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EDITORIAL



Dear readers

Late October will see the third edition of the Cybathlon: an international competition established by ETH Zurich in which people with physical disabilities tackle everyday tasks with the help of assistive technology. For many people, tools such as wheelchairs, prosthetics and robots provide essential support in navigating the challenges of daily life more effectively. There are barriers everywhere, which is why ETH architects strive to create a built environment that does not hinder access but rather respects, connects and integrates people. Because barriers always lead to exclusion – whether spatial, linguistic, digital or social.

As the first person in my family to attend university, I have a strong interest in eliminating barriers to education. We are justifiably proud of our Swiss education system, which is flexible enough to provide multiple routes to future careers. But we must remain vigilant and ensure that talented young people can continue to pursue their own paths regardless of their socio-economic background. When it comes to social cohesion, I firmly believe that educational mobility is key.

The term “barrier” has many meanings. For a biologist, it may refer to cell membranes; for a sociologist, to the social factors that hinder equal access. In this issue of *Globe*, we take a closer look at how barriers arise – and how they can be overcome.

I hope you find it an inspiring read!

Joël Mesot,
President of ETH Zurich

GLOBE – the magazine for ETH Zurich
and ETH Alumni



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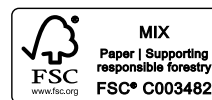
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COVER

This issue of *Globe* features a series of illustrations that represent the six values of ETH Zurich: inclusion, ingenuity, empowerment, responsibility, openness and respect. “Inclusion – Create a sense of belongingness” is the value depicted on the cover.

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Images: Claudio Sostizzo; Alessandro Della Bella

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NEW + NOTED



Image: Gian Ehrenzeller / Keystone

The rockslide almost reached the village of Brienz.

Improving landslide predictions

The Brienz landslide in 2023 is an example of the mass movements that can occur in mountain environments. Together with his team, ETH professor Johan Gaume is working on methods to assess the impact of such events. He recently developed a new piece of simulation software which was able to predict down to virtually the last metre where the debris from the Brienz landslide would come to rest.

His model – unlike previous ones – is based on the actual materials involved in such an event. It is also entirely three-dimensional and requires only three components: a digital elevation model plus the volume and properties of the materials released. These properties – such as the solidity or the frictional drag of the landslide mass – can be evaluated using conventional laboratory tests. Although the software was originally developed to simulate snow

avalanches, it is also relatively easy to model other materials such as rock, ice or water.

The threat of a Brienz landslide was an opportunity to put the new software to the test by forecasting what kind of impact such a major event might have. Two scenarios were created for the prediction, one dry and the other involving large quantities of water, which makes the material more fluid, thus adding extra uncertainty to the forecast. It was the dry scenario that actually occurred – and the forecast turned out to be highly accurate.

The team now plans to optimise the software to ready it for practical use in the future. As well as developing models that take into account the interaction between solids and liquids, they will also be seeking ways to simulate process cascades, where one event triggers another in a cascading sequence. They also plan to improve the efficiency of the code and to add a graphical user interface, making the models more user-friendly. ○

A gel that breaks down alcohol

Drinking heavily on a regular basis is bad for your health. Common alcohol-related diseases include liver disease, inflammation of the gastrointestinal tract and cancer. Now, a team of ETH researchers led by Raffaele Mezzenga has developed a protein gel that breaks down alcohol in the gastrointestinal tract.

Initial studies on mice show that a gel of whey protein fibrils quickly and efficiently transforms alcohol into harmless acetic acid. This occurs before the alcohol enters the bloodstream, where it would normally

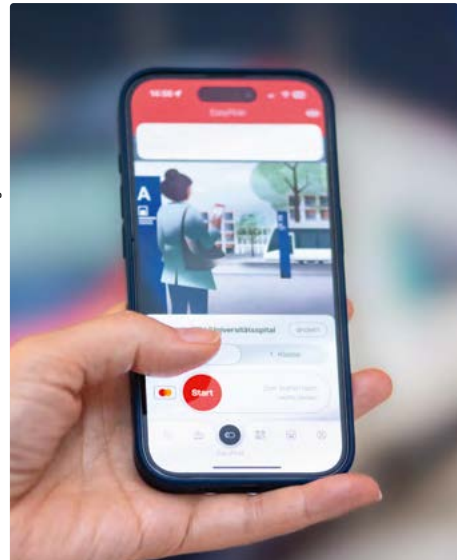
develop its intoxicating and harmful effects. In future, the gel could be taken orally before or during alcohol consumption. The researchers have already applied for a patent for their product, though various clinical trials still need to be performed before it can be authorised for human use. Having already shown that the whey protein fibrils in the gel are edible, they are confident that the trials will be successful. ○

Researchers outsmart Swiss travel app

The EasyRide function in the Swiss federal railways (SBB) app is advertised as “Switzerland’s simplest ticket machine”. A research team led by ETH professor Kaveh Razavi set out to trick the EasyRide system. They did this by manipulating location data, which caused the app to believe they were only moving around in a small area, whereas they were actually taking long train journeys. Their deception went unnoticed by the SBB app, which only registered the fake small-scale movements. Theoretically, this would have enabled the researchers to travel free of charge, though they also made sure to purchase a valid ticket for all the journeys they took.

The researchers notified SBB about the vulnerability and presented them with two proposals for fixing it. According to SBB, appropriate measures have now been taken to ensure that this kind of ticket fraud will at least be detected after the fact and penalised accordingly. ○

Image: Michel Büchel / ETH Zurich



The EasyRide function in the SBB app was open to manipulation.





Concentrated solar energy

Extremely high temperatures are required to produce cement and steel. Conventionally, this heat is generated by the combustion of fossil fuels such as coal or natural gas, which generates substantial greenhouse gas emissions. Renewables are not a realistic alternative, as their use would be inefficient for such high temperatures. A research team led by Emiliano Casati, a scientist in the Energy and Process Systems Engineering Group, and Aldo Steinfeld, Professor of Renewable Energy Carriers, has now identified a way to overcome these industries' dependence on fossil fuels. They have developed a thermal trap that uses solar radiation to generate temperatures of up to 1,050 degrees Celsius while also minimising heat losses from radiation. A key component of this device is a quartz rod which, thanks to its optical properties, can efficiently absorb sunlight and convert it into heat. The researchers are confident that one day this technology will be used to build high-temperature solar plants. This would allow solar energy to be used not only to generate electricity but also to decarbonise energy-intensive industries. ○

Image: Emiliano Casati / ETH Zürich

→ epse.ethz.ch

The future is digital – including in healthcare

Despite digitalisation being a mainstay in many areas of life, the healthcare sector is lagging behind. Jörg Goldhahn explains what the medical field can learn from banks and travel companies.



JÖRG GOLDHAHN is Professor of Translational Medicine in the Department of Health Sciences and Technology at ETH Zurich.

I can use my phone to check how much I've paid into my pension plan down to the last penny, buy a car online in a couple of clicks, track how much electricity the solar panels on my roof produce from minute to minute, and exchange private messages with friends. But recently, as I was getting ready to go on holiday, I had to make sure I packed my paper vaccination passport, as it contains information that I don't have anywhere in digital form. In Switzerland, the debacle over the security of the Swiss online vaccination record platform has further undermined trust in the management of digital health data. So it would seem that paper still has its uses!

Going abroad on holiday is by no means the only scenario in which it would be helpful to be able to access my healthcare information online, just like I can with my bank account. Why were banks able to pull off this complex digital transformation

so smoothly, while the healthcare system seems to view it as such a monumental and unmanageable task? Granted, banks have a lot more money to play with. But the fact remains that they know what it means to be efficient. Their customers are now embedded in the workflow, dutifully making their own bank transfers online. This actually lowers costs, which in turn feeds the bank's profits. Some of these savings are even passed on to customers, as in the case of international transfers – at the insistence of the EU.

And it isn't just the financial sector, of course. The travel industry also recognised early on that digitalisation was the only way to tackle increasing cost pressure. As a result, customers now benefit from cheaper prices. And travel operators can see where their customers are at the push of a button, allowing them to respond promptly in the event of an emergency.

These examples highlight just how much of an outlier the healthcare system is: at the moment, the medical field is saving neither time nor money through digitalisation – and if it is, these savings are not being passed on.

Unfortunately, in many areas where digital technology is used, little evidence has been produced showing that it saves us anything at all. But

the potential for wide-ranging benefits is certainly there: digital technologies can save time in everything from diagnosing and treating patients to streamlining operations in hospitals. Money can be saved both by reducing immediate costs and avoiding follow-up costs or duplicate tests. And there are all sorts of efficiency gains that could potentially be achieved in human resources. Ideally, each new digital solution should yield at least one real area of cost savings. And those savings should definitely be passed on – preferably to patients. ○

Further blog articles at:
→ ethz.ch/zukunftsblog-en

Jörg Goldhahn wrote this article together with his colleague Anja Finkel for the *Schweizerische Ärztezeitung*, a publication for the Swiss medical community.



Medicine has yet to tap the potential of digitalisation.

Image: elenabs/Adobe Stock

Carbon-neutral chemicals

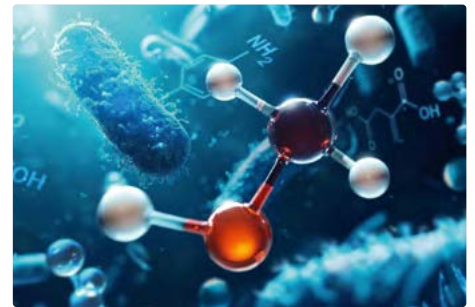


Image: Sean Kilian

Bacteria that feed on methanol and produce sustainable chemicals.

