Seismologist Andreas Fichtner explores the Earth's interior 37 A forensic look at biodiversity 40 Alumna Sandra Herrmann: from ETH to NASA 45

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EDITORIAL

"Health and medicine are key areas at ETH Zurich."

We enjoy a high quality of healthcare here in Switzerland – but we pay an equally high price for it. The big question for health policymakers is therefore: How can we harness the huge potential of technology so that medical innovations are affordable and accessible to as many people as possible?

At ETH Zurich, health and medicine are key areas, with more than 100 professors undertaking research in these fields. In recent years, the university has also stepped up its collaboration with other players in the healthcare sector. By leveraging these partnerships, we aim to accelerate the translation of research discoveries into everyday clinical practice. To find out what makes these cooperations successful and where the stumbling blocks lie, we conducted an in-depth interview with Monika Jänicke, CEO of the University Hospital Zurich, Rahel Kubik, senior consultant at Kantonspital Baden, and our very own Vice President for Research, Christian Wolfrum (page 16).

Advances in technology continue to reshape job profiles in the healthcare sector. In response, ETH recently launched a new and innovative Bachelor's degree in Human Medicine. This year, graduates from the programme's inaugural intake went on to complete Master's degrees at universities in Zurich, Basel or Lugano – and they are now ready to begin applying their knowledge for the benefit of patients.

I wish you a pleasant read – and the very best of health!

Joël Mesot,
President of ETH Zurich

Globe – the magazine for ETH Zurich and ETH Alumni

COVER

Clara Ehrenzeller

has dreamt of becoming a doctor ever since she was a child. Four years ago, she began the Bachelor's degree programme in Human Medicine at ETH Zurich and has since progressed to a Master's programme in Medicine at the Università della Svizzera italiana (USI) in Ticino. Her favourite part of studying at ETH was being able to put her newfound knowledge directly to the test in a variety of internships. Alongside her studies, Ehrenzeller is involved in the Swiss Medical Students' Association (swimsa). "I want to help ensure that medical studies remain fit for the future," she explains.

Mohammed Said

first completed an apprenticeship as an IT technician, followed by two years of military service in the Swiss army. Having returned to education, he is now in his third semester of the Bachelor's degree in Human Medicine at ETH Zurich. In future, he would like to work abroad as a doctor or researcher, bringing his knowledge to bear in places where people are not as fortunate as in Switzerland. After completing the Bachelor's programme, he plans to pursue a Master's degree at the Università della Svizzera italiana (USI) in Ticino – and is already looking forward to discovering a new culture and language.

Images: ETH Zurich / Markus Bertschi; taken at Kantonsspital Baden

NEW + NOTED

FOCUS

Images: Annick Ramp; Nathan Lindstrom

COMMUNITY

REPORT

PROFIL

NEW + NOTED

Image: ETH Zurich / Matti Barthel

The Ruki River in Africa is one of the darkest blackwater rivers in the world.

Is this the world's darkest river?

During a scientific expedition in the Congo Basin, a team of ETH researchers from Professor Johan Six's Sustainable Agroecosystems Group came across a river that was unusually dark in colour: the Ruki. This mighty tributary of the Congo River had never before been scientifically studied, so the team embarked on a year-long project to record its water level and volume of discharge. They also analysed how much dissolved organic matter was present in the water.

The reason the Ruki is so dark is that it contains large amounts of dissolved organic material and hardly any sediment because of the river's low gradient. Most of the carbon-rich material in the water is washed into the river by the rain, which falls on dead jungle vegetation and leaches out organic compounds from the decomposing plants. The process accelerates in the rainy season, when large areas of the forest flood and remain underwater for weeks, during which dead vegetation stains the water the colour of tea.

Peat bogs in the Congo Basin store some 29 billion tonnes of carbon. However, carbon isotope analysis has shown that most of the carbon in the Ruki comes from the forest vegetation and not from the peat bogs along its course. In what is the first study of this major jungle river, an international research team led by ETH Zurich has now explained why its waters are so dark – and what this says about the river system's carbon balance. ○

Video: ETH researchers study the Ruki
→ youtu.be/ohUepTebMOg

Cloëtta Jubilee Prize goes to two ETH professors

To mark its 50th anniversary, the Max Cloëtta Foundation has awarded a special Jubilee Prize to two ETH Zurich professors, Tanja Stadler and Barbara Treutlein, in recognition of their outstanding research and achievements in the field of biomedicine. The two scientists, who both work in ETH Zurich's Department of Biosystems Science and Engineering in Basel, are to share the 250,000 Swiss franc prize, which will be used to fund their research.

As Professor of Computational Evolution, Tanja Stadler intends to invest her share of the prize money in advancing the real-time analysis of huge data sets of pathogen genomes. Such analyses are essential for comprehensive epidemiological forecasting. Barbara Treutlein, Professor of Quantitative Developmental Biology, plans to use her portion of the prize to explore how particular types of neurons emerge during the development of the human brain – and how we can mimic these processes to create human neurons in vitro. ○

Image: ETH Zurich / Carolin Arndt

Professors Barbara Treutlein (left) and Tanja Stadler from the Department of Biosystems Science and Engineering at ETH Zurich.

Clean energy from chicken feathers

Image: Adobe Stock

Keratin from chicken feathers can be used to make a cheap, environmentally-friendly membrane for fuel cells.

The poultry industry incinerates some 40 million tonnes of chicken feathers each year, releasing large amounts of carbon dioxide and toxic gases in the process.

A team of researchers led by ETH professor Raffaele Mezzenga teamed up with Nanyang Technological University Singapore (NTU) to find a way of putting these feathers to good use. The scientists were able to extract the protein keratin from the feathers and convert it into ultra-fine fibres. These fibrils can then be used to fabricate the membrane of a fuel cell.

In conventional fuel cells, such membranes are made from expensive and highly toxic chemicals. By contrast, the innovative keratin membrane can be produced cheaply without the usual environmental impact. The team has already filed a patent for their keratin-based technology, which could also be used for other renewable energy systems. ○


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autobau
pwc
DEKRA
speedgoat
SIBATRON AG
3
ELEKTRISOLA
DOHNER

Image: ETH Zurich / Alessandro Della Bella

0.956 seconds

Students from ETH Zurich and Lucerne University of Applied Sciences and Arts have set a new world record for electric vehicle acceleration. Their self-built electric race car, which they named mythen, powered from 0 to 100 km/h in just 0.956 seconds over a distance of 12.3 metres, prompting joyful celebrations among members of the Academic Motorsports Club Zurich (AMZ). For the better part of a year, the students have spent every spare minute working on their electric vehicle, overcoming setbacks and returning to the drawing board time and time again to refine individual components. Guinness World Records has now officially confirmed that mythen broke the previous world record for the fastest-accelerating electric vehicle. The team accomplished this remarkable feat at Switzerland Innovation Park in Dübendorf, directly opposite the students' workshop. They knocked more than a third off the previous record of 1.461 seconds, set in September 2022 by a team from the University of Stuttgart. ○

Video: New world record
⟶ youtu.be/mvoFemftA34?

Academic Motorsports Club Zurich (AMZ):
⟶ amzracing.ch

The future of work

How productive are we when we work from home? It's an increasingly common question, but Gudela Grote argues that it says more about our view of human nature than about effective ways of working.

GUDELA GROTE is Professor of Work and Organisational Psychology in the Department of Management, Technology and Economics at ETH Zurich.

The year 2020 showed us that being flexible about when and where we work can benefit both employees and employers. We already knew about the potential stumbling blocks – blurred boundaries between our professional and private lives, difficulties in maintaining informal contacts, and the many challenges of virtual leadership and team cohesion. But during the pandemic, we did our best to overcome these problems. As the impact of Covid-19 wanes, these challenges have re-emerged. Fortunately, we now have a clearer idea of how to tackle them – and also how to create a more humane way of working.

In a recent paper that looks at ways of optimising productivity, Stanford economists argue that the future lies in hybrid working. Their findings, which are backed by decades of research in work and organisational psychology, show that when people work solely from home, their productivity drops by 10 to 20 percent, whereas it does not suffer and may even increase slightly if they engage in hybrid working.

One area where researchers saw a drop in productivity was among data-entry workers who performed monotonous tasks from home – though

It's difficult to find a meaningful measure of productivity for employees working from home.

it is unclear whether their domestic conditions were actually conducive to productive work. In another example, the researchers found that call-centre workers engaged in hybrid working took fewer breaks and less sick leave. Yet productivity assessed in those terms could be more of a reflection of increased pressure at work and pres-

enteeism. These examples show how difficult it is to come up with a meaningful measure of productivity – without a knowledge of the context, any metric is open to subjective interpretation.

PERSONALISED WAYS OF WORKING This fact is neatly illustrated by a study in which employees claimed that working from home increased their productivity, whereas their supervisors argued the opposite. I am confident that if the supervisors were to evaluate solely their own work from home, they would also claim they were more productive – provided, that is, they actually like working from home.

Ultimately, the current debate about whether it is more productive to spend two days working from home and three days in the office, or vice versa, is not particularly fruitful. Instead, we should be having a frank discussion about new ways of working and a constructive debate about which hybrid-working models are best suited for whom and for which jobs. If I am hiding at home to avoid contact with my team or my supervisors, or because my work is so dull that I want to seize every opportunity to do something else, then the real issue is not whether people should be working from home two or three days a week, but rather how we need to improve the substance of our work and our work relationships.

NEW QUESTIONS The debate about how we will work in the future is here to stay, and it raises a number of other questions. As new technologies and new forms of organisation continue to emerge, how much will people still need to work? Various models of the four-day week are already being tested, from working four days at the office to spending some or all of those days working from home. If robots were to take over our work at the factory or bank, then perhaps we would not need robots to care for the elderly members of society. And perhaps this, too, would end up making our work more humane and meaningful. ○

Read more blogposts at:
⟶ ethz.ch/zukunftsblog-en

Image: Adobe Stock

How to decarbonise heavy vehicles?

Image: Colourbox

Heavy trucks are unlikely to be zero-emission in the near future.

With HGVs (heavy goods vehicles) accounting for almost one-third of annual global CO_2 emissions in the transport sector, their decarbonisation has a key role to play in efforts to achieve net-zero greenhouse gas emissions by 2050.

A team of researchers led by ETH professor Tobias Schmidt has now used a model to determine which technologies will dominate in the road freight sector by 2035. Their results show that without policy measures to decarbonise heavy-goods traffic, a large proportion of HGVs will still be fuelled by diesel in 2035. Widespread adoption of zero-emission lorries that are powered by battery or green hydrogen will hinge on how much they cost relative to conventionally powered vehicles. Reducing toll charges for zero-emission lorries would be one effective way to promote the electrification of HGVs.

