ETH Zürich

Globe

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The magazine of ETH Zurich and ETH Alumni

No. 3, September 2013

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Dear readers

Over 7 billion people currently live on Earth; by 2050 it is expected to be 9 billion. Feeding the ballooning global population while preserving scarce natural resources is one of the biggest challenges faced by the human race.

In Switzerland, the expertise of agricultural scientists and food engineers is highly sought after, as is revealed by a recently published job-market study, conducted in conjunction with the Swiss Association of Engineering-Agronomists and Food Science Engineers ("SVIAL"). According to employers from the agricultural food industry, there is a particular demand for qualified experts with extensive methodological and management skills.

In order to be able to overcome the challenges of the global food system, while simultaneously satisfying the needs of Switzerland, a new generation of systematically oriented agricultural scientists is called for. Corresponding courses at ETH Zurich's Department of Environmental Systems Science focus on the basics in ecology, biology, economics and production science and engineering. Cultivating the interface with the food science and nutrition course is especially important.

With the World Food System Center, a competence centre that brings together professors from different disciplines, ETH Zurich is making a key contribution to research. The aim is to lay common foundations for the sustainable production and reliable supply of high-quality, healthy food for the global population.

At the core of this is a system-based approach that incorporates the entire value-added chain of food production.

The world food system also encompasses all the natural resources that are necessary to produce food. It includes the management and processing of these resources and the distribution and consumption of the food, taking all the relevant ecological, economic, health-related and social aspects into account. The research areas range from the molecular and organismic level to cross-system issues.

In order to impart practice-oriented knowledge and to train urgently needed experts, the Center works closely with politics, industry and institutions both at home and abroad. Thanks to private funding, the initiative was soon able to gather speed. The current issue of *Globe* offers a glimpse into the range of projects at the World Food System Center and should whet your appetite for more.

Ralph Eichler
President of ETH Zurich

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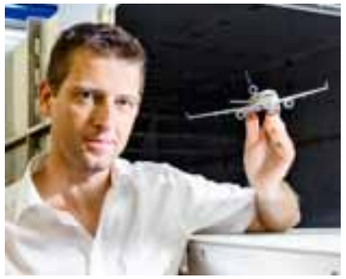
Globe is also available in German and English in a free tablet version

Students from the geomatics Master programme investigate a topical case: the Sarnen landslide.



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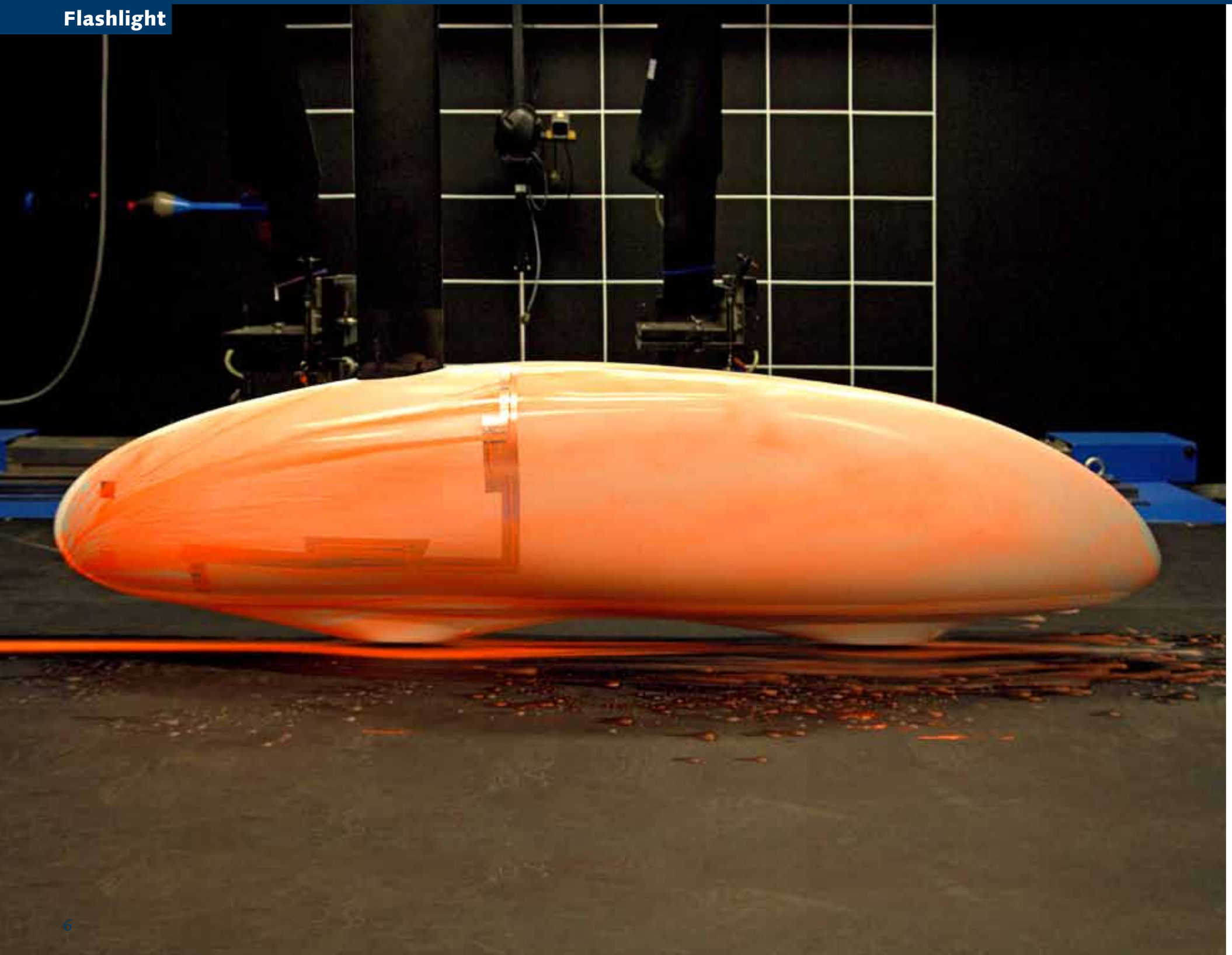


The art of engineering and muscle power

In reality, the aerodynamically shaped egg (still in the wind tunnel here) is a tandem and can reach speeds of up to 90 km/h in races. It was designed and built by ETH Zurich students as a focus project for their Bachelor degrees in mechanical engineering.

The project is called Cieo (Latin for "I move"). The students teamed up with industrial partners to build a vehicle that is propelled solely by the muscle power of two drivers. An aerodynamically shaped, ultralight body and an ingenious positioning of the two drivers – lying horizontally on top of one another, practically head to toe – are the most notable elements responsible for the high speeds that Cieo can reach.

Cieo is currently showing off its capability in various races. At a competition near Dresden in July, the team easily smashed the world record for the distance covered by a tandem in one hour: 83 kilometres. The previous world record of 74.51 kilometres had stood since 1980. Now the students want to give their fellow competitors a run for their money in other international competitions.

