ETH zürich

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GLOBE

April 2020

Life under lockdown at the university

PAGE 6

A long road togETHer

Joël Mesot, President of ETH Zurich

As I write the foreword to this issue of *Globe*, Switzerland is gradually emerging from the confines of the lockdown. While the strict measures have had the desired effect, we still face the challenge of striking the right balance between limiting economic damage and mitigating the spread and any possible flare-ups of the virus in the population. ETH Zurich is also resuming its operations in stages. Research was first to restart and will be followed a little later by teaching and the return of staff to their workplaces.

It feels good to be restoring at least some degree of normality. Yet it's becoming increasingly clear that we can't simply flick the switch back on. The situation remains fragile, so we can only return to work at the university if we respect hygiene and physical distancing guidelines.

The past few months have been a challenging experience for everyone at ETH and in the wider world. I want to thank all of you for everything you have done during this difficult period. The crisis has prompted both solidarity and a tremendous surge in creativity. This has manifested itself in terms of online teaching, initiatives by the ETH community to assist society in dealing with the pandemic and, of course, research projects that aim to help tackle the virus and its consequences.

This issue of *Globe* examines life at ETH during the lockdown. Perhaps it will soon be over – I certainly hope so, for all our sakes. Whatever the case, I firmly believe that we will learn from these experiences. The insights we gain will provide valuable input for the rETHink project and boost our ongoing efforts to develop and strengthen ETH.

I hope you enjoy reading this issue. Keep safe and healthy!

Globe, the magazine for ETH Zurich and ETH Alumni

ETH zürich

Cover image: Nicola Pitaro / Editorial: Markus Bertschi

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Images: Alessandro Della Bella (2); Markus Fischer / PSI

A snapshot in time

April 2020: the coronavirus pandemic has forced ETH to find creative ways to move forward. *Globe* takes a behind-the-scenes look at the ETH Zurich lockdown.

IMAGES Alessandro Della Bella and Nicola Pitaro

Empty laboratories, unusual silence. Access is only permitted in exceptional circumstances.

ETH has shifted as many teaching, research and administrative processes as possible online.

Face-to-face teaching has been suspended and ETH is now in emergency mode, with most members of the university working from home. Priority number one is containing the spread of the coronavirus; hence the decision in mid-March to shift as many teaching, research and administrative processes as possible online – a feat that was achieved virtually overnight. Ulrich Weidmann, Vice President for Infrastructure and interim Vice President for Personnel Development and Leadership, heads up the university's coronavirus crisis management team. In an interview he summed up the situation on 1 April 2020 as follows: "To a large degree ETH hit the turbocharge button on decentralising and digitising its operations, and the university has remained functional."

None of this would have been possible without the extraordinary commitment shown by everyone involved, from the coronavirus task force to all the students, teachers, researchers and staff affected by the current situation. The crisis has also been particularly challenging for administrative areas that normally play more of a background role, such as the Safety, Security, Health and Environment (SSHE) department, the Human Resources department, the IT Services team and other staff units. Despite the lockdown, some essential on-site services are still up and running. These include security and cleaning staff, delivery and postal services, and staff in charge of supervising critical research facilities. Researchers and students engaged in COVID-19-related projects can also keep working on site.

Six weeks into the lockdown, the time has come for ETH to gradually start easing its way back towards a new normality. This, too, is challenging. Far from simply reversing the steps taken to enter emergency mode, the university will be embarking on a much longer process that will last until the end of 2020 and require equally good planning and careful monitoring. This process is not covered in the current issue of *Globe*. But however far down this route ETH finds itself when this issue is published, we can be sure that the effects of the lockdown will continue to be felt for a long time to come. ○

The postal service is still up and running. Ordered goods are received by the logistics centre and then delivered to the recipient.

The Emergency Desk continues to act as a central point of coordination. Keeping a watchful eye on the buildings is essential – even if they are nearly empty.

Research into beating COVID-19 has top priority: these researchers are developing a low-cost, easy-to-use ventilator that is also suitable for use in developing countries.

40 %
drop in electricity consumption at ETH during lockdown.

1,060
lectures moved to online formats.

400 %
increase in data traffic and a big rise in VPN usage as people work from home.

Silence reigns in this Hönggerberg cafeteria. Most dining facilities on campus are closed.

Getting online teaching up to speed

ETH Zurich has suspended all on-campus classes from 16 March until the end of the semester. Fortunately, teaching is continuing online – so students won't miss out on their lectures. A snapshot of life under lockdown in early April.

TEXT Martina Märki

ETH has entered lockdown mode. Its once bustling buildings are now silent. Yet teaching continues – just in a different format. All lecturers at ETH Zurich have now switched to presenting their lectures online. In pre-coronavirus times, online learning was tried out occasionally or used for specific purposes, but now it has become the only way of doing things. This sudden switch is a remarkable feat not only by lecturers and students, but also by the staff that provide technical and didactic support. One such unit working behind the scenes is the Educational Development and Technology department (LET).

New challenges

"ETH has an excellent technical infrastructure, so we were able to accommodate the sudden demand without any delay," says Gerd Kortemeyer, who heads up LET. "We already had robust, tried-and-tested solutions in place such as recording in auditoriums, the Moodle learning portal and the ETH Polybox file sharing platform, to name just a few." But even though central preparations were already underway in early March to switch over to distance learning, the situation was far from easy. Normally, ETH places great emphasis on classroom teaching: the direct interaction between students and their teachers – who also work as researchers – is a defining characteristic of the university. "In this respect, ETH had less experience with online teaching than some other universities, particularly ones abroad," says Kortemeyer. "Perhaps less experience than people might expect from a technical university."

This means that only a few of the systems and processes were geared to an immediate and comprehensive switch to online teaching. "But when it came to the crunch, we showed our strength as a technical university by tackling the challenge in a creative yet

Online teaching during the coronavirus crisis: this live physics lecture includes demonstrations of experiments.

pragmatic way," says Thomas Piendl, part of the IT Services for Teaching team.

One of the most important decisions was choosing a suitable online teaching tool that could be rolled out in a rapid, straightforward and comprehensive way. ETH opted for Zoom, commercial software designed for video conferences, webinars and similar online activities. "Zoom enables us to simulate the experience of classroom teaching," explains Kortemeyer. "Though we obviously have to adapt and make compromises here and there." Soon after, Zoom faced widespread public criticism over security lapses – but after a thorough evaluation and examination of the current legal situation at ETH Zurich, the decision to use Zoom was upheld.

Positive feedback

The tool itself has been well received by lecturers and students alike. "Using Zoom at home is working surprisingly well for me. I can see that over 300 students are watching and can interact with them via the chat function. I'm actually getting more questions that I do in the lecture hall," says Andreas Steiger, lecturer in the Department of Mathematics. With everyone being asked to stay home as much as possible, students are grateful to have interesting online courses. "I've already received emails from students saying that it actually makes being under house arrest fun!" says Steiger.

The Department of Physics is also using Zoom, but hooked up to an external camera pointing at a whiteboard in the empty auditoriums where lecturers now hold lessons. "In our main physics lectures we rely on the whiteboard and the ability to demonstrate experiments in the auditorium," explains Guillaume Schiltz, who works as an educational developer in the Department of Physics. Schlitz is helping other lecturers in the department develop new teaching methods. "We mounted a kind of undercover operation on 14 and 15 March to equip the auditoriums so that teaching staff would be able to live stream their lectures via Zoom," he explains. While teaching, lecturers can switch between the whiteboard, PowerPoint slides and experiments at the push of a button. Students attend the virtual lecture via Zoom and can also ask questions, which the lecturer then answers in the auditorium using one of these three methods.