The chemical industry currently relies on fossil feedstocks to produce chemicals such as plastics, dyes and artificial flavours. Using modified bacteria, researchers from ETH Zurich have now come up with an alternative platform for producing any kind of biochemical substance.

These efforts revolve around methylotrophs, a group of bacteria that feed on methanol. Methanol can be synthesised from carbon dioxide and water – and it can be made “green” by ensuring that the energy required for synthesis comes exclusively from renewable sources. It can then be metabolised by methylotrophic bacteria and converted into other chemicals.

However, natural methylotrophs are difficult to cultivate. To simplify this task, a team led by ETH professor Julia Vorholt introduced methylotroph genes into the model bacterium *Escherichia coli*. After more than a year with various modifications, the bacteria were finally able to survive with methanol as their sole feedstock.

The potential for industrial use is clear: introducing additional genes into these microbes will cause them to convert methanol into whatever biochemical substance is required – and they can do so in a carbon-neutral way. ○

A better understanding of brittle bone disease

People with osteogenesis imperfecta, or brittle bone disease, face the constant risk of broken bones. This is due to a hereditary genetic defect which leaves patients with an unstable bone matrix. Now, a team of researchers led by ETH professors Xiao-Hua Qin and Ralph Müller has developed a new cell culture model that allows bone formation to be investigated in the lab.

In a close approximation to normal bone development, the in vitro model provides a porous hydrogel matrix that is easily colonised by bone-forming cells. This allows them to multiply and form a three-dimensional network with each other and their offshoots. There are two key advantages to this method: firstly, the model only requires a small number of patient cells, and secondly, it eliminates the need for animal experiments in line with the 3R concept. The researchers have already patented their model and now hope to make it available to potential industry partners. ○



Image: AIM Biotech

Bone cells can be grown on a chip like this.

Blood-sucking inspiration

Once a leech is attached to a host, it penetrates the skin with its teeth and generates negative pressure that makes blood flow from the wound. A group of researchers led by ETH professor Jean-Christophe Leroux has now applied the same principle to develop a new device for taking blood samples. Designed to work like a suction cup, it can be used instead of conventional needles when taking blood. This is particularly heartening news for people who have a phobia of needles.

Easy to use and cheap to produce, the new device could also be used by non-medical personnel in developing countries to diagnose diseases such as malaria. Before the device can be rolled out on a large scale, researchers first need to find the optimal material mix and run trials with test subjects. ○



Image: Colourbox

When they swallow, leeches create negative pressure that makes blood flow from the wound.

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extract.ethz.ch/en/



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OVERCOMING BARRIERS



FOCUS | Barriers are obstacles: they hinder access to buildings or to education, they exclude people, and they make everyday life more difficult. Barriers can arise in many different areas of our lives. This issue of *Globe* highlights how researchers at ETH Zurich identify barriers – and how they help us overcome them.

ILLUSTRATIONS Crafft AG



INGENUITY Use creative imagination for complex problem solving.

For a world without barriers

In the international Cybathlon competition, people with physical disabilities undertake routine tasks with the aid of assistive technology that can be seamlessly integrated into everyday life. Below, we present three ETH teams that will be putting their innovative solutions to the test at this October's event.

TEXT Deborah Kyburz



Image: Markus Bertschi / ETH Zurich

Help from a four-legged friend

Developed by the Robotics Systems Lab at ETH Zurich, ALMA is a quadrupedal robot equipped with a range of sensors and a robotic arm. Unlike other entries in the Cybathlon discipline for assistive robots, all of which are attached to a wheelchair, ALMA moves autonomously on its own four legs, controlled by paraplegic pilot Sammy Kunz via a quadstick – a type of mouth-operated joystick. Deploying the robot as a separate system provides greater mobility, say team managers Carmen Scheidemann and Andrei Cramariuc. “But our biggest asset is also our biggest liability,” Scheidemann explains. “Because we have to ensure that ALMA moves safely without bumping into any objects.”

In competition, the team has ten minutes to complete ten everyday tasks. For example, the pilot must use the robot to open a door and then close it behind them, or to pick up an apple and hold it in such a way that the pilot can take a bite. The quadstick used with ALMA features various tubes. By blowing or sucking, the pilot is able to control the different axes of the robot: either its quadrupedal platform or its gripping arm.

PILOT AND ROBOT IN SYNC “At a preliminary event in February, we had eight minutes to complete four tasks,” says Scheidemann. “In the end, we needed just over six.” The team is therefore confident about achieving a good score at the upcoming championship. In preparation for October’s event, various refinements to ALMA have been made in close cooperation with Kunz. Most of these involved enhancing the controls so that Kunz can operate the robot with as little practice as possible. “We suggest an improvement, and Sammy gives us feedback on what works for him and what doesn’t,” explains Scheidemann. “Then we make the necessary modifications.” Whereas 15 hours of practice were required before the preliminary event in February, improvements to the control system have now drastically reduced preparation times.

Helping to open doors: Cybathlon pilot Sammy Kunz uses his mouth to steer the assistance robot, while Carmen Scheidemann from the Robotics Systems Lab monitors the test run. Come October, the pressure will be on.

—> cybathlon.ethz.ch

Both managers have hugely enjoyed working with Kunz. “It’s really fulfilling to be working on a project that has the potential to bring about such a major improvement in the day-to-day lives of people with disabilities,” says Cramariuc. ANYmal robots, which provide the quadrupedal platform for ALMA, are already in use for a variety of industrial jobs, including the inspection of oil rigs. The current challenge is to deploy assistive robots not only in controlled environments but also in everyday situations. The team will continue to refine ALMA. “But it will be a good few years before the platform is ready for market,” Scheidemann cautions. “We’re still very much at the experimental stage.” ○

—> cybathlon.ethz.ch/de/teams/rsl

Cameras and a vibrating belt

Pressing the right doorbell, finding a free seat and navigating an area containing obstacles of various heights are just some of the challenges that blind pilot Lukas Hendry will face in the Vision Assistance Race at the Cybathlon. Technical support comes from the Sight Guide team, which will guide Hendry using data from two cameras strapped to his chest. Patrick Pfreunds Schuh, one of the team managers, describes how the technology works: “We use one camera for positioning – that is, to tell us where Lukas is and where he’s heading. The other is a depth camera that takes 3D measurements of the surrounding area.” There’s also a third camera which the pilot holds in his hand to assist with tasks that require objects to be examined in more detail. All three cameras transmit information to a small, lightweight computer that Hendry carries on his back. The computer crunches the data and sends Hendry corresponding instructions via an audio signal. Finding a system with enough computing power was surprisingly difficult, says Pfreunds Schuh: “When your pilot is in the race, you need to be processing the input as quickly as possible. Otherwise, he might collide with an obstacle, which is obviously something we want to avoid!” The Sight Guide team is hopeful about making further improvements before the Cybathlon, such as making the audio signals that convey the instructions more easily understandable. —>

In addition to the computer and cameras, Hendry also wears a special vibrating belt that tells him in which direction to move. “We don’t want to say exactly how this belt works, because it’s what gives us our competitive edge!” says Pfreundschuh with a smile.

A WORTHY CAUSE The Sight Guide team consists of doctoral candidates and students from the Autonomous Systems Lab at ETH Zurich, the Robotics and Perception Group at the University of Zurich and the Institute for Mechatronic Systems at Zurich University of Applied Sciences (ZHAW). For the doctoral students, the Cybathlon is both inspiring and enjoyable, which is why they are happy to work on the project in their spare time. Every month or two, they meet up with Hendry to perform mock-ups of the tasks they will face in the Cybathlon. Hendry then supplies feedback – for example, on how fast he receives the instructions – and many of the tweaks he suggests can be applied on the spot. Working with the pilot is one of the things that makes this project so special, says Pfreundschuh: “It’s great to see Lukas sailing through tasks that would be impossible for him without our technology. It makes me happy and proud to see the benefits we can provide for blind people simply by putting theory into practice.” The goal is to continue improving the technology once the Cybathlon is over – and Pfreundschuh hopes to find a new generation of students willing to take the reins. ○

—> sightguide.tech

Sensing the ground while wearing prosthesis

A key drawback of a prosthetic leg is that wearers are unable to feel the ground beneath their foot. The absence of sensory feedback on where their foot is positioned and how firmly it is touching the floor makes it difficult to walk, especially on uneven terrain or when climbing stairs. This is the main reason many patients decide against a prosthesis. But it doesn’t have to be this way, as Stefan Poth has discovered since becoming a pilot in the Cybathlon. He is taking part in the competition with his own prosthetic leg, which has been fitted with a special insole in the shoe. Developed by the NeuroLegs team, this

insole is equipped with sensors that gather information on what the researchers call the foot-ground interaction. This includes feedback on whether Poth’s weight is on the toe, middle part or heel of his prosthetic foot. Data on where he is stepping is sent to a microprocessor attached to his waist. The computer processes the data and converts it into electrical stimulation by activating electrodes on an elastic belt that Poth wears around his leg stump. “Depending on where Stefan is stepping, electrical stimulation is applied in real time to either the front, side or back of the stump to replicate the sensation that would normally be perceived in the foot,” says Noemi Gozzi, co-manager of the NeuroLegs team.