Project link:
www.cieo.ch →
A film about the project:
www.youtube.com/watch?v=0fJZ2paZZJM →

Active nano-substance

An antioxidant that keeps

Scientists from ETH Zurich have patented an active nano-substance that protects other molecules from oxidation. Compared to many of its predecessors, the researchers' antioxidant keeps for longer, which makes it just the ticket for industrial applications.

It could be used to help food keep for longer, but also as an anti-aging substance in cosmetic products. The nano-antioxidant is composed of a silicon oxide nanoparticle and the natural antioxidant gallic acid. The silicon oxide nanoparticles prevent the gallic acid molecules from sticking to each other and thus becoming ineffective. Moreover, the nano-antioxidant is temperature-resistant.

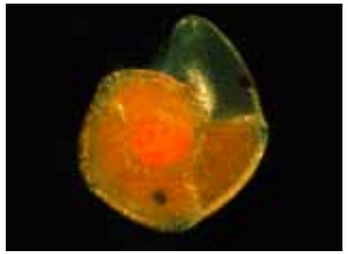
3D-models of trees produced with intelligent algorithms.

Disney Research Zurich

Colourful 3D worlds calculated faster

Nowadays, Hollywood films thrive on special effects and the integration of virtual objects. In order to reconcile virtual and real elements, real objects need to be measured three-dimensionally and converted into a digital model, which is traditionally achieved with a 3D laser scanner. However, this method is expensive as the scanners are only able to record fine structures with difficulty, and colours not at all. An artist therefore has to colour the objects manually on the computer afterwards.

A team of researchers from ETH Zurich and Disney Research Zurich has now devised a new method that enables the user to calculate detailed, colour 3D models on their computer using high-resolution photographs taken with a conventional single-lens reflex camera. While the three-dimensional reconstruction of series of photographs is nothing new, until now it was inefficient. For instance, calculations for images with one to two megapixels would take up to several hours before now. Using the new algorithm that the researchers have developed, however, the same process now takes less than ten minutes for a 21-megapixel image.



The plankton species Foraminifera lives in the depths of the ocean.

Haliplankton

Atlas of the tiny organisms

A lot less research is conducted into oceans as a biosphere than into terrestrial ecosystems. We especially know very little about the distribution of plankton, the organisms that make up the staple diet for marine ecosystems. In a large-scale project coordinated by researchers from ETH Zurich and the University of East Anglia (GB), scientists have now collected data on plankton distribution from 500,000 measuring points around the globe and condensed it into a global atlas. It has just been published under the name MAREDAT in a special issue of the journal Earth Systems Science Data.

ETH Zurich leapfrogs up the rankings

ETH Zurich also confirmed its world-class position in the recently published Shanghai Ranking, where it finished in twentieth place – three places higher than in 2012. The top universities are Harvard, Stanford and Berkeley.

Ticker

New publication

ETH Zurich's Sustainability Report

ETH Zurich has published its second sustainability report. Written in English, the Sustainability Report 2011–2012 unveils various key ecological, economic and social facts and figures, concrete objectives and their degrees of fulfilment. At ETH Zurich, sustainability follows an integrated approach that encompasses teaching, research and campus life.

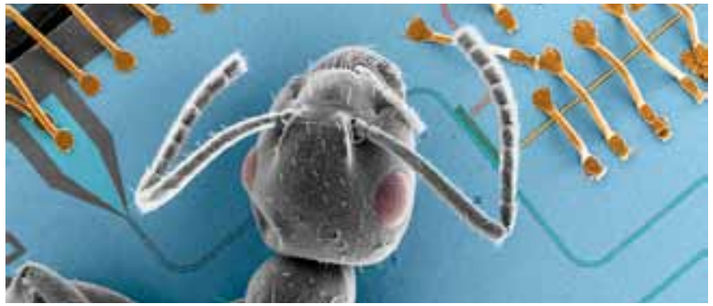
Link to the report:
www.sustainability.ethz.ch/index_EN →

Mario Stucki with the prototype of his fluorine-free outdoor coat.

Master project

A fluorine-free outdoor coat

Waterproof and breathable clothing often contains problematic fluorine compounds. As part of his Master project, ETH Zurich student Mario Stucki has developed a fluorine-free membrane that can hold its own among commercially available products. This polymer material with nanoscale pores is not only fluorine-free, but also more waterproof than comparable membranes and just as breathable. Moreover, a coat prototype proves that it is wearable.



The ant depicted on the superconductive chip indicates the scale of the electrical circuitry used for teleportation.

Teleportation

Physicists "beam" information

For the first time, physicists from ETH Zurich have succeeded in teleporting a piece of information in a system with superconductive electrical circuitry. They managed to transport the information six millimetres from one corner of a chip to the other, without physical particles actually covering the distance from the transmitter corner to the receiver corner. The basis for the experiment is a phenomenon from quantum physics, a connection between separated particles where one particle "knows" what information the other particle contains – which, to non-physicists, might sound like telepathy. Quantum physicists refer to this phenomenon as the particles' "entangled state."

To prepare for the quantum teleportation, the team of researchers headed by Professor Andreas Wallraff brought the transmitter and receiver unit into an entangled state. The physicists then programmed a piece of quantum-mechanical information in the transmitter unit. Because the two units are "entangled" with each other, the information can also be read on the receiver unit.

Award winners

App for a personalised newspaper

The de Vigier Foundation has presented its start-up award, which has the biggest prize money in Switzerland (CHF 100,000), to ETH Zurich spin-off company Newscron. Its founder, Elia Palme, who completed his doctorate at ETH Zurich a year ago, has developed a Smartphone app that enables users to put together their own personalised newspaper. The app currently scours 200 news websites from all over Europe. The users can personalise their settings and decide on which topics and from which countries and regions they would like to receive news. The app also offers access to several leading European media outlets and to local news. It is thus the perfect supplement to similar apps that chiefly focus on American news portals.

Link to the website:
www.newscron.com →

Master's student Johannes Gerber slides the laser scanner into position – one of the methods twenty students from ETH Zurich used to study the Sarnen landslide.

Geomatics

Landslide field research

Christine Heidemann

During their three-week surveying course in June 2013, twenty students from ETH Zurich's Master programme in geomatics took on an especially topical "case": using various methods, they studied the landslide in the Hintergraben region near Sarnen.

In a matter of seconds, a third of the village was gone – washed away by an enormous river of mud and debris that had been triggered by heavy rainfall and severe weather. Thirteen people lost their lives. On that day, 14 October 2000, the village of Gondo in Switzerland's Upper Valais region went down in the annals of natural disasters.

