collections," Andraschke explains. "For example, we have to clarify whether we are allowed to post class photos or children's drawings from the History of School Education Collection just like that, even if they are already several decades old."

Not an end in itself

There are approximately 1,200 academic collections in Germany alone, and roughly twenty percent of all stock has been digitalized so far. In the collaborative project "Collections, objects, data skills," or SODa for short, Udo Andraschke will now share his expertise with other institutes of higher education. The joint project involving FAU, Humboldt-Universität Berlin, the Interessengemeinschaft für Semantische Datenverarbeitung (syndicate for semantic data processing) and the Germanisches Nationalmuseum has received nearly three million euros in funding from the German government, with approximately one million allocated to FAU. "At FAU alone, we were able to establish four new positions focusing on the one hand on the ethics of digital objects and legal issues, and on the other on the development of technical infrastructure, 2D and 3D digitalization and using technologies from machine learning," Andraschke explains. Digitalizing objects is not the only way Andraschke hopes to revive and revitalize the collections, however. "I am a passionate organizer of exhibitions," he admits. Together with the School Museum in Nuremberg, Andraschke regularly designs special exhibitions in which objects from FAU's History of School Education Collection play a central role. In 2025, some of the over 100 year old specimens from the Anatomic Collection in the Museum of Medical History from Ingolstadt will be on view. Together with colleagues from the relevant subjects, Andraschke is also planning to exhibit the Antique Collection and parts of the Pre- and Early History Collection in the new lecture hall complex from the Faculty of Humanities, Social Sciences, and Theology to make them available to a wider audience. "We want to show, both in the analog and the digital worlds, that the collections are still very much of relevance today. Digitalization should not be an end in itself, but rather an opportunity to question the real objects from a different angle, to take a new look at them, and to investigate them using other means and methods."
For his work digitalizing the FAU collections, Udo Andraschke has been recognized as "FAU Innovator 2024". ■ **mm**

FAU's collections

- Anatomical Collection
- Antique Collection
- Astronomical Collection
- Botanical Garden and Scented Garden
- Botanical collections
- Ethnological Collection
- Geoscientific collections
- Computer Science Collection
- Mathematical Collection
- Medical Collection
- Medical Moulage Collection
- Musical Instrument Collection
- Pathological Collection
- Pharmacognostic Collection
- History of School Education Collection/ School Museum
- University archive
- Collections at the University Library
- Pre- and Early History Collection
- Zoological Collection

Need for **Speed**

High speeds and precision are the order of the day at High Voltage Motorsports, where students design and build racing cars in their workshop in Tennenlohe.

High Voltage – the first thing that comes to mind at FAU is not the debut album of the Australian rock band AC/DC, although it does have something to do with electricity. Instead, it is the name of the Formula Student association, where FAU students work together to design and build racing cars. Students founded the association in 2007 under the name "High-Octane Motorsports e.V.". Although they focused on combustion engines until 2021, since then they have moved over entirely to electric cars. "Changing our name to 'High-Voltage Motorsports e.V.' was the logical step after we switched over," explains association chair Ferdinand Wurm. "Our decision reflects the changes in the automotive sector as a whole. That apart, only electric vehicles have been permitted to take part in Formula Student Germany since 2024."

Sharing the workload

Designing and building a racing car is a complex process. A lot of factors have to be taken into consideration before a vehicle like the latest version named 'FAUmax rho' can take to the racetracks of the world. "The fun all starts at the end of the racing season in September," explains team leader Paul Burkholz. "We work on designing the vehicle until the turn of the year, and then work on building it until the rollout date in early summer."
In order to work as efficiently as possible, the High Voltage team is split into several smaller sub-teams who take care of the various different aspects. All in all, there are six engineering sub-teams for the various construction groups on the car, consisting of a team leader and their team, such as the "aerodynamics" sub-team led by Ferdinand Wurm in season 2023/24, or the "chassis" sub-team led by Paul Burkholz.

As well as the engineering teams there are also three other sub-teams responsible for the organization of the association and the aspects cost & manufacturing and business plan. In total, approximately 50 to 60 students work together each season, with most staying in the association for two years on average. The students study various degree programs at FAU such as Mechanical Engineering or Electrical Engineering, but also Business Administration or Cultural Geography.

FAU Innovation Award 2024

High Voltage does not develop its cars from scratch each season, rather, they take over successful concepts and construction details from previous models. Nevertheless, the students continue to work on improving their racing cars. They either arrange for the required components to be made by external companies or build them themselves in their own workshop. "Complicated individual parts that have to be lathed or milled are made externally, for example for the chassis," explains Paul Burkholz. "We make other parts like the car body of carbon laminate or the cable harnesses for the electronics ourselves in our workshop."
The association is run entirely by students and is financed via sponsors. While FAU and other parties give High Voltage financial assistance, certain companies sponsor the project with 3D printed components or by providing milling or lathing services or software licenses. "We can also make use of equipment and knowledge at certain university departments, for example in order to run material tests," says Paul Burkholz. When it's time to hit the racetrack in summer, the team has put many months of time and effort into constructing their car and carrying out many test drives.
In recognition of its dedication and commitment to constantly improving their racing cars, High Voltage Motorsports e.V. was awarded the FAU Innovator Award in 2024 in the category "students". ■ **bo**

Formula Student

The Formula Student is available in many different countries, but High Voltage Motorsports e.V. predominantly attends races in Europe. This season, the association decided to attend three races: First of all the Red Bull racetrack in Spielberg, Austria. Several weeks later they went to the Hockenheimring in Germany and then directly from there to the Formula Student Alpe Adria at the Bugatti-Rimac test track near Zagreb in Croatia. There, the cars and the teams competed against each other in various disciplines: acceleration, skid pad, autocross and endurance. The overall score also includes static disciplines such as assessing the concept behind the car and the development process (engineering design), possible marketing strategies (business plan) and an analysis of costs and manufacturing (cost & manufacturing).

More than **a gut feeling**

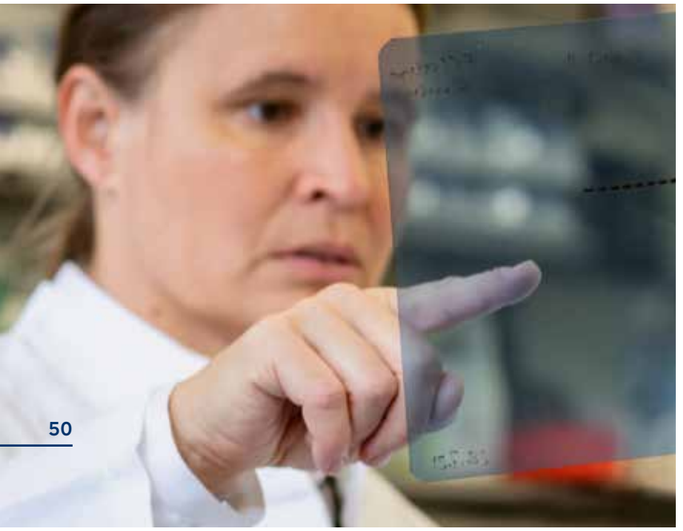
What role does our digestive tract play in triggering Parkinson's, multiple sclerosis or Alzheimer's? Beate Winner is the speaker for a clinical research group exploring this question.

It is approximately six meters long. It is home to huge quantities of bacteria, viruses and fungi, totaling roughly ten times more than the number of cells we have in our body. And it may have a decisive influence on whether we fall ill with Parkinson's, multiple sclerosis or dementia over the course of our lives.
We are talking about the gut. For a long time, medicine only cared about its decisive role in digestion. In recent years, however, it has become the focus of research for a quite different reason. "We have reason to suspect that a number of neurodegenerative diseases, diseases in which the nerve cells in the brain are damaged or destroyed, begin in the gut," Beate Winner explains. "They only spread to the brain in the second step."

Transport pathways to the brain
The Professor of stem cell models for rare neural diseases is the speaker of the clinical research group KFO 5024, which investigates these connections. Prof. Dr. Claudia Günther, Professorship for Gastrointestinal Pathophysiology at FAU, is responsible for scientific coordination. Interdisciplinary tandems of neuroscientists and gastroenterologists work together in the KFO with the aim of unraveling how the digestive tract exerts its influence over the gray cells. There are a number of potential communication channels. It is known that certain bacteria can trigger inflammation in the gut. The messenger substances in the immune system that are released as a result may travel to the brain via the bloodstream and presumably trigger inflammatory reactions in our brain. "Nowadays, it is believed that this process may contribute to the onset of multiple sclerosis," says Winner. For diseases such as Parkinson's, another channel may play a role: the vagus nerve. Clusters of a protein

Prof. Dr. Beate Winner

is a neurologist and neuroscientist, whose research focuses predominantly on neurodegeneration. After completing her specialty training in neurology and specializing in neuro-degenerative diseases, she was awarded a Feodor Lynen Research Fellowship from the Alexander von Humboldt Foundation, and worked in Fred H. Gage's laboratory at Salk Institute, La Jolla, USA. Since 2017, Winner has been the head of the Department of Stem Cell Biology, and she is the speaker of the Center for Rare Diseases Erlangen.



Beate Winner uses western blotting to analyze the biochemical properties of proteins

known as alpha synuclein are found in certain regions of the brain in Parkinson's patients, in particular in those responsible for movement. It forms clumps in nerve cells and damages them. "Interestingly, the same protein is often found in the digestive system of people with chronic inflammatory bowel diseases," explains the FAU scientist. "These patients have a higher risk of developing Parkinson's disease."

It is possible that alpha synuclein is initially created in connection with a chronic inflammatory bowel disease, before moving from there to the brain and triggering Parkinson's disease. The intriguing question is how the protein gets there. The vagus nerve, that links the brain to the digestive tract, is one possible candidate. Nerve fibers do not only transfer electrical impulses, they also act as a type of railway line that the body can use to transport molecules over long distances. "That is, however, only one of the options that are being discussed at the current time," says Winner. It is also possible that the alpha synuclein is packed into little membrane-bound vesicles known as exosomes, that then reach the brain via the bloodstream."

The working groups led by Prof. Dr. Jürgen Winkler (molecular neurology) and Prof. Dr. Stephan Wirtz and Prof. Dr. Raja Atreya (gastroenterology) are currently conducting a clinical study on these questions. The researchers hope to gain a new understanding of the role played by the "dispatching" of the alpha synuclein from the digestive tract into the brain in the triggering of the disease. "We also want to understand better how inflammatory changes in the gut can make nerve cells become ill. Our hope is that in future we may be able to treat this neurodegenerative disease before it damages the brain," Winter emphasizes.