Calculations made using the model show that the goal of electrifying new goods vehicles by 2035 is only on track for small vans and medium-sized lorries – and that this will almost exclusively involve battery power. One reason that batteries are so popular is that a hydrogen lorry requires about three times as much renewable electricity as a battery-powered one. Moreover, the costs of battery-electric lorries are set to fall faster than those of hydrogen-powered ones. ○

Drug delivery via suction cups

Many drugs used to treat diabetes, obesity and prostate cancer consist of relatively large molecules. These medications have to be delivered into the bloodstream via injection and cannot generally be administered in the form of a tablet.

Image: Luo Z et al. 2023; modified

A suction cup to administer medication via the mucosal lining of the cheek offers an entirely new method of drug delivery.

A group of researchers led by ETH professor Jean-Christophe Leroux has now developed a suction cup that can painlessly deliver even large molecules like peptides into the bloodstream via the mucous membrane of the cheek. Patients press the suction cup – which measures just 6 by 10 millimetres – onto the inside of their cheek. The medication is absorbed by the mucosal lining in a matter of minutes, and the suction cup can then be removed.

Researchers Nevena Paunović and David Klein Cerrejon now plan to found a start-up, Transire Bio, to bring the suction cup to market, with the support of a Pioneer Fellowship from the Hauser Foundation. Their new method could spare millions of patients the fear and pain associated with receiving injections. ○

Making ocean acidification visible

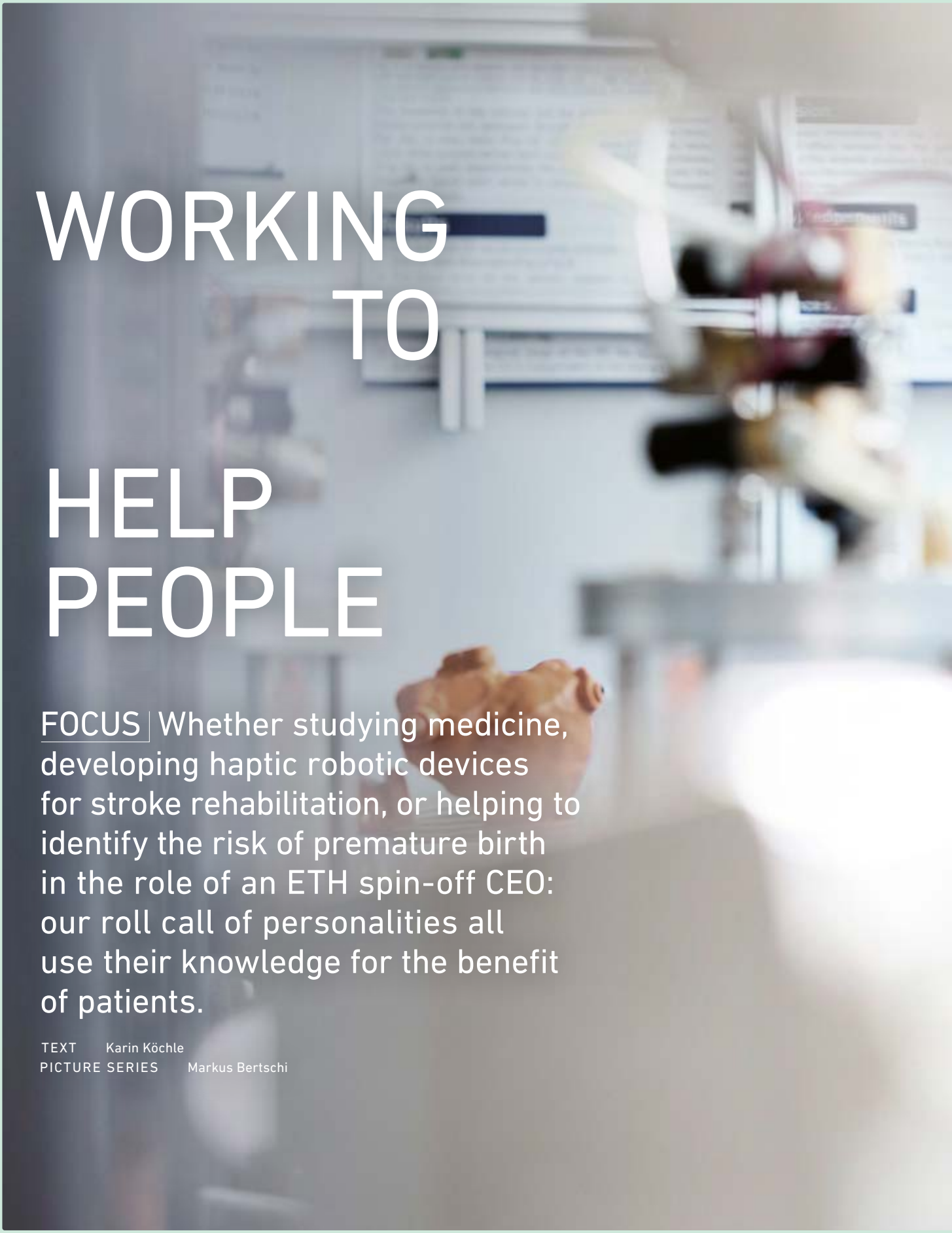
Not only do our oceans absorb much of the extra heat caused by the increased concentration of greenhouse gases in the atmosphere – they also absorb about one-third of the CO_2 emissions produced by human activity. One of the consequences of this is ocean acidification, which has a major impact on marine life.

Many people are unaware that the oceans are also affected by climate change. ETH professor Nicolas Gruber and his team are hoping to change that with a web-based graphics tool that uses colour-coded bars to depict ocean acidification over the past 40 years. Anyone can access this new ETH tool, which can be used to visualise the change in acidity in over 60 regions.

In a more recent study, the research team showed conclusively that human-induced CO_2 emissions are causing the progressive acidification of the world's oceans. ○

Image: ETH Zurich / Nicolas Gruber and Luke Gregor

Ocean acidification from 1982 to 2021: each year appears as a coloured bar, with the colour indicating the acidity.



WORKING TO HELP PEOPLE

FOCUS | Whether studying medicine, developing haptic robotic devices for stroke rehabilitation, or helping to identify the risk of premature birth in the role of an ETH spin-off CEO: our roll call of personalities all use their knowledge for the benefit of patients.

TEXT Karin Köchle
PICTURE SERIES Markus Bertschi

MARIANNE SCHMID DANERS spent the first 15 years of her career as a registered nurse. Her interest in technology then took her from the intensive care unit to ETH Zurich, where she completed a Mechanical Engineering degree with a focus on biomedical applications. Long fascinated by specifically human applications of technology, she regards her chosen field as the ideal place to combine her experience in nursing and mechanical engineering. Today, she works in the Biomedical Applications research group at ETH Zurich, where she is developing new and smart methods to provide precisely tailored care for hydrocephalus patients.

TEAMING UP FOR BETTER HEALTH

What's the best way to translate research findings into clinical practice? A discussion with Monika Jänicke, CEO of the University Hospital Zurich, Rahel Kubik, head of radiology at Kantonsspital Baden, and Christian Wolfrum, VP for Research at ETH Zurich.

TEXT Corinne Johannssen and Florian Meyer

Research translation has been a hot topic in the headlines in recent years. What's the best and fastest way to transfer the results of basic research into clinical practice?

RAHEL KUBIK: It's really important that any new method developed by researchers should address an existing challenge in clinical care. Costs in the healthcare sector are skyrocketing, so we need to ensure that research translation generates an actual benefit – and that means identifying genuine needs. But the success of a translation project also depends on the various professional groups involved: doctors, basic researchers and nursing staff all need to share a common language and have a bond of familiarity and trust. Research translation can be a long, hard road – so you need to make it a shared journey.

MONIKA JÄNICKE: You hit on two very important points there: trust and interprofessional teams. The ability of interdisciplinary teams to shorten the journey from basic research to clinical practice is something I find particularly fascinating.

CHRISTIAN WOLFRUM: As well as an interdisciplinary team, you also need people working at the interfaces. One way to make faster progress is by appointing people to dual roles. In terms of professorships, for example, that would mean someone holding two positions simultaneously, one at a hospital and one at ETH Zurich. You tend to get quicker results when you're familiar with both worlds.

JÄNICKE: Exactly. If you have ties to multiple institutions, you feel a connection to them and understand what resources they have. Each individual institution has its own particular strengths, whether that's Kantonsspital Baden, ETH Zurich or the University Hospital. By combining those strengths, you can get more done in less time.

WOLFRUM: Get the structures right and you inevitably make translation faster. That only falters when you're confronted with situations that require incredible amounts of energy to break new ground.

Where does the most energy get wasted?

KUBIK: Most of the hurdles that hinder collaboration with basic research can be found on the hospital side. For example, we have much stricter privacy policies in the healthcare arena. Patient data is hugely sensitive and needs protection.

WOLFRUM: We urgently need a solution that will enable a more progressive approach in this area. Obviously, I'm not talking about weakening data protection standards. But we do need to create clear guidelines and a uniform, standardised approach. Over-regulation can stifle innovation.

JÄNICKE: A good example of this is how each canton has its own data protection regulations, so the rules on what's allowed differ from one canton to the next. It's a tricky topic, because everyone is ultimately doing their best to handle patient data responsibly. But, above and beyond this, it really isn't an efficient way to go about it.

KUBIK: I've also noticed this uncertainty creeping into collaborative projects. We really need a framework agreement so that we don't have to renegotiate the terms of cooperation for each and every project. It's time to remove some of the administrative hurdles so that we can focus more of our attention on research and innovation. I would even go so far as to say that being in Switzerland puts us at a disadvantage here. My colleagues in the US and Asia can carry out huge research studies into artificial intelligence, databases and personalised medicine. Those kinds of data-rich studies are impossible here, unfortunately, yet they are exactly what we need to translate basic research into better patient care.

WOLFRUM: That's an important point. North America and Asia really are a long way ahead of Switzerland when it comes to large, data-intensive medical studies. There's no doubt that the nationwide initiative Swiss Personalized Health Network has recently made enormous strides in strengthening data-based medical research and improving data sharing between universities and hospitals, but we still have a long way to go.

JÄNICKE: And it's not just about removing obstacles. I think we also need to focus on incentivising innovation. So many of our colleagues working at the interface between lab and clinic are intrinsically motivated to come up with beneficial new developments for patients and for society. But we need to be ready to bear the costs of the innovations they produce. It can take years to negotiate a remuneration model for a new method! We should be taking a bolder approach.

"We need to combine our strengths to get more done in less time."