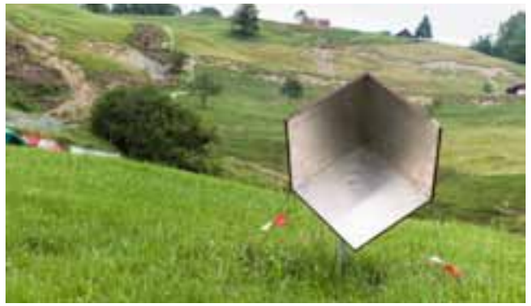
Fortunately, landslides do not always have quite such drastic consequences as in Gondo. However, after long, snowy winters the risk is especially high that hillsides might take on too much water, become unstable and slide down into the valley under the influence of gravity. And since many villages lie right on or near the path of potential landslides, the consequences can sometimes be devastating. According to the National Platform for Natural Hazards (PLANAT), the proportion of unstable areas throughout Switzerland is six to eight percent.

One of these areas is Hintergraben in the district of Sarnen, the capital of the Canton of Obwalden, where things came to a head in April and May of this year. When the ca. 30-hectare hillside section threatening the town was moving as many as twenty centimetres a day, the government declared a state of emergency. Following an extreme winter in 2012/2013, the slope became waterlogged and the clay-like layer upon which the loose soil sits grew increasingly soapy, ultimately turning into a perilous, slippery slope. Metre-deep cracks opened up, roads and electricity pylons were damaged and numerous inhabitants were forced to leave their homes.

Metre-long cracks in the sod bear testimony to the tremendous force with which the slope above Sarnen slipped down into the valley. At times, it even slid up to twenty centimetres a day.

Into the disaster area at short notice

The fact that they could carry out their three-week surveying course here, of all places – an active area still at risk from a landslide – was particularly exciting for the twenty students from ETH Zurich's geomatics Master programme. Their three-week field course was supposed to be conducted at the Dirru rock glacier on the eastern face of the Matter Valley. As there was still too much snow there in June, however, there was a last-minute change of plan. And so the students set off for Hintergraben with one course leader and six assistants from the Institute of Geodesy and Photogrammetry at ETH Zurich to record and model the landslide with different geodetic measuring techniques.



Corner cube reflectors, which reflect the signals from the radar positioned three-and-a-half kilometres away. This enables the extent to which the terrain is shifting to be observed.

Not only were they supposed to learn how to use the different equipment; the idea was also for them to find out which measuring technique or which combination of methods is most effective to gauge a landslide.

And so, on this Friday afternoon, smaller groups of students stand on the area furrowed by the mudslide, huddled around various instruments including a modern laser scanner that is about to be tested on a landslide for the first time. An intense discussion ensues. The laser can't record the movement of the slope sufficiently; its measurements are too rough, even though the students have measured many millions of points in the last few days. They have also hit a brick wall with stationary GPS because of the short duration of the fieldwork, as doctoral student Pascal Theiler reports. However, there is evidence that the lower section of the area is sliding more.

Besides the mobile GPS equipment, a tachymeter is being deployed – that is a device that measures directions, distances and altitude differences all at the same time – and so is a drone. This drone, a quadrocopter, allows the students to take horizontal and diagonal images of the landslide area for documentation purposes and to produce a 3D model of the area.

The so-called corner cube reflectors are particularly striking. They look like a metal box on a stand that is open on two sides. "They reflect the radar signals we set up three-and-a-half kilometres away down by Lake Sarnen," explains postdoc Sebastian Tilch.

Using the radar, the students could theoretically observe the entire slope and determine its displacements down to a few millimetres. However, the thick vegetation interferes with the measurements as they reflect the radar signals too unevenly.

So far, the traditional point-measuring equipment, including the tachymeter, has proved the most effective, says Andreas Wieser, one of the professors supervising the project. He has travelled in from Zurich today, the last day of fieldwork, to talk to the students about their experiences of the last few weeks. He seems satisfied: the level of commitment is high, and the results provide the authorities with valuable additional information to complement their own measurements.

For instance, this information revealed that the landslides had reached their zenith in April and May. Now, a month on, the researchers from ETH Zurich conclude that while significant displacements can still be detected, their scale is considerably smaller. "The largest shifts detected with our equipment are less than one centimetre a day", says doctoral student Maroš Bláha. Only too aware of the sensitivity of the topic, however, the students err on the side of caution with their conclusions. After all, it is ultimately about so much more than simply trying out various pieces of equipment. For the people here, it is about their livelihood.

Once all the instruments have been packed away again, all that remains for the students to do is to thank the local population for their hospitality. After all, they did grant them access to their land for two weeks. And so the Sarnen landslide will not just go down in history as a latent natural hazard, but also as an exciting research object for students from ETH Zurich. ■

Degree in geomatic engineering and planning:
www.geomatik.ethz.ch/index_EN →

1 Doctoral student Maroš Bláha prepares the drone for lift-off. The students used it to take pictures of the area and produce a 3D model.

2 The quadrocopter is GPS-controlled. The sensor is located in the cover of the drone, which reaches an altitude of around 100 metres.

3 The camera and its mount. The latter controls the angle from which the photos are taken.

4 In all, the students flew the drone three times over the slope bearing the scars of the landslide.

5 Some course participants attentively follow the manually controlled launch of the drone before the autopilot takes over.

6 Besides the photos from the camera, all the key flight data such as the route, altitude and time can be followed live on the computer.

Eating better

Bio or high-tech, local or global, veggie or meat, functional or traditional? For consumers in industrialised nations, food is available in an unprecedented abundance and variety. However, we are often oblivious to what is behind the meals on our plates, how they are produced and what effect they have. While much of our food production is convenient and tastes nice, it isn't sustainable. Researchers at the World Food System Center are looking for ways to create high-quality, healthy food for everyone, using environmentally friendly means.

What ends up on our shelves

The product range in our shops is constantly changing. But who decides what goes on sale? What processes are hidden behind the products we buy? Dr Sibyl Anwander, Head of Public Affairs and Sustainability at Coop, Michael Siegrist, Professor of Consumer Behaviour and Achim Walter, Professor of Crop Science at ETH Zurich offer us answers.

Roland Baumann and Felix Würsten

When you buy food, what do you pay attention to?

Sibyl Anwander: Things like Fair Trade, organic products and variety are important to me. But we don't stock any convenience foods. When shopping I keep the children's preferences in mind – although we have the problem that they don't eat any vegetables. That can be a bit limiting.

Achim Walter: In my case it's usually my wife who does the shopping. She's a vegetarian and she uses lots of different vegetables in her cooking. She looks out for organic and regional products. I tend to buy the things that brighten up our lives – wine, beer and sometimes sweets for the children.

Michael Siegrist: We both go out to work and I do around 80 percent of the shopping. I have a hedonistic leaning. What's most important for me is the taste of the food. Labels are of secondary importance. We have two sons: one eats everything, while the other is a bit more difficult.

Children seem to play an important role when shopping. Does this influence the range of products in the shops?