Solutions for lab courses

Another major challenge facing ETH is how students will be able to complete their practical courses without access to the lab. For physics students, work is already underway to create simulations that allow them to generate data and collect measurements by manipulating virtual instruments. Students are also asked to conduct experiments at home using their smartphones. "All smartphones have a variety of sensors that can be used to conduct physics experiments," says Schlitz. As of early April, however, the task of supplying students with simulations and smartphone experiments was still very much in its early stages.

The Department of Materials was also concerned about how students would be able to continue the experiments with materials and chemicals that they normally carry out in the lab. "Fortunately our lab director acted very early on in anticipation of what was to come," says Lorenzo De Pietro, educational developer at D-MATL, explaining that assistants were encouraged to record videos of experiments while it was still possible. These recordings are now being used as a basis for discussing experiments and theories during live Zoom meetings. Combined with other resources and pre-prepared data sets, this gives students the tools they need to complete their lab courses without interruption. Unfortunately, some materials experiments – for instance, forging metals and carrying out tasks in workshops – cannot be replaced so easily. "We'll have to offer these at another time," says De Pietro.

A test of endurance

The results may not be perfect, but the initial obstacles have been overcome with a healthy dose of energy and enthusiasm. Some challenges will only become apparent with time, however. "I think reality will only start to set in over the next few weeks. That's when the psychological strain will start to surface," says Kortemeyer. One concern is that students sitting alone at home in front of their laptops may simply give up in the absence of a supportive campus environment, not finishing the semester or even dropping out of university altogether. In order to combat this, Kortemeyer is determined to ramp up efforts to improve online assessment tools.

"Generally speaking, our lecturers are doing a fantastic job. It's amazing how quickly they've adapted to the new situation."

Thomas Piendl, IT Services for Teaching

"Generally speaking, our lecturers are doing a fantastic job. It's amazing how quickly they've adapted to the new situation, even though this might be the first time that some of them have ever held online lectures," says Thomas Piendl. However, he encourages staff not to forget their students' perception of online learning amid this flurry of activity. Can everyone really take part in the live sessions? What about students in different time zones? Do they have enough bandwidth to join an online video meeting? And do they have the option to download recorded lectures? These are the kinds of issues that lecturers have to consider.

"Right now, we need to be having in-depth conversations," says Andreas Reinhardt, learning innovation specialist at LET. He points out the necessity of being more vigorous in ascertaining what students need. It's perfectly possible that teaching methods that worked well in the past no longer fit the new reality. Students might struggle to cope with a two-hour livestreamed lecture, for example, meaning that more thought has to be given to planning breaks. They might also want an opportunity to do more assignments so they can achieve their learning goals. Reinhardt also emphasises the importance of students receiving regular feedback on their learning progress.

Fortunately, some groundwork had already been laid for ETH's switch to virtual instruction. ETH has had an online learning infrastructure in place for some time now, for instance for receiving feedback on assignments, discussing possible exam questions, doing quizzes, participating in online question-and-answer sessions and holding discussions on forums. "Many lecturers had already started investing in interactive digital learning environments in a number of different ways," says Reinhardt. Even before the coronavirus crisis, some classes at ETH took a blended learning approach by offering online videos, interactive scripts and simulations. These digital learning tools can now be integrated into the new online teaching environment. Equally important is the invaluable support provided by LET. ETH Rector Sarah Springman asked LET to launch a special student survey on distance learning to keep track of how things are going. This gives lecturers prompt and comprehensive feedback on what is working well and what could benefit from further tweaks as the semester unfolds.

Thinking about the future

Kortemeyer is already looking ahead to the future. He says that ETH still needs to expand its infrastructure to manage online course content. Options for archiving content, holding discussions and mixing and remixing recordings could lighten the load for many. "We don't want people having to constantly reinvent the wheel," he explains. What's important, he insists, is ensuring that the incredible amount of new teaching content generated during the lockdown remains accessible in the future. No matter what happens, Kortemeyer believes that ETH will be a different institution once the crisis ends. One possibility he envisages is a steady, organic shift towards blended learning where some elements of teaching are conducted online, which would enable classroom teaching to be used in different – and perhaps more efficient – ways. Some lecturers have already commented that the logistics of certain types of interactive group work are actually easier to manage online than in the lecture hall. ○

“The crisis has shown we can count on each other”

Detlef Günther, Vice President for Research at ETH, normally focuses on his job of promoting research. Never did he imagine that he would one day have to grant special dispensation for researchers to even enter their laboratories. A conversation about life under lockdown.

TEXT Martina Märki

Mr Günther, when did you first suspect that ETH would have to shut everything down?
My responsibilities include the Singapore-ETH Centre SEC in Singapore as well as the reorganisation of the Swiss National Supercomputing Centre CSCS in the Canton of Ticino. Both those areas were hit by the coronavirus sooner and more severely than we were. I also have a Thousand Talent Fellowship from Wuhan University after working there as a visiting professor, so I was watching what was happening in Asia very carefully right from the start. The Executive Board was also on top of things, and we were closely monitoring and discussing global developments from an early stage.

So how did you prepare for the crisis?
We were obviously devastated by the idea of having to stop people physically coming to the university and shutting everything down. I don’t think any of us on the Executive Board ever imagined we would have to do something like this one day, but it helped that we were very much in agreement on which path to take. We got straight down to drawing up key measures for each individual area, with tremendous support from all the various offices and departments at the university.

What measures did you put in place for researchers?
We were determined to enforce the lockdown as fairly and transparently as possible, so we worked very closely with the department heads. They have an excellent grasp of ongoing research activities, so their preliminary evaluation made it much easier for us to take quick decisions on which critical infrastructure and experiments needed to be maintained and supported. We also specified that experimental research on COVID-19 could continue in the labs.

What reaction did you get from researchers?
They backed the decisions made by the Executive Board. Obviously there were some concerns raised in isolated cases, but overall we received very encouraging feedback. I’m very grateful for the understanding shown by everyone affected by this crisis – so a big thank you there.

What were the key decision-making criteria?
Some research infrastructure has to be maintained no matter what. There were also a number of experiments that had to continue or could only be shut down gradually, for example to preserve long-term data sequences or valuable materials and reagents. But we didn’t start any new ones. We simply gave people sensible timeframes based on each individual situation to react. So with the help of the departments, we were mostly able to keep things in proportion.

Vice President Detlef Günther is proud of the creativity and flexibility displayed by ETH researchers.

Were there any areas where shutting down research was particularly difficult?
One tricky decision was the cryo-electron microscope used for structural analysis in biology. Sample preparation is an important step in that process – and a very time-consuming one. The samples can’t be kept very long: they have to be measured as soon as possible. We didn’t want to interrupt that process, especially since popping the sample into the microscope only takes one person and everything else can be done remotely. We also erred on the side of caution with animal experiments in order to protect our animal stocks. The ETH Phenomics Center (EPIC) did a fantastic job sorting that out – an impressive joint effort by management, staff, supervisors and researchers.

Doctoral students who need experiments for their thesis have been impacted hard by the lockdown.
The ETH Executive Board is doing everything it can to ensure that nobody slips through the cracks due to the current crisis. We’ve made sure to notify everyone about the most important steps we’re taking. Finding a viable solution for individual cases ultimately comes down to a conversation between the doctoral student and their supervisor. That’s an integral part of good doctoral supervision.

What does the lockdown mean for Switzerland’s research community?
Every sector in Switzerland and the rest of the world will suffer some sort of collateral damage from the coronavirus crisis. Research is just one sector among many, so researchers like me really shouldn’t complain! Recruiting new researchers in the near future is bound to be a challenge unless we see a major loosening of travel restrictions. And we will also have problems with spin-offs and other aspects of the innovation sector.

What can ETH do to help tackle this crisis?
From a very early stage – almost as soon as we started planning the lockdown – we were asking researchers to submit ideas for research projects related to COVID-19. What we wanted were projects that could be executed and implemented promptly, so the conditions were slightly different to those of our normal funding tools. The bottom-up creativity of people’s responses was just extraordinary, and it’s a reminder of just how flexible and committed researchers are at this university.