Monika Jänicke

"ETH has some 100 professorships conducting research into medical topics. This new platform transfers ETH expertise from the lab to the clinic."

Christian Wolfrum

KUBIK: The healthcare system is not designed to reward innovation. That's definitely a problem.

Christian Wolfrum, why is collaboration with hospitals so important to ETH?

WOLFRUM: ETH has defined health and medicine as one of its strategic action areas. We can only pursue that through cooperation with clinics. Our insistence on linking basic research to its application is an integral part of what we stand for at ETH. We work with external partners in all areas of technology transfer. That includes industry, professional associations and, of course, hospitals.

JÄNICKE: And the same applies in reverse. You can only succeed by getting all the key players to work together.

KUBIK: That applies to all the institutions along the entire healthcare chain, including the rehabilitation centres that offer follow-up care, for example.

What distinguishes a university hospital from a cantonal hospital when it comes to research?

JÄNICKE: Our strengths lie in different areas. If ETH was conducting a study into lung transplants, they would work with us, because we specialise in that field. But for more common diseases, a cantonal hospital would be the more suitable partner, because it does a better job of covering the full spectrum of diseases in the population.

KUBIK: We're pretty small compared to the University Hospital Zurich. That obliges us to take an interprofessional, interdisciplinary approach ⟶

Rahel Kubik, member of the executive board of Kantonsspital Baden and head of the Institute of Radiology.

to our work, which I see as a positive. And because we do less research here, our patients are always eager to participate in studies.

WOLFRUM: Of course, there are also many areas where there's an overlap. Switzerland is a small country. So if we need high case numbers, we have to get all the hospitals involved, whether cantonal or university. That's a great example of combining resources can achieve impressive results.

How important is physical proximity when it comes to collaboration?

KUBIK: Personal contact is important, because it gives basic researchers useful insight into our clinical work. At the same time, we learn more about the time and intellectual effort required to get a new method or an innovative device working.

JÄNICKE: It's easier to share knowledge when people work in relatively close proximity and are in regular contact. But it's also about the fun and energy of the whole process. When everyone is motivated to reach the same goal, you tend to get a better output and achieve more robust results.

Monika Jänicke, CEO of the University Hospital Zurich.

WOLFRUM: Successful research doesn't just require specialist knowledge; it also relies on the soft skills of each individual partner.

JÄNICKE: I should add that being in close proximity doesn't only mean working next door to each other. It's also about being part of a network like Zurich-Baden or Zurich-Schlieren. And if we want to drive innovation, we should also be talking about new shared workplaces. For example, our campus at the University Hospital has so many listed buildings that we can't build the kind of innovative lab facilities they can in Schlieren.

ETH Zurich recently created a digital platform for clinical research.

WOLFRUM: That's right. We've launched our Clinical Trial Unit, which is primarily a virtual environment. But it also has a sizeable office in Baden as well as one in the new ETH GLC building right next to the University Hospital. This new platform forges

> "The healthcare system isn't designed to reward innovation. That's definitely a problem."
>
> Rahel Kubik

Christian Wolfrum, Vice President for Research at ETH Zurich.

links to hospitals, thereby enabling our researchers to team up with them on clinical research. ETH has some 100 professorships conducting research into medical topics, and this new platform is a great way to transfer ETH expertise from the lab to the clinic.

KUBIK: ETH has significant expertise in many areas that are becoming increasingly important to the field of medicine, such as artificial intelligence, robotics, medical devices and wearable health technology. Ultimately, basic research should be about improving patient care. As a healthcare provider, we need to make sure that it gets translated into clinical practice.

JÄNICKE: It's important to remember that we're educating the medical professionals of the future – and that new technologies will form a key part of their day-to-day work.

Speaking of education: the first students to take the Bachelor's degree in Human Medicine at ETH have now finished the next level of their studies, with the initial cohort completing their Master's degree this year. What impact does education have on clinical practice?

KUBIK: Medicine is undergoing a profound transition, and I see plenty of disruption ahead. I have no idea if the job of radiologist will still exist in its present form 20 years from now, but I'm sure we'll see new professions emerging. We need to lay the groundwork for a new generation of doctors. ETH graduates have a slightly different profile, which I think nicely complements traditional university degree programmes. But, even more importantly, they have the ETH network, which I think offers huge advantages when it comes to delivering translational research projects and technological innovations that will benefit patients.

JÄNICKE: A background in science is a great asset for everyone involved, and the technical and digital aspects will take on increasing importance as medicine continues to advance.

How might technological advances transform the practice of medicine?

KUBIK: The next generation of doctors will need different skills. The ability to evaluate and interpret technologies will grow in importance.

JÄNICKE: Despite the fact that healthcare is becoming more and more dominated by technology, we mustn't forget the human dimension. We need that emotional component more than ever. The more technical medicine becomes, the more important it is to display emotional intelligence and empathy when dealing with patients.

WOLFRUM: Medicine must continue to focus on the human factor. ○

PROMOTING COLLABORATION To ensure that the wide range of medical research at ETH converges ever closer with the concrete needs of clinical practice, close collaboration between research labs and clinics has never been more vital. Thanks to the ETH MedLab programme, outstanding junior doctors can spend a year carrying out research into a clinically relevant issue in the appropriate ETH laboratory. Each year, two or three MedLab Fellows are selected in a competitive process and can have the research year credited towards their Swiss Medical Association (FMH) education as further training. The young doctors benefit from the expertise of scientists at ETH, while the scientists acquire experience in clinical issues.

Show your support:
—〉 ethz-foundation.ch/en/medlab-fellows

ROGER GASSERT is Professor of Rehabilitation Engineering at ETH Zurich. Having contracted Covid-19 in April 2021, he spent nine weeks in a coma and came close to death following numerous secondary complications. After this experience, he plans to waste no time ensuring that patients benefit from his research and technological expertise. Recent developments from Gassert include portable haptic robotic devices for the treatment of hand function in stroke patients. Technology like this helps improve therapeutic outcomes: in this case, by enabling patients to do rehabilitation exercises at home.

IMPROVING PATIENT SAFETY

On the road to recovery, patients come into contact with clinicians from a whole range of disciplines. The importance of targeted collaboration between these disciplines is something medical students learn early on at ETH Zurich.

TEXT Florian Meyer

When illness strikes, people generally turn to a doctor for help. He or she prescribes the appropriate medicine and determines whether any other treatment might be necessary. The relationship between patient and doctor therefore plays a major role in recovery. Yet this is just one of several important relationships in this context. While on the road to recovery, patients come into contact with healthcare professionals from many different disciplines, each of whom applies their unique skills and techniques to help the patient get better.

Take the example of a 56-year-old female patient who is suffering from bowel cancer with liver metastases. Various medical tests confirm that surgery is the only option, and a resection is performed to remove the rectum. The patient then begins a course of chemotherapy, which is agreed upon in consultation with the attending doctor. At the same time, this case also involves many other aspects: the removal of the patient's rectum means that she needs a colostomy, a surgically created opening in the abdomen. She therefore receives support from a specialist stoma nurse who explains how the colostomy bag must be changed several times a day and shows her how to care for the skin around the stoma. By helping the patient become accustomed to this artificial bowel opening, the nurse becomes a further important point of contact. The patient also makes regular visits to the pharmacy to get advice on taking her medication and alleviating the adverse side-effects of chemotherapy.

Before the patient leaves hospital, the doctor, specialist nurse and social worker arrange a meeting with the patient and her relatives. The woman is told how to continue her treatment at home, and the social worker lists the available home-care services and explains what is covered by her health insurance fund. Back in her flat, she is supported by the community health team, Spitex. Eventually, doctors tell the 56-year-old patient that she will require further surgery and another round of chemotherapy. At this point, she ⟶

chooses to supplement her treatment with complementary medicine, but her condition deteriorates and she decides to start palliative care. Her care coordinators set up an interprofessional meeting to which her family is also invited.

This case study illustrates how multiple healthcare disciplines can work together to meet a patient's needs. The idea is to integrate the patient within a network of medical and healthcare professionals who assist her in her recovery. Studies show that seamless interaction between the various disciplines increases the quality of patient care and patient safety while also reducing costs. With many healthcare services increasingly being provided on an outpatient basis – that is, without an overnight stay in hospital – a holistic, interdisciplinary approach to care is becoming more and more important.

EXEMPLARY TEAMWORK In practice, however, integrated and well-coordinated patient care is far from being the rule. Overwork, poor coordination and staff shortages all hamper interdisciplinary cooperation. For patients, the processes involved often appear confused and inconsistent. Sick individuals are concerned solely with their own health, not with how health might be defined according to different professions.

"Treatment is teamwork and should be delivered in a patient-centred way," says ETH professor Jörg Goldhahn. He works at the Institute of Translational Medicine, which aims to take research findings from bench to bedside – in other words, from the laboratory research setting into clinical practice. Goldhahn also serves as Director of Studies for the Bachelor of Human Medicine at ETH Zurich, which was launched in 2017. The team responsible for this ETH Bachelor's programme developed a new training module that focuses on interprofessional collaboration from the patient's perspective. They created the module in a joint project with Kantonsspital Uri, the nursing college Berner Bildungszentrum Pflege and the coordinators of pharmacy-related degree programmes at ETH. "It's modelled on the kind of teamwork that is common in engineering; we took this tried-and-tested approach and applied it to the healthcare sector," says Goldhahn.

"Treatment is teamwork and should be delivered in a patient-centred way."

Jörg Goldhahn

"Students have no difficulty in developing an interdisciplinary understanding of patient care."

Claudia Schlegel

This joint module gives medical, pharmacy and nursing students an insight into the expertise and working methods of other healthcare disciplines and shows them the roles and responsibilities these professions have in patient care. "By bringing together medical, pharmacy and nursing students on the same course, we encourage them to learn from and about each other. It helps them see how important it is to view the various aspects of patient care not in isolation, but from an integrated, patient-centred perspective," says Claudia Schlegel. As Co-Leader of Training and Transfer at the Berner Bildungszentrum Pflege, she played a key role in designing the interprofessional course as a member of the ETH Bachelor of Human Medicine project team.

A doctor's education should be based on what they will need in the future, says Goldhahn: "Working in interprofessional teams will be even more common than it is today. We want students of medicine to prepare for that environment early on." The course is taught to ETH medical students in their fifth semester over 12 afternoon sessions.

FIRST-HAND EXPERIENCE Real-life situations form the basis for this interprofessional training. As well as experiencing births together with midwifery students, the medical students develop drug therapies with pharmacy students and learn how doctors and nurses can work together to develop pa-

tient treatment plans. The course also includes sessions at Kantonsspital Uri and at GP practices. The point of these visits is for students to see for themselves what collaboration means under real-life conditions and to observe the practical challenges that medical professionals face at the interfaces and during handovers.