Research into inflammation with stem cells

Nowadays, excellent treatments are already available for treating chronic inflammatory bowel diseases such as Morbus Crohn. However, their success varies from patient to patient. Their success also only becomes apparent after some time has passed. KFO 5024 is therefore also investigating new methods aimed at allowing physicians to determine earlier whether the inflammation in the gut is receding or not.

Parallel to these studies on patients, the scientists are also conducting laboratory experiments with human cell cultures, using cell clusters generated from stem cells. These can be used, for example, to study how the function of the intestinal wall changes with chronic inflammation and which molecules are released as a result. Winner and her working group are able to cultivate such tissue for example from skin cells taken from patients. "We re-program this starting material and create exactly the tissue that we would like to investigate," she explains.

Only relatively little is known about the influence of the digestive tract on the brain at the current time. Winter, who is originally from Straubing, believes that this will change in the coming years. One thing is clear from the findings so far: "Keeping your gut healthy and having a positive influence on the intestinal flora, i.e. the composition of bacteria and fungi in the gut, by eating a diet rich in fiber and probiotics is certainly not a bad idea." ■ **fl**

Testing **strength**

Alexander von Humboldt Professorship 24 25

Benoît Ladoux is a biophysicist and an Alexander von Humboldt Professor at FAU. He investigates how cells react to physical influences, a topic that is of interest, for instance, to cancer research.

Benoît Ladoux has spent most of his career in Paris and Singapore. He is used to big cities, and Erlangen is his first experience of a university town near a forest. "It is fantastic to be able to get out and jog in the beautiful countryside," he says.

The physicist does not focus on plants in his research, however, instead he concentrates exclusively on cells in humans and animals. He investigates how cells deform, react to each other and re-align under certain conditions. "Cells' proportions change, for instance, through physical forces or due to the environment," Ladoux explains. "Cells can become hard, as is seen for example in breast cancer."

At the intersection between various disciplines

Originally, Ladoux wanted to study astrophysics, but that would have involved first and foremost observation. He discarded his original plan, also after having the opportunity to conduct research on molecules while completing his military service in France and soon realizing that the various scientific disciplines are all irrevocably intertwined. "Today, I am conducting research at the intersection of physics, biology, medicine and engineering. FAU is unique in the opportunities it offers for working in such an interdisciplinary setting," the researcher explains.

Ideal working conditions

His place of work is located in the new, cutting-edge Max-Planck-Institut für Physik und Medizin, the interdisciplinary joint research center of FAU, Uniklinikum Erlangen and the Max Planck Institute for the Science of Light (MPL). Here he has the ideal working conditions: The Chair of Biophysics has recourse to an interdisciplinary team of experts and numerous high-tech tools, such as high resolution microscopes. As a Humboldt Professor, Benoît Ladoux hopes to gain new insights into cancer research and to translate this directly into new health care. ■ **stm**

They worked together to develop "Fighting Lupus": Dr. Sandra Jeleazcov and Prof. Dr. Benedikt Morschheuser.

Two against the wolf

FAU Innovation Prize 24 25

Taking a playful approach to raising awareness of serious diseases and opening up new channels for patient communication: the app "Fighting Lupus" developed by Sandra Jeleazcov and Benedikt Morschheuser.

Imagine a girl: young, lively, incredibly talented. Suddenly she becomes ill: LUPUS, a cute name, but a brutal autoimmune disease." These are the opening words in a video about the new "Fighting Lupus" app that immediately grabs your attention. Lupus erythematosus (SLE) is an autoimmune disease that was thought to be incurable - until the first patient succeeded in overcoming the disease after a treatment involving cells from her own body at Uniklinikum Erlangen in 2021. The app takes this real heroic story and transforms it into virtual reality, using a game to raise awareness of possible treatments and disease mechanisms. "We are opening up entirely new channels for patient communication, as the app allows patients to experience what is happening in their body together with the team of doctors treating them," explains Sandra Jeleazcov, who is in charge of knowledge management at Department of Medicine 3 at Uniklinikum Erlangen. Just how innovative the app is has been proved by it winning several awards, including the Deutscher Digital Award and the Deutsche Preis für Onlinekommunikation 2024.

The educational game "INFLAMMANIA"

A wild chase through our body, battles against dangerous intruders and tricky battles against spies and traitors – all that is offered by INFLAMMANIA 1+2, the two serious games that were also developed at FAU. The educational games can be played on the computer, smartphone or tablet and explain processes that take place in our bodies in the case of chronic inflammatory diseases. Allergies, chronic infections and autoimmune diseases also affect many children and adolescents, either directly or in their family. The games are a fun way of helping to recognize symptoms at an early stage and seek help. INFLAMMANIA 2 won third place in the German children's software prize TOMMI 2022 in the category "apps".

The benefits of educational games

Jeleazcov had the idea for the app after speaking to patients and their relatives. "It became clear again and again during conversations that they all had a great need for information, but there was a wide range of different preferred means of communication." She thought about it, remembered the positive experiences they had had with the learning games INFLAMMANIA 1+2 (see box) and contacted Benedikt Morschheuser. The assistant professor of Information Systems at FAU heads the gamification research group at the Institute of Information Systems and is a great fan of game-based learning. "Fun is just another word for learning" is his favorite quote from Raph Koster, a famous game designer. Morschheuser is convinced that digital games have a huge potential for passing on medical knowledge in a motivating, tangible and understandable way. In his research, he works on developing principles to gain a better understanding of how various gaming elements work. Together with doctors, Jeleazcov and Morschheuser developed the innovative communication approach for "Fighting Lupus", and the Cologne-based company "onliveline" implemented it for them.
The app is a new form of consultation or conversation with patients and will be incorporated into treatment in future within the context of a clinical study. Sandra Jeleazcov and Benedikt Morschheuser won the award FAU Innovator 2024 for their project. ■ **ez**

"Hello, **my friend!"**

What is the importance of EELISA for FAU? An interview with Joachim Hornegger, Johanna Hojer and Melanie Viebahn.

Eight countries, ten universities, one alliance – that is the European Engineering Learning Innovation and Science Alliance, or EELISA for short. In May 2024, students, researchers, members of staff and presidents of the involved universities met in Erlangen for the EELISA Grand Meeting. Among those present were FAU President Joachim Hornegger, who was head of the EELISA Governing Board from March until November 2024, Johanna Hojer and Melanie Viebahn from the FAU EELISA team.

What made the biggest impression on you during the EELISA Grand Meeting?

Joachim Hornegger: I was very impressed by the friendly atmosphere. Now our communication has become much more cordial. It's a great feeling when a president writes "Hello, my friend!" That gives the conversation a personal touch and is the basis for the type of collaboration we would like to see at EELISA.
Johanna Hojer: Our joint visit to the Bergkirchweih beer festival definitely contributed to the relaxed atmosphere. These meetings always also involve cultural exchange, and we treated our over 70 international guests from more than 8 countries to a traditional cold platter and a liter of beer at Erlangen's famous beer festival, the Berg.

Johanna Hojer

studied Communication Science and Political Science at Otto-Friedrich-Universität Bamberg and Applied Conflict Management at Friedrich-Schiller-Universität Jena. She completed a placement at Press and Communication at FAU and various other internships in the area of journalism. As a member of staff in Strategic Projects she has been responsible for the internal organization of the EELISA team and communications in EELISA since 2022.

Melanie Viebahn

studied International Management with Engineering at the South Westphalia University of Applied Sciences and Medical Process Management at FAU. After various positions in the areas of medicine and project management, she has been responsible for the topics innovation and entrepreneurship ecosystems at EELISA since 2022, working closely together with the FAU start-up team led by Christoph Heynen. She is also the deputy head of Strategic Projects.

What are FAU's goals for EELISA?

Joachim Hornegger: My goal is that at some point FAU members do not only see themselves as FAU members but also some time in the future as EELISA members. One of our common goals, for example, is for our students to use the opportunities for exchanges. I think we have huge potential in this respect. The aim of the EU is for 50 percent of our students to gain experience abroad as part of their studies. EELISA offers the perfect framework.

Johanna Hojer: It is not only students who have the opportunity to go abroad. Members of staff can also travel, learn from their colleagues abroad and gain valuable experience. No matter whether they work in research or administration. We organize global programs on certain topics especially for research support staff and arrange visits to our partners, for example TalTech in Tallinn in spring 2024.

Melanie Viebahn: When it comes to innovation, we also have several plans in the pipeline for all EELISA members. One example is a series of events with the FAU Ambassador and expert for innovation management John Bessant, which lots of people have already signed up for and is starting next month. In addition, the patent lawyer Andrea Zehetner is giving an online course on intellectual property that is popular not only with FAU researchers but also at our partner universities.

What feedback have you received so far from participants?

Johanna Hojer: The students who have been abroad with EELISA report back to us enthusiastically on their visits to companies on location, or on the way a topic is explored from different perspectives and by experts in the field. We have even received a handwritten thank you letter. A lot of students are very keen to have the opportunity to spend a few days abroad. That is easier to integrate into their degree program than a whole Erasmus semester. And they make contacts and friendships with students from the whole of Europe.

Melanie Viebahn: Of course, that also helps our other major goal: Connecting the individual innovation ecosystems within EELISA to form a common network. At FAU, we are working in many different ways to publicize the opportunities offered by EELISA. We hope that in future even more students, researchers and staff will make the most of the wide range of opportunities. ■ **mw**

EELISA

EELISA is an alliance of ten universities from eight European countries, and FAU has been a member since the outset. The European University Alliance was founded in 2020 with EU funding in order to strengthen collaboration between the universities in teaching, research, studying and innovation and to encourage European solidarity. Members of FAU can benefit from a wide range of opportunities at partner universities in Paris, Pisa, Madrid, Budapest, Bucharest, Zürich and Istanbul, and funding is available for joint activities. Researchers from all disciplines, students and stakeholders from industry and politics can network with each other in EELISA communities to tackle the challenges of a sustainable future together.

eelisa.fau.de

Impulses for **human rights**

Legal expert and sinologist Eva Pils knows Chinese society inside out. As an Alexander von Humboldt Professor, she aims to raise the visibility of human rights research at FAU.