Other universities have similar initiatives.
Absolutely, and it’s spreading across all sectors. Collaboration and networking are now more important than ever. We managed to get some structures in place to achieve that very quickly in the ETH Domain. That evolved into a national task force that provides scientific advice to the Federal Office of Public Health, with lots of ETH researchers lending a helping hand.

What do you think the future holds?
A lot depends on whether we see a second wave of coronavirus. If society as a whole wants to find the best way out of this crisis, then we will all need to work together. That’s why we need to apply caution and prudence when it comes to easing the lockdown. The mutual support shown by everyone at ETH during this crisis has clearly shown me that we can count on each other. ○

Podcast with Detlef Günther:
→ www.ethz.ch/podcast

Image: Gian Marco Castelberg

Research under lockdown

ETH researchers are normally found in the lab. We asked researchers from the Department of Physics what it's like working from home.

TEXT Samuel Schlaefli

It's mid-April, and Günther Dissertori – a professor at the Institute for Particle Physics and Astrophysics – is in the middle of a Zoom video conference. His video background is a picture of the place where he usually works: the LHC particle accelerator at CERN. But his current office and laboratory are located in the guest room of his house – and it's been that way for over a month.

"Being at home hasn't really made a perceptible difference to how much work I'm doing!" says Dissertori. As Director of Studies, he took charge of organising the shift to online teaching in the Department of Physics. "I've never seen people pull together as a team so efficiently," he remarks. It took only about 14 very long working days to achieve the new normal. "It was exhausting, but everybody simply accepted what needed to be done. It's incredible what we achieved in such a short period of time," says Dissertori.

Key piece of lab equipment missing

Daniela Rupp, Professor of Nanostructures and Ultrafast X-Ray Science, joined ETH last September. She was right in the middle of setting up her research group when the lockdown drove everyone out of the department. "Last Friday was when we would have moved into our lab," she says. Right now, the new instruments they ordered are arriving at ETH on a daily basis, so two members of her group regularly drop into the lab to receive deliveries and ensure invoices are paid. But with borders closed and goods transport heavily restricted, the delivery of a powerful laser from California – the centrepiece of Rupp's research – has been postponed until June. Alongside lab experiments, the majority of Rupp's research is conducted using giant, internationally coordinated X-ray lasers. "This summer we were due to take part in three slots of measurement time in Germany, Italy and the US," says Rupp. "All of them have been postponed as a result of the crisis." Fortunately, Rupp and her team are still busy analysing, interpreting and publishing the data from previous experiments.

Dissertori also saw his hands-on research come to a virtual standstill. His group plays a major role in analysing data collected by the CMS particle detector at CERN in Geneva. Scientists there shut down all their measurement instruments in just two weeks. The 27-kilometre-long particle accelerator was already out of operation for maintenance, says Dissertori. "The physicists, engineers and technicians who modify and upgrade the scientific instruments on site have been hit particularly hard by this lockdown," he says. "Most researchers specialising in data analysis can continue their work from home relatively easily." The professor is, however, concerned about the travel restrictions and hiring freeze at ETH. He had already received funding from the SNSF for a new research project that was due to start in June. He and his team had interviewed doctoral students and postdocs and notified the first round of successful candidates – but it is now far from clear how the hiring process will move forward.

Nadja Hartmann works in Professor Ursula Keller's group in the field of ultrafast spectroscopy. She was at the point of finishing her doctoral thesis when the lockdown began. "I'm still missing one important lab experiment," she says. Hopefully she will at least be able to carry out a few more series of measurements before handing in her thesis in October, she says, but right now she is focusing on the theoretical portion, trying to finish as much as possible while she is stuck at home. She worries that she will have to defend her thesis under new conditions dictated by the pandemic – with no family or friends in the audience and no chance of getting together with everyone to celebrate her graduation properly. "That would be a real pity," she says.

Efficient meetings with less travel

Despite all the restrictions, all three researchers acknowledge that there are some positive aspects to the lockdown. "I tend to work more at home, but I have more flexibility in organising my time," says Hartmann. After some productive hours of work first thing in the morning, she generally goes for a run at around eleven. Depending on her energy levels, she might then finish a bit earlier in the afternoon before returning to her thesis in the evening.

Rupp recalls how the team meetings she organised for her new group on Monday mornings often stretched on for ages. The online equivalent is far more efficient, she says. The lockdown inspired her to set a rule that all team members have to send their reports and discussion points to the meeting chair by Sunday midday. "Everyone is well prepared," she says. "We zip through the agenda item by item and have a proper set of minutes at the end of the session." She is determined to maintain this structure even when things return to normal.

Dissertori says that the COVID-19 crisis has made him much more aware that many flights taken for research work can be replaced by video-conferences. For the first time in its 66-year history, the CERN Council convened by video conference this April. Normally the participants travel to Geneva from all over the world. What's more, the fact that people no longer need to shuttle between meetings actually frees up more time. "My daughter has really benefited from that," says Dissertori with a smile. His wife is already insisting that he should work from home one day a week even after the lockdown ends. Indeed, it's perfectly possible that we will see more research work being conducted remotely in the future. ○

Combating the pandemic with creativity

While many research projects have been put on hold, research related to the coronavirus continues to gather pace. Numerous projects and initiatives have been launched to help bring the pandemic under control.

TEXT Markus Gross

Empty lecture halls, empty laboratories – the number of researchers physically present at ETH during the lockdown has been reduced to a bare minimum. Only essential staff are permitted to enter the university's buildings, while everyone else is working from home. Yet there are still a few research labs where the lights are on and the equipment is running. Key research infrastructure – such as the Swiss National Supercomputing Centre in Lugano and the Swiss Seismological Service – must remain open. Laboratory animals must also be cared for. And then, of course, there is COVID-19-related research, which has been rapidly ramped up and expanded.

Some experts such as mathematicians and statisticians are able to support government and cantonal authorities by working from home, while other researchers are dependent on their laboratory infrastructure. Since access to laboratories during the lockdown is only permitted for initiatives aimed at combating the current crisis, researchers were asked to submit ideas for potential coronavirus projects. The conditions were that the projects must offer immediate benefits for the coronavirus pandemic and be able to be implemented promptly.

Three dozen entries in just five days

Uwe Sauer, a professor at the Department of Biology and head of the ETH Research Commission, received the entries and reviewed them with support from a small team of experts. "As a member of the ETH Research Commission, I'm very much on top of research at our university," he says. Nevertheless, the number of creative proposals put together by his colleagues in just five days took him by surprise. A total of 36 projects from a wide range of disciplines were submitted, with around one-third from engineering and two-thirds from life sciences. Just one week later, 22 projects had been given the green light. In the end, the number was over 30.

The approved proposals include a project by Tanja Stadler, a professor at the Department of Biosystems Science and Engineering, to analyse the origin and distribution pathways of coronaviruses based on their genetic make-up. One of her goals is to help scientists evaluate the efficacy of prevention measures, allowing the authorities to determine whether new cases of coronavirus infection are domestic or imported. Using this method, her team was able to demonstrate that the measures taken by the government against the virus have been successful. Since these measures were put in place, each person has gone on to infect just one person on average instead of the figure of two or three prior to the lockdown. "The situation has been stable since the measures were taken. We have definitely slowed the spread considerably," says the ETH professor at the beginning of April. "People are still contracting the virus on a daily basis, but the increase is now linear instead of exponential." The analysis does not, however, show the impact of each specific control measure on stabilising the situation. (More about Tanja Stadler in *Uplift*.)