NEVER CHANGE A WINNING TEAM Poth’s team for the leg prosthesis race is made up of students from the Neuroengineering Lab at ETH Zurich. Affiliated with the Department of Health Sciences and Technology, the lab is headed by ETH professor Stanisa Raspopovic. This year’s team is building on the valuable experience gained in the previous Cybathlon four years ago. “Instead of starting from scratch, we’ve actually been able to improve our technology this year. For example, we’ve made it a lot more user-friendly,” says Valerio Aurucci, the second of the team’s two managers. The belt Poth wears around his leg stump was developed by this year’s team to avoid having to attach electrodes to his skin one by one, which has also made the system more reliable.

Gozzi emphasises how rewarding it is to see their research being put into practice: “We’re trying to develop systems that will make people’s day-to-day lives easier. Stefan’s reaction when he felt a sensation from his foot for the first time was something very special – and it certainly made up for all those hours in the lab!” The Neuroengineering Lab is one of the leading research groups working on peripheral nerve stimulation, and Aurucci sees major benefits in the innovative solution they have developed: “The biggest advantage is that our system can be used with any prosthesis.” Getting to a market-ready product will require more development and additional safety features. The two team managers – both of whom are doing their doctorate at ETH – are therefore carefully considering their next step. Should they stick to research and hand over NeuroLegs to the next generation, or take the plunge into business by setting up a spin-off? The future is theirs to decide. ○

—> cybathlon.ethz.ch/en/teams/neuro-legs

EMPOWERMENT

Develop and trust in the competence of others.

Equal access
to education
is essential.



ETH doctoral student Rolf Imseng comes from a working class family. He joined ETH Vice President Julia Dannath and ETH professor Ursula Renold to talk about the obstacles he has faced due to his background. Their discussion delves into social mobility in Switzerland – and the key requirements for an education system that offers equal opportunities to all.

TEXT Simone Gohl and Corinne Johannssen

IMAGE Markus Bertschi

From left to right:

JULIA DANNATH is Vice President for Personnel Development and Leadership at ETH Zurich.

—> ethz.ch/vppl

URSULA RENOLD is Chair of Education Systems in the Department of Management, Technology and Economics at ETH Zurich.

—> ces.ethz.ch

ROLF IMSENG is a doctoral student in the Department of Architecture at ETH Zurich and a member of the First Generation Network Zurich.

—> sites.google.com/view/firstgen-zrh

Rolf, you studied architecture at ETH Zurich and are now embarking on a doctoral project. You were the first person in your family to attend university. What led you to study at ETH?

ROLF IMSENG: I come from a traditional working class family in the canton of Valais. My mother works in an admin role, and my father is an electrician. I spent most of my childhood with my grandparents, who had a background in farming and trades, where working with your hands was the norm. But I was determined to get my upper secondary school-leaving certificate and study architecture, and I was lucky enough to have a mother who backed me every step of the way.

Julia, you also completed secondary school and went on to higher education. Was that fairly typical for your family?

JULIA DANNATH: In my grandparents' generation, the men earned the money, while the women mostly looked after the home and family. Things shifted slightly in the next generation, with my father and my uncles opting for an academic path, whereas my aunt and my mother followed a non-academic one. For me and my sister, going to university was a given, just as it was for my brother. That was definitely new to my generation. I wasn't an academic high-flyer, especially at junior school, but my parents always believed in me – especially my father, who was a secondary school teacher. It was my parents who gave me the security and the confidence to pursue an academic career.

Ursula, you began your career with a dual VET programme offering a commercial apprenticeship, and now you're Chair of Education Systems at ETH.

URSULA RENOLD: To be honest, I had absolutely zero interest in school when I was 15. I was more interested in how money works in society. It seemed to play an important role, so I opted for a VET programme in banking. But that was just a typical teenager mindset, and I soon developed a craving for knowledge. The vocational baccalaureate —>

“There was nobody in my family to show me the academic ropes.”

Rolf Imseng

didn't exist then, so I went back to do the federal academic baccalaureate. Because I wanted to be independent, I worked at the same time – and continued to do so right through my time studying economics, sociology and history. My first contact with ETH was in the 1990s, and I loved it so much that I stayed on as a researcher and later co-founded a spin-off company.

You went on to become Director of the Federal Office for Professional Education and Technology. What lessons did you learn in that role?

RENOLD: I saw poor quality education systems in a lot of countries. It made me want to go back to ETH to find ways of helping those countries by transferring knowledge. Today, my chair offers assistance to around 30 countries, helping them to find sustainable ways of ensuring that all young people have equal access to education.

DANNATH: So would you argue that the Swiss education system is a successful model that should be exported to other countries?

RENOLD: I have fairly radical views on that. We can't export our system, but we can develop a theoretical basis that can help us identify what might be a functional equivalent in other countries. That might mean looking at how vocational education and training dovetails with stakeholders from the employment market, so that they can do a better job of integrating young professionals. For example, not all countries have professional associations. It's about understanding each country and then pinpointing where you can make reforms to tackle things such as high youth unemployment. Italy, for example, has a youth unemployment rate of around 25 percent.

Social mobility is when an individual's social status is not determined by their family background. What factors hinder social mobility?

RENOLD: First and foremost, most countries don't have a flexible education system. Once a young person is on a specific track, they're stuck on it.

Is that true of Switzerland, too?

RENOLD: No, not at all! Switzerland is a prime example of how to get this right and has an extremely flexible system. I can't think of any other country that does it better. That's why I tell parents that it doesn't matter where your child starts once they finish compulsory schooling. The main thing is to get through those difficult teenage years, and then there are so many different options on the table. You can also see from the data that we have a good socio-economic mix of students at our universities. In Switzerland, two out of every three young people complete a dual VET programme, which includes an apprenticeship. We have good social mobility here thanks to the vocational baccalaureate and the universities of applied sciences, which were set up in 1996. As of 2012, we're actually seeing more people graduating from the universities of applied sciences than from universities. That's exactly how it should be, because it's what the Swiss economy needs.

Rolf Imseng, what obstacles have you faced?

IMSENG: I really wanted to study at ETH because of its reputation in the world of architecture. But I quickly lost heart when I saw how expensive it is to study in Zurich. Fortunately, I won a scholarship from a foundation. That helped me keep my head above water in those early days, but there were still times when I found myself wondering where the money for the next semester would

“Switzerland is a prime example of how to get this right and has an extremely flexible system.”

Ursula Renold

come from. I also faced a very different kind of obstacle in not having anybody from my family who could show me the academic ropes. My family has also never understood how a study programme – listening, learning and, in the case of architecture, building models – can be such hard work!

DANNATH: Feeling like an outsider in your own family can't be easy. It's incredibly important to feel like you belong, and that's just as true when you're studying or working. I want everybody at ETH to have that feeling. One thing that can help is having a shared goal. For example, everyone at ETH is driven by the idea of providing education for the coming generation, creating knowledge and feeding that into society. It's what unites us.

But being an outsider does at least offer a certain freedom in the sense that you don't have to follow in anyone's footsteps?

IMSENG: Absolutely, especially in architecture. I don't have an architect father who I might end up disappointing! Studying architecture at ETH was a real challenge, but I managed it – and I did it for myself.

RENOLD: I felt something similar when I was working and doing my baccalaureate at the same time – the self-doubt and the inner conflict with myself and the people around me. But that experience is hugely beneficial for your subsequent career. You know what you're capable of. You have the strategies you need to overcome challenges. And you set an example to others.

DANNATH: Exactly, and we need those kinds of examples to highlight how diverse people are and to show that mobility can happen in all directions. Having equal access to educational opportunities means that people bring their own skills and their own vision. And then they can choose what they want to do.

The First Generation Network Zurich also emphasises the importance of role models.

IMSENG: That's right, and that's why I got involved. Ever since I was a teaching assistant, I've been very open about my background, which is why younger students often came to talk to me. So, when they launched the First Generation Network Zurich last year, I was immediately on board. We're all the first in our family to enter the academic world, and we meet up once a month to swap ideas and help each other out. I enjoy passing on my experience

and responding to the kinds of questions that students' families can't answer, such as how doctoral studies work or what to wear to an interview.

DANNATH: That's important work you're doing. The fact that the network has come from the community makes people much less inhibited and much more likely to share their experiences.

RENOLD: By making role models visible, we help foster social mobility.

DANNATH: Exactly, and there are some really prominent figures in that position. For example, Joël Mesot, the ETH President, was a first generation academic. Role models are also about how we identify: we build our sense of identity through shared origins, shared values and shared experiences. Your experiences, Rolf, will be very different to those of your family. That's why we've adapted

“Having equal access to educational opportunities means that people bring their own skills and their own vision. And then they can choose what they want to do.”

Julia Dannath

the core programme we offer on National Future Day. Only a third of the places are now reserved for the children of ETH members, so we're actively promoting the involvement of children from families that have no ties to ETH. We want to generate a better mix. And we'll need more of that kind of thinking if we want to create more role models and expand people's horizons.

IMSENG: My heart leaps when I hear you're welcoming children from families with a non-academic background! That's exactly what I dreamed of when I was a kid. ○

From dams to membranes

Research at ETH Zurich deals with barriers in a wide variety of fields, including cell biology, drug delivery and spatial planning. Below, we look at examples from six different disciplines.