Anwander: At Coop we look very carefully at which products we introduce in which price category so as to offer a diverse range that sets itself apart from what our competitors are offering, but also meets consumer expectations. Twenty years ago we introduced organic products, and just a few years ago we started selling old varieties in our Pro Specie Rara range. There was no direct demand because there was nothing on offer. But we did anticipate societal developments with this.

On the other hand, we also remove products from the range specifically for sustainability reasons. For example, the fish product range is regularly reviewed in line with the Guidelines of the WWF Seafood Group. This leads to delistings or a change in the product range in terms of fishing grounds and fishing methods. Wherever possible, we source products from MSC-certified fisheries or organic fish farms. When it comes to the product range, the retail trade plays a gatekeeper role in both a positive and a negative sense.

And what role do consumers play?

Anwander: In the end, they decide whether a product will be successful or not. Of course, the retail trade can influence purchasing decisions through product placement, promotions or accompanying communication. Nonetheless, around three-quarters of new products don't convince customers in the longer term. So, besides the regulars, there is a constantly changing range of products.

Flavour and price: they are the most important purchasing criteria for foods, say Achim Walter, Michael Siegrist and Sibyl Anwander (from left).

Does agriculture also contribute to changes in the product range?

Walter: Yes, innovations also come from agriculture. Let's take the example of the apricot. It has undergone major development over the last 15 years. In Switzerland you can now buy apricots from Canton Valais from June to September. A few years ago that would have been inconceivable. There was a time window in July/August of about two weeks when apricots were ripe.

On what criteria do consumers base their purchasing decisions?

Siegrist: Price plays an important role, and so does flavour. Products can be very healthy and manufactured sustainably. But if they don't taste good, people won't buy them. Then there are the additional benefits like organic sourcing or convenience that appeal to different segments.

Aren't consumers confused by the immense product range?

Siegrist: In psychology there is the paradox of choice. When the choice is too large, consumers are unhappy because they think that they didn't make the best decision. Practice, however, shows that they shop where there is a large selection. They can indeed cope with the large range by sticking to trusted brands and products.

Is that the reason why so many new products are a flop?

Anwander: You see both: customers who are disappointed when a familiar product is no longer in the shelves and customers who like to try out new products. We can influence purchasing decisions through the recipes in our magazine. We can use them to demonstrate, for instance, that an animal is not just made of fillets. Swiss consumers also respond very well to price campaigns. When a product costs less or receives additional points, people buy it more.

What are the most important food crops?

Walter: In terms of calories, wheat, rice and maize are the most important crops. They cover more than 50 percent of global calorie requirements. In terms of weighed quantity, fruit and vegetables account for a larger share because of their high water content. However, the three cereals are taking on increasing importance because a growing proportion of foods is produced from components of these three crops. There is also a concentration in consumed cereal crops. For instance, oats, which were still very important 40 years ago, are scarcely grown any more in Switzerland today.

Interviewees:

Sibyl Anwander is responsible for Public Affairs and Sustainability at Coop. The ETH alumna was a researcher and lecturer for more than 10 years at her Alma Mater before taking up a position in 2001 with the Swiss wholesale distributor where she, amongst other things, published the first sustainability report. She chaired the Business Social Compliance Initiative (BSCI) and is a member of the advisory bodies of various other organisations that subscribe to sustainability.

Achim Walter has been a Full Professor of Crop Science at the Institute of Agriculture of ETH Zurich since 2010. He is engaged in research on the growth performance of plants for the purposes of the further development of crops and the more efficient shaping of future agricultural systems. He develops imaging methods for the characterisation of environmental reactions and the genetic characteristics of plants.

Michael Siegrist has been an Associate Professor since 1 April 2007 and since 1 August 2013 a Full Professor of Consumer Behaviour at ETH Zurich. His main areas of research are risk perception, risk communication, acceptance of new technologies and decisions amid uncertainty. One specific area of his work is consumer behaviour in conjunction with food.

How much potential is there for further development of these plants?

Walter: In the case of local products like the apricots I mentioned, consumers will continue to see tangible cultivation successes in the future. In the case of wheat, rice and maize, however, the biological limits have almost been reached. Any further increase in yield is almost inconceivable.

What criteria play a role in cultivation? Is it all just about yield or about flavour, too?

Walter: Flavour must exceed a specific threshold value for the product to be bought at all. I remember "Holland tomatoes" that appeared in shops 30 years ago. I stopped buying them, as did many other consumers. Today, we have tomatoes that are far better products in terms of flavour and quality.

Anwander: Production, harvest time and storage duration also have a major impact. The longer a fruit matures on the tree, the easier it is for it to fully use its genetic potential – with the consequence that products of this kind cannot be stored for so long any more and sometimes have an unsightly spot. Cost considerations also come into play because the risk of not being able to sell ripe products is greater.

Do consumers still have a sufficiently good relationship to products?

Siegrist: It is true that food production is a black box for more and more consumers. Who's been to a slaughterhouse? Who's visited a farm? Naive ideas about how food should be produced are consequently on the rise. The volume of food that is needed cannot be produced in the manner suggested by advertising spots. Products like that would be far too expensive, at least for most consumers.

Isn't the distorted image of production conditions in retail trade advertising rather problematic?

Anwander: We are engaged in a balancing act. On the one hand we have new technologies aiming to rationalise the production process. On the other hand, less technology is sometimes used today, for instance in the case of additives for preservation. The products are processed more gently. However, it is true that people are no longer familiar today with the interactions between the composition of products, processes and shelf life. This raises the question as to whether people really want to know each and every process. After all, we consume not only rationally but also emotionally. Sustainability issues like animal welfare, organic farming, Fair Trade or regionalism can be conveyed far better through images than, for example, through an eco-audit on the packaging.

Nevertheless, these are highly idealised images.

Anwander: Yes, that's right, in advertising we sometimes convey the image of an intact world. Surveys show that above all men around the age of 40 who work for banks and insurance companies would like to experience this intact world with their children. However, I think that we have to start talking again about agricultural markets and the interactions mentioned in a slightly more proactive manner. And also about the logistics achievement that means there is a range of products of this quality and freshness every day in each shop.

Mr Walter, how do you see this balancing act?

Walter: Raising awareness amongst consumers about how food is produced is very important to me. Today, children can explain how a smartphone works but they don't know how basic foods are produced. As teachers, we are called on to identify ways of conveying this knowledge.

Food waste is a widely discussed topic. According to surveys one-third of all food is not consumed but thrown away. Why is that?

Anwander: In my opinion, this whole topic is currently being blown out of all proportion by the media. It starts with the failure to distinguish between food losses that occur during production and transport, and food that is actually thrown away by consumers. In the case of food losses it's about the raw products, about how products with longer shelf lives can be produced and transport losses reduced. This is a major problem, particularly in developing countries. However, the current debate focuses on food discarded by private households and restaurants. Food is not as important as it once was. Whereas it still accounted for around one-third of household expenditure 50 years ago, today this figure is scarcely 10 percent. This has an impact on how foodstuffs are handled.