Fast and effective assistance

Meanwhile, Professor Emma Slack-Wetter from the Department of Health Sciences and Technology and Professor Markus Aebi from the Institute of Microbiology are working on optimising a COVID-19 vaccine that is intended to protect against a wide range of coronaviruses, meaning that it should also be effective against future variants. Other teams are working on practical, readily available resources to assist with care and prevention.

These include cost-effective ventilators for patients requiring respiratory support, antiviral materials for treating flat surfaces such as door handles, and membranes that can be used to enrich the oxygen content in the air to more than 50 percent. "These are efficient solutions that could also offer relief in less affluent countries," says Sauer.

Providing patients with enough oxygen is one of the key challenges facing medical staff, especially in poorer countries. The SARS-CoV-2 coronavirus attacks the lungs, so people infected with COVID-19 need air enriched with oxygen. By coming up with new ideas and prototypes for cost-effective oxygen concentrators, researchers at ETH Zurich hope to avoid a worldwide oxygen shortage caused by the pandemic. The team publishes its design plans and videos on its project website, enabling the concentrators to be replicated almost anywhere in the world using materials that are readily available.

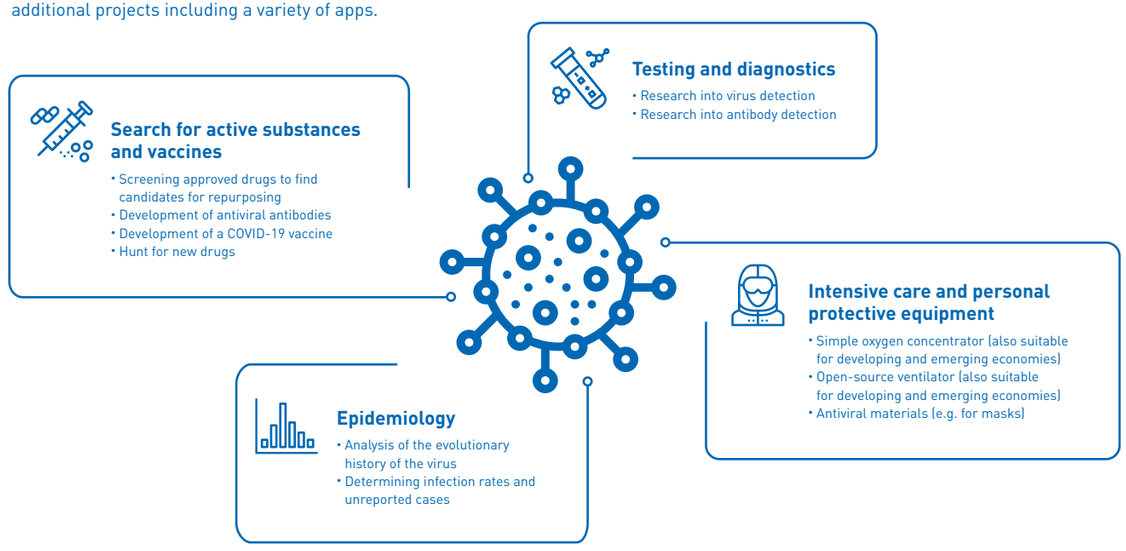
A number of ETH Zurich spin-offs are also working intensely on their own contributions to containing the pandemic. Spectroplast, which specialises in the 3D printing of silicone products, is one example. The company was born out of the ETH Pioneer Fellowship programme, and their expertise is now very much in demand. "We have been inundated with requests," says Spectroplast CEO and ETH alumnus Manuel Schaffner. Recent orders include a contract at the end of March to produce seals for breathing masks.

Everything else on hold

Detlef Günther firmly believes that everyone should be supporting government and civil service decision-makers in the coronavirus crisis. As Vice President for Research and Corporate Relations at ETH, he is responsible for research during the lockdown. "For ETH, that means working together to find solutions to the problems we are currently facing and engaging in constructive collaboration," says Günther. ○

Coronavirus research at ETH:

ETH Zurich has approved over 30 laboratory projects to accelerate research into the SARS-CoV-2 coronavirus (see diagram). Scientists are working from home on additional projects including a variety of apps.



ETH in action

Times of crisis require rapid and unconventional responses. Here we take a look at six examples of how ETH and its partners are supporting the battle against coronavirus.

03

05

02

01

COVID-19 Science Task Force

The Swiss National COVID-19 Science Task Force provides scientific advice to the Federal Council Coronavirus Crisis Unit and other authorities in the fight against coronavirus. The ETH Domain initially convened an ad-hoc task force in March. This was subsequently integrated in the Science Task Force, which also incorporates the expertise and initiatives of the Swiss National Science Foundation (SNSF), swissuniversities and the Swiss Academies of Arts and Sciences.

→ ncs-tf.ch/en

02

Students step up to help

ETH students have come up with various initiatives to help in the current crisis. Pharmadelivery, a platform developed by the Swiss Pharmaceutical Students Association (asep) in collaboration with pharmacist associations, enables pharmacies to connect quickly with students who are eager to help. Another new web platform is Students4Hospitals, which was launched by ETH students on the Bachelor's degree programme in Human Medicine. Students of all disciplines from across Switzerland can register on the platform to be placed on relief missions in healthcare institutions.

→ pharmadelivery.ch
→ students4hospitals.ch

03

Access to essential lab infrastructure

The ETH Domain's Academic Resources for COVID-19 (ARC) platform is a rapid and effective tool for matching resources to needs. Switzerland's hospitals and diagnostic laboratories require critical support – and researchers can offer resources including equipment, active agents, reagents, knowledge and staff. One example is the Department of Environmental Systems Science at ETH Zurich, which has made its lab equipment available to the Canton of Thurgau for coronavirus testing.

04

The Swiss contact tracing app

Contact tracing apps are one strategy for helping to contain the coronavirus pandemic. Switzerland is pursuing this option through the SwissCovid App developed by EPFL and ETH Zurich. The project forms part of an international collective that involves researchers from both institutions. The app works by tracing infection chains, using Bluetooth to determine proximity to other mobile phones on which the app is also installed. Users who subsequently test positive for coronavirus can report this in the app, which then sends notifications to everyone who has been in close contact with that user. The app does not store any personal data on centralised servers. Anyone who has come into contact with an in- fected person can choose to self-isolate or get tested, for example.

05

Engineering for healthcare

HelpfulETH is a joint research initiative between ETH Zurich and EPFL. Engineers are asked to develop rapid solutions to tackle the day-to-day problems facing hospitals and other healthcare institutions, ranging from medical equipment to technical resources such as face shields and a sterile device for protecting hospital staff's smartphones from the virus. The main production centre at ETH Zurich is the Makerspace, a workshop in the Student Project House that is operated by students and equipped with 3D printers and laser cutter machines.

→ helpful.ethz.ch

06

Spin-offs offer their expertise

ETH spin-offs are also lending a hand in the battle against coronavirus. One example is HeiQ, an ETH startup specialising in innovations in the textile sector. It has developed an antiviral and antibacterial treatment method suitable for all types of textile fibres. The treated fibres can deactivate various viruses, including coronaviruses. This method is now being used to manufacture virus-repellent textile protective masks. Other possible applications are protective clothing for medical staff, ventilation filters and curtains.

→ heiq.com

CORONA IMPULSE FUND

ETH management will ensure that money from this fund is released quickly and without red tape and is focused where it is needed most and will have the greatest impact. The aim is to support research projects and the development of materials and engineering solutions in the fight against the pandemic.

→ www.ethz-foundation.ch/en

On site

To protect everyone's health and safety, most ETH staff are working from home – but not all jobs can be done remotely.

TEXT Martina Märki

Research into COVID-19

Shana Sturla, Professor of Toxicology, is working with her team to find inhibitors that could pave the way to effective drugs by blocking the life cycle of the coronavirus.

Services

Bilgin Dontas handles enquiries and orders at the Campus Info desk. His job includes distributing incoming post to the Campus Info mailboxes.