At the Bern and Aarau nursing colleges, medical students practice how to draw up a patient discharge plan together with nursing students and simulated patients – that is, people trained to play a specific patient role which allows students to practice their communication and consultation skills. This activity helps the students see things from the perspective of other professions and from that of the patient. They also learn to express their opinions within an interprofessional team in such a way that their observations and considerations are incorporated in the final decision on which treatment to recommend for a patient.

THE OPTIMAL DOSE The joint modules for Bachelor's students in Human Medicine and Master's students in Pharmacy are based on the same premise. Doctors and pharmacists are both members of the medical profession and have specialist knowledge of medicines, so it makes sense for both sides to attempt to understand and appreciate each other's expertise. Doctors tend to look at how a drug can be applied to treat a specific disease in the human body, while pharmacists tend to focus on the active ingredients a medicinal product contains. "We show students how interprofessional communication between doctors and pharmacists can help identify the optimal dose, and how to avoid undesirable side-effects or risky interactions when combining several drugs," says Elvan Kut. A lecturer and programme coordinator on the ETH Master's programme in pharmacy, Kut also works as a pharmacist in Zurich.

When it comes to drug therapy, patient safety is a vital part of the treatment process. That's why medical, pharmacy and nursing students all take this subject together – because valuable feedback on therapy is equally likely to come from nurses and physiotherapists. This feedback is particularly helpful in the case of complex or chronic complaints such as cardiovascular disease, cancer, dementia, chronic respiratory disease and diabetes, all of which cannot be completely cured and require repeated treatment. In order to avoid errors in a patient's course of treatment, it is vital that all the clinicians involved feel able to express their concerns if they notice something is wrong. However, this willingness to speak up requires a high degree of trust between different professions and is sometimes hampered in practice by interpersonal issues or organisational hierarchies.

COMMUNICATION CHALLENGES In some cases, circumstances can make it hard to address sensitive aspects of a patient's treatment, as Abinaa Senthilrajan knows all too well. She completed her Bachelor's degree in Human Medicine at ETH this year and is now studying medicine in Lugano. One of her cases involved a supermarket employee who was so badly affected by Covid-19 that doctors had to put her in an induced coma for two weeks. She struggled to wake from the coma and continues to suffer from long Covid today. Interprofessional collaboration on her case ran smoothly despite the disruption caused by the pandemic, but understanding the patient's wishes and concerns proved to be difficult. Her knowledge of German was extremely basic, and her daughter was unable to visit as often as necessary due to the pandemic restrictions. "Communication is a vital factor and forms the basis of any successful medical treatment," says Senthilrajan.

"What we've seen so far suggests that students have no difficulty in adopting the perspective of patients and healthcare professions and developing an interdisciplinary understanding of patient care," says Schlegel. "They see that all medical and healthcare professions work for the benefit of patients, even though they use different methods to achieve this." ○

Continuing education and training in the field of medicine:

Bachelor of Human Medicine
⟶ ethz.ch/humanmedizin

Master of Pharmacy
⟶ master-pharmazie.ethz.ch

MAS ETH in digital Clinic Research
⟶ mas-dicr.ethz.ch

CAS ETH in Modern Concepts in Clinical Research
⟶ mas-dicr.ethz.ch/cas-programmes/cas-mccr

PAIN RELIEF WITHOUT DEPENDENCE

ETH researchers have teamed up with Kantonsspital Baden to find ways of preventing patients from becoming dependent on opioid painkillers.

TEXT Fabio Bergamin

Much attention has recently focused on the use of opioids, which include morphine and related painkillers such as oxycodone. Though regarded as a blessing for patients suffering from severe and acute pain, they can also be a curse due to their potentially addictive nature and the risk of fatal overdose. The opioid crisis in the US and Canada, where tens of thousands of people die of overdoses each year, is now casting a shadow over Europe, where the number of prescriptions for opioids such as oxycodone has seen a big jump over the past decade.

Opioids also feature large in the research collaboration between Kantonsspital Baden's hospital pharmacy and the Institute of Pharmaceutical Sciences at ETH Zurich, a project that has been running for over four years. ETH's participation in this project is led by Professor of Pharmacoepidemiology Andrea Burden. A key role is played by her colleague Dominik Stämpfli, who splits his time between working as a clinical pharmacist at Kantonsspital Baden and as a scientist in Burden's research group at ETH.

OPTIMAL THERAPY Both researchers work on a number of topics, including the risks that medication poses to patients and how drug administration can be improved to ensure patients derive the maximum benefits from their course of treatment. Their goal is to minimise the frequency of side-effects, the risk of overdose and the development of drug dependence.

Re-hospitalisation also forms part of their research. A key goal of care is to avoid any post-discharge complications that might make it necessary for a patient to be readmitted after leaving hospital. Once again, opioids emerge as a key

factor here, as an ETH Master's student was able to show in a data analysis under the supervision of Stämpfli and Burden. This analysis revealed that patients who were still being prescribed opioid painkillers at the time of discharge from hospital had an increased risk of being re-hospitalised within 30 days. "The results confirmed what we already knew: that we need to take better care of patients that receive opioids," says Stämpfli.

According to an analysis of health insurance data – excluding patients who receive opioids for cancer pain and opioid-dependent patients receiving controlled quantities under medical supervision – around one-third of people in Switzerland who are prescribed opioids by a doctor continue taking the medication for over 12 months. Yet evidence suggests that while opioids are useful for treating acute pain and for palliative care, they should not be taken for longer periods of time to treat chronic pain. This is because long-term use may increase sensitivity to pain, hinder rehabilitation or lead to opioid use disorder with the risk of overdose. Recommendations on how to make the best use of these drugs in hospitals are therefore vital. At Kantonsspital Baden, a team is now working with resident clinicians, nurses and primary-care practitioners to put together appropriate guidelines. This will also include advice on how doctors and nurses can work together to ensure that patients eventually come off their opioid medication.

DISCHARGE WITHOUT OPIOIDS "Patients need better support with opioid therapy; we shouldn't be leaving them to deal with this alone," says Burden. This support might include monitoring patients more closely while they are still in hospital, as well as making an earlier start on tapering off the dosage. "Ideally, this tapering process would be completed before the patient leaves hospital, so that they can be discharged without opioids," says Stämpfli.

Meanwhile, patients who still require opioid painkillers after leaving hospital should be given detailed information on how to use their medication properly, either through talking to a clinician or in the form of leaflets. Patients and their primary-care practitioners need to know how quickly they should taper off opioid medication for acute pain. Kantonsspital Baden is therefore working with Burden on a study that will assess the effectiveness of different tapering strategies.

"It's not about withholding opioids from patients, because they have the right to relief from excessive pain," says Burden. "It's more a question of making responsible use of this type of pain-relief medication, which basically means using it for short-term relief from acute, severe pain and combining this with a clear exit strategy."

The collaboration between Kantonsspital Baden and ETH offers benefits for both sides. "ETH Zurich doesn't have a medical faculty; by working with the hospital, we get the opportunity to conduct research using patient data and to carry out clinical studies," says Burden. The key benefits for her come from the close contact to doctors, nurses and pharmacists who work with patients on a daily basis – in other words, practitioners who have plenty of pressing questions. "Scientists like us have the research expertise and can help them find the answers they need," she says. ○

Image: Adobe Stock

Opioid-based painkillers pose a risk of overdose or of developing dependence.

ANDREA BURDEN is Professor of Pharmacoepidemiology in the Department of Chemistry and Applied Biosciences at ETH Zurich.
⟶ pharmacoepidemiology.ethz.ch

DOMINIK STÄMPFLI splits his time between working as a clinical pharmacist at Kantonsspital Baden and as a scientist in Burden's research group at ETH Zurich.

NOÉ BRASIER is a clinical researcher and medical doctor. It was while working at the University Hospital Basel that he first became interested in the emerging field of sweat analysis. As a MedLab Fellow at ETH Zurich, he was the first researcher to embark on a large-scale study of molecular heat-stress markers. The aim of this project is to develop on-skin methods of measuring and monitoring heat stress. His research could also pave the way for non-invasive digital molecular diagnostics in other areas – for example, in the treatment of fever patients.

There are some striking parallels between how skin wounds heal and how malignant tumours grow. Cell culture can help us understand the mechanisms involved – but animal testing still has a role to play.

TEXT Fabio Bergamin

HOW WOUNDS HEAL – AND CANCERS GROW

Picture the scene: you're chopping an onion, and suddenly the knife slips, leaving you with a painful cut on your index finger. It's something most of us have probably experienced at one time or another. Fortunately, these kind of wounds usually heal within a week – but sometimes things take a more complicated turn. Wounds can become infected after surgery, for example, and many elderly people suffer from chronic open wounds that won't heal. And even when the healing process runs smoothly, it may still leave an unsightly scar.

Wound healing is the main area of research of ETH professor Sabine Werner. A biochemist by training, her interest lies in the molecular and cellular mechanisms used by cells to heal wounds and form scars. In one of the most significant milestones of her research career, Werner was able to show that activin – a cellular growth factor – is a major orchestrator of wound healing. Moreover, she showed that this factor not only plays a key role in wound healing but also in the development of cancer.

This research had its roots in animal testing. A number of years ago, Werner was conducting experiments with mice to identify genes and proteins that are expressed at higher levels in both wound healing and cancer – and that was when she hit upon activin. Using cell culture models, she went on to study the mechanisms by which this factor acts. By performing further tests on mice, she was able to show that the right level of activin at the right time is vital if a wound is to heal normally. Blocking this factor in mice significantly impairs wound healing. By contrast, when cells produce high levels of activin, wounds heal faster – though too much activin is associated with the formation of larger scars.

"I wanted to stick solely to in vitro testing rather than using animals in my research," she says. But she soon realised that animal testing was essential if she was to have any hope of fully understanding the wound healing process. She also knew that if she wanted the results of her ⟶

research to benefit patients with impaired wound healing, she would need to collaborate closely with clinicians in hospitals.

OUT OF CONTROL In further tests on mice with small skin tumours, Werner was also able to show that increased activin levels stimulate tumour growth and that the cancer cells increasingly invade the surrounding tissue. "We see many of the same biochemical and cellular processes taking place both in wound healing and in the development of multiple types of cancer," she says. "In the case of wound healing, these processes come to a halt once the wound has been repaired. But in cancer, they spiral out of control, and malignant tumours harness the mechanisms involved in wound healing in order to stimulate their own growth."