> "Food production is a black box for more and more consumers."
>
> Michael Siegrist

Do we simply have to live with losses on this scale?

Siegrist: What's interesting about this debate are the moral undertones. We could also talk about the clothes we buy and never wear. Or about smartphones that we purchase although our old ones are still working. The fact that the debate concentrates on food has to do with the old-fashioned idea that we have to eat up what's on our plate because someone else is starving. We have to be careful with political demands seeking to teach people the "right" way to behave. I'm not advocating that we throw food away. But we have to let consumers decide whether they prefer to eat fresh bread or first use up stale bread.

What is the retail trade doing in this area?

Anwander: Years ago we decided that, if possible, we wouldn't throw away any food in our shops. To this end, we have a whole cascade of recycling measures. We reduce the price prior to the expiry of the sell-by date and work with aid organisations who distribute perfectly fresh food to needy individuals. Some products are passed on to farmers as animal feed and the rest is converted into biogas.

What's the situation on the production side?

Walter: Distinctions have to be made between different world regions when it comes to post-harvest losses. In developing countries, transport losses are the predominant factor. They have no cold chains, the transport infrastructure is underdeveloped, etc. A great deal could be achieved by expanding the infrastructure. In Switzerland, losses are mainly caused by the fact that it is no longer possible to sell products with minor defects or blemishes. This leads to post-harvest losses here, too. The farmers also recycle products they cannot sell via other channels, even if it's just on their own compost heap.

Anwander: For me, what's far more worrying is that today we only use a small part of an animal. In the past, everything was eaten – from the calf's head to the pig's tail – or turned into specialties. Today, we only use the hindquarters or fillet from a cow. This is a luxury that is scarcely mentioned at all. From the ecological angle this is even more worrying, because the conversion of plant into animal protein already entails a major loss of efficiency.

What impact does globalisation have on meat consumption?

Siegrist: Meat consumption is bound to increase across the globe. In countries that are undergoing economic development, consumption is rising even if it's still on a low level. But given the large number of people who can now afford to buy meat, this has a major impact on demand. Nor is there any reason to believe that this is going to change. People rarely forego meat willingly.

Genetically modified products are another topic that is the subject of controversy. Will the Swiss population accept them in future?

Siegrist: The reason why consumers reject genetically modified products is, in my opinion, the lack of benefits. The products are not cheaper and they don't taste better. At the same time, there are no genetically modified products because no one wants to get his fingers burnt. No producer or retailer wants to be the first – out of fear of NGOs like Greenpeace. However, I am convinced that products of this kind would be quickly accepted if they were available in shops like they are, for instance, in the USA.

> "The topic of food waste is currently being blown out of all proportion by the media."
>
> Sibyl Anwander

That's surprising given that they are rejected in the surveys.

Siegrist: We have to distinguish between whether people respond as citizens or consumers. In referenda the Swiss are always in favour of stiffer animal welfare laws. They are in favour of a moratorium on genetic engineering and for not overly large production plants, i.e. for morally correct production processes. At the same time, the same people purchase meat abroad where it is far cheaper but produced under completely different conditions.

What is the main benefit of genetic engineering?

Walter: Genetically modified foods are grown today on an area that is three times the size of the area for organic food. And this area is constantly growing. In the USA and in South America almost 100 percent of the soya and maize varieties that are grown are transgenetically modified. In the USA, that goes for sugar beet too. These plants offer the advantage that they are more resistant to disease and thus more reliable in production. The farmers can produce more cost-effectively, but their dependence on seed manufacturers grows. That is the reality. I don't think that many Swiss people think about this when they eat a hamburger in the USA.

So attitudes could change?

Walter: The reservations amongst the population at large are considerable, for the reasons mentioned by Michael Siegrist. Things will only change when the cultivation of genetically modified plants becomes part of the normality around us.

Siegrist: And if prices change and you have to pay a mark-up for GMO-free products.

Anwander: The legislation clearly states that the people who use the technology and reap the benefits are responsible for ensuring a clear separation of genetically modified products from those that are GMO-free. In reality, however, it is the people who forego the technology who have to go through the certification process. This means that they are the ones who incur the costs, not the people who enjoy the advantages. Until the risk-benefit question has been properly discussed, genetic engineering will continue to be a subject of controversy in Switzerland.

And the retailers don't want to expose themselves in this regard if at all possible?

Anwander: There are clear marketing considerations, too. As a food sector we have a competitive edge because Switzerland is the only country in Europe to have fully renounced genetic engineering in cultivation and feed. There are no additional costs because everyone has followed suit. One problem of genetic engineering is that there are still certain prejudices in people's minds – for instance higher herbicide or pesticide consumption or a dependency on seed manufacturers. Up to 10 years ago we had an intensive dialogue in Switzerland. Unfortunately, it was broken off.

> "Genetic engineering burst onto the scene with big promises. Today, it is viewed more soberly."
>
> Achim Walter

Mr Walter, how do you see the debate about genetic engineering?

Walter: Genetic engineering burst onto the scene with big promises. Today, it is viewed more soberly. Certain genetic modifications are an interesting tool. What is always forgotten in the discussions is the time horizon. The domestication of our crops took hundreds, thousands of years. Similar changes cannot be achieved with genetic engineering from one day to the next. We need long-term programmes with regular monitoring of whether the modifications in the field have achieved the desired result. It's in the nature of things that this is a time-consuming process.

Anwander: Climate change might thus contribute to the acceptance of genetic engineering because farmers will need new breeds faster. Classical breeding takes at least 20 years – whether we will still have this time in the face of rapid climate changes is questionable. Genetic engineering could help to speed up breeding procedures.

Walter: Genetic diversity is important above all in respect of climate change. For all the main crops there are varieties that can thrive on less water or at higher or lower temperatures than prevail in a specific region today. In Switzerland we will have a different climate in 20 years' time from the one we have now. We will need varieties that can make do with slightly less water, offer improved yield reliability or perhaps thrive at higher altitudes. We must tap into this biodiversity potential. ■

Beastly good food

The quality of animal-based foods that end up on our plates depends directly on what was on the menu for the cows, sheep and co. Agricultural scientists from ETH Zurich have been studying this correlation and working meticulously to find the ideal feed mix.

Christine Heidemann

One of Michael Kreuzer's laboratories is not for people with sensitive noses. It reeks. A bit like liquid manure. At least that is the impression the intense odour makes on the inexperienced visitor. This professor of agricultural science at ETH Zurich soon clears up the mystery: it isn't liquid manure in the eight containers brimming with a brownish liquid; it's the contents of a cow's stomach from the nearby animal hospital that is sloshing about – the contents of its largest forestomach, the rumen, to be precise. This doesn't make the stench any less revolting, but it does make work easier for the researcher and his team. After all, the rumen simulator enables them to test umpteen times what would otherwise only be possible in an elaborate animal experiment.