Alexander von Humboldt Professorship 24 25

Eva Pils discovered her fascination for the topic of human rights in China while studying in Heidelberg, Peking and London. Her knowledge of the language, society and legal system in China led her to believe from an early stage that while the country might become more open from an economic point of view, it will not become a constitutional state. After completing her doctoral degree, the legal expert and sinologist worked at the Law Faculty of the Chinese University of Hong Kong and was involved in establishing its Center for Rights and Justice. She often traveled to mainland China, where she met dedicated defenders of human rights. "Seeing how these people uphold their civil courage in spite of putting themselves at risk of persecution gives me hope for possible long-term change," explains Eva Pils.

Encouraging dialog

In 2014 she moved to King's College London, and was appointed as a professor there in 2018. One of her research topics is the phenomenon of transnational repression. "Persecution and suppression is not restricted to within the country itself. For example, critics of the system, including students and researchers from China, are also kept under digital surveillance while they are abroad," she explains. However, that does not mean that China ought to be declared an "enemy". Instead, it is important to recognize the influence it exerts but still to leave channels open for dialog. Eva Pils therefore also analyzes the reaction of liberal democracies towards autocracies and the extent to which they may be complicit with autocratic injustice. At FAU, the Humboldt Professor wants to contribute towards making the interdisciplinary Center for Human Rights Erlangen-Nürnberg (FAU CHREN) a globally active and visible institution for research and teaching in the area of human rights. "For years now, I have been working with colleagues from CHREN. Here at FAU, I appreciate the fact that the legal sciences, social sciences and the humanities work together," says Pils. "I am very pleased to be able to research from now on at a place that lays such a strong focus on human rights." ■ **stm**

The **brain engineer**

Silvia Budday explores how our brain reacts to mechanical forces. Since 2024, her work has been funded by an ERC Starting Grant. The young professor in mechanical engineering does not see being a scientist and being a mother as a contradiction in terms.

It would have been too far by boat. So Silvia Budday and her husband, both enthusiastic sailors and water sports enthusiasts, traveled to Vancouver by plane. Two and a half weeks annual leave is not really anything unusual. However, the engineer spent two weeks of it attending conferences, and was even involved in organizing a symposium. “I am glad that I was able to combine both and that Dominik was able to look after our two year old son during the conferences.”

Silvia Budday holds the Chair of Continuum Mechanics with a focus on Biomechanics created within the context of the High-Tech Agenda Bavaria at FAU. She investigates how our brains react to mechanical influences. “That is important, for instance, during brain surgery,” she explains. “If a tumor has to be removed, forces are automatically exerted on surrounding tissue. Until now, we do not know what strain it can withstand and when it is irreparably damaged.” The MAGERY project led by Budday for which she acquired a Starting Grant in 2023, one of the most prestigious grants from the European Research Council, aims to close this gap in the knowledge.

The practical part of the research is not for the faint-hearted: Silvia Budday and her team of researchers dissect small cubes or cylinders from the brains of organ donors. The tissue samples are compressed or stretched and observed down to the cellular level using a multiphoton microscope. “We use the data gained from our measurements and observations to feed mathematical models and simulations,” explains Budday. The plan is to develop improved virtual and augmented reality applications for neurosurgery, on the one hand for training purposes and on the other as support during surgery. “We lay great store by the feedback we receive from surgeons, as while we hope to protect healthy tissue, we do not want to have red lights flashing all the time during operations and potentially distracting the team.”

Rollercoaster instead of Otto engine

Although her childhood dream was originally to become a zoo director or a journalist, Silvia Budday, who grew up near Stuttgart, decided to study mechanical engineering after leaving school. “During the introductory lecture at the Karlsruhe Institute of Technology, the professor introduced the Otto engine stating that this example of state of the art German engineering makes hearts beat quicker. To be honest, I just wasn’t inspired.” It was a different story when Budday completed an internship at a Munich rollercoaster manufacturer: “I was completely fascinated with all the models and simulations showing how changing the smallest parameters can have a major effect. How much momentum does the carriage need for the next peak? Is it safe in the bend? Which stretches

"Mention is often made of the challenges of juggling a family and an academic career. This has never really crossed my mind. If you are passionate about something, you always manage to organize everything."

Prof. Dr. Silvia Budday

Silvia Budday consulting her working group in the laboratory.

do visitors find exciting? How quickly can the rollercoaster accelerate without putting the passengers at risk?
Silvia Budday wrote her Bachelor's thesis on this topic, and spent one year at the Purdue University in Indiana, USA, on a DAAD scholarship for her Master's degree program that she completed in 2013 as the best in class. It was here that she finally decided to focus on biomechanics. In 2014 she went to Erlangen, to the Chair of Technical Mechanics (LTM) and Paul Steinmann, who supervised her doctoral thesis together with Ellen Kuhl from Stanford University. Ellen Kuhl has also been conducting research at FAU since July 2024 on an ERC Advanced Grant. "In Erlangen, we have established an amazing level of expertise in the area of brain mechanics that is now pooled together in the collaborative research center 'Exploring Brain Mechanics'," explains Budday.

Combining family and career

The professor and soon to be mother of two never really wonders how to juggle her family and her academic career. "If you are passionate about something, you always manage to organize everything," she says. She has a committed childminder she can rely on, and takes her son with her on business trips whenever possible. The late afternoon is reserved for her family, and in the evening she usually sits back down at her computer to concentrate on her research or prepare lectures. "The fact that I can arrange my time flexibly is a huge advantage of an academic career." However, it is still a challenge, as her husband Dominik, who has also completed a doctoral degree in mechanical engineering, has a demanding job as a product manager at Siemens.
Whenever they find the time, they both enjoy sailing at the Dechsendorfer Weiher near their home, only a few kilometers away from Erlangen. "It's true that there are definitely larger lakes, but you shouldn't underestimate the winds we get here," says Silvia Budday. They enjoy taking their boat, or alternatively their SUP, out on the lake, depending on the weather conditions. In Vancouver, they had considered hiring a sailing boat, but the weather was too rough in the end. However, they made a point of doing the obligatory whale watching. Are there any plans for a major journey? "My husband would like to cross the Atlantic," the researcher admits. "But I think we have quite literally missed the boat. An adventure like that is not without risks, and you definitely think twice about it when you have children. But a few days without land in sight, nothing but the sea between us and the horizon, that is something we definitely want to experience at some time." ■ **mm**

Time zones **and nerve cells**

Japan, USA, Germany: No matter in which country he lives and conducts research, the neuroscientist Tomohisa Toda wants to find out what makes the nerve cells in our brain robust.

It all started with the kitchen unit. More accurately, the missing kitchen unit, which left Tomohisa Toda and his wife quite baffled. In Japan, where the neuroscientist grew up, and in the USA, where he has spent several years conducting research and living with his family, the apartments were always fully equipped. “In our first apartment in Germany, we had to wait ten weeks for our fitted kitchen,” remembers the researcher, who has been Professor of Neural Epigenetics at FAU and at the Max-Planck-Zentrum für Physik und Medizin in Erlangen since 2022. “When we arrived, we already had our first child, and could definitely have done with a working kitchen.”
However, the researcher is no stranger to coping with challenges, as is clearly demonstrated by his academic career: In 2011, Toda completed his doctoral degree in neuroscience at the University of Tokyo in his homeland Japan. A little later he moved to the USA as a postdoctoral researcher and worked at the Salk Institute for Biological Studies in San Diego. There he conducted research into epigenetic mechanisms of adult neural stem cells, and whenever he felt stuck in the laboratory, he would take his surfboard out in the lunch break and come back with new ideas. “I do sometimes miss being directly at the beach,” he admits. “But our decision to come to Germany was definitely the right one.” Here, he believes that research and private life is considerably less “competitive” than in the USA or Japan. “In my homeland, raising children is an extremely competitive business. I don’t want to subject my children to that,” he explains. And the scientist in him appreciates the possibility of being able to conduct fundamental research in Germany. “In the USA, you always have to justify your research and provide results as quickly as possible.”

Starting Grant prompts a move to Germany

The suggestion of making a change came from a German colleague and friend in San Diego, who brought the Starting Grant of the European Research Council (ERC) to Toda’s attention. Researchers of any nationality can apply for the prize in the early stages of their academic career. Toda grasped the chance, submitted his documents, received the coveted ERC Starting Grant in 2019, moved to Germany with his family and used the funds to launch a research

"The Long Night of Sciences is a great way of introducing science to children. I really like that about Germany."

Prof. Dr. Tomohisa Toda

group at the Deutsches Zentrum für Neurodegenerative Erkrankungen (DZNE) in Dresden. Together with his team, the neuroscientist, who has unique expertise in neurobiology and epigenetics, decoded several protein-based mechanisms that are responsible for the long-term functioning of nerve cells. His findings were met with great interest at FAU, leading to the researcher moving to Erlangen in 2022 with his wife and in the meantime two young sons. From Dresden to Erlangen, or from Saxony to Bavaria, as his move took place under the framework of the High-Tech Agenda Bavaria. After a lot of looking, the family found a large apartment in Erlangen city center (with a kitchen this time), and have since settled in extremely well. "Our children can walk to the international elementary school and then go from there to sport," Toda explains. He cycles to the university or the Max-Planck-Zentrum für Physik und Medizin, where he focuses on his fundamental research. In 2023, Tomohisa Toda was awarded a Consolidator Grant from the ERC for this research, worth two million euros in funding. Over a funding period of five years, the Toda group's project NEUTIME will investigate the role of ribonucleic acid (RNA) in maintaining brain function and processes involved in the aging of the brain. "Certain RNA molecules in the nerve cells in the brain last a lifetime without being renewed," explains the scientist. "It is therefore crucial that they retain their function and their cell type." How that works, and above all, what makes the neurons robust, is what the team now hopes to find out. "That may prove to be a key to preventing and treating neurodegenerative diseases such as Alzheimer's," Toda hopes. The research group hopes to present their findings next year at the Long Night of Sciences, as Toda is a great fan of the event. "So many people come who are interested in science," he enthuses. "It is a great way of introducing science to children. I really like that about Germany." However, as is hardly surprising, he is less keen on German bureaucracy. He keeps coming up against difficulties with it both personally and as a researcher. He and his wife often end up discussing these issues in their lovely kitchen. ■ **ez**

What makes neurons robust

Tomohisa Toda is a neuroscientist and wants to find out what make neurons robust and what role ribonucleic acid (RNA) plays in maintaining brain function and in processes involved in brain aging. Neurons are the nerve cells in our brain. They send and receive all signals and ensure that our body functions correctly. However, neurons age too and are therefore an important risk factor for neurodegenerative diseases such as Alzheimer's, dementia or Parkinson's. The decisive factor for effective treatment concepts is a basic understanding of the aging process and which key components are involved in cell function. The Toda group is carrying out research into this and has already been able to show that certain RNA molecules exist a whole lifetime in the brain's nerve cells without being renewed. Future research projects should give a deeper insight into the underlying biophysical mechanisms.