Through her collaboration with dermatologists at the university hospitals in Zurich and Lausanne, Werner regularly receives biopsies from skin cancer patients for use in her research. Experiments with this tissue showed that tumours that grow aggressively also produce excessive levels of activin, and that this activates the same biochemical processes.

"To get the best results in biomedicine, you have to combine as many techniques as possible," says Werner. "We need to study these mechanisms in human tissue – that is, in biopsies – and in good cell culture systems with human cells, but it's also important to study them in animals."

Scientists all over the world are currently making huge efforts to optimise and improve cell culture models. Werner, too, is involved in this research through Switzerland's interdisciplinary skin research project Skintegrity.ch. She is confident that cell culture will yield even more useful insights over the coming decades. "The balance will tilt more towards cell culture and away from animal testing," she predicts. Scientists already have access to complex and sophisticated cell culture models that consist of both dermal and epidermal layers and that even encompass different skin cell types. "We're already using these advanced methods wherever we can in our research," she says.

But there are still many areas of research in which cell culture is not an appropriate tool. Both wound healing and cancer are characterised by inflammatory responses that involve many different immune cells. Hormones play a role in wound healing and scar formation, as do growth factors, such as those produced by nerve cells embedded in the skin. With cell culture systems, it is impossible to reproduce all these aspects in a way that adequately reflects the complexity of the human body. Equally, cell culture cannot be used to study the formation of metastases in different organs.

"Testing on animals offers certain advantages and is, unfortunately, necessary. However, we still need to do everything we can to alleviate the suffering of laboratory animals and to reduce the amount of animal experimentation," says Werner. Her group is working on improving animal experiments and optimising pain management. In addition, modern biochemical methods of analysing wound material allow scientists to obtain meaningful results using relatively little material. This has enabled Werner's group to reduce the number of invasive animal experiments significantly in recent years.

QUEST FOR NEW DRUGS Werner hopes that her findings on the growth factor activin will lead to the development of potential new therapies. The idea is to create new drugs, particularly for cancer, that prevent activin from interacting with its targets, or that prevent it from activating specific biochemical signalling pathways. Werner is too focused on fundamental research to tackle this step herself, but she's working closely with clinicians to get the ball rolling. Any drugs that make it through this process will also have to be tested on animals before patients can benefit from them.

In Werner's experience, research into cancer always produces crossover benefits for wound healing, and vice versa. So it's perfectly possible that these drugs could also prevent the formation of large, unsightly scars. ○

SABINE WERNER is Professor of Cell Biology in the Department of Biology at ETH Zurich.
⟶ mhs.biol.ethz.ch/research/werner

SUPPORTING RESEARCH INTO SKIN DISEASES SKINTEGRITY.CH (www.skintegrity.ch) is a major interdisciplinary research project that seeks to make Switzerland a leading player in the field of skin research. By bringing together scientists, engineers and doctors, it promotes collaborative research into the causes of skin diseases and tissue repair disorders and fosters the development of innovative diagnostic procedures and treatments. Topics covered by the programme range from fundamental research to the production of artificial skin for transplantation and the development of imaging systems for the early detection of skin cancer and other skin disorders.

⟶ ethz-foundation.ch/en/projects/topics/health/skintegrity/

A BIG STEP IN JOINT RESEARCH

Surprisingly little is actually known about how the knee works. ETH professor Bill Taylor plans to change this with a unique technology and a new 22-metre-long experimental facility.

TEXT Karin Köchle

"The knee is the most exciting of all the joints in the human body," says Bill Taylor, Professor of Movement Biomechanics at the Department of Health Sciences and Technology. "And it's also the most complex. The knee joint is subject to tremendous acceleration and huge stresses, and it performs highly complicated movements." Taylor discovered his passion for the knee some 20 years ago. Since then, his goal has been to understand every last detail of how this joint works. "First, we need to determine what kind of stresses act on the knee and what kind of movements it performs – only then will we be able to understand why the joint sometimes becomes stiff, or cartilage is depleted, or pain occurs," he explains.

To learn more about how the knee works, Bill Taylor and his team are using an advanced form of videofluoroscopy – the imaging of skeletal structures within the human body by means of pulsed X-rays. Taylor combines this with an analysis of knee movement using skin markers, force plates and measurements of muscle activity. The Institute of Biomechanics at ETH Zurich first developed an automated moving fluoroscope over ten years ago in order to track the movement of the knee while walking and climbing stairs. This arc-shaped X-ray device was mounted on a robot that followed the movements of the joint. As the test participants walked, the entire apparatus moved with them, thereby recording moving X-ray images of the knee. These two-dimensional images were then used to create three-dimensional reconstructions and anatomical models, including the muscles and ligaments of the knee joint. This showed the amount of stress exerted on individual ligaments during specific movements, which in turn is important for understanding how pain develops.

UNIQUE MEASUREMENT DEVICE Although the original device provided much more accurate measurements than previous methods, it came with a number of drawbacks: images were in one plane only, and of a low resolution; likewise, on account of its design, only slow walking movements could be investigated. Taylor and his team therefore resolved to modify and enhance the original device. As Taylor explains, their vision was "to build a unique, state-of-the-art piece of equipment" that would set the gold standard, not only for basic research but also for clinical assessment of knee functionality. The goal was to provide answers to the following questions: Where best to begin with the rehabilitation of a damaged joint? When exactly does a knee joint need replacing? And which implant is best suited for a specific person? ⟶

Image: ETH Zurich / Michel Büchel

Final touches to the set-up: The video fluoroscope will soon be deployed for studies.

The approval of a grant application to the Swiss National Science Foundation gave the green light for the development of the new dual-plane video fluoroscope. In addition to an innovative bi-planar imaging unit, the new device features electric motors that accelerate extremely quickly, thereby keeping the knee in the field of view of the imaging unit throughout the full cycle of stair climbing or other everyday activities. In addition, the device is able to track the movement of the subject by means of a single marker. This is attached to the subject's knee but not to the fluoroscope, which means the subject is able to move freely.

BENEFITS OF A NEW LOCATION In autumn 2023, Professor Taylor and his team moved from the Hönggerberg campus to the new GLC building in the centre of Zurich. Transport and assembly of the new fluoroscope have posed major challenges, and both required lengthy planning. To ensure full functionality and compliance with all the safety regulations, the concrete foundations for the laboratory, which is located in the basement of the research building, had to be specially designed and constructed to accommodate the 22-metre-long test facility.

The proximity to clinics and other research institutions offers many advantages. "We work very closely with the Schulthess Clinic," Taylor explains. "They helped us with a number of aspects, including the design of the new device." Joint projects are also underway with Balgrist University Hospital, University Hospital Zurich and Kantonsspital Baden. The fluoroscope will be used for the first time at the new location to carry out a study of healthy test subjects. The aim here is to generate gold-standard data to enable a better understanding of the condition of intact knee joints. This will then serve as a benchmark for other studies, including an ongoing Innosuisse project that aims to examine study participants with artificial knee joints and deliver insights for the future development of implants.

Taylor, however, is already thinking several steps ahead. He would like to further reduce the already low radiation levels involved in this imaging process. This way, the technology could be used not only for peripheral joints such as the knee but also for more vulnerable parts of the body such as the shoulder or spine. Clinics are already beginning to show interest. ○

BILL TAYLOR is Professor of Movement Biomechanics at the Department of Health Sciences and Technology, ETH Zurich.
—〉 movement.ethz.ch

FOR TOMORROW'S HEALTHCARE With its new GLC building on the Gloriarank site, ETH Zurich has created an ultramodern lab and development facility in the Zurich City University District. Providing teaching, research and research translation in the fields of healthcare, medicine and medical technology, the cutting-edge facility was made possible by a generous donation from the Mäxi Foundation.

—〉 ethz.ch/glc-en

SABRINA BADIR completed both her undergraduate and postgraduate studies at ETH Zurich. For her doctoral project, she developed a device to gauge the risk of premature birth. Following a Pioneer Fellowship at ETH, she ventured into the world of business, setting up the ETH spinoff Pregnolia in 2016, together with co-founder Francisco Delgado. Her innovation in preterm birth diagnostics has since given rise to a CE-certified medical device, which is now in use in numerous clinics and practices across Switzerland (pictured here, the Gynhealth practice). Badir's dream is that one day every doctor's surgery will have a Pregnolia system alongside its ultrasound machine.

Image: ETH Foundation / Hannes Heinzer

Bring on the talent!

The Excellence Scholarship & Opportunity Programme (ESOP) encourages outstanding young people from Switzerland and around the world to complete their Master's degree at ETH Zurich. Excellence Scholarships give students the opportunity to focus fully on their studies and research.

This financial support not only benefits talented individuals, however. The recipients often end up holding important positions in business or science, or founding their own companies, thereby channelling their knowledge and skills back into society.

The ESOP provides support to the top two to three percent of each year's intake. Fully funded by donations, the programme attracts many talented individuals from all over the world. This year's Excellence Scholars come from 21 countries, including – for the first time – Georgia and Tunisia. With 28 men and 26 women, the proportion of women is higher than ever before.

The 54 Excellence Scholars embarked on their Master's degree programmes at ETH Zurich this September. ETH Rector Günther Dissertori (front left in the picture) was on hand to greet the talented students at the ESOP Welcome Day 2023. ○

→ ethz-foundation.ch/en/projects/topics/talents/esop/

More research for children and young people

Launched in 2019, the Botnar Research Centre for Child Health (BRCCH) aims to drive research on topics that benefit children and adolescents all over the world – especially those living in low- and middle-income countries. To achieve this goal, the University of Basel and ETH Zurich work closely with the University Children's Hospital Basel (UKBB) and the Swiss Tropical and Public Health Institute (Swiss TPH).

Over the past four years, the BRCCH – which is funded by Fondation Botnar – has supported some 80 researchers and 29 research projects worldwide. Fondation Botnar is now donating an additional 50 million Swiss francs to the University of Basel and ETH Zurich to expand the joint centre's activities. This latest funding will support the establishment of six new professorships – three in Basel and three in Zurich. The research areas of the newly appointed professors range from biomolecular diagnostics and the development, application and integration of state-of-the-art analytical methods to an investigation of ethical and political considerations in digitalised paediatric healthcare.

In future, these professorships and their respective research teams will work at a new BRCCH research facility strategically located at the heart of the University of Basel's Life Sciences Campus and adjacent to ETH's Basel-based Department of Biosystems Science and Engineering. ○

Botnar Research Centre for Child Health (BRCCH)
⟶ brc.ch

Fondation Botnar
⟶ fondationbotnar.org

Partnership between ETH and the UN

Image: ETH Zurich

UN Under-Secretary-General Guy Ryder (left) and ETH President Joël Mesot after the signing of the memorandum of understanding.