TEXT Karin Köchle, Deborah Kyburz, Corinne Landolt



Image: Eric Marmor / IDF Spokesperson, CC BY-SA 3.0, Wikimedia Commons

Predicting dam failure

Back in 2019, the collapse of a tailings dam at the Brumadinho iron ore mine in Brazil triggered a huge mudslide with catastrophic consequences for the environment and local population. For a long time, the causes of this dam failure were something of a mystery. After all, it had been some years since the pond behind the dam had been topped up with any new tailings, as the slurry of fine residues from ore processing are called. Eventually, however, ETH researchers were able to identify a physical mechanism and other factors that might explain the dam failure. Their model showed how initially small and insignificant slip surfaces in the tailings expanded horizontally over time. As a result, the layers of tailings began to move, causing the dam to collapse under their weight. Predicting failures of this kind is

impossible with conventional monitoring systems. This new model therefore offers a useful addition to risk assessment procedures for tailings dams.

—> igt.ethz.ch

Vital protection

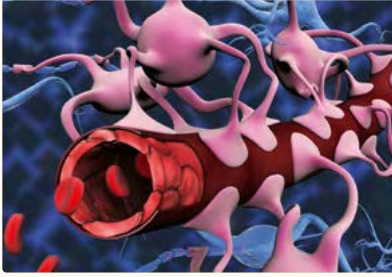
The skin provides an essential barrier, protecting the body against water loss and preventing the entry of allergens and pathogens. Injuries or disorders that compromise the integrity of this barrier could therefore have serious medical implica-



Image: Anna Naass / Adobe Stock

tions. Launched in 2016, Skintegrity is a major interdisciplinary project pursuing cutting-edge research into the skin and skin disorders. It brings together experts seeking to develop new methods for the diagnosis and treatment of wounds, inflammation and skin disorders. Skintegrity also provides training for scientists, doctors and engineers keen to apply this new knowledge. Originally named a flagship project of the Hochschulmedizin partnership in 2016, Skintegrity was elevated to a national research initiative in 2020.

—> skintegrity.ch



Hope for brain disorders

Neurological disorders such as depression, anxiety and epilepsy often have their origin in particular regions of the brain. As a rule, such areas cannot be treated with non-invasive methods such as medication. Now, however, ETH professor Mehmet Fatih Yanik and his team have developed a new technique that enables targeted drug delivery to specific parts of the brain. Using focused ultrasound, drugs are transported to the brain, via the blood, by means of biological carriers. Once released from these carriers, the drugs cross the blood-brain barrier without compromising the vital defence it provides against toxins and pathogens. This new method may lead to a breakthrough in treating neurological disorders.

—> neurotechnology.ethz.ch

The cell as a computer

In future, it should be possible to retrofit human cells with an artificial genetic programme that works in much the same way as an electronic switch. Cells reprogrammed in this way could then undertake vital biomedical tasks in our body – for instance, modified immune cells could be harnessed to destroy tumour cells. Since tumour cells have different genetic characteristics, such a programme would have to stipulate: “Destroy a cell if it is of type X or Y or Z.” In mathematics and electronics, this operation is effected by means of an OR gate. Cells programmed in

this way will be used primarily for medical diagnostics and therapy. ETH researchers at the Department of Biosystems Science and Engineering already made some initial advances with human cells of this type back in 2021.

—> bsse.ethz.ch/synbio

Non-toxic membrane

Much outdoor wear features a breathable, waterproof membrane. This has tiny pores that are permeable to the vapour droplets produced from sweat but not to the much larger droplets of rain. Many of these membranes contain hazardous fluorine compounds that are harmful to health and the environment. To Mario Stucki, this was a problem that needed solving. While studying at ETH, he came up with an eco-friendly membrane that is free of fluorine compounds. The inspiration came during his Master’s thesis, which he completed as a member of the research group led by Wendelin Stark, Professor of Functional Materials Engineering. He followed up this idea in his doctorate and later as a commercial project, which resulted in the ETH spin-off Dimpora, set up in



Image: Dimpora

partnership with Anna Beltzung. Their latest development is a membrane based on castor oil in place of crude oil.
—> dimpora.com

Curbing urban sprawl

Image: Benjamin Müller / ETH Library Zurich, Image Archive



The construction of new housing in Switzerland continues to carve up the countryside and pave it with impermeable surfaces. As well as increasing the volume of traffic, this ballooning urban sprawl also throws up insurmountable barriers to animal and plant life. To arrive at a sustainable approach to spatial and landscape planning – not least for the benefit of future generations – it is vital to find a balance between economic, environmental and social considerations, the three key factors in this field. At ETH Zurich, the Institute for Spatial and Landscape Development now has three research groups looking at the increasingly complex interplay between these aspects. A deeper understanding of this problem will help identify a sustainable strategy for curbing urban sprawl and excessive traffic in built-up areas.

—> irl.ethz.ch



RESPONSIBILITY Be accountable for our actions.

For many people, architectural norms create barriers to accessibility. How might we re-imagine our built environment to make it more inclusive?

TEXT Corinne Landolt

Rethinking architecture

Architecture can be brutal, says Spanish architect Anna Puigjaner. “It constantly divides society into those who can – and those who can’t,” she explains. “Take a staircase, for example: it’s just one architectural element, but it draws a sharp line between people who can climb stairs and people who can’t.”

Many architectural norms are actually only suited to a minority, and for some people, they may even create insurmountable barriers. “Architecture isn’t neutral; it has a real impact on society,” says Puigjaner. “Unfortunately, architecture has reinforced and reproduced a whole host of prejudices over the past few decades.”

ARCHITECTURAL NORMS FOR A MINORITY For example, most homes are still designed with the needs of a nuclear family in mind: a living room where everyone can meet, one or two small bedrooms for children, and a larger bedroom for the parents. This reinforces the prejudice that most people live in a nuclear household. “Yet in Switzerland, and in my home country of Spain, only around a quarter of people live in such traditional structures,” says Puigjaner. “So, what about the other three-quarters who don’t live like this?” Households come in many different forms. They include people who live alone, friends

who live together, childless couples, large families, patchwork families, queer families and single parents. Yet for decades, the space they inhabit has been tied to a fixed standard. “That breeds a lot of preconceptions and entrenches existing power structures, including within families. The very fact that we give parents more space makes them seem more important than their children,” says Puigjaner.

ARCHITECTURE THAT DIVIDES Puigjaner advocates a form of architecture that does not create division. She was appointed as Professor of Architecture and Care at ETH Zurich in early 2023, and one of her focuses is the ageing society and the associated rise in health problems and disabilities. “We’re in a global care crisis, and we need to find new ways of dealing with it,” she says. “Architecture is a big part of the problems we face in this area.”

Specifically, her professorship examines the impact that things like care provision have on individuals and society as a whole. It looks at how the need to go shopping and run everyday errands affects people, and it asks what architecture can do to break down barriers in this context. “The private sphere is still the place where things like personal hygiene, taking medication, and more mundane activities such as cooking, cleaning and washing take place – and our houses, villages and cities are designed to reflect that,” says Puigjaner.

As a result, care work – which encompasses caregiving and support for household members as well as domestic chores – is still stuck in the nuclear family mindset, which expects members →

of households to live together under one roof and look after one another. This premise, which seldom corresponds to the reality of older people's lives, has far-reaching implications. "In our ageing society, many people are unable to look after themselves and perform daily chores and caregiving tasks in the way they were once expected to do," says Puigjaner. "We've created a built environment that encourages all sorts of asymmetrical dependencies, and it's time we redefined how that works."

EVERYDAY HURDLES "These obsolete structures put enormous pressure on the healthcare system and on us as citizens," Puigjaner adds. "They draw a sharp distinction between different segments of society, between dependent and independent individuals – in other words, between those who can, and those who can't."

Many older people have to leave their home to access certain types of care, support and amenities. This can force them to travel significant distances. For many, even cooking can be a struggle, because they are physically or mentally incapable, explains Puigjaner. "We therefore need to design our villages and towns in a way that eliminates the binary between dependents and caregivers and replaces it with productive interdependencies," she adds.



Image: "From Oaks to Barrels," Aude Sahiti

Momoyo Kaijima's students explore how architecture can break down barriers between village and city life.

And it's not just the elderly or people with physical disabilities who count as dependent: all of us are likely to experience different kinds of dependencies during our lifetimes, whether as children, as parents, when we have a health issue, or while living alone.

MOVING CARE INTO THE PUBLIC REALM Care work needs to be redefined and shifted from the private to the public sphere, says Puigjaner: "We need to consider the daily tasks and chores that involve dependence as part of urban planning, as part of the public infrastructure, just like we do with libraries or with the water and electricity supply." By taking care work out of the "hidden" private realm, she says, we can fulfil many of society's needs and break down barriers for an ever-expanding segment of the population.

Puigjaner argues that we should promote infrastructure that makes it easier for people to care for themselves and run everyday errands; for example, by making such infrastructure easy to access and by combining as much as possible under one roof. She believes such an approach would also ease the economic burden on the healthcare system and relieve pressure on care institutions such as community health services.

Puigjaner has been looking at how shared kitchens and day-care centres can bring people together. She is particularly interested in Japan, which – just like Switzerland – has an increasing proportion of elderly and single-person households. Since the devastating earthquake in Fukushima in 2011, there has been a rise in the number of people who report feeling helpless and excluded. Efforts to address their needs include the creation of a new type of shared kitchen in Tokyo, which operates like a community centre and is open to everyone. "These urban kitchens are a meeting point for neighbours, where people can come together to cook and eat. They don't replace people's private kitchens – they complement them," she says.