Prof. Dr. Tomohisa Toda

completed his doctoral degree in neurosciences at the University of Tokyo in 2011. As a postdoctoral researcher, he moved to the Salk Institute for Biological Studies in San Diego, where he conducted research into the epigenetic mechanisms of adult neural stem cells. In 2019 he was awarded an ERC Starting Grant from the European Research Council (ERC) and set up a research group at the Deutsches Zentrum für Neurodegenerative Erkrankungen e.V. (DZNE) in Dresden.
In 2022, Toda moved to FAU and the Max-Planck-Zentrum für Physik und Medizin (MPZPM) Erlangen under the High-Tech Agenda Bavaria. Just one year later he was awarded a Consolidator Grant from the ERC after his research group was able to prove that certain RNA molecules exist a whole lifetime in the nerve cells in our brain without being renewed. The Toda group hopes to unravel the complex process involved in the aging of the brain and gain a better understanding of neurodegenerative diseases as a result.

Responsibility from the outset

Why FAU is an excellent location for young researchers, and what advice FAU President Joachim Hornegger has for them.

The President's office in the Schloss in Erlangen. Joachim Hornegger has just come out of a marathon of back to back meetings. An interview about early career researchers and new talent is quite relaxing for him. That's not really surprising – it is his favorite topic, after all.

Prof. Hornegger, FAU has set itself the goal of becoming one of the most attractive universities for early career researchers.

What are you doing to reach your goal?

A lot! We encourage young talents from an early stage, while they are still students. FAU firmly believes in research-oriented teaching. That means that we introduce students to the concept of research questions and encourage them to develop their own questions during their Bachelor's degree already, or at the very latest once they start their Master's. From an early stage, they experience the passion that drives researchers, and have opportunities to make their first contacts with other academics and establish a network, making the decision to commit to a doctoral degree less daunting when the time comes.

If they do decide to do a doctoral degree, they have more opportunities at FAU than elsewhere. We are the university with the most DFG-funded research training groups in the whole of Germany. We have also been able to establish a number of doctoral degree programs using funding from the Free State of Bavaria. We are one of three teaching institutions of the Max Planck School of Photonics. And thanks to

our unique innovation ecosystem here in the region we have innumerable doctoral collaborations with partners from industry and society, where talented researchers can complete a doctoral degree on the job, if that is what appeals to them.

"We want FAU to gain the reputation of being the perfect place for early career researchers."

Prof. Dr. Joachim Hornegger

After a doctoral degree, we invest in supporting our postdoctoral researchers with our FAUnext program. The program brings together young researchers from different disciplines and encourages them to share experiences with each other, for example about their career plans and paths. In addition, participants also receive personal career coaching sessions and training courses from excellent specialists in all the different areas you have to master if you want to be a successful early career researcher – from the acquisition of third-party funding to innovative teaching to developing your own style of leadership. At FAU they have the opportunity to assume responsibility from an early stage, for example as the head of a junior research group.

We want FAU to gain the reputation of being the perfect place for early career researchers who are looking for a great location with a strong environment and good connections to academia, industry and politics.

Excellent infrastructure for early career researchers is no guarantee of success on its own, however. Which three pieces of advice would you pass on to young people based on your own experience?

First of all: Always keep an eye on your peer group. What are the others up to, what stage are they at? That is particularly the case for publications. The aim should be to publish first-class publications. Secondly: Early career researchers must take care to include interesting aspects in their CV. For example, I still think that spending time at an international university is extremely important, and I would recommend everyone to spend some time abroad. My third recommendation is to get involved in teaching. Anyone who is aiming for a career in academia needs to be good at more than just research: Holding good lectures and sparking enthusiasm for the topic allows you to attract very good students. These then help increase the performance of your own working group, and the quality of your publications. It is a win-win situation.

What is the point of young people becoming involved in science communication or administration of academic affairs? Many people are of the opinion that it is not worthwhile.

I don't agree. Outreach creates visibility, for the university and for the researcher's own work. Anyone who wants to enter academia today would benefit from learning as early on as possible to explain their own research to the general public. That also helps for funding applications. Believe me: Reviewers are just human too.

As for the administration of academic affairs: Of course, you have to make sure that you have enough time left for research and teaching. But participating in the Faculty Council or an appointment committee can give you valuable insights into the mechanisms of a university and which criteria are taken into consideration when making important decisions. And having a better understanding of this is no bad thing, for example when it comes to your own appointment procedure. Experience like this is also extremely advantageous if you want to move from academia to industry, or to a profession calling for management and project-related skills. It also helps you build up a network within the university, which can be beneficial for future career plans.

Nowadays, many early career researchers become discouraged when they see how strong the competition is and how few positions are available in the system, for example professorships.

I understand. And everyone involved in academia should always have a plan B. We provide our young people with such a good education, they will have opportunities wherever they choose to go. However, it is true that anyone striving after a career in research will have to perform at an extremely high level. In my opinion, anyone who is mobile and is very good at what they do will have excellent prospects. And by "very good" I mean in accordance with very clearly defined criteria for quality. That may be excellent performance regarding publications – publications in good academic journals that are cited regularly remain hard currency in the academic world. Another important criterion is acquiring third-party funding or awards from an early stage. For example, we do our very best to offer early career researchers who gain an ERC Grant, one of the most important research awards in Europe, a long-term perspective at FAU. We don't always manage, but it is at the very top of our list of priorities. ■ **bm**

On the **right track**

Science Minister Markus Blume and linguist Michaela Mahlberg about High-Tech Agenda Bavaria, digital technologies and the role of social media.

With its High-Tech Agenda Bavaria, the Free State of Bavaria has launched a unique innovation offensive. The aim: Even more research and teaching on cutting-edge technologies in Bavaria. And: Sparking enthusiasm for the new developments among the general public. Bavaria's Science Minister Markus Blume in conversation with Linguistics Professor Michaela Mahlberg about AI, science communication and TikTok.

Markus Blume: FAU is proud that you have accepted the appointment in Erlangen. And we are also very pleased on behalf of the Free State. You are a child of the High-Tech Agenda Bavaria.

Prof. Dr. Michaela Mahlberg: Yes, that's true. What I particularly like about the High-Tech Agenda is that is not only concerned with making investments, but also with encouraging new approaches, or new ways of thinking. The way universities organize their disciplines is a reflection of how the world is seen. For example, most universities have one drawer for linguistics, one for mathematics and another one for physics. But that is not the way the world works anymore, problems are complex and we have to work together to solve them.

Markus Blume: With the High-Tech Agenda Bavaria, we have just given the political incentive, financial fertilizer, if you like, to make the ground fertile – roughly 5.5 billion euros. The institutes of higher education have free reign to decide themselves how to use these funds. FAU's approach is fantastic. As shown, for example, by them succeeding in attracting you to Erlangen. What are your plans at FAU? I need to make sure that our money is well invested (laughs).

Michaela Mahlberg: Yes, definitely! We are currently establishing a new department, Digital Humanities and Social Studies, and are using the funding from the High-Tech Agenda Bavaria to encourage research at the intersection between digital technologies and society. In the department, my own research focuses on language, I already have a colleague who focuses on literature, and other professorships in the pipeline. An appointment procedure is currently underway for a professorship focusing on images and objects. Our aim is to form a team capable of researching the fundamental areas of digital reality in our society as comprehensively as possible.

Markus Blume: This is where it becomes clear that FAU is a modern university which offers the entire spectrum of academic disciplines: Traditionally extremely strong in engineering and technical subjects but at the same time on the right track when it comes to the humanities and social sciences.

Michaela Mahlberg: Exactly. Another important aspect is that our Digital Humanities are located in the same building as Artificial Intelligence in Biomedical Engineering and

Politics meet science: A conversation between Markus Blume and Michaela Mahlberg

Data Science. That is not always the case. It is not unheard of for there still to be universities where the humanities have no contact at all with subjects exploring new technologies from one year to the next.

Markus Blume: That means we can expect exciting things from you when you all meet up at the coffee machine...

Michaela Mahlberg: Rather while playing table soccer.

Markus Blume: Even better – we could do with a table soccer table in the Ministry too, the best ideas are sparked when you get moving. I like your approach: Not automatically accepting that technology is beneficial per se, but rather using it to serve people and at the same time creating awareness of how technology can benefit people.

Michaela Mahlberg: Exactly. The discourse in society on innovation and future potential is crucial. If when we talk about AI we focus on the problems and fears, if we keep mentioning that AI will ruin jobs and that it poses a danger from a data security point of view, then it is inevitable that AI gets a bad reputation. However, it is also worth looking at the positive angle: How can AI help people, how can it perhaps even improve society? Narratives influence the future. Each transformation requires its own story in order to be successful.

Markus Blume: I have unfortunately noticed that enthusiasm for such questions is often sadly lacking. If you post a picture on social media of your hike through the mountains at the weekend, it rockets. But if you report on the exciting research in the field of digital humanities here in Bavaria, then all you get is a complacent shrug of the shoulders. At the same time, people are frightened about the impact of AI on our world.

Michaela Mahlberg: If you watch movies involving AI, then the plot often revolves around something going wrong. The technology gets into the wrong hands, humanity is destroyed. Movies are fiction, but stories in our society work in a similar way. We need to work against that trend and tell interesting stories in which people can see themselves as playing an active part.

Markus Blume: Are you on TikTok?

Michaela Mahlberg: Not yet, but on all the other channels. Are you?

Markus Blume: Yes, I have a TikTok account and I want to become more active there in future. It is an important channel. Our Minister President Markus Söder is very successful there. He shows us how it works: Politics and research must go to where the people are. And nowadays that's TikTok. We can reach hundreds of thousands of young people there who we otherwise wouldn't reach.