With the aid of the artificial cow's stomach, the scientists are looking to find out which feed components are broken down how quickly in the rumen and which nutrients are released. Their aim is to increase the quality of meat and dairy products while reducing methane production. For while a cow's rumen is riddled with up to four kilograms of microorganisms and can thus digest the most fibrous of feedstuffs that would otherwise not be digestible in the intestinal tract, it also produces the aggressive greenhouse gas methane.

However, Kreuzer's research is not just about improving animal products and making their production more environmentally friendly. When he talks about his vision of the food of the future, for him that also means finding alternative feed crops for livestock in poorer countries so that they also produce enough meat and milk in lean periods. "This would vastly improve the supply of vital amino acids, vitamins and minerals to the population of developing countries."

And last but not least, the agricultural scientist's team advocates species-appropriate husbandry, such as a more sensible use for old laying hens. Their carcasses are of no interest to the food industry or consumers, says Kreuzer. If anything, old hen meat ends up in poultry sausages or chicken soups.

"Consequently, we are on the lookout for new possibilities as to how, for example, we can get poultry sausages made from laying hens to taste better by giving them special chicken feed." The researchers are also experimenting with different herbal supplements to prevent the meat in chicken soups from going off so quickly. Both should make old hens more attractive to industry and consumers.

As varied as Kreuzer's project might seem at first glance: at the end of the day, for this expert in animal nutrition and his senior assistants Ruth Messikommer, Svenja Marquardt, Angela Schwarm and Joël Bérard, it all comes down to finding the right feed mix. Once this is found, desirable properties in animal-based foods can be enhanced specifically – such as the taste or the concentration of healthy, unsaturated fatty acids, especially omega 3 fatty acids. Like cooks who create new recipes, Kreuzer and his team also repeatedly try out new ingredients, which they pack in little feedbags and place in the artificial rumen for digestion before testing the combination on real animals.

Less is more

"In developed countries, we tend to eat too much meat and would be better off eating fewer but higher quality products," says the researcher. However, the problem with fatty acids, for example, is that rumen microbes transform unsaturated ones into saturated ones so that ultimately not much remains of the former. As a result, Michael Kreuzer's work-

group is looking for feed supplements that halt this process.

Fats made of linseed, acacia tannin and saponins, such as from the tropical soapberry, turned out to be particularly promising ingredients: if the researchers mix small amounts of these substances with the feed and give them to the rumen simulator for it to "eat", the omega 3 amino acid proportion in milk and meat fat increases and the microorganisms also produce less methane.

Moreover, field trials on alpine pastures revealed that meat from lambs and calves that are reared at higher, unfavourable locations exhibit more omega 3 amino acids.

This might sound like a paradox. But although the locations are steeper and offer a lower quality of food, they are also richer in species, as Kreuzer explains. "In the case of dairy products, we have known for some time that demanding alpine locations have a positive impact on the amino acid pattern; now we are able to show that this is also the case with lamb and beef."

A similar effect is also evident from studies on yaks in Nepal and cows in Peru: the higher the animals are reared, the more favourable the amino acid pattern for butter and milk turns out to be. Although it is not as distinct as in the Alps, as Kreuzer concedes, it is certainly provable.

In South America, the researchers from ETH Zurich also tested feeding animals with alternative shrubs. For while the main focus is on refining food further by spicing it up with healthy ingredients here in this country, the scientists are seeking possibilities for feeding animals at least "a bit better" in less developed countries, as Kreuzer puts it.

Even tiny advances have a major impact: "Not only can people consume more meat and dairy products; they can also sell them and secure a small income for themselves." Initially, however, it is naturally hard work to grow the new bushes.

Workshops and plant guides

As an aid, the ETH Zurich researchers offer workshops and compile plant guides in the relevant local language. "After all, you don't achieve very much if you only publish in scientific journals," Kreuzer sums it up, and fetches a jar of ground leaves from his office cupboard. "That's calliandra, for example, a shrub that proved ideal for dry areas with poor soils in our feed experiments in South America." However, whether developed or less developed, all countries are affected by one particular problem: the methane production that is part and parcel of livestock farming. This greenhouse gas is a major culprit in global warming – 21 times worse than the same amount of carbon dioxide! So more climate-friendly products are clearly the way of the future.

Older cows, more methane?

In the project "Long Life Cow", which is funded by the Mercator Foundation and conducted at ETH Zurich's World Food System Center, Kreuzer is now looking to investigate whether the useful life of the cows influences the production of methane.

"The global trend is leaning towards keeping dairy cows for increasingly shorter periods of time," says the ETH-Zurich professor. In Switzerland it is three and a half years, in Germany already under three and in the USA often only one and a half in which they produce milk. That means the duration of a cow's milk production is sometimes shorter than the one to two and a half years it takes to rear them. This might be efficient in the short term, but in the long run the amount of effort that goes into replacing retired cows is too great. These matters are currently being studied in environmental-economic models. Moreover, scientists are looking to measure the methane production per kilogram of milk.

From this autumn, a doctoral student from the group will thus place 40 animals in the respiration chambers at the Agrovet Strickhof project's new metabolism centre in Lindau. For four months he will measure how much oxygen the cows use up and how much carbon dioxide and methane they emit, using different feed compositions. One of the herds from the Plantahof in Landquart, where the animals come from, has only been given basic feed such as grass or hay for the last ten years. The other herd, however, has also received concentrated feed consisting of grain or soy – thus feedstuffs that are also eaten by humans, and which should thus be used as little as possible.

Once again, the rumen plays a key role in these experiments. How does the environment inside it change according to the feed? And how long does the respective feedstuff take to pass through the forestomach? "The passage rate could be one explanation as to why different amounts of methane are formed. The longer the food festers in the rumen, the more methane is produced." In a few months, this researcher will know a lot more. ■

Animal Nutrition Group:
www.an.ias.ethz.ch/index_EN →

High-tech in the meadow

Agriculture has a major impact on our environment. Using experiments with meadows, pastureland and arable land, Nina Buchmann examines how various forms of farming affect the climate, for example. Her work also uses physics-based methods.

Felix Würsten

Nina Buchmann does not venture to predict how we will feed ourselves in the future. But this professor for grassland sciences is very sure about one thing: "In future we will have to produce our food in a far more sustainable manner than we do today – all over the world." Here in Switzerland, too, where the population is relatively well informed about these matters, there is a need for greater awareness about how agriculture affects the climate, for instance, or how cultivation methods impact biodiversity. "As consumers we have to learn to understand how we in our current situation can make a contribution through how we act – for instance, by deciding what foods to buy or what to do with surplus food."

As a scientist, her tasks included participating in this debate. "As researchers, we are called on to throw light on the interactions between production, processing, consumption and waste." Nina Buchmann is one of the driving forces behind the founding of the World Food System Center at ETH Zurich and is now its Director. She is thus actively involved in the Globe Switzerland initiative, an education programme in the field of earth system sciences that is partly funded by the Federal Office for the Environment (FOEN). She wants to explain to school pupils what is happening on farms today. "We have a distorted view of how food is produced."