In Singapore, the government began setting up shared kitchens a few years ago. The result was a substantial drop in spending on elderly care. "The people who use these kitchens provide mutual support, which greatly reduces dependency," says Puigjaner. "It's a naturally evolving form of healthcare, and we need to look at how to make that part of urban planning."

MAKING IT ROUTINE Bogotá took this one step further with its "Manzanas del Cuidado" programme, in which authorities in Colombia's capital converted

little-used libraries into public day-care centres. These include a laundry service, a public nursery and a kitchen that anyone can use, as well as spaces where medication can be obtained and taken.

The Manzanas del Cuidado have been hugely successful and could be a good example for Europe to follow, says Puigjaner. “The way that our cities, houses and flats are built right now makes us feel dependent,” she explains. “If we can’t handle something within our own four walls, we’re told that we have to go to a dedicated place to get help. Imagine how it would transform society if, instead, we could make all that part of our daily routine! If we could choose whether to cook at home or in a shared kitchen, even when we were still capable of cooking by ourselves. Then, when the day came where we needed support, we wouldn’t feel we were dependent on anybody or anything. We would simply follow the same routine and continue to have those same relationships with other people.”

RETHINKING EDUCATION Momoyo Kaijima also emphasises the connections between society and architecture. “The architecture industry as we know it has existed for around 150 years. For a long time, the established structures and construction processes were fit for purpose. But nowadays we’re increasingly aware of the ways in which architecture can exclude people and the impact this has on individuals and on society as a whole,” says ETH professor Kaijima, who originally hails from Japan.

Like Puigjaner, Kaijima is keen to question norms and overcome barriers. In her case, this means focusing on public buildings in areas such as administration and education. Classrooms have barely changed for decades, she says, and teachers still stand at the front of the class, even though that no longer makes much sense. “Teachers and pupils are both meant to be working towards a specific learning goal together. They don’t need a rigid structure to achieve that. Instead of facing each other, they could be exchanging ideas and discussing things in small groups – and breaking down the invisible barrier between them in the process,” Kaijima explains. In her view, the educational content that modern schools wish to provide should also shape the architecture – including the design of the classroom and the school building itself. And she firmly believes that a place of learning should be geared not only towards the children and the teaching staff. The population in both Switzerland and Japan is ageing, while the number of children is



Image: MAIO

Shared kitchens, such as this one in Tokyo, help make people less dependent.

declining, especially in rural areas. “That’s going to cause problems in the future, but at the same time it’s a wonderful opportunity to think about how we define quality in learning, to reflect on what we can learn from each other as a society, and to imagine how a building can be accessible and suitable for different generations, from small children to the elderly,” she explains.

Kaijima’s goal is to forge connections not only between the generations, but also between people from all sorts of different backgrounds and lifestyles. Together with her students at ETH, she is studying the interactions between these different realms in the hope of finding new ways to overcome barriers, inhibitions and anxieties.

EVERYONE IS INCLUDED Switzerland’s current building rules and regulations primarily address issues of physical accessibility, such as the maximum distance a wheelchair user should be expected to negotiate. Both ETH professors criticise the lack of similar provisions for neurodiverse individuals. “The incidence of mental illness and disorders in our society is increasing, and architecture should be responding to that,” says Puigjaner. “For example, we need spaces that are less visually stimulating and easier for people to negotiate, as well as different kinds of entrances and exits and also niches that people can retreat to.” →



Image: c-a-r-e.xyz

Welcome to the Care Kiosk! A project by Anna Puigjaner's students that seeks to shift care work from the private to the public sphere.

In the Spring Semester, the Architecture and Care professorship ran a course in conjunction with Theater HORA, which employs actors with learning disabilities. Together, they developed a model of an inclusive city that would reflect the needs of as many people as possible, regardless of disability or neurodiversity. "The collaboration was very fruitful, and it prompted the students to reflect on urban spaces and inclusion and consider what needs to change in architecture," says Puigjaner.

NO TIME TO LOSE Today's students are very open to the concept of inclusion and acknowledge the need for a shift in mindset, say the two architects. That's important, because both professors agree that the next 20 years will see architecture undergo a major transformation.

"Obviously we can't simply demolish everything and build again from scratch. But we do need to find out how we can renovate our existing structures and make them physically accessible to as many people as possible," says Kaijima. Puigjaner agrees: "We need to think fast, because demographic change is happening at an alarming pace, and architecture is slow to shift. But at least we can make sure we're ahead of the curve!"

ANNA PUIGJANER is Professor of Architecture and Care in the Department of Architecture. Generous funding from the Stavros Niarchos Foundation (SNF) helped set up the professorship.

—> c-a-r-e.xyz

MOMOYO KAIJIMA is Professor of Architectural Behaviorology in the Department of Architecture at ETH Zurich.

—> kaijima.arch.ethz.ch

ACCESSIBLE LEARNING

ETH Zurich also aims one day to be fully accessible to everyone. Most of its teaching and research buildings already meet the legal requirements. But fostering inclusiveness and participation is about more than just eliminating obstacles to mobility and navigation on the university grounds and in its buildings; it also means offering education in an accessible format. That's why ETH launched its Digital Accessibility project, which is part of the Barrier-free at ETH Zurich programme. By harnessing digital materials, this e-accessibility project aims to promote accessible learning at ETH.

—> ethz.ch/e-accessibility-en

FOCUS

OPENNESS Be accessible and receptive.

Embracing failure

ESSAY by Moritz Mussgnug

Making mistakes is a marvellous thing. All of us can benefit from the growth that comes from failure, the chance to make a better future by learning from past mistakes. That's why we have always fostered a no-blame culture at the Student Project House. The "fail-forward" approach is a key part of our mindset.

The Student Project House is a place where undergraduates and doctoral students from ETH Zurich can follow up their own ideas. By welcoming students who are intrinsically motivated to pursue an idea and giving them an opportunity to run their own project, we create what we believe is a really valuable working environment. We cultivate important cross-disciplinary skills such as communication, leadership and project management – mainly in interdisciplinary teams, adding an extra dimension to traditional learning formats. Whether an idea has anything to do with a student's course of study is irrelevant to us, because the learning comes from the project itself. What matters are the goals a team chooses to set, the goals it achieves – and also the ones it doesn't. We see setbacks and a team's response to failure as part of an important process, with the fail-forward approach at the heart of that.

For us, a successful project is one where the team starts out with an idea they believe in. A team that discusses, probes and tests their idea and then goes on to improve, tweak and expand it. Whether that then leads to more testing and tweaking or a complete rethink is up to them! For us, success is not a market-ready product, but rather a team that has purposefully gone through this process of testing, failing and adapting. That's the core learning effect that will benefit students in their future careers.

We employ coaches at the Student Project House to support the project teams. These coaches – and I am one of them – believe wholeheartedly in the students' ideas. We ask difficult questions. We motivate them. But we never pressure them to choose a particular topic or finish by a certain deadline. And we never dictate which path they should take. We do, however, cultivate an environment that removes barriers to participation. For example, no-

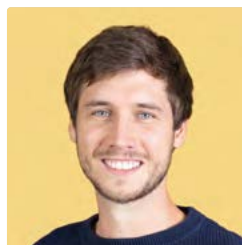
body has to apply to come here; every ETH student is welcome. There is no selection procedure, and no competition between projects. We don't evaluate project ideas, and we don't give grades or credits.

This approach is even reflected in the architecture of the Student Project House. Everything is open plan, so escaping to a secluded meeting room is not an option. Neither coaches nor teams have a dedicated workspace – that's just one example of the flat hierarchies here.

When a project comes to an end, the coach and team take a moment together to look back and reflect. Sometimes, we create a timeline to review how the project progressed. That helps us identify the highs and lows. It's always heartening to see how teams intuitively understand that the tough phases were much more instructive than the times where everything ran smoothly. It's the challenges and setbacks that help the students emerge stronger.

The fact that we don't grade students or their ideas makes it much easier to talk about failure. It transforms the discussion into a positive exchange of ideas, which nicely rounds off the project. And it's something the students can take pride in long after their time at the Student Project House is over. ○

Image: Courtesy of anonymous



MORITZ MUSSGNUG is head of Ideospace and interim co-head of the Student Project House at ETH Zurich.
—> sph.ethz.ch



RESPECT Have high regard for all people.

COMMUNITY



Image: Alessandro Della Bella / ETH Foundation

Prize-winner Marco Hutter with Max Rössler.

Robotics expert Marco Hutter wins Rössler Prize

Marco Hutter, one of the world's most respected pioneers in robotics, has been awarded this year's Rössler Prize. ETH Zurich's most richly endowed award, which is worth 200,000 Swiss francs, was presented by ETH President Joël Mesot and prize donor Max Rössler at the Thanksgiving event put on by the ETH Foundation.

Hutter's work on the movement and autonomy of AI-controlled walking robots has fundamentally realigned robotics research, propelling ETH Zurich to the forefront of this field. The Rössler Prize comes in recognition not only of his pioneering scientific work, but also of his outstanding achievements in the areas of technology transfer,

entrepreneurship, and community and project initiatives. ETH Zurich President Joël Mesot commended Hutter for his success in building a "broad network of cooperation".