Michaela Mahlberg: Social media is really important. If we are not there, then we are leaving the door open for other people who we would perhaps prefer not to be there.

Markus Blume: We have to make sure that social media is not flooded by the scaremongers who say we should switch AI off. Or by those who use these channels for their propaganda or fake news.

Michaela Mahlberg: That is a big topic. We have to create discourse that speaks much more effectively to people and society...

Markus Blume: And banishes fake news! I recently came across a quote from Hannah Arendt that mentioned "continual lying", suggesting lying has always been around.

Michaela Mahlberg looks for text patterns to investigate the social function of language.

Alexander von Humboldt Professorship 24 25

Technical advances have also led to advances in the opportunities for lying. She probably never dreamed that anything like the internet would ever be invented.

Michaela Mahlberg: That's a coincidence. I have just made a podcast on Hannah Arendt with a colleague from Birmingham, Lyndsay Stonebridge, in which we discuss our turbulent political times. How many people today know of Hannah Arendt? Her ideas are more relevant today than ever.

Markus Blume: In my case, it is probably because I didn't only study Physics, but also Political Science and have also been confronted in recent years with the question of what is actually going on in the echo chambers of the internet as part of my job. We are not only experiencing a digital transformation, but also a fundamental upheaval in society. And the tools needed to ensure that this upheaval benefits society seem to have not yet been developed. We need a new Enlightenment!

Michaela Mahlberg: That makes it clear how important science and education are in this context. If we don't invest now, it will end up being very costly. It is also important that we approach science from various standpoints and bring together various points of view: For example technology and the humanities. Or like you: physics and politics.

Markus Blume: So, once I'm finished in the Ministry I'll come and knock on your door as a research associate.

Michaela Mahlberg: Do that, and then we can make TikTok videos together! (both laugh). ■ **sk**

From Birmingham to Erlangen

Michaela Mahlberg really wanted to become a teacher. While studying mathematics at the University of Bonn, she learned programming and came into contact with corpus linguistics in English, and that was when she realized the potential of this combination of subjects and decided to go into academia. "Analyzing a language and recognizing patterns as a means to understand politics, society and history - it's fascinating," explains the linguist and mathematician. Mahlberg has conducted research at universities in Italy and the UK. In 2013 she was appointed to a professorship at the University of Nottingham, and moved to the University of Birmingham in 2015, where she was appointed the Director of the Centre for Corpus Linguistics. As a Humboldt Professor at FAU, Michaela Mahlberg is in charge of the Department of Digital Humanities and Social Studies, founded in 2021. "FAU allows me to play an active part in developing new structures for cutting-edge research," she explains.
When assessing texts, Mahlberg focuses on a number of topics, from children's literature to social media. Her research is currently focusing on the water crisis, a project that started out as a pilot study in Birmingham. As she is convinced that "the major problems facing humanity always also have a language dimension," she is investigating how we can raise awareness of water scarcity and the importance of protecting resources among broad sections of the population. She analyzes newspapers, UN reports, and works of literature in order to understand what importance is accorded to water. This can then be used, for example, to derive communication strategies.
Originally from the Rhineland, Michaela Mahlberg has chosen to settle in Erlangen, where language also has an important role to play in her free time: She interviews experts on current topics for her podcast. New episodes of "Life and Language" have already been recorded in FAU's podcast studio. ■ **stm**

A robust **catalyst**

The energy transition is at risk of becoming a failure if hydrogen cannot be produced in a sustainable manner. Catalysts that are put under extreme conditions are required to produce this hydrogen. In conjunction with three other researchers, Karl Mayrhofer is therefore searching for robust and cost-effective accelerators for such reactions.

Electricity from wind power, solar cells, and other sustainable sources either has to be used immediately or stored. Effective batteries are available for smaller applications, electric vehicles or for the home. Hydrogen produced from water using electricity will become increasingly important for larger applications such as in the steel industry or for railways on tracks that are not electrified. Karl Mayrhofer, Chair of Electrocatalysis at FAU and director of both the Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (HI ERN) and the Institute of Energy Technologies (IET) at

“Our processes enable us to investigate in a short time what such catalysts will look like after ten or more years of operation.”

Prof. Dr. Karl Mayrhofer

Forschungszentrum Jülich, carries out research on catalysts for this reaction.
Mayrhofer had already focused on climate change, a process that is being accelerated by modern civilization, and potential countermeasures as early as 1996 when he started his degree: “As a chemist, I can hopefully contribute to solving these problems and look for technical solutions,” he thought at the time.
After completing his studies in his native Austria at TU Wien (Vienna), he decided to complete his Master’s thesis in industry. “This is where I conducted research on fuel cells that were powered by hydrogen.”
This was followed by a doctoral thesis completed at TU Wien and during a stay at the Lawrence Berkeley National Laboratory in California, USA, which involved more research into the chemical reactions required for producing hydrogen. This is where he met Matthias Arenz, whom he later joined at TU München, in order to continue research into catalysts for water electrolysis and extracting hydrogen from water. Arenz is now head of the Department of Chemistry at the University of Bern, while Karl Mayrhofer came to FAU via the Max-Planck-Institut für Eisenforschung in Düsseldorf, and the close collaboration between these two researchers continues to be very important for the success of both groups.

Electrolysis even makes platinum age

The reason for this research is obvious: “Sustainably-produced hydrogen not only stores energy, but can also be produced in regions with large amounts of solar power such as Australia, the Middle East or North Africa,” explains Karl Mayrhofer. “For example, if it is stored in liquid organic hydrogen carriers, which are also being researched at FAU and HI ERN, it can be transported relatively easily to central Europe in tankers.” In addition to solar power, of which there is a plentiful supply, the production of cost-effective hydrogen also needs another ingredient: A good catalyst.
It has been available in the lab for a long time, where the costly precious metal platinum is often used. This has been working extremely well for several decades, but it has one major drawback for the large-scale production required for the energy transition: “The reaction operates at high voltages and in extremely acidic or extremely alkaline solutions that place huge strain even on catalysts made of precious metals and therefore make them age very quickly,” explains Karl Mayrhofer. In business terms, this means the life of such electrolysis plants is limited, which makes hydrogen production quite expensive. “This would be very bad news for the energy transition,” says Mayrhofer.

Finding the perfect material

To solve this problem, he has been examining the aging process of fuel cells and catalysts for water electrolysis since his doctoral thesis. He is attempting to understand the processes that make important components more durable and thus make hydrogen production more cost-effective. The aim is to produce catalysts with an operating life of more than ten years. Due to the fact that it’s impossible to test suitable materials for such a long period of time, FAU researcher Mayrhofer is developing high-throughput processes that put the materials under extreme strain, thus recreating years of wear in a much shorter time in the lab.
“These methods enable us to examine the aging process more quickly and more precisely in order to develop processes that at least slow down the deterioration,” explains Karl Mayrhofer.
These high-throughput processes at FAU form one of four pillars on which the Synergy Grant called “Directed Evolution of Metastable Electrocatalyst Interfaces for Energy Conversion” (“DEMI” for short) from the European Research Council (ERC) is based. The groundwork is supplied by a team from the University of Copenhagen, which is calculating how four or five components must be combined and what the surface structure should look like to enable the reaction to take place as efficiently as possible. A group from Ruhr-Universität Bochum uses these components to create model material libraries with varying concentrations, which Matthias Arenz and his team subsequently use to synthesize the combinations analyzed theoretically and in models in their labs as nanoparticles with highly active surfaces. “Our high-throughput process enables us to investigate in a short time what such catalysts will look like after ten or more years of operation,” says Mayrhofer about the fourth stage of the process towards producing a cost-effective and powerful catalyst for the high hopes being placed on hydrogen as a driver of the energy transition. ■ **rk**

Crowning achievement for top-level researchers

Even the Starting Grant awarded by the European Research Council is a prestigious award that usually paves the way towards the title of professor. The fourth and highest level, the “Synergy Grant”, is the crowning achievement of these grants, which many applications don’t ever achieve. “From more than 395 groups in 2023, only 37 received a Synergy Grant,” remembers Karl Mayrhofer, who is a member of one of these successful teams. A total of 395 million euros of funding is available for these groups. Ten million of this amount was awarded to the collaboration between FAU researcher Karl Mayrhofer, Jan Rossmeisl from the University of Copenhagen, Alfred Ludwig from Ruhr-Universität Bochum and Matthias Arenz from the University of Bern to develop catalysts to produce hydrogen in large-scale electrolysis plants that have a much longer operating life and are more cost-effective than what is currently available. Collaborations such as this for implementing a ground-breaking research project are the prerequisite for a Synergy Grant. “We have been working very closely for 15 years. This has led to more than 50 joint publications and the idea for the Synergy project,” says Karl Mayrhofer. “We are now looking forward to achieving our ambitious goals together during the next six years and to making a significant contribution to the energy transition.”

Eavesdropping in the Arctic

Astrophysicist Anna Nelles searches for neutrinos on Greenland's ice fields. She hopes to gain new insights into processes that occur in space.

In space, two black holes merge to form one, releasing huge amounts of energy. However, the location in the universe where this happened remains quiet and dark. This is because the light cannot escape from the surroundings of the black holes and is absorbed. This is also what happens to most of the particles that are released during this process. Only a small inconspicuous elementary particle penetrates the cloud of dust surrounding the black hole and then travels through galaxies and planets until it finally lands on Earth and penetrates the ice fields of Greenland.

Anna Nelles would like to find this particle. She is Professor of Experimental Astroparticle Physics at FAU and a researcher at the Deutsches Elektronen-Synchrotron (DESY) in Zeuthen, Germany. Her research focuses on finding evidence of exactly these particles, known as neutrinos. "Neutrinos are small neutral elementary particles that can be stopped by almost nothing," Nelles explains. They can penetrate galaxies, planets, walls – and humans. Billions of neutrinos pass through us every second. But we don't feel a thing as neutrinos only rarely interact with other matter, which is why they are very difficult to detect. However, this is not the case in high energy events such as those in space where extremely large amounts of energy are released. This occurs, for example, when two black holes merge to form one, or when a black hole rips a star apart. "There are various types of neutrinos," explains Nelles.