Most people don't know, for instance, that farmers use highly specialised technologies in many areas." It is this distorted perception that leads to contradictory behaviour. "We have an idealised notion of how farmers should produce their goods. At the same time, we want cheap food if possible. That can't work."

Biodiversity is worth it

In various projects, Buchmann is examining exactly how agriculture influences the environment. For instance, with her team in Panama she has compared the carbon uptake of forests and pastureland. To their great surprise, the researchers discovered that the CO_2 balance of pastureland was highly unfavourable over the two-year measurement period. Grassland turned out to be a major source of CO_2, releasing large amounts of this greenhouse gas into the atmosphere. What this means, in the final instance, is that soil carbon stocks are gradually being diminished – with disastrous consequences. Because the land is overused by the large numbers of animals, the soil loses its productivity and becomes worthless.

One long-standing component in Nina Buchmann's research is the Jena experiment that has been up and running since 2002 and looks at biodiversity in grassland. Every year, very different areas are farmed there, ranging from a simple monoculture down to a meadow with 60 different species. One important finding of this large-scale, long-term experiment is that highly biodiverse areas are not only more stable vis-à-vis non-native species, they also have a higher productivity.

In practice, farmers are interested not just in how much grass grows on their land but also in the quality of the feed. Contrary to widespread opinion, biodiverse meadows do

not lag behind in this context either. This means: the higher the number of species that grow on the land, the higher the productivity coupled with the same quality of feed. Buchmann is convinced that findings of precisely this kind have practical relevance. They confirm the fact that preserving biodiversity is worthwhile.

As a scientist, she immediately asks herself the next question. Why are biodiverse meadows more productive? For all the plants are competing for the same resources: light, water and nutrients. One important factor is probably the timeline, since the individual species grow and blossom at different times. Buchmann now wants to examine whether this really is a decisive factor. To this end, she has chosen an unusual study approach. Together with her team and with the assistance of small garden cameras, she plans to observe the grass growing on the test sites. This will generate large volumes of pictures that can be evaluated using the corresponding image processing methods. "In this project we also want to establish a new method that can be used for the main topic of biodiversity."

Sophisticated technology

Buchmann uses innovative measurement methods in Switzerland, too. At a total of six sites, including the three ETH research stations Chamau, Früebüel and Alp Weissenstein, she examines the exchange of greenhouse gases and water vapour between the soil and the atmosphere. The researchers record the concentrations of these gases 20 times a second, using infrared gas analysers and laser spectrometers. "Thanks to our dense monitoring we can always accurately state when the most nitrous oxide is released into the atmosphere after the application of liquid manure," explains Buchmann. "This is important because nitrous oxide is a powerful greenhouse gas."

Buchmann here draws on a physics-based method – laser spectroscopy – which up to now had scarcely been used in the agrosciences. "In the case of these measurements it's not just the technology that is sophisticated. Large volumes of data are also generated. That's why we need specialists on our team who work with these devices and are able to process these mountains of numbers efficiently." Buchmann wishes to use these measurements to show how the alpine grazing that is widespread in Switzerland – which involves keeping the livestock over the summer at various high altitudes – fares in respect of the greenhouse gas balance. "The first results indicate that these forms of farming don't do so badly at all," she explains. "This would be an important message in the discussions about how much agriculture contributes to the climate problem."

Trees are more sensitive

Buchmann's team also uses high-tech instruments to demonstrate how different types of vegetation react to aridity. In the extremely low rainfall spring of 2011, the researchers were able to demonstrate that forests react to water shortage in a completely different way from meadows. Whereas grasses and herbs more or less behaved in the same way as under normal conditions, the trees immediately adjusted their water balance when too little water was available. Buchmann explains these differences through the plants' different life strategies: "Grasses are constantly being eaten or burnt. That's why they can adjust so well and survive events like this. By contrast, trees live far longer and grow differently from grasses. That's why a tree reacts more sensitively and immediately reduces water evaporation."

Knowledge about how different types of vegetation react to varying weather conditions is important if you want, for example, to use climate models to estimate the consequences of increased aridity. "Only when we understand what happens in the various ecosystems during these phases can we realistically depict these processes in the climate model," explains Buchmann. There is another large-scale project which she is about to launch with other scientists in the ETH Domain and at the University of Zurich. The researchers want to collect information on the spread and activity of various types of vegetation, recorded with cutting-edge remote sensing methods, and to combine this with the local measurement data of Buchmann's group. As she explains: "In this way we will obtain an accurate picture about which greenhouse gases are released where in Switzerland, and how ecosystems react to environmental change." ■

Grassland Sciences Group:
www.gl.ethz.ch →

Food in lieu of pills

Cholesterol-lowering margarines, yoghurts with bacterial cultures to boost the body's defences, heart-friendly pastries – can you buy health from the supermarket? "Yes," claim today's advertising promises. "Perhaps," say researchers from ETH Zurich as they subject our food and digestive system to intense scrutiny.

Martina Märki

Too much fat, too much sugar and not enough exercise: in developed countries, it would appear, eating makes you ill these days. Obesity, diabetes, cardiovascular diseases and cancer are on the increase and healthcare costs are running into billions. On the flipside, there is a dream: food that not only tastes nice and does you good, but can also help to prevent or cure illnesses. Food as medicine: if you believe what advertising and product declarations on yoghurts, margarines and co. tell you, this dream has already come true. Supermarket shelves are increasingly filled with food products to which health-enhancing substances have been added. Functional foods (see box on p. 34) also promise to become a multi-billion-dollar business.

Eating yourself healthy – the idea is nothing new. It was already introduced, if not exactly invented, in Switzerland over 100 years ago. In 1900 the Swiss doctor Maximilian Bircher-Benner concocted a meal that consisted of mostly uncooked oatmeal, grated apple and nuts: Bircher muesli. For many of the ailing luxury patients who flocked to his clinic on the Zürichberg, the dish initially came as quite a shock; for the new converts, however, Bircher muesli almost became a religion.

Oats as super-food

Laura Nyström, a professor at ETH Zurich's Institute of Food, Nutrition and Health, is well aware that this raw-food diet is not everyone's cup of tea. However, she was particularly taken with one ingredient of Bircher muesli: "We have been conducting extensive research into one of the components of oats," she explains.

The substance is called beta-glucan and is regarded as one of the plant fibres with the most promising positive effects on health. According to research, for instance, beta-glucan helps to reduce the cholesterol level, the cause of many heart diseases. Moreover, it delays the surge in the blood sugar level after a meal and enables it to decrease more slowly – good news for people at risk from diabetes and anyone who has to contend with voracious appetites and obesity. And last but not least, the plant fibres regulate digestion as roughage and could thus reduce the risk of developing bowel cancer. In short, Nyström is convinced that "Beta-glucan really is a super food component as far as boosting your health is concerned." And compared to other potential vegetable sources, oats contain an especially large amount of this super-substance – around five to eight times as much as rye, for instance.