Security

Angela Käppeli works for the ETH Zurich security team. She patrols the Hönggerberg campus, checking that all the buildings' security systems are working properly.

Library

The ETH Library is working hard to make sure everyone still has access to the information they need. Staff send books and journals to people's homes by post and scanned copies of individual articles and chapters by email.

Facility management

Caretakers and building service engineers ensure ETH buildings remain in good condition while the university is in lockdown. Paulo Marques looks after the ETH Main Building.

Communication

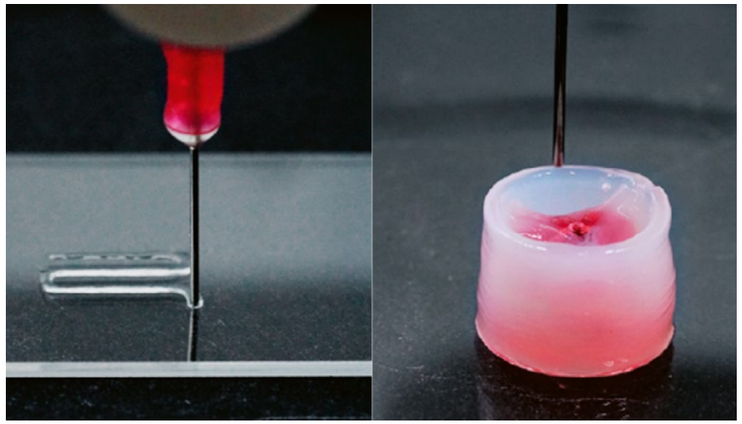
Communication technologies are a lifesaver in lockdown. Armin Brunner, Head of ITS Multimedia Services, provides assistance during an online information session for all ETH members.

NEW AND NOTED

Materials science

PERSONALISED IMPLANTS

Progress in precision biomaterials is hindered by the fact that researchers have to find a new carrier ink for almost every new 3D printing application. ETH researchers working in Mark Tibbitt's group have now produced a universal carrier ink that liquifies when pushed through the 3D printer nozzle but then quickly solidifies into shape. This dramatically simplifies the development of new applications, paving the way for personalised biomaterial implants.



The new carrier ink can be used to produce personalised implants such as heart valves.

Zukunftsblog

Sustainability

GREATER COMMITMENT TO THE SDGs

A better world for everyone: that's the idea behind the 17 Sustainable Development Goals (SDGs) set by the United Nations. Universities bear a particular responsibility for achieving these goals, argues Christine Bratrich.

→ www.ethz.ch/zukunftsblog-bratrich-en

Christine Bratrich, Director of ETH Sustainability

Digitalisation

A BIT MORE DEMOCRACY?

What should society do about the tech giants' growing monopolies? Let's make them more democratic by giving users a say in decisions, suggests Hans Gersbach.

→ www.ethz.ch/zukunftsblog-gersbach-en

Hans Gersbach, Professor of Macroeconomics, Innovation and Policy at ETH Zurich

Health

WITH THE POWER OF SOCIAL NETWORKS

When we make decisions, we're often influenced by our social environment. This can be used to encourage people to adopt cleaner and healthier lifestyles, says Suchita Srinivasan.

→ www.ethz.ch/zukunftsblog-srinivasan-en

Suchita Srinivasan, postdoc at the Chair of Energy and Public Economics at ETH Zurich

Read the full version of these and other blog posts at:
→ www.ethz.ch/zukunftsblog-en

Images: Elia Guzzi; Giulia Marthaler (2); courtesy of S.Srinivasan

Process engineering

CARBON-NEUTRAL INDUSTRY

Reducing net CO_2 emissions to zero is particularly challenging for the chemical industry. Most of the carbon required to make plastics and medicines currently comes from oil and natural gas. CO_2 is released not only during the production process, but also when these products are burned at the end of their life. Using methanol production as a case study, researchers from ETH Zurich and Utrecht University compared various approaches for achieving net-zero CO_2 emissions in the chemical industry. The primary conclusion of their study is that this goal is, in fact, attainable. However, all the approaches they examined have both advantages and disadvantages.

One approach involves sequestering CO_2 emissions underground. The advantage of this option is that today's production processes would not need to be changed. However, geologically suitable storage sites are only found in some parts of the world. Another approach would see industry using carbon captured from air or waste gases. This would require the rebuilding of large parts of the industrial infrastructure as well as extremely large amounts of electricity. The third option would be to use biomass as a raw material. Although this method consumes less electricity than the others, it requires huge tracts of land to grow the crops.

The researchers' work also informs the discussion about possible future aviation fuels. The study shows that aircraft could continue to use fossil fuels – but only if the CO_2 they emitted was captured from the air and sequestered, or if the fuels could be obtained from biomass.

Research group:
→ www.spl.ethz.ch

CO_2 emissions from the chemical industry contribute significantly to climate change.