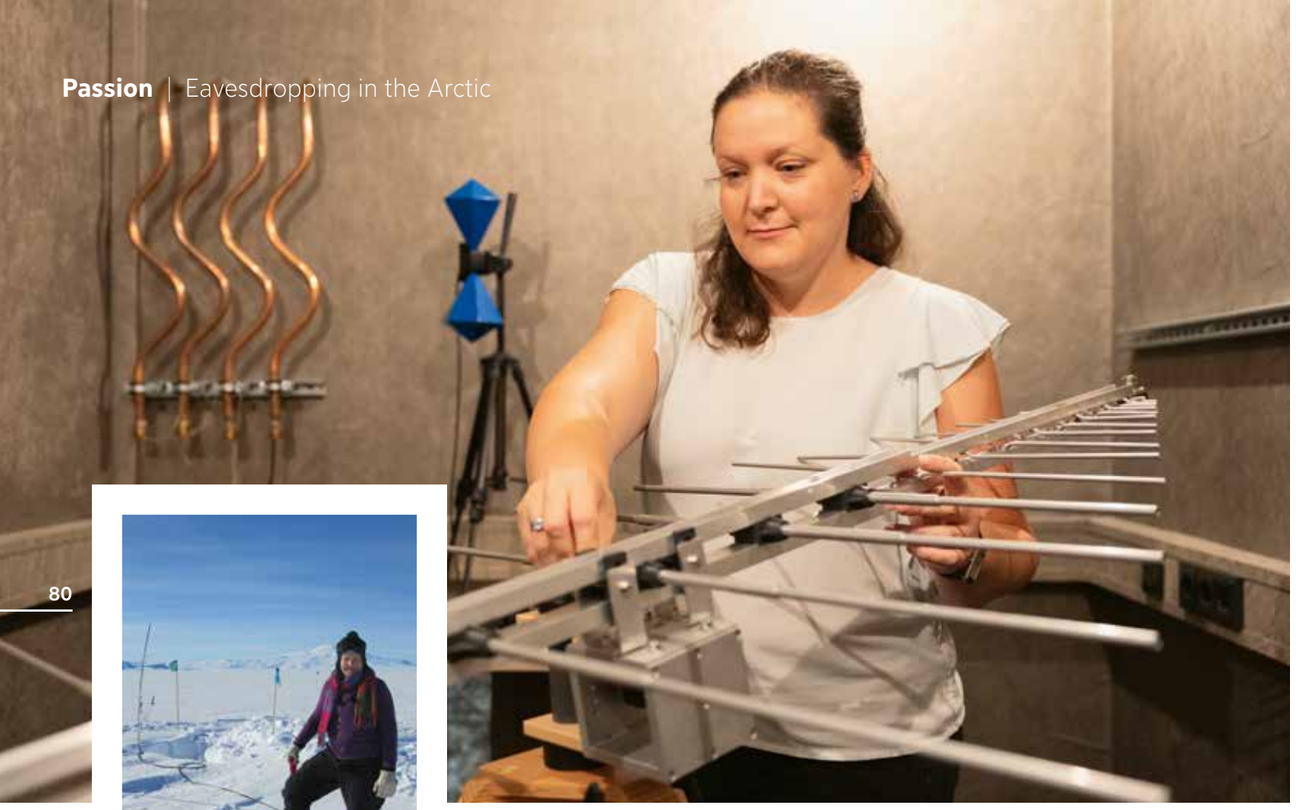
"The Sun produces many neutrinos and they also exist in our atmosphere. Extragalactic neutrinos are created during extremely high energy processes in the universe. I am interested in these extremely energy-rich neutrinos from space." The problem is that neutrinos become rarer the more energy they have. "A neutrino like this occurs maybe once per year in a cubic kilometer of ice. This means we have to monitor very large quantities of ice at the same time."

Eavesdropping on neutrinos in the ice

This is exactly what Anna Nelles and her team are doing in Greenland – with antennas. When a high-energy neutrino interacts with an atomic nucleus, the process generates radio waves that can be detected by special antennas. Anna Nelles says there are two reasons why she is trying to detect neutrinos in Greenland, of all places: "People emit a lot of radiation. Every tablet, every cigarette lighter you click generates radio emissions. We wouldn't be able to identify the neutrinos because of the large number of background signals. This is why we need an extremely remote location." In addition, says Nelles, the signals in a block of ice are much easier to map than in the floor, for example, since it would absorb radio emissions. "If we detect a radio impulse out of nowhere in the ice, we know that it must have been a neutrino."

Prof. Dr. Anna Nelles

studied physics and business and economics at RWTH Aachen, Germany, and completed her doctorate in physics at Radboud University Nijmegen, Netherlands from 2010. This was followed in 2015 by a period as a postdoctoral researcher at the University of California. Before coming to FAU, she worked as the head of an Emmy Noether research group at Humboldt Universität zu Berlin. Nelles has been Professor of Astroparticle Physics at FAU since 2019. She also works as a researcher at the Deutsches Elektronen-Synchrotron (DESY) in Zeuthen, Germany. Her research has been funded by an ERC Starting Grant since 2023.



Top: The measurements in Erlangen are conducted in special shielding chambers.

Bottom: Anna Nelles installing antennae in the ice.

If you were to take a map of Greenland and mark the highest point directly in the center, you would know where the FAU team is setting up its antennas. At temperatures of minus 20 degrees Celsius, the researchers have to wear thick winter clothing and protective goggles to drill holes in the ground. A canopy protects them from the wind and flying snow. The holes for the antennas have to be 100 meters deep and 23 centimeters wide. A special drill is required to make them: "We use the world's largest mechanical drill, which is used in glaciology or the study of ice and glaciers," says Nelles. Each station has three of these holes that contain a total of 24 antennas. Red flags mark the location of the antennas after they have been installed. Electricity is generated using solar panels and wind turbines. 35 of these stations are to be built by 2027 that can collectively monitor 50 cubic kilometers of ice. Eight stations are already in place. This complex construction project is being financed by various sources of funding that the participants have put together. Among others, Nelles contributed an Emmy-Noether-Grant from the DFG. Since the stations operate independently from each other, data is already being transmitted from Greenland to Germany, 3000 kilometers away.

What happens with the data?

The data is analyzed by Nelles and her team in Erlangen and Berlin. To do this, her work has been funded by an ERC Starting Grant since 2023. The European Research Council (ERC) awards Starting Grants to promising young researchers to enable them to establish their own research groups and to independently pursue research projects with great innovative potential. Nelles hopes to gain new insights into the processes that occur in space such as black hole mergers and would like to see something unexpected: "I think it would be a bit boring if we detected just neutrinos that originate from precisely the source that we are observing. I really would like to see at least one neutrino from a completely unexpected source that will turn our known models upside down." ■ **mw**

A lawyer for **missing people**

Grażyna Baranowska joined FAU in 2024 as Professor of Migration Law and Human Rights. She aims to make a contribution to interdisciplinary research at the Center for Human Rights Erlangen-Nürnberg.

Grażyna Baranowska at the Street of Human Rights in Nuremberg.

I have always been fascinated by the variety of debates connected to human rights and the relevance of the topic for society," explains Grażyna Baranowska. Her research focuses predominantly on missing people, human rights violations at borders and memory laws. She is particularly keen to link research to practical experience.

The researcher, who studied European Studies and Turkish in Poznań and completed a doctoral degree in Law in Warsaw, has plenty of practical experience. Most recently, Grażyna Baranowska led a Marie-Curie project on missing migrants at the Hertie School. Before that, she held several different positions, including one at the German Institute for Human Rights. In August 2022, she was appointed by the UN Human Rights Council to the working group on enforced or involuntary disappearances.

FAU offers the ideal conditions

At FAU, the Professor for Migration Law and Human Rights will also conduct research at the Center for Human Rights Erlangen-Nürnberg (FAU CHREN). She is particularly looking forward to this new challenge: "I am looking forward to making a contribution to research into regional, national and international developments in the area of human rights, together with colleagues from different disciplines." FAU offers ideal conditions for human rights research: With its many years' experience in this area, the University is in a unique position compared to others.

Grażyna Baranowska is continuing her research and teaching at the interface between international human rights and migration at FAU. She will provide support for law degree programs in the specialization "Fundamental and human rights" and will be responsible for the Refugee Law Clinic Erlangen-Nürnberg. It is important to her that students have the opportunity to gain international practical experience, for example by becoming involved in studies and statements for the United Nations. ■ **mk**

The present **and the future**

Andrea Bréard is the new Vice President Education. In our interview, she explains how she would like to combat discrimination at FAU, what is meant by educational integrity and what role AI can play in teaching.

Prof. Bréard, like your predecessor, you would like to put an end to discrimination in education. But do not all students have the same opportunities for accessing courses, libraries and teaching materials?

In theory yes, but they often do not have the opportunity to actually access them.

Could you explain what you mean?

One form of discrimination is physical. For example, if I am blind it is not so easy for me to make use of everything that is on offer. I cannot read a book if it is not written in braille or available as an audiobook. Another form of discrimination involves a student's personal background. For example, if you grew up without books, sitting in the library and wading through books while studying at university will not come easily to you. You need a family background where someone is encouraged to read literature for educational purposes.

What has FAU achieved in recent years to stop this kind of discrimination?

For example one thing that has just been finalized, but was predominantly pushed through by my predecessor Bärbel Kopp, the fourth attempt. Students should have an extra attempt if they fail a written examination. This removes a psychological barrier for those students who suffer from examination anxiety and lifts pressure off them if they are not automatically de-registered from the university after failing three examinations.

Where is there a need for further change and improvement?

One topic we are currently pursuing in the team is making examinations anonymous. There are very many empirical studies that prove that examinations are marked differently if the name doesn't sound German and that there is a correlation between an oral presentation and a subsequent written examination. Studies have shown that this is due to unconscious bias that affects the evaluation of the examination. Counteracting disadvantages for students from non-academic families is also important to me, also because this reflects my own family background. Children from such families often lack the ability to argue their case or give constructive criticism. Anyone lacking these skills is at a major disadvantage in the academic world. I would like to improve the services offered at FAU to iron out these deficits.

Another time you mentioned that you pursue the concept of "educational integrity". What does that mean and which role should this concept play in teaching at FAU in future?

Prof. Dr.
Andrea Bréard

holds the Chair of Chinese Studies at FAU, focusing on the philosophical and cultural history of China. She conducts research at the intersection of mathematics and Chinese studies and investigates the history of science in China from Antiquity until the present. Before coming to FAU as a Humboldt Professor, she was a researcher and professor in cities including Paris, Peking, Heidelberg and New York. She studied mathematics, computer science and Chinese studies in Munich and Shanghai. As well as German, she speaks seven languages, plays two instruments and is a triathlete.