Marco Hutter has long enjoyed the support of the ETH Foundation. Back in 2007, while still a student, he was one of the first Excellence Scholars. In 2010, funding from a Pioneer Fellowship enabled him to take his walking robot from the research stage to a commercial application, which gave rise to the spin-off ANYbotics. Since then, a further seven start-ups have emerged from the research group of this enterprising ETH professor. ○

Alumni Spotlight: impressions from around the world

The ETH Ambassadors Blog has launched Alumni Spotlight, a new series in which ETH alumni share their experiences and insights. In a recent blog post, Bettina Hännys writes about her career move from flight attendant to environmental scientist – and about how it's never too late to follow your dreams. Meanwhile, Xuejiao (Jo) Han describes how her work on energy storage will help combat climate change. And Nicoletta Piccolrovazzi,

who sits on the board of an NGO and takes care of children with disabilities, writes about an unforgettable trip to a refugee camp in Uganda.

If you would like to write an alumnus blog post and inspire others with your story, please contact the desk of the ETH Ambassadors Blog. ○



ETH Ambassadors Blog:
→ ethambassadors.ethz.ch

Apprenticeship graduation ceremony

“Following successful completion of your vocational training, you now hold the key to unlock your full potential in life.” It was with these words that Lukas Vonesch, Head of HR Consulting, welcomed the 51 ETH Zurich apprenticeship graduates to the 2024 graduation ceremony on the ETH Hönggerberg campus. The goal and guiding principle of ETH's vocational training programme, he said, was to empower young people for the future world of work.

In his ceremonial address, Ulrich Weidmann, Vice President for Infrastructure, underscored the multiple benefits of vocational training at ETH: “Your qualification with us is of lasting value. It gives you not only training in a specific vocation but also a lesson in character building – and it is thoroughly imbued with the ETH ethos.” ETH provides vocational training in fifteen different professions. ○

Image: Leandra Wüthrich / ETH Zurich



This year's apprenticeship graduates at ETH Zurich.

The future of medicine starts here

In the Gloria Cube, teaching, research and translational research are all geared towards the same end: healthcare and medicine. ETH Zurich celebrated the inauguration of its brand-new laboratory and research facility this summer.

TEXT Florian Meyer and Deborah Kyburz



Image: Alessandro Della Bella / ETH Zurich

The new Gloria Cube laboratory and research building is home to 16 professorships in health sciences and biomedical engineering.

The Gloria Cube – ETH Zurich’s newest building – is located in the Gloriarank area of Zurich’s university district. This summer, the health sciences and biomedical engineering departments moved into the newly inaugurated building, which stands at the intersection of the ETH campus and the Fluntern residential district. The Gloria Cube is now home to a total of 16 research groups from the fields of movement sciences and sport, rehabilitation and biomedical engineering, and applied translational research. The project was made possible by a generous donation from the Mäxi Foundation. Researchers have access to eight floors of seminar and training

rooms, laboratories and offices. Half of the floors are underground, putting the top floor at the same height as the gardens of the residential buildings located above.

FROM LAB TO REAL LIFE The Gloria Cube was designed to provide an inspiring environment for students and researchers to think and work. Its central location close to University Hospital Zurich and the University of Zurich makes it the perfect place for interdisciplinary collaboration and for translational research, which seeks to convert scientific discoveries into clinical solutions that can be

used to treat patients. Keen to exploit this potential, ETH Zurich chose the Gloria Cube as the site of its newly established Digital Trial Innovation Platform (dTIP). Designed as a technology platform for human medical research, the dTIP provides infrastructure and team support for ETH researchers engaged in clinical trials of new therapeutic approaches and in developing new medical solutions.

Another way of translating research knowledge into practice is through education. The Gloria Cube caters to this purpose with its six seminar rooms and its innovative “Skills Lab @ETH”, an applied learning and practice centre where medical students can teach each other basic medical skills, such as the use of ultrasound technology.

ARCHITECTURE WITH FLAIR The name Gloria Cube (GLC for short) references the shape of the building and its location. It also reflects one of the building’s signature features: the translucent cubic glass blocks that characterise the facade and appear inside the building – for example, on the stairs and on the ceiling.

The Gloria Cube is distinguished by its compact design: instead of towering into the sky, it merges seamlessly with ETH’s existing ETZ building to form a ring-shaped ensemble. This endows the inner courtyard with a deeper purpose as a place for people to meet, a quality that is enhanced by the new Archimedes restaurant, which is open to the public. The project also required a practical integration of the Paul Scherrer lecture hall into the ensemble, including enhancing its use as a teaching and event venue.

As well as adding a final flourish to the ETH Zentrum campus, the Gloria Cube also connects the ETH buildings to the adjacent residential zone via walkways and a green area. This smooth transition from the university to nearby homes enhances the neighbourhood feel. In recognition of the bold approach taken by architects Roger Boltshauser and Armin Baumann, the Gloria Cube has won awards for both its architecture and engineering. ○

The Gloria Cube will be opening its doors to visitors on 28 and 29 September, 2024. Find out more and book your place: → openhouse-zuerich.org

Two videos showcase research in the Gloria Cube:



PHILANTHROPY



DONALD TILLMAN
Managing Director of
the ETH Foundation

Solidarity with the start-up community

It can take major resources to set up a successful business – not least in the deep tech sector, where significant investment is often required to get a start-up off the ground. At ETH, our young entrepreneurs are resolute in their pursuit of this sometimes distant prize. They are confident they will succeed, which is why we created the Pioneer Pledge: a personal, non-binding promise to provide philanthropic support to ETH and its entrepreneurial ecosystem at some point in the future. When? As soon as the time is ripe. When the business begins to return a steady profit, for example, or when a spin-off is sold. One company founder leading the way here is Bernhard Kratzwald from Ethon AI, and the full list of people who have already embraced the idea of giving something back is available on the ETH Foundation website. If you’re an entrepreneur yourself and would like to help nurture the entrepreneurial spirit, then please get in touch. We thank you for your solidarity with the start-up community! ○

→ ethz-foundation.ch/en/pioneer-pledge

ETH retains seventh place

In a repeat of last year's excellent performance, ETH Zurich has taken seventh place in the latest QS rankings. This is the tenth time in a row that ETH has been ranked among the world's leading ten universities. Alongside top scores for academic reputation and international outlook, it was the university's achievements in the area of sustainability that helped it retain seventh place. As in previous years, ETH was outperformed solely by universities from the US and UK. This year's rankings, which include more than global 1,500 universities, are headed once again by the Massachusetts Institute of Technology (MIT). ○

Guidelines for use of generative AI

ETH Zurich has formulated guidelines for the use of generative AI in education. In the interest of academic integrity, ETH is appealing to the principles of accountability, transparency and fairness, calling on teaching staff and students to exercise responsibility with regard to any content they teach or submit. Staff and students should declare when and where GenAI has been used and ensure that no copyright material nor any private or confidential information is used in conjunction with commercial GenAI tools. The legal aspects of GenAI use are covered by existing exam regulations and by a new declaration of originality. ○

Top award for risk assessment spin-off

ETH spin-off CLIMADA Technologies has landed first prize in the Finance & Insurance category at this year's Venture Awards. The company emerged from the Chair for Weather and Climate Risks and has developed an event-based simulation platform for assessing the socio-economic impact of weather and climate events. The spin-off uses mathematical models to compile risk assessments that enable companies, public authorities and other decision-makers to better prepare for growing weather and climate risks. Four other ETH spin-offs also made it onto the podium: Procavea Biotech, Optiml, RTDT Laboratories and qCella. ○



Image: Venture

Founder and CEO of CLIMADA Technologies Sebastian Glink (left) and Head of Business Development Alvaro Pacheco.

IN PERSON



Nina Cabezas Wallscheid is researching the impact of nutrition on the human blood system. Her research team aims to identify the ideal diet for a long and healthy life.

NINA CABEZAS WALLSCHEID is Professor of Stem Cell Biology and Ageing at the Department of Health Sciences and Technology.

→ itm.ethz.ch

You grew up on the Costa Brava and studied in Barcelona – places where other people go on holiday. What was that like?

For me, it was an opportunity to get to know people from all over the world. Roses, a small village on the coast, was a great place to make international contacts and brush up my language skills. My mother is German, my father Spanish, and we had neighbours from many different countries. That just gave me an even more international outlook!

What's so special about the stem cells that eventually develop into blood cells?

Blood stem cells are quite unique: over time, they are able to renew the body's entire population of blood cells. But problems with the regulation of these blood stem cells can lead to leukaemia. We think that correct nutrition can keep the stem cell pool healthy over your lifetime.

What impact does diet have on a healthy blood system?

A major one. We and other researchers have shown that essential nutrients can significantly impact our blood system. Vitamin A and vitamin C, for example, are vital for maintaining a healthy pool of stem cells in the blood.

Is there a perfect diet to guarantee a long life?

Recent years have seen advances in the search for the perfect diet – or for the ideal nutrients that would extend our lifespan. There is work that links intermittent fasting with longevity, for example. One of the aims of our lab is to identify and enrich the specific nutrients that make up the ideal diet for a long and healthy life.

You've already climbed Kilimanjaro. Is the Matterhorn next on the list?