ETH Zurich seeks to apply its skills in research, knowledge transfer and technology transfer to help tackle global challenges. Numerous ETH researchers already work with the United Nations (UN) in pursuit of this goal – but now this collaboration is being stepped up.

This October, ETH President Joël Mesot and UN Under-Secretary-General Guy Ryder signed a joint memorandum of understanding, committing ETH and the UN to push ahead with the development of technology-based social innovations to overcome global challenges.

Challenges highlighted in the memorandum of understanding include peace, security and sustainable development – issues that have concerned the United Nations since its founding. The idea is to combine the university's knowledge in the areas of conflict research, development cooperation and food safety with its expertise in the AI-based analysis of large data sets, and to step up efforts to make these resources available to the UN. ○

Dipping into the treasure trove

ETH Zurich's collections and archives include plenty of hidden treasures. Some of these are now on display in the new "extract" exhibition space in the Main Building.

TEXT Franziska Schmid

Image: ETH Zurich / Collections and Archives

Entitled "Biodiversity: vulnerable richness", extract's current exhibition reveals all sorts of fascinating, previously untold stories.

The Fungarium at ETH Zurich boasts an impressive collection of rust fungi, totalling over 70,000 specimens – and they're just the tip of the iceberg! Taken as a whole, the university's collections and archives, which span some 20 specialised areas of natural science and cultural history, contain in excess of 10 million artefacts and documents.

The diversity of these holdings is extraordinary. Highlights include the old books, fossils, rocks and minerals of the Earth Science Collections, the ETH Materials Hub for architects, the rich treasures of the Graphische Sammlung and more than 3.5 million photographs in the Image Archive. ETH Zurich also houses two literature archives: the University Archives and the Archives of Contemporary History.

But what led ETH Zurich to acquire these holdings in the first place? "It's true that many of these collections have evolved over time. But the idea that it's just some kind of dusty nostalgia trip is completely untrue," says Michael Gasser, head of ETH Zurich Collections and Archives. The countless artefacts, texts and images continue to play an important role in teaching and research. Examples include a recent project involving mathematical models from the Collection of Scientific Instruments and Teaching Aids, which were digitised in 3D and analysed and compared using digital methods.

A DIGITAL TREASURE TROVE The primary goal is to make the holdings accessible to as many people as possible. Current strategies rely heavily on digitisation, an area in which ETH has been making enormous progress. Platforms such as e-rara and E-Pics, for example, provide worldwide access to

over 75,000 valuable books, as well as to periodicals ranging from the second half of the 15th century to the early 20th century. The collection of rust fungus has also been completely digitised, allowing the specimens to be admired on screen in all their glory.

The suggestion that collections and archives might be losing their relevance is wrong on two counts. Firstly, the increasing use of artificial intelligence is fuelling a renewed interest in collections as a treasure trove of useful data. This data can be used to develop new services, which will then perform tasks such as searching for the names of historical figures, places and other "named entities" and automatically linking them together. "Secondly, it's clear that people still have this tremendous urge to experience physical exhibits in a real-life setting," says Gasser.

EXTRACTED TREASURES This is the thinking behind extract – a brand-new space created by ETH to showcase its collection and archive holdings (see box). Its first exhibition, which focuses on biodiversity, includes fascinating exhibits such as insects from the Entomological Collection and plants from the United Herbaria of the University of Zurich and ETH Zurich. "We've deliberately chosen to display exhibits that are relevant to current research topics," says Gasser.

The extract space is part of the new exhibition wing of the ETH Main Building, which also houses the Graphische Sammlung and the new permanent exhibition of the Thomas Mann Archive. All three exhibition spaces are open to visitors throughout the day.

Proof of their popularity came during the most recent edition of Zurich's Long Night of Museums, when over 1,800 people visited ETH. "The exhibition spaces in the Main Building are a wonderful opportunity for ETH to show that it's open to everyone," says Gasser. Ivory tower is very much off the menu – bring on the rust fungi! ○

Browse all the ETH Zurich Collections and Archives:
⟶ ethz.ch/collections-archives

EXTRACT Housed in two small rooms in the ETH Main Building, this space presents visitors with a choice selection of exhibits and documents from the collection and archive holdings of ETH Zurich. The current exhibition is dedicated to the topic of "Biodiversity: vulnerable richness".

⟶ extract.ethz.ch/en/

PHILANTHROPY

DONALD TILLMAN
Managing Director of the ETH Foundation

A special bequest

One of our jobs at the ETH Foundation is to offer professional advice to people who would like to remember ETH Zurich in their will. This often gives a fascinating insight into lives that have been connected to ETH in some way. Take Sylvan Eigenmann, for example: his late father, Hans Loeffel, studied and wrote his doctorate at ETH before working for many years as Professor of Mathematics and Statistics at the University of St Gallen. Professor Loeffel was very interested in the historical side of his subject and wrote a biography of Blaise Pascal. During his lifetime, he built up a considerable collection of antiquarian books. According to his son, Professor Loeffel always felt a strong bond to ETH. In memory of his father, Sylvan Eigenmann has therefore bequeathed these valuable volumes, including many first editions, to the ETH Library. It is here that they now reside, safe and sound in the Rare Books collection, serving as an example of how we do all that we can to accommodate the last wishes of ETH donors!

⟶ ethz-foundation.ch/en/legacies

Image: Hannes Heinzer

Moldovan President visits ETH

Image: ETH Zurich / Alessandro Della Bella

Swiss President Alain Berset, Moldovan President Maia Sandu and ETH professor Lars-Erik Cederman (left to right).

The future of the democratic world was the topic of Moldovan President Maia Sandu's visit to ETH Zurich. After talks on bilateral cooperation, President Sandu and Swiss President Alain Berset arrived at the university to talk about Moldova's role in the broader geopolitical context of Eastern Europe and the impact of Russia's war of aggression in Ukraine. This was followed by questions from students.

The distinguished guests were welcomed by ETH President Joël Mesot, who greeted them in a packed Auditorium Maximus. As Mesot explained in his welcome speech, ETH Zurich may be best known for engineering and sciences, but the university also conducts research in international security policy and advises the Swiss authorities. The event was hosted by Lars-Erik Cederman, who heads up ETH's International Conflict Research Group. ○

IN PERSON

Seismologist Andreas Fichtner uses the newest technologies to explore the interior of the Earth. His research with seismic waves has also found applicability in the field of medicine.

ANDREAS FICHTNER is Professor of Seismology and Wave Physics in the Department of Earth Sciences.
—〉 cos.ethz.ch

Does your research support efforts to predict earthquakes?

Predicting earthquakes is like balancing a needle on its tip and being able to say exactly in which direction it will fall – only even more complex. Instead, we focus on understanding the earth's interior as precisely as possible, in order to quantify the mechanisms of earthquakes and the tremors they cause.

What are the latest findings?

I'm fascinated and amazed by how modern technologies can help us reveal the inner workings of our planet. Among such technologies are not only supercomputers and faster simulation algorithms, but also fibre-optic telecommunications networks. Today, we can use fibres as dense sensor networks.

Is computing power reaching its limits?

The bigger problem is the increasing number of users and their needs, rather than the computing power itself. We're actively testing new approaches such as quantum computing to see if they can improve the situation.

You also work together with hospitals. What can you as a seismologist contribute to medical research?

We conduct foundational research for developing medical imaging techniques. The goal is to adapt modern simulation and analytic algorithms – originally developed for understanding the earth – to much smaller scales in medical settings. Here we take advantage of the physical and mathematical similarities between seismic and ultrasound waves.

You are a researcher, co-founder of the ETH spin-off Mondaic and Director of Studies at the Department of Earth Sciences. Do you ever have time to just switch off and relax?

Leisure wouldn't be leisure if one had enough time for it! Having little leisure time is a price I happily pay for having my hobby as my career. I get to work on fascinating subjects that will hopefully also contribute to human advancement, and I'm supported by a brilliant team! ○

TEXT Karin Köchle

Image: ETH Zurich / Nicole Davidson

The solar race car built by the ETH student team Alpha Centauri.

Across the outback in a solar car

It doesn't get much tougher than the World Solar Challenge, which sets participants the daunting task of driving 3,000 kilometres across the Australian outback in a self-built car powered exclusively by solar energy. During the race, which lasts between four and five days, temperatures in the drivers' cabins can reach up to 50 degrees Celsius.

This year, students from ETH Zurich took part in this thrilling competition for the first time, driving Aletsch, a solar-powered car they had developed themselves. By no means did all teams reach the finish line, but the endeavours of the ETH students were rewarded: after six days, they finished the race in twelfth place. ○

Video of the Bridgestone World Solar Challenge:
⟶ youtu.be/Lm_tBi-2Snc

IPCC appoints new vice-chair

Sonia Seneviratne, Professor of Land-Climate Dynamics at ETH Zurich, is Switzerland's new representative on the Bureau of the Intergovernmental Panel on Climate Change (IPCC). The IPCC periodically assesses the state of scientific knowledge on the causes and impacts of climate change, on the options for reducing and mitigating carbon emissions, and on the preparation of greenhouse gas inventories. The panel's reports provide the information and decision-making basis required to develop climate policies.

The IPCC Bureau advises the panel on the scientific and strategic aspects of its work and oversees preparation of the IPCC reports. The IPCC is made up of 195 governments. ○

Image: Manuel Rickenbacher

Sonia Seneviratne has been elected to the Bureau of the Intergovernmental Panel on Climate Change (IPCC).

Wherever possible, Stefan Liniger and Irma Radončić build their experimental models by hand.

Music and design in harmony

TEXT Nicole Davidson, Corinne Johannssen

The construction industry is responsible for almost 40 percent of global CO_2 emissions. In their desire to mitigate this impact, architects Irma Radončić and Stefan Liniger – both graduates of ETH – have set up ZATO, a design studio that investigates innovative architectural concepts. Projects include the development of new fabrication methods designed to explore radical ideas of space while conserving resources.

Alongside architecture, another one of their shared passions is music. Their initial project, which they created and ran at ETH Zurich, led to the development of a new process for fabricating double-curved concrete shells. These are used to clad the internal walls of a classroom and thereby convert it into a space for classical chamber music. At the ETH Student Project House, Irma and Stefan had the opportunity to explore their ideas and gather valuable experience. Driven by a boundless curiosity, the two are now setting their sights on creating better and better concert spaces. ○

STUDENT PROJECT HOUSE This creative thinkspace and makerspace is open to ETH students from any discipline. The support they receive in developing and implementing their own project ideas helps the students learn about the different stages of the innovation process.