"AI can accompany students on their learning journey. However, it can also be tempting to delegate too much to AI and to stop actively practicing your own language skills in the process. I think that is extremely dangerous."

Prof. Dr. Andrea Bréard

Someone who acts with academic integrity does not plagiarize and does not fake their research data. It is similar in teaching: A student who acts with integrity does not use any tools in their assignments that they have not explicitly declared or that are not allowed. However, it also covers how I treat fellow students with a disability, or whether I pay heed to diversity, both as a student or as a member of teaching staff. And if I am a lecturer, do I treat all students equally? As you can see, it affects students and teaching staff equally.

Why should the university encourage students' personal development? Is this not the responsibility of the parents or schools?

Indirectly, it is also the university's responsibility. We want to encourage talent and raise the researchers of the future. We educate people. And education covers more than imparting subject knowledge, education also entails personal development. Students leave the university and will then play a role in shaping the new generation of students in companies and schools. But we are not the parents, that is true. If they have been negligent, we cannot make up for all that the children may have missed out on. However, I do believe that studying should also be a period of personal development for students.

Artificial intelligence is playing an ever more important role in many academic areas. As Vice President Education, how do you view the significance of AI for teaching?

I see opportunities and risks. One example for the major opportunities it brings can be seen with our computer scientists. They have developed an AI system to accompany students on their learning journey. Using weekly evaluations, students can determine where they have deficits, pinpoint what they have not understood and why they were unable to solve a specific task. AI can tell each student where they need extra support and what they need to look over again. The AI also looks for "study buddies" who are good in the areas where you may be struggling.

Symbolic transfer – Andrea Bréard takes over from Bärbel Kopp as Vice President Education.

You can then get in touch with each other. Teaching staff cannot afford to provide such tailored, individual support, especially not in degree programs such as computer science with large numbers of students. There are of course subjects where AI is being used to a lesser extent to date. For example in the humanities, where the emphasis is less on logic and precise modeling and more on discussion.

And what risks do you see?

If students rely too heavily on machines doing everything quicker and better, for example translating and summarizing a text. It is very tempting, as it works really well with translation machines like DeepL or ChatGPT. But the temptation is that you let the machines do too much of the work for you, you end up only reading summaries and don't bother looking at the whole text any more. Or you stop training your language skills, as you just let the machine translate everything without checking it. I think that is extremely dangerous.

What is FAU's approach to AI in teaching?

FAU is taking a proactive approach. We are asking people to think about how they can actively use AI effectively in teaching or how they can develop innovative formats, with or without AI. One way we can encourage an innovative approach is with our Prize for Innovative Teaching. It is financed with the Innovation Fund for Teaching, to which FAU contributes 185,000 euros every year. ■ **bo**

HIV vaccine soon a reality?

Virologist Klaus Überla and his team are developing new immunization strategies against HIV, building on decades of experience.

One in 1000 people is HIV positive in Germany. That means that the proportion of people infected with HIV in Germany is higher than ever before. Some people may find that surprising, after all people have been well educated about HIV and AIDS for decades now.
Klaus Überla, Director of the Institute of Clinical and Molecular Virology and Chair of Clinical and Molecular Virology names two main reasons for the rising numbers: “In the last 20 years we have developed very effective treatments. As a result, fewer people infected with HIV are dying than the number of people newly diagnosed. That of course leads to a rise in numbers.” In addition, Überla adds, roughly 10 percent of those affected are not aware of their condition, and risk infecting others. Nowadays, human immunodeficiency virus, HIV for short, can be treated well with a lifelong antiviral therapy. There is still no vaccine. Überla is one of the researchers who are trying to change that.

A vaccine against HIV?

For over thirty years, Überla has worked at developing vaccines against HIV and exploring why immunization strategies pursued to date have failed. “During our research, we have basically tried out all types of immunizations,” he explains. At the current time, he and his working group are conducting research into a passive immunization procedure. While active immunization procedures involve encouraging the organism of the vaccinated person to trigger an immune response, in other words to produce antibodies, through contact with an antigen, in the passive immunization procedure, antibodies are transferred directly. The vaccinated person is protected whenever the antibodies are present in their body. A promising development: “We know that there are antibodies which are effective against many different HIV variants at once,” explains Überla.

Preventing infection from the very first cell

The virology team at FAU is exploring whether passive immunization is capable of preventing infection of the very first cell. When the HIV virus infects a cell, it incorporates its viral genetic material into the cell’s genome. This ensures that the virus’ genome exists for as long as the cell lives. If the cell divides, the viral genome is transferred to both daughter cells. “If I don’t prevent the very first cell from being infected, I risk these latently infected cells activating the viral genome at some point in the future, thereby creating new virus variants. “We

Prof. Dr. Klaus Überla

studied medicine at FU Berlin and completed his doctoral degree there in 1991 with a thesis on using experimental immunotherapy to treat tumors. As a postdoctoral researcher, he went to Boston to the Dana-Farber Cancer Institute at Harvard Medical School. In 1993, he returned to Germany and established his own working group in the Institute of Clinical and Molecular Virology in Erlangen, where he completed his habilitation in 1997. After professorships in Leipzig and Bochum, Überla was appointed Chair of Clinical and Molecular Virology at FAU in 2015, and is also the Director of the Institute of Clinical and Molecular Virology at Uniklinikum Erlangen. Überla was a member of the Standing Committee of Vaccination (STIKO) from 2017 until 2024, and was recently appointed its chair. Since 2019, he has also been the First Vice Dean of the Faculty of Medicine.

were able to show that the neutralizing antibodies that block the virus from entering the cell provide protection for the first cell. This is referred to as sterilizing immunity."

Inspiration from cancer research

In his work, Überla can rely on the research of his predecessor Harald von Hausen, the founding director of the Institute of Clinical and Molecular Virology. He was the first to suspect that cervical cancer may be caused by human papillomaviruses, and conducted the first studies on this in Erlangen. The successful development of the HPV vaccine therefore has its origin in Erlangen, and zur Hausen was even awarded the Nobel Prize in Medicine in recognition of his groundbreaking work. "We are using the papillomavirus vaccines as particle-based vaccine platforms," explains Überla. "Our aim is to attach the HIV envelope protein to the surface of the HPV particles. In this way we hope to use the highly immunogenic structure of HPV particles to improve the immune response to the HIV protein." It will still take a while until a usable vaccine can be created, however. "It is a long-winded process," explains the immunologist. "We are talking about development times of 20 to 30 years."

Innovative approaches in research training group

Überla himself does not spend much time in the laboratory nowadays. Instead, he is in charge of a working group consisting of doctoral candidates, research associates and technical staff. He supports them with their research questions and helps to find the suitable experimental methods. He is also head of the research training group "Novel antiviral approaches from small molecules to immune intervention." The aim of the research training group is to support a group of doctoral candidates working in a similar area, both with regard to content and the relevant skills. The doctoral candidates in this research training group focus on antiviral chemotherapy. They hope to discover medicines against certain viral or cellular structures and decode the mechanisms behind them. They also hope to develop new immunization strategies. "Sooner or later, a combination of these procedures will be introduced," Überla suspects. "I'm excited to see which new approaches will arise from the research training group." ■ **mw**

From the lecture hall to **a chain of restaurants**

Philipp Selzle, founder of the smart food chain "Kaspar Schmauser", about his time at FAU, his business idea and lots of post-its.

He currently runs five restaurants in Nuremberg, Erlangen, Fürth and Leipzig, with plans for three more already in the pipeline: FAU-alumnus Philipp Selzle is one of the founding members and managing director of "Kaspar Schmauser" – a vegan restaurant chain focused on healthy eating. In our interview, the entrepreneur explains how he successfully gained a foothold on the food market and why he is so happy to return to FAU.

Mr. Selzle, can you tell us a little about the start-up process behind "Kaspar Schmauser"?

We wrote down everything you need to open a restaurant or establish a whole chain of restaurants on post-it notes. We ended up with roughly 500 little yellow, orange and blue notes. And then minute by minute it became clearer what we were doing and how we were going to do it.

What is your company philosophy?

We want the guests who come to our restaurants to feel happier when they leave. And we do that by providing tasty food that is also vegan, modern and sustainable.

How did you arrange the organization of your company with three partners?

We work together really well, because each of us has their own personal expertise. We vote on decisions – with three people there is never a stalemate, which is a major advantage. 2:1 is fairly common, but each of us accept it if the vote goes against us.

What has stayed with you from your time at FAU?

I only have positive memories of my time at university. I particularly enjoyed the lecture "Entrepreneurs and businesses", as it included a lot of practical examples. At FAU, I also learned to work independently: You need to learn to follow a structure. You need to take care of things yourself.

What would you pass on to younger generations as the secret to success?

Study what you enjoy. You will then put more effort in, as you enjoy what you are doing. In the long term, you will be more successful as you go your own way without being influenced too much by other people. ■ **nb**

The whole alumni interview is available on **fau.eu/alumni**

Skateboards and foxgloves

The biologist Jennifer Munkert and mechanical engineer Marcel Bartz have been awarded this year's Prize for Excellence in Teaching from the Bavarian Ministry of Science and the Arts.

It is not unusual for Marcel Bartz to come into the lecture theater with a cart in tow. Today he is planning to disassemble a clutch in order to explain the topic of drive technology. "Writing equations up on the board has its place and is still important. However, it should always be linked to practical applications," emphasizes the team leader for machine elements and tribiology, who works at the Chair of Engineering Design and holds lectures in engineering design and machine elements. Just as his parents sparked his own enthusiasm for technology, so he hopes to pass on his enthusiasm by teaching for and with students. "I enjoy the fact that we are dealing with practical applications, with electric cars, e-bikes, wind power plants or trains, all of which are connected to topics such as climate change and sustainability." In his research, the 39 year old engineer and keen skateboarder explores how to design structural components for drive systems, for example in skateboards. "It is always possible to alter and improve the axes, or indeed anything incorporating rolling bearings. Generally speaking, our aim is to reduce friction and material wear and tear, which in turn reduces energy consumption and saves resources."
Marcel Bartz explains that while research requires you to take an analytical and methodical approach, for teaching it is important that you change perspectives and present topics in a way students can understand.