Image: Shutterstock

Automation

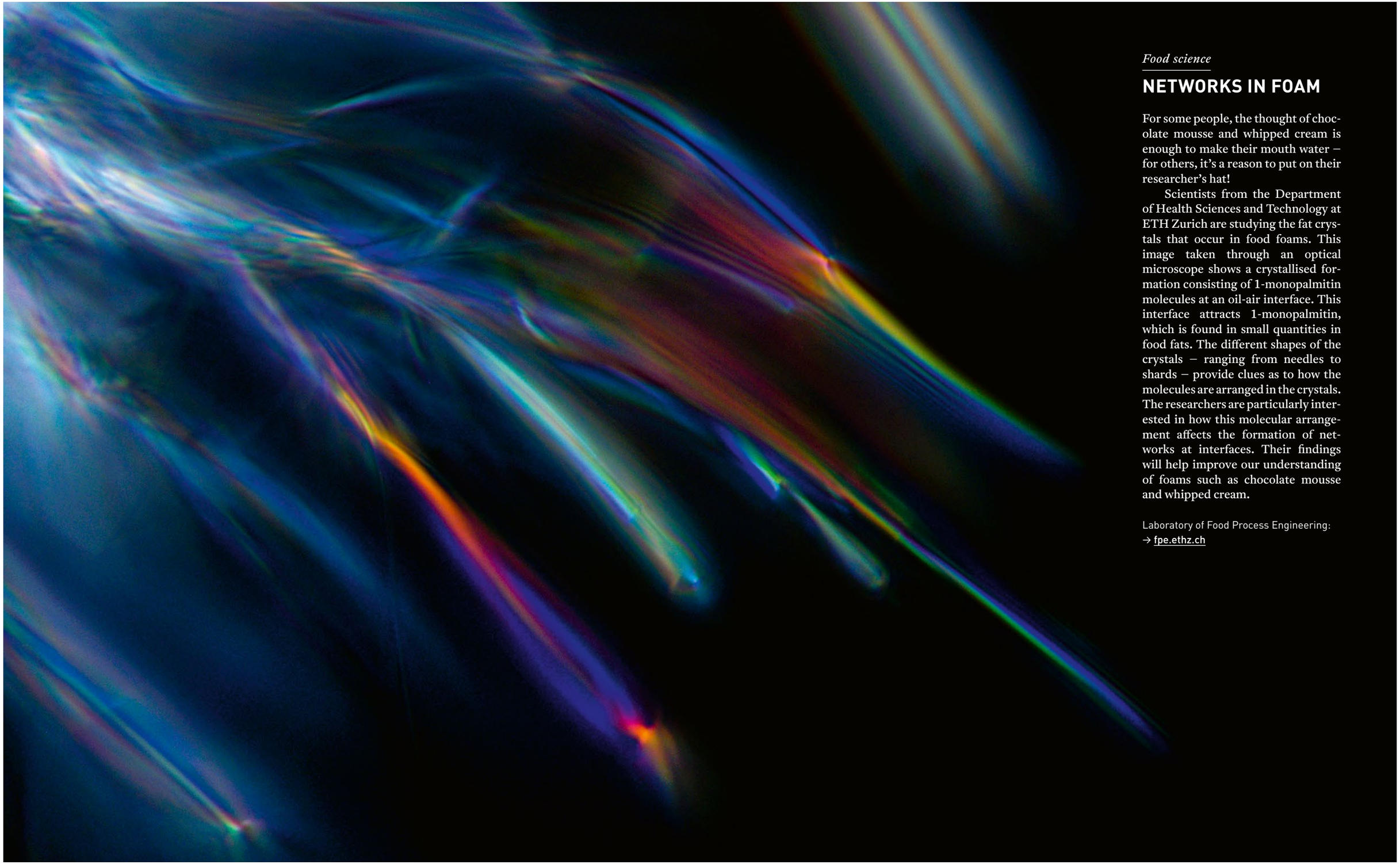
LOOKING SMART

Stripes, dots or a classic check: much of the elegance of shirts and other garments lies in the pattern or print. Yet in many cases these patterns do not match at the seams, because seamless transitions would require a huge amount of manual work in the production process. This is one example of how automation has the potential to improve certain processes in the clothing industry.

Katja Wolff, a doctoral student at ETH Zurich's Interactive Geometry Lab, embarked on a project to automatically align textile prints along seams. To do this, she developed an algorithm that calculates how sewing patterns need to be positioned on a fabric to ensure that the pattern transitions smoothly at the seams when the fabric is sewn together. To manufacture garments in this way, a 3D simulation of the item of clothing is loaded into the programme and then combined with the desired fabric print. The algorithm automatically adjusts the sewing pattern to ensure the garment exhibits global symmetry. The rest of the tailoring process can then be carried out in the traditional way.

Learn more about this topic and read other research news from ETH Zurich at:
→ www.ethz.ch/news-en

NEW AND NOTED



Food science

NETWORKS IN FOAM

For some people, the thought of chocolate mousse and whipped cream is enough to make their mouth water – for others, it's a reason to put on their researcher's hat!

Scientists from the Department of Health Sciences and Technology at ETH Zurich are studying the fat crystals that occur in food foams. This image taken through an optical microscope shows a crystallised formation consisting of 1-monopalmitin molecules at an oil-air interface. This interface attracts 1-monopalmitin, which is found in small quantities in food fats. The different shapes of the crystals – ranging from needles to shards – provide clues as to how the molecules are arranged in the crystals. The researchers are particularly interested in how this molecular arrangement affects the formation of networks at interfaces. Their findings will help improve our understanding of foams such as chocolate mousse and whipped cream.

Laboratory of Food Process Engineering:
→ fpe.ethz.ch

Image: Kim Mishra

ETH GLOBE 2/2020

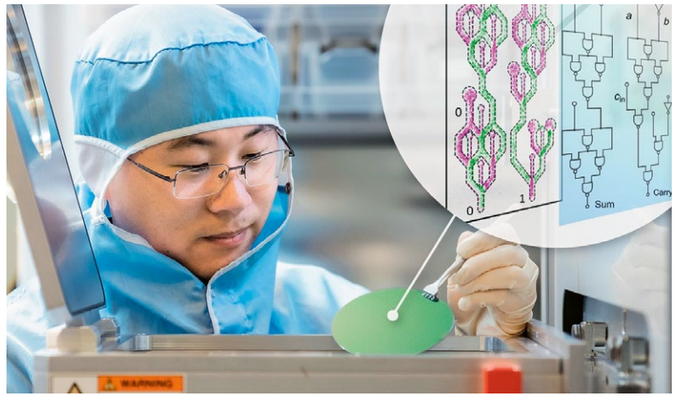
Materials science

Combining magnetic data storage and logic

Computers normally store and process data in separate modules. But now researchers at ETH Zurich and the Paul Scherrer Institute have developed a method that allows logical operations to be performed directly within a memory element.

Anyone who has ever accidentally pulled out the plug of a desktop computer will recall the painful moment when they realised that any unsaved information was lost forever. That's because computers make a clear distinction between the tasks of computation and data storage. Whatever data the computer is currently using is stored in the main memory, which – like the computer's CPU – relies on current-controlled transistors. This means the main memory is "volatile": as soon as the power disappears, so does the data. Software, images, videos and any other data that require long-term storage are stored in non-volatile memory such as flash memory or a magnetic disk drive, from where they can be loaded into the main memory as and when needed.

Under the leadership of Pietro Gambardella and Laura Heyderman, a team of scientists from ETH Zurich and the Paul Scherrer Institute (PSI) is now hoping to revolutionise this decades-old principle. Their goal is to build a fast, non-volatile memory system that can also perform logical operations on the data such as NOT, OR and AND. They recently reached an important milestone on that journey, which was described in an article in the prestigious scientific journal *Nature*.



Postdoc Zhaochu Luo with a chip that features both racetrack memory and logic.

Fast racetrack memory

Researchers have been working on the development of magnetic racetrack memory for a number of years. This new type of memory is much faster than traditional hard disk drives in which a read/write head must be moved to a specific region of the disk surface by mechanical means. In contrast, racetrack memory elements work by using current pulses to move tiny magnetic regions, or domains, up and down nanowires that are just a few hundred nanometres thick. In these domains, all the magnetic moments – like tiny compass needles associated with the material's atoms – are oriented in the same direction and can thus be used to represent the binary states 0 and 1. By eliminating the need for the mechanical movement of a read/write head, racetrack memory offers much faster access times than traditional hard disk drives. Nevertheless, even data stored in this way would normally have to be loaded into main memory to be processed.

"What we've managed to do now is to perform logical operations directly within this kind of memory element," says Zhaochu Luo, the postdoc researcher who drove the project forward. Computers use logical operations to process data. For example, the logical operator NOT inverts a bit, switching its value from 0 to 1 or vice versa. Normally this operation is performed in the main memory, with the data being read from and rewritten to the magnetic hard disk but not directly processed there.

A curious interaction

"Our method works differently," says Pietro Gambardella. "We use an electric current to reverse the polarity of the magnetic regions, thereby performing a NOT operation on the stored data. We do this by harnessing a rather peculiar exchange interaction that occurs when we deposit a magnetic cobalt film on a platinum layer." As a result of this interaction, the magnetic moments are neither parallel nor antiparallel to each other, as would normally be the case. Instead, due to the presence of the platinum layer, the interaction causes the magnetic moments in adjacent domains to align perpendicular to each other. "It's almost as if a compass needle were to suddenly point east instead of north," says Gambardella.

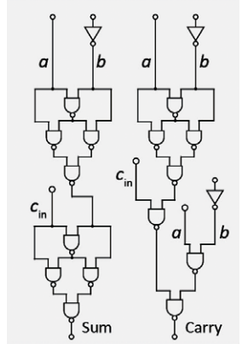
This perpendicular alignment of the magnetic moments also leads to a preferred sense of rotation of the magnetisation between one domain and the next, similar to how a corkscrew rotates in a specific direction. So if a current pulse is now passed through the platinum layer, the flowing electrons gradually change the polarity of the atomic "compass needles" in the magnetic cobalt layer. This moves the information encoded in the magnetisation and creates a travelling magnetic domain. Then, at predefined locations where the perpendicular interaction is strong, the direction of the magnetisation in the travelling domain is inverted. This corresponds precisely to a logical NOT operation.

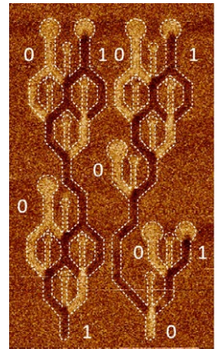
It is possible to combine such operations in different racetrack memory elements, thus providing other logical operations such as AND, OR and NAND. These can be assembled into more complex circuits, for example to add two numbers together (see image). But, unlike conventional circuits based on semiconductors in which each transistor requires its own power supply, the new racetrack memory circuits only need to be supplied with current at the input and output.