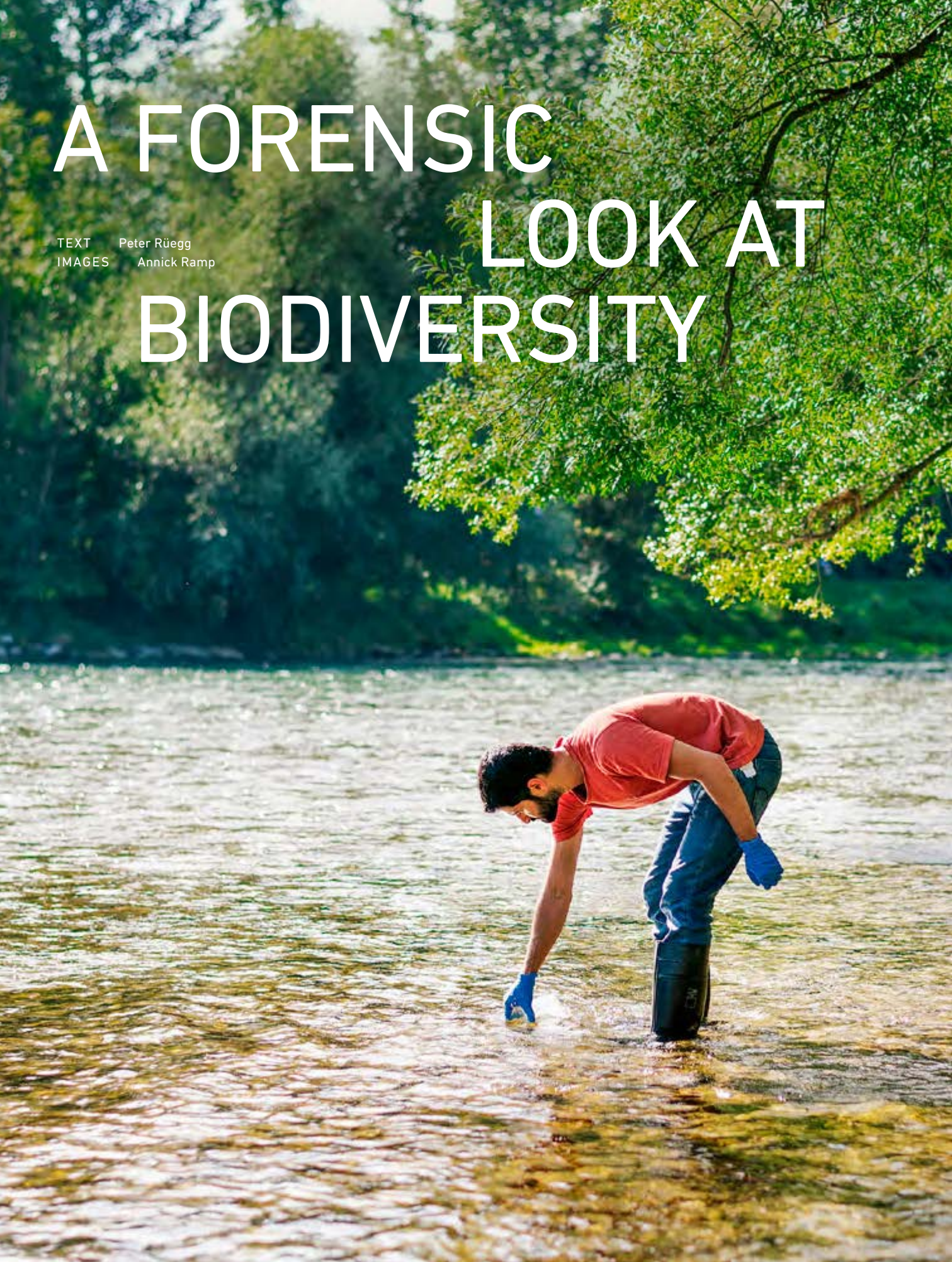
→ sph.ethz.ch

Video: ZATO
→ youtu.be/ix-ijQljKLs

Image: ETH Zurich / Nicole Davidson

A FORENSIC LOOK AT BIODIVERSITY

TEXT Peter Rüegg
IMAGES Annick Ramp



REPORT | From the giant blue whale to minuscule microbes, all creatures on this earth continuously shed traces of their DNA. These clues help researchers to determine the degree of biological diversity.

ETH doctoral student Anish Kirtane stands in the middle of the River Limmat near the Werdinsel island, below the city of Zurich, wearing a large pair of rubber boots. For an afternoon in late September, the weather is exceptionally warm. Sunlight sparkles on the rippled surface of the water; people loll on the banks of the river, enjoying the autumn sunshine; there are even some intrepid bathers, drifting downstream on the current.

Kirtane dips a measuring beaker into the water, holds it up for inspection, pours off a little, and then wades back to the bank. Awaiting him, in the shade of a willow tree, are the postdoc researcher Cátia Lúcio Pereira and Master's student Zora Doppmann. They relieve him of the sample. Using a large syringe, Pereira extracts the water and fires it through a flat, square-shaped filter.

Doppmann produces a felt tip and notes the temperature, date, time and place at which the sample was taken. She then casts a final, inquisitive eye over the filter. Is there anything there? As yet, she is unable to say. Back in the lab, however, the three ETH scientists will discover whether it contains any DNA traces from living organisms. That's what they're hoping to find – just like the forensic experts in the TV crime series *CSI: Miami.*

Anish Kirtane uses a measuring beaker to remove half a litre of water from the Limmat.

SET THE BALL ROLLING Every living being sheds genetic material into the environment, be it in the form of faeces, flakes of skin, mucus or cells. These molecules of DNA end up in soil, water, the sediment of a lake, the branches of a tree and even in the suspended matter carried in the air.

This project aims to extract DNA molecules from samples collected from the environment and then analyse them according to their fundamental building blocks. Using sophisticated computer programs, the researchers will then compare these DNA sequences with those in reference databases, looking for matches with sequences that are known to belong to a particular species or group of organisms. This will give them an idea of which creatures might be present in a particular area.

Although the method is not new, it is only in recent years that it has started to become established. The first attempts to identify bacteria on the basis of DNA traces in water and soil samples date back to the late 1980s. But it wasn't until 2008 that European researchers first demonstrated the presence of frog DNA in a sample of water. Since then, this method has taken off.

At the same time, the emergence of new techniques for rapid and comprehensive DNA sequencing has provided a further boost for scientists working on environmental DNA. These include Kristy Deiner, Professor of Environmental DNA at ETH Zurich. She heads up the group that includes Anish Kirtane, Cátia Pereira and Zora Doppmann.

As of 2015, high-throughput sequencers have been routinely used for environmental DNA analysis. These devices can rapidly decode unsorted mixtures containing millions of different DNA ⟶

1
Researchers in the clean room prepare DNA samples for sequencing.

2
A syringe is used to pass river water through a filter. Any DNA molecules will remain trapped.

molecules in just one run. "We used to have to separate each strand of DNA from the others and purify it before we could analyse its sequence," Deiner explains. "This is the technical revolution that really set the ball rolling."

CHEAP AND FAST In the meantime, the three researchers have delivered their samples to the lab. Pereira and Doppmann are in the clean room. Dressed in white protective suits, they look like astronauts. Through a pane of glass, Kirtane watches his colleagues process the filter pad and treat it with solutions to wash out material containing DNA. They then purify and prepare the samples so that the solution contains only DNA.

"It's vital to prevent any contamination," Doppmann explains. Even a minuscule trace of DNA, either from themselves or from outside, could render the samples useless. Before entering the clean room, the researchers must therefore pass through an airlock and put on protective suits, all of which takes time. Furthermore, all the air pumped into the clean room is first filtered. At night, UV lamps are turned on to break down any DNA molecules that might have been accidentally introduced. After each test, all the surfaces must be cleaned with bleach.

Working with genetic material gathered from the environment remains a complex and expensive procedure, not least because it requires a sophisticated lab infrastructure, special chemicals and expensive instruments. Nevertheless, this new approach is cheaper and faster than traditional methods that involve collecting and possibly killing organisms in order to determine their species. "Environmental DNA analysis is non-invasive," Deiner emphasises. "No harm comes to any animal

3
Cátia Pereira and Anish Kirtane discuss the best way to filter samples and thereby monitor for the presence of genetic material in the water.

3

or plant when we extract their DNA from water or soil samples." Moreover, researchers require only a very small amount of DNA to determine a species.

And sample collection is easy – a fact that Deiner and her team intend to exploit. In a soon to be launched project, for which she has secured an ERC Starting Grant, Deiner plans to extend this form of research beyond the scientific community and enlist the support of informal helpers worldwide. On the International Day for Biological Diversity (22 May 2024), volunteers will be asked to take water samples from 1,200 lakes around the globe, filter the water on site and then send the filters to ETH Zurich for analysis. There, any DNA will be extracted, decoded and compared with reference data. "It's a great example of a citizen-science project," says Pereira, who is coordinating the project and will help with analysis.

One goal is to identify as many species as possible and compare species diversity at the different collection sites. In addition, the researchers will investigate whether a monitoring system based on environmental DNA is feasible on a global scale. In return for their help, participants will receive access to the data and information about which species have been detected in their samples.

ALPHABET SOUP ON THE SCREEN Once the researchers have peeled off their protective suits, they take the samples down to the Genetic Diversity Centre, two floors below. One of the rooms ⟶

contains a seemingly unremarkable piece of equipment that is, in fact, one of the expensive DNA sequencers. "Once we've been in here, we're not allowed back into the clean room, even if we've forgotten something," Pereira explains. "So, we have to make sure we plan everything properly."

She taps the screen in front of her with her index finger. The computer has generated DNA sequences from a previous water sample. The document onscreen shows endless sequences of the same four letters, A, C, G and T, which stand for the four building blocks of DNA. A comparison with reference data reveals that one of the sequences can be assigned to a tree – the sycamore – and another to a stinging nettle. Other sequences have no name. "There are still a lot of gaps in the reference database, so we can't always say which species or group the sequences belong to," she says. The research team therefore hopes that one day other researchers will systematically process genome reference data from a wide variety of organisms and then store this in publicly accessible databases.

Despite these shortcomings, Pereira firmly believes that the environmental DNA method is fundamentally changing the way science captures biodiversity. "It won't ever replace traditional methods," she says. "But the e-DNA approach will certainly complement them. We're always going to need experts in taxonomy and ecology, because a species list only ever makes sense in terms of the specific habitat." ○

ETH SPIN-OFF USES E-DNA ANALYSIS The e-DNA approach is suitable for more than just academic research. In 2021, Kristy Deiner teamed up with two colleagues to set up SimplexDNA AG. This spin-off offers a variety of services, including soil biodiversity analysis, fish diversity monitoring and a quagga service to monitor for the invasive quagga mussel in Swiss waters.