Quiz with expert knowledge

Jennifer Munkert hopes that her research will make a contribution to treating diseases. At the Division of Pharmaceutical Biology, she is interested in a plant that forms grape-shaped flowers and is toxic: foxgloves. The active substances she is interested in are classed as cardiac glycosides. Her research focuses on their bioactivity and biosynthesis.
Originally, doctors used these substances to treat cardiac insufficiency. However, they also have the potential for fighting tumors and viruses. "With our Brazilian partners, we are working to identify less toxic cardiac glycosides, that are still effective against, for example, herpes simplex viruses," she explains. In her current project, she is combining cardiac glycosides with a natural system for transporting active substances, which allows her to link her own research focus with the new areas of interest at the Division.
The 39 year old also supervises lectures and laboratory courses in the subjects biology and pharmacy. Like her colleague Marcel Bartz, she uses a digital tool for feedback and includes young people in current research. She sees her remit as extending beyond merely teaching subject knowledge to encouraging students' personal development. Recently, she worked with students to develop a "Phytochemistry Escape Room," a quiz game where you have to use your specialist knowledge to escape from a room. "For me, good teaching means using innovative teaching methods and being willing to try out something new," says Jennifer Munkert. ■ **et**

"A special place in the world"

Robert Busch, CEO of Siemens and chair of the University Council, about his time at university in Erlangen, the potential of FAU and what physics has to do with leading a company.

Mr. Busch, what three things come to mind when you think about FAU?
Physics, great people, Erlangen.

You studied and completed a doctoral degree in physics here. How did you find out about the University?
I was brought up in Erlangen. The University, like Siemens, defines the city and is simply part and parcel of life here. My first impression as a student was of the old lecture hall in the Glückstraße with the creaky wooden benches. I loved it! Later we moved to the campus in the south of Erlangen. It had quite a different charm.
And I always liked the university's international character: I even spent a semester abroad myself, in Grenoble. While working on my Diplom thesis and doctoral degree, I then saw how the university attracted a large number of international doctoral candidates and postdoctoral researchers.

You are familiar with a lot of universities throughout the world. What characterizes a successful university for you?
The infrastructure plays an important role, modern laboratories for example, followed by the range and quality of the lectures on offer. This depends in turn on high-caliber professors. The surroundings of a university also play a major role. Are there innovative companies where students can work on their theses? What support do students receive if they want to launch a start-up? At the end of the day, it is the total package which counts.

Is the total package at FAU attractive?
Definitely. FAU is one of the most innovative universities, not only in Europe but in the world. Exceptional research with top-notch professors. The Executive Board is extremely successful in attracting top academics and award winners to FAU. And FAU is an attractive destination for outstanding students from across the globe.
The ecosystem surrounding the university also has a role to play. The university is in a unique position. The region boasts a number of large companies such as Siemens, a technology company, Schaeffler, the largest automotive supplier in the world or Adidas, as well as successful small and medium sized enterprises that are world leaders in their sectors. Research institutes such as the Fraunhofer, Helmholtz and Max Planck institutes are all situated locally.

FAU must improve the marketing of its strengths, explains Robert Busch.

Another decisive factor for me is the city itself with its pleasant and welcoming atmosphere. Lots of people we transfer here with Siemens ask, why not Munich or Berlin? But after six months they don't want to leave anymore, as the quality of life is so high here. All of that together makes FAU a very special university.

Praise aside, where do you still see potential for improvement?

No matter whether we are talking about a university, a company or an economy: growth matters. I therefore believe that it is crucial that student numbers at FAU continue to rise. The second point is infrastructure. There was a bottleneck in investments that is now being successively resolved. That is very good, as it will also attract more students. The next point would be to become more international, to attract even more international students – the best of the best.

Marketing is crucial in this respect. The first city to come to mind for anyone who wants to study in Germany is either Berlin or Munich. FAU must improve the marketing of its strengths.

FAU is an important collaboration partner for Siemens. What makes the University attractive for your company?

One aspect are the amazing professors working in areas of relevance to us as a company. We always say that Siemens connects the real world to the digital world. It is exactly at this intersection between hardware and software, in automation, in medical engineering and so on that FAU is active.

We benefit from the top students, as we are always on the look out for good people. We have partnerships with universities in many places across the globe. The takeover rate is highest for FAU graduates. I am one of them myself. I wrote my doctoral thesis at Siemens and then stayed on in the company.

You have been in the University Council since 2017, and have been the chairman since 2019. What do you want to do for FAU?

I would like to give something back to the University. I can provide my network of contacts, support collaborations and advertise FAU. I love doing so.

For several semesters now, you have also taught a seminar in Business Studies. What motivates you?

First of all, the seminar is characterized by the fact that we cover topics of relevance to Siemens, typically an analysis of companies or start-ups in a certain area of technology. That is fascinating for us.

Above all it is fun speaking to young people, seeing how they tackle an issue and then asking unexpected questions. It can stretch them to their limit at times, but it's great to see how they cope.

What tips would you give young people who want to start studying?

Most importantly: Choose a subject that sparks your curiosity and passion. That motivates you to study. The second point is relevant not only to studying: Make an effort, keep practicing, even when the going gets tough. That is the only way you will get better. And finally, consider the question of where you are aiming to go with the subject you choose to study. At the end of the day, a degree program is an investment for life. The aim is to earn money at some point.

Another aspect that is just as important is the willingness to make an effort. This is important for your own career, but even more so for Germany. We are starting to lose this virtue. That harms us in the long term. We are losing our competitive edge! We do not have any natural resources, we live off the innovative abilities of our people. And of the people who come to us.

Was your choice of degree a choice based on passion?

Towards the end of my time at school, I was very interested in chemistry. After one semester of physics, however, I realized that that was the right choice. My focus was on theoretical physics and I was always fascinated by expressing the world in formulas and learning to understand it better as a result.

I am often asked what physics – I even specialized in theoretical physics – has to do with running a company....

And what do you reply?

I think there are a lot of parallels. What are the features of theoretical physics? The world is so complex it can barely be described. Accordingly, we try to simplify it using formulas and then come fairly close to the truth. It is similar for a lot of topics and decisions that I am faced with. I need to pinpoint what is important, blend out unimportant aspects and come to a decision in a limited amount of time. Physics teaches you how to do that. As a company, we produce technology. And a basic understanding of that also helps me as the boss of the company.

Where do you get your inspiration?

In my job, I am lucky to meet and interact with lots of interesting people. Not only top politicians, company directors or people from tech companies, but also young people who are launching start-ups, or colleagues from production who have great ideas. It is very rewarding. ■ **sk**

Robert Busch studied Physics at FAU and wrote his doctoral thesis at Siemens. He was appointed CEO of the global player Siemens in 2021.

From a stone desert **to a blooming oasis**

What used to be a deserted space in the Lange Gasse is now a little paradise. The path towards the FAU WiSo oasis was anything but easy, but the fact that it was successful at all is largely thanks to Iris Dieterich.

It was an ugly piece of land, unused and unsightly," remembers Iris Dieterich, representative of the board at the School of Business, Economics and Society at FAU. "But once the first rough work was finished, suddenly bees appeared and dug little nests in the earth. I was surprised how quickly the new biotope was accepted."

The first step on the way to creating a sustainable garden at the entrance to FAU's School of Business, Economics and Society in Lange Gasse 20 in Nuremberg began with an email. "We have a great idea and funding, and are desperately looking for a location, otherwise the 10,000 euros will go to waste," was the gist of the message Iris Dieterich, Head of the School Administration, received in her inbox.

"We certainly have land that is not being used," she thought, replied to the brothers Jonas and Niklas Götz who had sent the email, one of them a landscape gardener, the other a construction machinery mechatronics technician, and started the ball rolling.

Nothing but a stone desert

In November 2023, the first machines arrived to dig up approximately 600 square meters of earth and make room for the garden. But it looked anything but promising at the beginning: There were huge piles of earth, deadwood and brushwood, it looked really uninviting and inhospitable. Nothing but a stone desert."

It didn't take long for critical voices to make themselves heard. "Some people questioned whether it was really such a good idea to build something like this in the entrance area." Nevertheless, the work went ahead as planned, natural stone walls were built, high quality earth was brought in and slowly but surely the transformation started to take place.

Lots of helping hands

The first plants were planted in April 2024, and things started to take shape. "A little wood was planted, a herb garden, berry bushes – suddenly everything started to grow and flourish." The two initiators were very dedicated: "They dug up the earth, planted plants, coordinated volunteers and even got a school class involved. Approximately 15 people from the city, members of staff and students all got involved. It is unbelievable how much dedication went into the project." Iris Dietrich was also impressed by how committed certain individuals were to the project, for instance Chair secretary Doris Zinkl. "She just approached the brothers and then got involved in the project straightaway. Now she is out working in the garden every day. The project wouldn't have been possible without people like her."

Herbs for the cafeteria

In the meantime, the garden has not only won the Environmental Prize from the city of Nuremberg, it has also become the perfect example of a place that encourages a genuine community spirit. Staff from the neighboring cafeteria gather fresh herbs from the raised beds. "It is just lovely to smell the lavender and sage while sitting there. And the best thing is that the garden is respected. There is no vandalism and considerably less garbage."

A paradise for the future

The WiSo oasis at FAU is not only a place to relax, it is also a symbol of what is possible if people come together to shape their own world of work. "There are lots of factors standing in the way of implementing projects like this. But at the end of the day, we managed, in spite of all the challenges," says Iris Dieterich with pride. "The garden thrives from team work and anyone who is interested is welcome to come and join in." ■ **lg**

Joint visit: The initiators Niklas (left) and Jonas Götz (right), Nuremberg's mayor Marcus König and FAU WiSo Head of the School Administration Iris Dieterich.

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Outstanding

The FAU Magazine has won the German Design Award 2025. It is the winner in the category Excellent Communications Design, Editorial.

The German Design Award is the premium award from the German Design Council. With its worldwide reach and its international reputation it is one of the most prestigious design awards there are. 16 nationalities are represented on the jury of the German Design Award 2025. The jury consists of reputable design experts from industry, teaching and academia as well as the design industry.

GERMAN DESIGN AWARD WINNER 2025

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With its motto “Moving knowledge”, FAU stands for innovation, diversity and passion. Discover more about FAU’s values, its key research priorities and what it offers students and the general public.

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