Uses in the Internet of Things

"Initially I see our technology primarily being used in microprocessors with low computing power," explains Gambardella. One example that is particularly relevant in today's world is the Internet of Things, in which a variety of devices and sensors communicate with each other directly. The computers in these kinds of devices need to offer "instant-on" capabilities – meaning immediate operation without the delay of uploading an operating system – and low energy consumption. A technology combining magnetic memory and logical operations would be ideal for this application.

In principle, says Gambardella, there is nothing standing in the way of operating larger computers in the same way. But in practice, he confesses, this is unlikely to happen any time soon: "Optimising the materials and manufacturing processes for this purpose is a very expensive business for chipmakers, so it's too early to say whether our technology can replace conventional semiconductor technology." Even so, he argues, this new approach is certainly interesting enough to warrant further investigation to discover how far it can be taken. The researchers have already applied for a patent, so perhaps we will eventually end up with a computer that allows us to pull the plug without worrying about losing data. — Oliver Morsch





A logical circuit to add together two numbers (left) can be built using magnetic racetrack memory elements (right).

Images: Markus Fischer, PSI

COMMUNITY

Philanthropy

GENERATING KNOWLEDGE

By Donald Tillman

"Things could be worse – at least we have our health!" How often we have reassured ourselves with this saying, little realising that the past few months would cause us to worry so much about our loved ones' health – and in some cases our own. As we browse the daily figures and study the graphs, we are painfully aware that there are limits to what current knowledge can achieve. We recognise the importance of pushing the boundaries of knowledge and fervently hope scientists can speed up the process. It is these boundaries that the ETH Foundation strives to expand in its mission to accelerate high-quality research. The events that have unfolded this spring provide a striking example of how we need new discoveries sooner rather than later. With the help of donors and partners, researchers at ETH Zurich can increase the pace at which breakthroughs are made. Our supplement *Uplift* offers some insights into how ETH research could benefit your health. With any luck, you might find a project that you would like to accelerate by offering your support!

→ www.ethz-foundation.ch/en

ETH Foundation

NEW MEMBER OF BOARD OF TRUSTEES

Tina Wüstemann has joined the ETH Foundation's Board of Trustees. As a leading lawyer and partner at Swiss law firm Bär & Karrer, where she heads the private client team, she has extensive experience in advising private clients and companies on complex estate and succession planning matters. She also advises charitable foundations. Wüstemann's wealth of expertise and international network make her an excellent addition to the Board of Trustees.

European Research Council

ERC ADVANCED GRANTS

The European Research Council (ERC) has awarded its ERC Advanced Grants. Two of these went to scientists from ETH Zurich: microbiologist Julia Vorholt and pharmacologist Jean-Christophe Leroux will each receive some CHF 2.58 million of funding for their projects. Leroux is working on the suppression of cellular defence systems for gene therapy. Vorholt is aiming to find ways of introducing new metabolic characteristics into cells on a modular basis.

Reforming the biology curriculum

EVOLUTION AS A NARRATIVE

Students at ETH have traditionally begun their biology studies by learning about plants and animals, very much in line with standard biology curricula. Starting this autumn, lecturers in the Department of Biology at ETH Zurich will be taking a new approach by using evolution as the guiding narrative for the Bachelor's degree programme. Students will begin by examining the chemical virtuosity of relatively simple unicellular organisms such as bacteria and archaea. Only then will they move on to the extremely complex regulatory processes that were necessary for the emergence of highly developed organisms such as plants, animals and humans. "By aligning our course content to the history of how organisms developed, we can focus more on highlighting general principles and interdependencies and less on teaching disconnected facts," says Julia Vorholt, Professor of Microbiology, who initiated the reform of the curriculum.

Microbes were one of the earliest life forms.

The resulting concept is unparalleled anywhere in the world: a Bachelor's degree programme that confronts students with big, unresolved questions right from the outset, inspiring their curiosity and stimulating critical thinking.

Image: Eline Keller-Soerensen; artist's impression: iStock

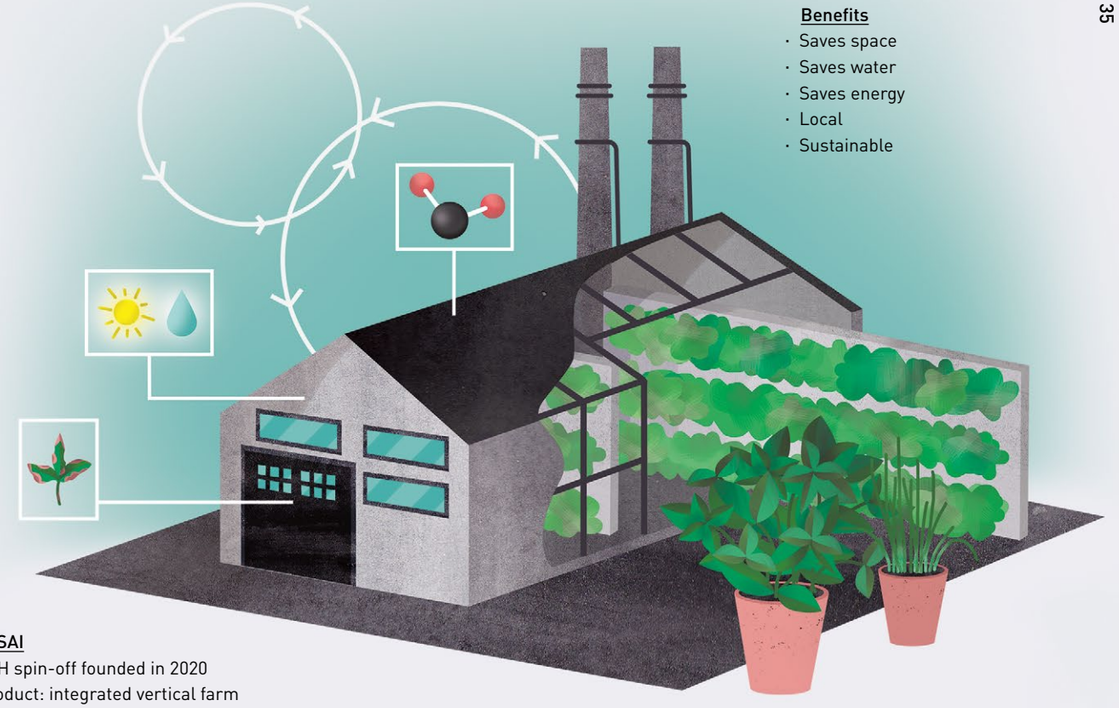
Transfer

Aiming high

Magnificent golden fields of rapeseed swaying in the wind certainly make for an idyllic landscape – but this traditional type of farming requires a lot of land. Yasai, a fledgling ETH spin-off, decided to look for an alternative. Now the company's founders are aiming high with what they call "integrated vertical farming". Their vision is to produce high-quality local food in old industrial buildings by creating vertical farms that require minimal water.

As well as growing crops vertically, the other key to their innovative concept is a circular economy. By recycling and reusing water, CO_2 and bioenergy, Yasai can use waste from cities to promote plant growth in its vertical farms. The company also uses its own organic waste – such as inedible plant roots – to generate energy.

Yasai is currently planning its first large-scale vertical farm in Gossau, Switzerland. It already offers private individuals the opportunity to purchase vertical farms that can be customised to grow herbs, salad or strawberries.