Find out more:
—〉 simplexdna.com

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Experts in the field: Anish Kirtane, Cátia Pereira and Zora Doppmann discuss the merits of the e-DNA method.

MODERN ADVENTURER

TEXT Stéphanie Hegelbach
IMAGES Nathan Lindstrom

Whether on research vessels or testing her limits as an analog astronaut and pilot, alumna Sandra Herrmann has an irrepressible appetite for adventure, fuelled in part by her experiences at ETH Zurich.

"I hope nothing happens to my family while I'm gone," thought Sandra Herrmann as she climbed the five steps of the aluminium staircase leading to the NASA space capsule. She would be sharing this cramped space with three other people for 45 days – her only contact to the outside world the voices of mission control and a weekly phone call or email from home. This was the ETH alumna's first experience as an analog astronaut: from January to March 2023, she led the same day-to-day life as if on board the ISS, but confined within a space capsule at NASA's Johnson Space Center in Houston, Texas. Such simulations give scientists new insights into how to streamline procedures and tackle challenges and group dynamics on space missions. "I wanted to test my own limits while helping to advance scientific knowledge," Herrmann says.

ETH ENCOURAGES OPENNESS Embracing new experiences to expand one's horizons – it's a motto that applies to many of the activities undertaken by this intrepid alumna, who also enjoys piloting aircraft in her spare time. She attributes some of her adventurous spirit to her time at ETH Zurich. "My doctoral studies at ETH inspired me to seek out new experiences and boost my personal development," she says. When Herrmann came to Zurich in 2006, having completed her Master's in geology and palaeontology, it was the first time she had ever lived outside Germany. When she joined Hans Thierstein's research group at the Department of Earth Sciences, she quickly learned the value of broadening her horizons. "Our group was incredibly diverse: we came from different cultures and had very different outlooks and hobbies. That really whetted my appetite for that kind of environment," she says. Immersing herself in the plentiful opportunities offered by ETH, she was fascinated by the international vibe and inspired by what she describes as the crème de la crème of science. "The time I spent at ETH just blew me away!" she says.

ALL HANDS ON DECK Much of what she learned at ETH continues to be useful today. As part of her job with the International Ocean Discovery Program (IODP), which collects and analyses core samples from the ocean floor, she spends up to six months a year on the high seas with a diverse group of scientists. "The capacity to keep an open

"I wanted to test my own limits while helping to advance scientific knowledge."

Sandra Herrmann

mind and be respectful of each other is essential on these missions; it's the only way to get things done as a team," says Herrmann. She is in charge of running one of the labs on the vessel and familiarising researchers with the instruments on board. Having the chance to work with the sediment samples is something that never ceases to amaze her. "These cores contain visible evidence of when the dinosaurs became extinct. Holding something like that in your hands is just incredible," she says.

Expeditions normally last 60 days, plus several days of preparation and follow-up in port. Once the research trip gets underway, the crew of some 120 people rarely sees land and is engrossed in the 24-hour-a-day schedule that operates on board. "Initially, the new group of scientists are pretty confused and nobody really knows what they're supposed to be doing. But by the start of the second week, everyone's got their bearings. It all starts running like clockwork, and two months in, we're like one big family," says Herrmann. Even so, the cramped quarters and strict routines can sometimes be difficult to cope with. "Week six is often particularly tough. The excitement has faded, and people are tired and starting to get homesick," she says. That's when the family bonds forged by the team really kick in, with people grabbing a coffee and chatting about their loved ones back home whenever there's a pause in the drilling.

LIFE ON THE EDGE Herrmann is particularly fascinated by these kinds of group processes and how they can be successfully navigated on a mission. Previous voyages have taught her to be sensitive to the changes in mood of those around her and to respond accordingly. "My experiences at sea also came in useful in the NASA capsule," she says. "When the group started to get homesick, I delved into my bag of tricks and pulled out a dance party!"

The parallels to life on board a research vessel made it easy for Herrmann to deal with her first mission as an analog astronaut in the Hera capsule. But she was also quick to notice the differences – for example, in her surroundings. On the research vessel, Herrmann often spends quieter moments staring at the sky and enjoying the sweeping views to the horizon. In the cramped space capsule, monitors were used to simulate a view of outer space. "You can't see trees, grass or water; there's no birdsong, no sounds of anything around you, and none of the familiar smells of nature," says Herrmann. "It really felt like I was in space." It was these sensations that she found herself looking forward to most, once the 45-day mission was over. "All I wanted to do was lie in the grass, look at the sky and enjoy the fresh scent of the soil," she says.

THE NEXT ADVENTURE BECKONS It's only when Herrmann returns from a voyage that she settles into some kind of routine: until September 2023, she was based at the IODP headquarters in College Station, Texas, as part of a team developing software for the scientific characterisation and evaluation of core samples. "It was like having a 9-to-5 job. I went for my run at noon, and after work I had a coffee with my husband before we wheeled the plane out of the hangar," she says. She recently obtained her commercial pilot's licence and is now working on adding the multi-engine rating to her certificate. But she's still unsure if she would like to become an airline pilot or try out aerobatics. "It's not like I plan these kinds of things. I'm simply open to trying new things, and I say yes to whatever fascinates and inspires me the most," she says. The most important thing is that the projects she takes on are compatible with her family commitments to her American husband and her parents in Germany.

Herrmann's latest adventure has taken her to San Diego. In October 2023, she took up her new post at the Scripps Institution of Oceanography. Once again, blue waters beckon, though this time on a mission to study seawater temperature, salinity and other oceanographic parameters. ○

SANDRA HERRMANN studied geology and palaeontology at TU Bergakademie Freiberg and completed her doctorate in natural sciences at ETH Zurich. She subsequently emigrated to the USA and spent 12 years working for the International Ocean Discovery Program (IODP) in various posts. Since October 2023, she has been conducting research at the Scripps Institution of Oceanography in San Diego.

○ *focus*Terra Fairy Tale Sundays

Alpine magic

There's something mysterious and wonderful about the Alps. Why did they form here? Are there similar mountain ranges elsewhere on Earth? Who or what dwells in their crystal caverns and at their craggy tops? Equipped with walking sticks and rations, we'll embark on an adventure to explore the secrets of these mountain peaks. Together with the Swiss Fairy Tale Society, *focus*Terra invites you to enjoy an exciting afternoon of fairy tales with musical accompaniment and hands-on activities to help children unearth the secrets of the colourful Alpine landscape. The perfect outing for the entire family (children aged six and above).

4 February 2024, 2.00 – 4.30 p.m.

Find out more:
⟶ focusterra.ethz.ch/en

Image: musicaldiscovery.ch

○ Music at ETH and UZH

Surprise January concert

Zartir, the new programme presented by the Gurdjieff Ensemble, includes the music of Georges I. Gurdjieff as well as folk songs by the Armenian poet and musician Paghtasar Dpir, and the ashugs (troubadours) Sayat-Nova and Jivani.

23 January 2024, 7.30 – 9.30 p.m.
Auditorium Maximum, ETH Zurich

Tickets:
⟶ musicaldiscovery.ch

Image: ETH Zurich / Andreas Eggenberger

Zurich's annual IT workshop offers visitors of all ages the chance to dive into the world of online security.

○ Informatiktage 2024

Online security

Next year's Informatiktage (Computer Science Days) will focus on the important topic of online security with a series of lectures, programming workshops and demonstrations aimed at both professionals and enthusiasts. The varied prgramme of events includes activities for school classes, teachers, children, young persons, adults and senior citizens.

The computer science workshop was launched in 2016 by companies, organisations and universities in the Greater Zurich Area. Their shared goal is to provide a hands-on experience of the world of IT, accessible to everyone. The ETH Department of Computer Science and IT Services have partnered the event since its inception.

Starting 18 March 2024
ETH Zurich, Universitätsstrasse 6, CAB

Information and programme:
⟶ informatiktage.ch/eth

○ Wyss Zurich BioSTARS

Fostering new talent

The Wyss Zurich BioSTARS talent programme offers young people from 16 to 18 the opportunity to dive into the world of the life sciences, technology and research – and to discover how entrepreneurship can harness this knowledge to deliver beneficial impacts for human health. The summer camp gives participants an inside look into the work of research labs in the Greater Zurich Area as well as promising start-ups.

Summer vacation 2024
ETH Zurich Zentrum campus and Schlieren campus

Registration:
⟶ mintpepper.ch/wz-biostars

○ Tour

A pocket-size lab

Microchips can be turned into highly compact labs that perform and automate various routine tasks on a pocket-size platform. They can also be used for far more complex analytical procedures in medical and diagnostic applications and in biological analyses. Organised by the ETH Department of Biosystems Science and Engineering, this tour shines a light on the very latest bioanalytical research methods. The tour is accessible to wheelchair-users.

12 December 2023, 6.15 – 7.15 p.m.
ETH Department of Biosystems Science and Engineering, Basel

Registration:
⟶ tours.ethz.ch/en

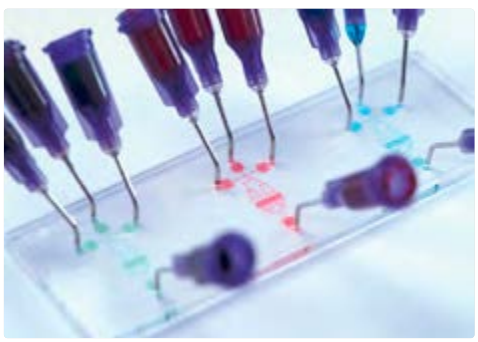

Image: ETH Zurich / André Kling / Petra Dittrich

○ Recommended reading

The common lumpfish

In this turbulent novel, set in an uncertain future, the biologist and fictive ETH alumna Karin Resaint is commissioned to assess the intelligence of the common lumpfish. Also in pursuit of this specimen of marine life is the shady environmental impact officer Mark Halyard. Since the establishment of a global trading system for extinction certificates, it has become painfully expensive for corporations to be implicated in the eradication of an intelligent species. Unfortunately, it seems that the last remaining example of the common lumpfish has fallen victim to an accident. Or has it? Together – albeit for different reasons – Resaint and Halyard set off on a frantic quest across Europe to track down the last surviving lumpfish. Despite its dystopian framing, this novel remains full of funny and surprising twists. Rarely has such an important environmental concern been portrayed in such a humorous way.

Liebeskind Verlag
ISBN: 978-3-95438-158-6
368 pages (in German)

Image: Liebeskind Verlag

OUT OF FOCUS

Medical research – as seen through the eyes of Michael Meister

Illustration: Michael Meister

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