Switzerland is a dream for nature lovers. For me and my husband, it's great to have so many options right on our doorstep, and we're already thinking about what our next adventure might be. We've even started taking along our three-year-old when we go hiking, kayaking or skiing. Climbing the Matterhorn would be fantastic, but also a pretty big challenge! ○

TEXT Karin Köchle



SLIPSTREAMING TO SUCCESS

TEXT Karin Köchle
IMAGES Alessandro Della Bella



REPORT | ETH student and top sprinter Géraldine Frey is preparing for her races with an innovative piece of equipment. Developed at ETH Zurich, the Airshield reduces aerodynamic drag, enabling athletes to train at speeds above their normal pace.

The sun blazes down, driving beads of sweat onto Géraldine Frey's forehead. With only a few seconds to go, she takes up her mark and slowly raises a hand to signal her readiness. Face tense with concentration, she waits for the green light, then launches herself along the track.

The silence in the arena is deafening, the stands empty. On this hot June day, the Letzigrund Stadium is hosting a different kind of meeting: a coming together of science and sport. Frey is part of a team testing an innovative piece of training equipment developed at ETH Zurich: a wheeled, wedge-shaped trailer with a Perspex body, towed by an electric go-kart. When running in the shelter of this "Airshield", an athlete experiences reduced wind resistance, allowing them to sprint faster than normal – an athletic technique called overspeed training.

PUSHING THE LIMITS Good weather has finally allowed the team to return to the arena. At the athletes' request, the Airshield is optimised for use in warm, dry conditions – and today is perfect. "We've been caught out by the rain a few times," Frey explains. "So it's great to be out on the track again." Time is running out in her race to prepare for the 2024 Summer Olympics in Paris. For the past three years, her eyes have been firmly fixed on this prize. "My goal is to peak in Paris," says the 27-year-old sprinter. "And for that, I'm willing to try out anything that might give me a few extra yards of pace." Running in the slipstream of the Airshield is a new form of overspeed training – pace drills in which equipment is used to boost tempo and hopefully attain new performance levels. As ever, proper preparation is key, and it will be another few hours →



1

1
Professor Melanie Zeilinger and project leader Andrea Carron check the camera and sensor in the Airshield.



2

2
Sensors incorporated in a belt record the athlete's movements.

3
Professor Christina Spengler prepares special insoles fitted with sensors to measure pressure distribution while running.



3

4

Sprinter Géraldine Frey stretches in preparation for the coming training session.



before actual training can begin. Project lead Andrea Carron, an ETH researcher, has now arrived at the stadium. His first job is to check that the electric go-kart used to tow the Airshield is fully charged. He then ensures that all the cables are properly connected and the complex technology is fully functional. He is joined by Professor Melanie Zeilinger from the Department of Mechanical and Process Engineering at ETH. Together, they eagerly await the first sprint. "We built the Airshield in a matter of months," Zeilinger explains. "To see athletes already training with it is just fantastic!"

OVERSPEED TRAINING But what exactly do the researchers hope to achieve? "We want to look at the benefits of overspeed training and how our equipment matches up to other methods," Carron explains. For athletes, speed training is all about optimising and internalising certain muscle movements and then reproducing that peak performance on the competition track. Given that air resistance increases as the square of speed, anything that reduces the aerodynamic drag on a sprinting athlete is going to provide massive assistance. But how does the Airshield compare with another piece of equipment used in overspeed training – an elastic cord attached to the torso, which tows the athlete along the track? Frey much prefers the Airshield, because it enables her to sprint faster than normal while also maintaining her natural running position. Similarly, there is none of the artificial acceleration provided by a cord. Instead, she has to sprint up to maximum speed entirely under her own steam.

The current Airshield, complete with go-kart, is a prototype, born of a request from the coaches of the Swiss sprint team, which includes Frey and reigning European champion Mujinga Kambundji. The hope was that ETH Zurich could develop drag-reduction equipment to help top sprinters train and, ideally, improve their performance in competition. The result is a project that brings together science, sport and technology. At its helm are Zeilinger and ETH professor Emilio Frazzoli, who developed the go-kart used to pull the Airshield. Researchers from the Institute for Dynamic Systems and Control at ETH Zurich developed an algorithm that automatically matches the speed of the Airshield to that of the sprinter. A more recent addition to the team is ETH professor Christina Spengler, a health science specialist who is looking at the new training system from the perspective of sports science.

In the stadium, meanwhile, temperatures are still rising. While workers hose down the empty stands with water, Frey and her two teammates begin their warm-up routine – an essential precaution to prevent injuries, even at 30 degrees Celsius.

CAREER ATHLETE AND STUDENT Frey has been mad about sport ever since junior school. Her focus on athletics came later, while at secondary school in the Swiss town of Zug. Although sorely tempted to turn professional, she was wary of committing herself entirely to a sporting career. To keep her options open, she chose to study pharmaceutical sciences at ETH, progressing to a Master's programme after finishing her Bachelor's degree. "ETH is a sport-friendly place and very accommodating about me being in the national squad," says Frey. "I really value that." If all goes according to plan, she will complete her Master's degree next year. →

Before then, however, she aims to give her all in preparation for the Paris Olympics.

Trackside, Christina Spengler is busy setting up her equipment on top of a vaulting box. A video on her laptop shows how Frey and the Airshield become synchronised. "When she sets off, the go-kart also starts moving, but at this point the Airshield is still travelling more slowly than the athlete," explains Spengler. "A sensor in the Airshield registers this difference in speed, and the go-kart accelerates accordingly." Based on Frey's speed and her distance from the Airshield, an algorithm calculates the precise acceleration required to maintain an ideal gap. In other words, the speed of the go-kart is controlled automatically. All the driver does is steer.

TECHNOLOGY MEETS SPORT Down on the track, Spengler is fitting special insoles into Frey's running shoes. Developed by ETH biomechanics specialist Roland Zemp and his Lucerne-based start-up, they measure where pressure is applied during a sprint. Spengler also attaches a belt with two sensors to Frey's lower back to record the athlete's movements. "These tools help us analyse the running dynamics and other biomechanical data," Spengler explains. A camera in the Airshield records the athlete as she runs, while the sensors in the belt and insoles capture other parameters that are key for comparing sprints with and without the Airshield and with an elastic cord.

With her warm-up complete and the sensor belt and special insoles in place, Frey is finally ready for her first sprint of the day. This is the third time she has trained with the new equipment, following a break of several weeks. "It always takes a moment to regain the confidence that the Airshield will keep pace with me," she says. "But after that I can really push it, which is such a brilliant feeling!"

Géraldine Frey bursts into action. Her coach, Lucio di Tizio, roars with encouragement: "Go Géry! Come on!" After 70 metres, she reaches the finish line. Frey is delighted with her times. Overspeed training might only add a centimetre per step, she explains, but after 50 steps that's already half a metre. "Running without air drag is an incredible feeling. It's almost like flying," gushes Frey. ○



Debriefing after the first sprint: Christina Spengler, coach Lucio di Tizio, Géraldine Frey (bottom, from left to right) and teammates Lionel Spitz and Lena Weiss (top).



COFFEE FARMING IN ZAMBIA

TEXT Samuel Schlaefli
IMAGES Claudio Sostizzo

ETH agronomist Fridolin Stocker worked on Swiss farms before discovering a love for Africa. Today, he manages a coffee farm in Zambia.

It's a Wednesday morning in May, and we're sitting in the office of Fridolin Stocker's coffee farm, enjoying his tales of day-to-day life in Zambia. It may be early, but he's already been up for five hours. He started with breakfast at 5.30 a.m. while catching up with the news on Swiss SRF radio and online with Swiss newspaper NZZ. Then he met with his assistant to plan out the day's work in the fields. "I spend around half of my time out on the farm and the other half in the office," says Stocker. A true all-rounder, his tasks include tilling the fields, planning fertiliser requirements, building houses, planning a new coffee-processing plant, repairing agricultural machinery and running the nursery. He currently grows coffee on 115 hectares, employing up to 220 people on his farm during the harvest months of May to August. This summer, for the first time, he will produce some 70 tonnes of arabica coffee for export to Switzerland, specifically the varieties Starmaya and Marsellesa. "We produce speciality coffee varieties for mid-sized roasters who are looking for high quality and sustainability," says Stocker. By 2025, his company Mount Sunzu Coffee hopes to be exporting 200 tonnes of coffee a year to Switzerland.

LIFE ON THE FARM Farming is not something that runs in Stocker's family. His father studied physics at ETH Zurich and went on to work as a patent lawyer, and his mother is a doctor. He grew up in Wil near St. Gallen, and many of his summer holidays were spent hiking in the canton of Graubünden. "I've always enjoyed being outside, and my interest in farming started from an early age," he says. His father even made him a child-sized pitchfork so that he could pretend to be a farmer. Once he started secondary school in Immensee, Stocker took any opportunity he could to help out on farms during school holidays, and he soon began picking up the requisite skills. When his school told him about the ETH degree programme in agricultural sciences, he glimpsed a way of combining his proficiency in mathematics with a passion for working the land.

Not long after, an acquaintance offered him an exciting opportunity to go to Zambia on a three-month agricultural assignment. "That's what sparked my love of Africa – and I've never looked back!" says Stocker. "I just couldn't believe how much fertile land was available, especially in a climate in which you can grow crops all year round." In Switzerland, he was used to a growing period of between five and eight months, depending on the altitude. As chance would have it, another student from his course, Luca Costa, was in Côte d'Ivoire at the same time, picking up work experience on a cocoa and rubber farm. Stocker visited him, and together they began hatching plans for their very own farm.