YASAI
ETH spin-off founded in 2020
Product: integrated vertical farm
→ www.yasai.ch

Illustration: Carolin Eitel

CONNECTED

Get involved

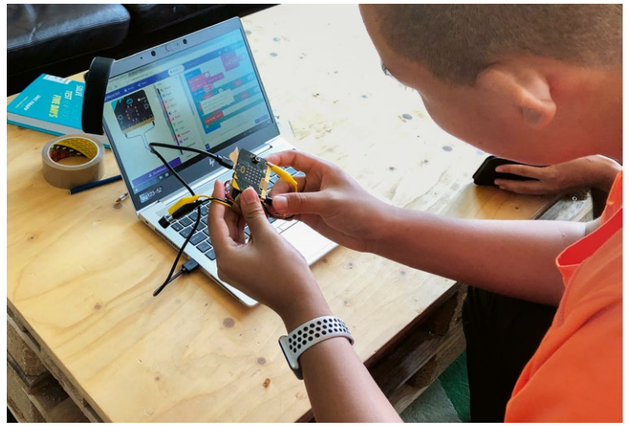
SUSTAINABILITY FOR THE SENSES

The Great Full is more than just a cookbook – it's an exploration of how we eat and what impact this has on our personal development, wider society and the planet. Drawing on a mix of stories, recipes and inspiring advice, ETH expert on global food systems Michelle Grant puts food firmly at the heart of the big challenges we face today. *The Great Full* throws a light on

how conscious eating, shopping and cooking can contribute to tackling these challenges while simultaneously fostering our personal wellbeing.

Recipes and more information:
→ www.thegreatfull.com

Author: Michelle Grant
Published by: The Great Full
ISBN 978-3-033-07457-6



Learning new programming skills

DIGITAL CREATIVITY FOR KIDS AND TEENS

CreativeLabZ and Zurich's Museum of Digital Art (MuDA) have joined forces to offer a wide range of online courses for 6- to 16-year-olds. Kids can choose from an online timetable and sign up for live-streamed lessons on topics such as programming, circuits and beat-making, all taught by real teachers. The Plant Science Center has developed dedicated courses on biotinkering, digital art and nature. Most require nothing more than common household items, though in a few cases students will receive a small kit by post.

Find out more and sign up for a class:
→ www.muda.co/ccc

ETH QUIZ

Our series of quizzes takes you on a journey of discovery through the wild, wacky and wonderful world of research and teaching at ETH Zurich.

Put your ETH knowledge to the test:
→ www.ethz.ch/news-quiz

ART MEMORY

Try out your skills on a new Graphische Sammlung game! Our Art Memory activity offers a fun way to discover art treasures from the 15th century to the modern day. How fast can you find the matching pairs?

Your opponent is the best time recorded so far:
→ www.gs.ethz.ch/en/memory

Images: The Great Full; Ulrike von Groll

Start discovering

THE LAND BETWEEN TWO CONTINENTS

Have you ever been to Iceland? Join *focus*Terra guide Léon Frey on his online tours to marvel at Iceland's wild landscapes and discover how they were formed by earthquakes, volcanoes and glaciers.

Check out all the latest online tours:
→ focusterra.ethz.ch/en/your-visit/online-touren

TAKING OUR RIGHTFUL PLACE

Women were a rare sight at ETH for a long time. Yet pioneering women have frequently managed to expand scientific horizons over the past 150 years with expertise and persistence – and an occasional dash of humour.

Read this story and others:
→ www.explora.ethz.ch/en

BETTER CITIES

Researchers at the Future Cities Laboratory (FCL) dedicate their time to designing better cities and tackling the most pressing urban challenges confronting cities around the world. How can we preserve biodiversity in urban environments? Will autonomous vehicles transform cities?

Check out the FCL podcast to find out more about these and many other topics:
→ www.fcl.ethz.ch/resources/fcl-podcast

ETH @ TEDXZURICH

How do you teach a robot to see? And is reality still real? These are just two of the questions under scrutiny in the TEDxZurich talks by ETH researchers such as Margarita Chli, Benjamin Dillenburger and Bob Sumner.

Watch the videos on YouTube:
→ www.bit.ly/ETHZurich_TEDTalks

A good read

ZUGEFALLEN

Dieter Imboden – the well-known ETH environmental researcher and influential shaper of Swiss science policy – uses his autobiographical journey as an opportunity to reflect on aspects of human existence. As he recounts his life story, he explores the big questions of identity, religion, society, politics, culture and science. Imboden's prose is precise and controlled, never slipping into nostalgia, yet tinged with a wry sense of humour. The result is a story that intertwines his professional achievements with his personal development. The German title *Zugefallen* refers to the lot that falls to each of us in life. Imboden proposes that life is not so much about following a defined plan, but rather developing a sense of curiosity, spotting opportunities and embracing them. "Life is what happens to us – it is happenstance in the truest sense of the word," he writes. "Yet that doesn't release us from the responsibility of giving shape to what happens in our life."

Author: Dieter Imboden
Zytglogge Verlag
ISBN: 978-3-7296-5038-1
(Available in German only)

Images: Léon Frey / *focus*Terra; Johannes Barbieri / ETH Library Zurich, image archive; Martina Piteo / TEDxZurich; Zytglogge Verlag

5 QUESTIONS

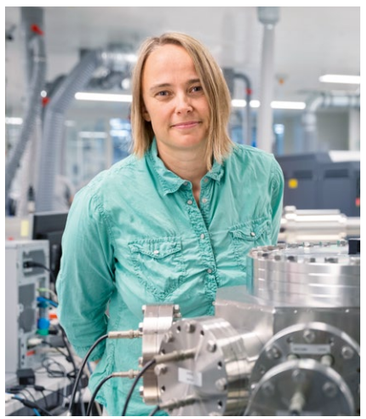
Maria Schönbächler investigates how our solar system formed. Her work often reminds her of the importance of breaking out of established patterns.

How is it possible to perform atomic-level research into the formation of the solar system if it stretches over millions of kilometres?
It does sound rather paradoxical! We study meteorites that originated from asteroids. By carrying out high-precision lab analyses with mass spectrometers, we can address many questions and precisely date planetary building blocks. We can also use our data to identify the fingerprints of stardust older than our Sun. This allows us to investigate processes that occurred before, during and after planetary formation.

How did you get into this area of research?
The planets were the topic I chose for my first big project at primary school. After I completed my Master's thesis in Earth Sciences, Professor Alex Halliday offered me the opportunity to do my doctoral thesis in the same field at ETH. There was no holding me back after that!

What's the most surprising thing you've learned over the course of your career?
When scientists discovered the first exoplanets, many people criticised their findings and were sceptical as to whether the planets really existed. In general it amazes me how long it can take new ideas to gain acceptance in the scientific community, such as plate tectonics for example. I think this probably has a lot to do with people's need to cling to old, established patterns.

In addition to your research and teaching, you're also an active supporter of equal opportunities. What's your goal?
To break out of the established patterns that have led to inequalities. The key is to become aware of the unconscious bias that can lead us to stereotype people. Awareness of how we label and classify others can help to eliminate discrimination and achieve the kind of genuine diversity that has been shown to make teams more successful.



Maria Schönbächler is Professor of Isotope Geochemistry in the Department of Earth Sciences.
→ geopetro.ethz.ch

"My dream discovery would be to map the Moon's geology."

What discovery would you most like to make?
The Moon still holds so many secrets. My dream discovery would be to map the Moon's geology, just as geologists did on Earth between 100 and 150 years ago. That would mark a huge leap forward in our understanding of how the Earth-Moon system formed, and it would no doubt produce all sorts of surprising findings! — Interview conducted by Karin Köchle

Image: Alessandro Della Bella

The economy needs new motors. We build them.

If the economy were driven by motors, they would be made by maxon. Our reliable and efficient drive systems work with precision, even when times are difficult. Combined with our encoders and motor controllers, they can be used to build impressively smart solutions. **www.maxongroup.com**

Precision Drive Systems

maxon