LEARNING OPPORTUNITY IN LAOS With his Master's degree in his pocket, Stocker immediately applied for a job as an agronomist with an international coffee producer in Zambia. The company chose a different candidate for the post, but offered Stocker a job in Laos. He agreed and spent two years working as a plantation agronomist in Pak-song in the south of the country, planning fertilisation and irrigation schedules, and devising production standards for over 1,200 hectares of coffee. "I was part of a team of agronomists from Asia, Africa, South America and Europe. Professionally, it was a hugely formative and enriching experience," says Stocker. He scoured the literature for new ideas on how to boost the efficiency of coffee growing in Laos. At the same time, he compiled statistics on how different agricultural practices affect productivity. "The work was directly connected to what I had learned at ETH," he says.

After two years, Stocker was posted to Tanzania, where his remit also covered the company's coffee farms in Zambia. Three years previously, he and Luca Costa had found a piece of land in Zambia where they hoped one day to fulfil their dream of running their own coffee farm. "It was love at first sight," says Stocker. "The land includes a lot of dry forest and part of Mount Sunzu, the highest peak in Zambia. And as someone from Switzerland, that ob-



“The work was directly connected to what I had learned at ETH Zurich.”

Fridolin Stocker

viously appealed to me!” By 2019, they had raised enough start-up capital to sign a 99-year lease on a 780-hectare plot. The land hadn’t been used for agriculture since the 1990s and was becoming increasingly overgrown. Before they could exploit it, their first task was to build an access road and bridge and lay an eight-kilometre-long, high-voltage power line.

In late 2020, Stocker resigned from his job at the international coffee producer and moved into a dilapidated stone house on the newly acquired land. After renovating the house, he immediately set to work establishing a nursery with 400,000 coffee plants. Right from the start, Mount Sunzu Coffee put its faith in a hybrid variety from a French grower. “It has the typical aroma of indigenous arabica coffee from Ethiopia, but it produces higher yields than the original variety,” says Stocker. The hybrid also offers superior resistance against fungal diseases and pests, he explains. To the best of his knowledge, Mount Sunzu Coffee was the first producer to introduce this new variety on a large scale. “It was obviously a risk, but I think we’re going to see some big changes in coffee growing over the next few years as conventional varieties struggle under the pressure of climate change.”

GLOBAL KNOWLEDGE FOR LOCAL FARMS Since purchasing the land, Stocker has devoted a portion of each day to optimising the use of resources on his farm, applying all the knowledge gleaned from 14 years of work and study. This expertise is evident in his water management strategy, use of pesticides and fertilisation methods. “By installing a spot irrigation system along the rows of coffee plants, we’ve managed to reduce our water consumption by 30 percent,” says Stocker. The system was developed in Brazil, and Stocker powers it using his own photovoltaic set-up. Nutrients for the plants are added to the water, meaning they can be applied more frequently but in smaller quantities. This increases fertiliser uptake while also reducing nitrogen emissions. Improving sustainability also makes financial sense, says Stocker: his method saves on synthetic pesticides and fertiliser, and also improves the quality of the soil, ultimately leading to higher yields.

Stocker is the only one of the original company founders who lives year-round on the farm in Zambia. Luca Costa, who handles marketing and sales, spends half of his time in Switzerland, while his brother Yanik Costa, the third partner in the business, works full-time from Switzerland overseeing the company’s finances and administration. Stocker is often alone, but there are too many opportunities in his adopted country for him to spend too long feeling homesick. He does admit to occasionally hankering after a good Swiss Alpine cheese, and he misses the chats with colleagues he used to have in his previous job and when he was studying in Zurich. Every now and then, he satisfies that urge by flying to a conference, where he can swap ideas with fellow experts and check out the latest progress in agricultural science. ○

FRIDOLIN STOCKER was born in 1990 in Zurich and grew up in Wil. He studied agricultural sciences at ETH Zurich and spent the next three years working for the coffee division of Olam International in Laos, Tanzania and Zambia. In 2020, he teamed up with two colleagues to found Mount Sunzu Coffee. Today, he manages the company’s coffee farm in northern Zambia, which employs over 200 people.

DISCOVER

○ Event

ETH-Klimarunde 2024

**Climate, energy, biodiversity:
For a sustainable and resilient future**

Switzerland faces the daunting challenge of securing energy supplies and maintaining biodiversity whilst also protecting the climate. These three factors – climate, biodiversity and energy – are crucial as we move towards a sustainable future. At the ETH-Klimarunde 2024, participants will discuss how these topics are interlinked and what trade-offs may arise as we attempt to address them.



Image: ETH Zurich

29 October 2024, 3 – 7.15 p.m., in German
ETH Zurich, Zentrum campus

Programme and registration:
—> c2sm.ethz.ch/events/eth-klimarunde-2024

○ Podcast

We are ETH

**Stories from alumni and friends of
ETH Zurich around the globe**

This podcast features conversations with people who have leveraged their ETH experience to create a company, a career and a way of life.

Listen to the episodes:
—> circle.ethz.ch/podcast



Image: Рн Заболотный / Adobe Stock

○ Treffpunkt Science City

Materials of the future

Might your scratched phone screen soon be able to repair itself? Could bioreactors be used to grow meat for our burgers? How dangerous are microplastics and particulate matter? And which materials will enable us to live a sustainable life? Offering a fascinating deep dive into the materials of the future, Treffpunkt Science City – ETH Zurich's public science programme – is designed to appeal to people of all ages. Run by researchers from ETH Zurich, the event includes an absorbing mix of lectures, live demonstrations and experiments.

This special event will be held on four Sundays from 27 October to 24 November 2024

Programme:
—> www.treffpunkt.ethz.ch

○ Public Tour

Inherited experience

Insights into epigenetics research

It is not only our DNA that defines who we are. We also inherit epigenetic marks from our parents – molecular signatures that may persist over multiple generations. The Department of Health Sciences and Technology at ETH Zurich conducts experimental research into how stress and trauma can be passed from one generation to the next. This laboratory tour will highlight the methods used by researchers to uncover the secrets of epigenetics.

26 November 2024, 6.15 – 7.15 p.m.
ETH Zurich, Zentrum campus

Browse more public tours and book your place:
→ tours.ethz.ch/en

○ Photo competition

Keep it CO₂OL

FocusTerra has launched a photo competition in the run-up to its special exhibition Keep it CO₂OL, which opens its doors in spring 2025. Pictures submitted to the competition should show, for example, beautiful aspects of nature or life that are worthy of conservation, the visible impact of climate change in Switzerland or strategies for protecting the climate. The deadline for entries is mid-November 2024.



Image: focusTerra

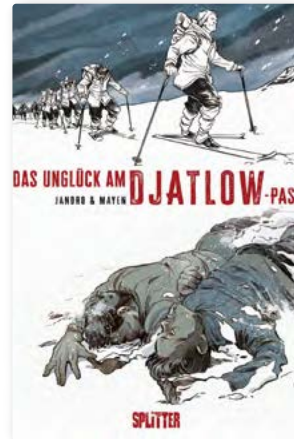
Find out more:

→ ethz.ch/focusterra-keep-it-cool-en

○ Recommended reading

The Dyatlov Pass incident

In January 1959, a group of experienced mountaineers set out on an ambitious trek in the Ural Mountains. None of the nine men and women returned alive. One month later, state prosecutor Lev Ivanov, who was renowned for his forensic rigour, was dispatched from Sverdlovsk to search for the bodies. The discovery of the nine corpses presented Ivanov with more questions than answers, however: Why had the trekkers not stayed together? Why had some of them headed out into the snow with no shoes on?



The precise circumstances of this tragic event remain unclear to this day. Many theories have been suggested, including a political assassination, an avalanche, drugs – or even radioactive contamination. Cédric Mayen and Jandro Gonzalez draw on these historical events as the basis for their thriller-style graphic novel. The appendix contains an explanatory interview with ETH professors Johan Gaume and Alexander Puzrin.

Splitter-Verlag
ISBN: 978-3-98721-383-0

THINK TANK

Image: Courtesy of anonymous; video: Nicole Davidson/ETH Zurich



Riverkin, a start-up founded by Jessica Droujko, measures water quality in freshwater ecosystems.

Measuring turbid waters

TEXT Karin Köchle

A keen kayaker, Jessica Droujko loves everything about water. Born and raised in Canada, she came to ETH Zurich to pursue postgraduate studies. During her doctoral project, she developed a turbidity sensor that became the cornerstone of her start-up company Riverkin, which analyses the quality of river water. Turbidity is caused by fine sediment suspended in the water. This can indicate a disturbance to a river system following, for example, heavy precipitation. Additionally, as the sediment contains nutrients, it serves as a measure of the water's ecological

health. Droujko now holds an ETH Pioneer Fellowship, which is designed to ease the passage from student to entrepreneur. "The Student Project House gave me full support with the transition from a doctorate to a pioneer fellowship," she says. At Riverkin, she has developed a wide-ranging sensor system that can record flow, temperature, sediment and conductivity. The start-up now plans to offer water analysis services that will help clients develop smart water management strategies. ○

STUDENT PROJECT HOUSE This creative thinkspace and makerspace provides ETH students with support in developing and implementing their own project ideas.

→ sph.ethz.ch



Video: Riverkin
→ youtu.be/obQ1PIRxpSs

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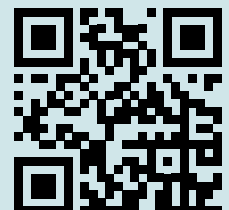
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