In other words, your daily dose of Bircher muesli is not a bad idea, the researcher says. The catch is that in order for enough beta-glucan to be absorbed for you to benefit from its full range of effects, you would have to eat a lot of Bircher muesli. Moreover, much depends on how the beta-glucan is processed and prepared, and in which combinations it is absorbed. Preparatory processes such as grinding, baking and cooking have a major influence on its efficacy – "often a negative one," says Laura Nyström. "There is still a lot more detailed research to be done into how and when beta-glucan works."

Meanwhile, we know that beta-glucan needs to be soluble and to exhibit a certain molecular mass to be physiologically active. Combined with water, beta-glucan becomes viscous. Precisely this property ensures that it is unable to pass through the pores of the intestinal walls. The pores are more or less blocked as a result, meaning that less cholesterol can be absorbed via the intestine. However, beta-

glucan loses its cholesterol-lowering properties and viscosity if treated with enzymes. As Laura Nyström and her colleagues discovered, oxidation processes occur during food processing, and it was feared until now that this had a primarily negative impact. Other research, however, suggests that certain forms of oxidation can also broaden the health-enhancing capabilities of beta-glucan. "This opens up a whole new research field," says the scientist.

In other words, it is worth taking a closer look at the seemingly so simple plant fibres. And that is precisely what Nyström and her team are doing. "Of course, we don't cook up any porridge in the lab," she explains. Instead, measurements are taken in test tubes under controlled conditions. Using liquid chromatography and mass spectrometry, the scientists are trying to trace the tiniest of changes at molecular level that are responsible for particular effects – the proverbial search for the needle in a haystack. The beta-glucan molecule often consists of over 10,000 sugar units – a miniscule change here or there can make a huge difference. "And it is these very changes that we are trying to determine for sure," says Nyström. "Thanks to today's highly sensitive methods, we can detect changes that have an impact."

Switzerland was not only a pioneer in things like Bircher muesli; the Swiss were also a driving force behind the recognition of beta-glucan as a health-enhancing additive by the European Food Safety Authority (EFSA) – here a major role was played by the Zug-based company Crea-Nutrition (which today belongs to DSM). Beta-glucan is today recognised by both EFSA and the Swiss Federal Office of Public Health (FOPH), and Swiss supermarkets have been selling corresponding products since 2012: breakfast cereals and various pastries enriched with beta-glucan. These are products that are not everyone's cup of tea, Nyström says, but they are a great help to potential heart and/or diabetes patients or people who have already been diagnosed with such diseases. For her, eating healthily is par for the course and functional food could play a key role in this respect.

Functional Food

Functional food is food with extra additives that are supposed to enhance health. Prime examples are probiotic yoghurts, margarines with plant sterols and products enriched with omega 3 fatty acids. More recent products are beta-glucan from oats and barley.

For a number of years, the European Food Safety Authority (EFSA) has been checking these foods, and health-related advertising claims are only allowed for products that it recognises. Around 80 percent of the food products that make a health claim actually fail to meet its strict requirements, including probiotic foodstuffs. Plant sterols and beta-glucan, however, are currently recognised as health-enhancing by both EFSA and the Swiss Federal Office of Public Health (FOPH).

Healthy thanks to bacteria

For much longer – for over fifteen years, to be precise – consumers have been buying another form of functional food in their supermarkets: so-called probiotic food. The most well-known are yoghurts and yoghurt drinks which have been enhanced with specific bacterial cultures that can have a positive impact on one's health. A digestive effect and a boost to the immune system are just some of the promises they make. However, what is actually so different about these products compared to normal yoghurt, which is also created solely from bacterial cultures? "The products are probiotic if the bacterial cells not only survive yoghurt production and storage, but also gastric juices and digestive processes in the gut, where they take effect," explains Professor Christophe Lacroix, a specialist in functional microorganisms. His food biotechnology group studies bacteria and fungi from food ecosystems to research their role in foodstuffs and their possible effects in the human and animal gut.

Lacroix does not primarily see his specialisation in the production of functional food. "Part of our work is also to find and characterise functional microorganisms that improve the quality, safety and healthiness of high-quality food." Many of his microorganisms primarily help to make food safer and keep for longer.

For instance, lactobacilli and propionibacteria cultures are used to reduce the development of mould in fruit yoghurts or the spread of other microorganisms in cheese or sausage that affect both their quality and our health – and not just to the delight of shop-owners and consumers here in this country, either. Lacroix and his team are also studying the microbial composition of traditional fermented African foodstuffs to make them safer and keep for longer. After all, the road from the field to the kitchen has grown longer in Africa, too.

Complex universe of the bowel

Lacroix is convinced that probiotic bacterial cultures can also make a direct contribution towards health, but only if they are used extremely selectively. And that is easier said than done. After all, the bowel is a universe with billions of microorganisms that are in close contact with the intestinal epithelium cells and have to work together in perfect

harmony in a healthy person. "Adding new elements to this universe can have unfathomable consequences."

For instance, Lacroix teamed up with Michael Zimmermann's Human Nutrition research group at ETH Zurich to look for ways to make the source of iron safer for women and children in Africa, who often suffer from iron deficiency. For studies have revealed that the risk of suffering from diarrhoea for people in areas where diarrhoeal pathogens are more common actually increased if they were given iron supplements. Lacroix and the Human Nutrition group were the first to examine more closely the impact of iron on the microorganisms in the bowels of children in regions of Africa with different hygiene standards. In further tests, they simulated the processes in the gut systematically in the test tube, so-called in-vitro intestinal fermentation models, which they combined with cell models. Studies on rats were then conducted to investigate in more detail the effect of iron on the composition and metabolic activity of the intestinal flora, and to find out how the gut reacts to it. The researchers compared the results with the data from clinical trials conducted in the Ivory Coast, Kenya and South Africa in collaboration with the Human Nutrition group. Consequently, they were able to demonstrate that iron is also a key factor in the production of butyrate in the intestinal flora, an important nutrient for intestinal cells with many cell-regulating functions.

Together with industry, the researchers are now working on a concept as to how babies in Africa can be supplied with iron without giving pathogens a helping hand, too. A combined strategy should guarantee the necessary source of iron while boosting "good" microorganisms that keep the pathogens in check and are able to stabilise the intestinal flora, such as bifidus bacteria. "A special form of functional food, if you like," says Lacroix, "but specifically developed for a highly specified group with precisely defined effects." And it is not intended as food or part of artificial baby milk but rather a supplement to boost intestinal health during treatment with iron preparations.

"Selected probiotic bacterial strains could also be useful to prevent or treat other illnesses," says Lacroix. For instance, his team has been researching a strain of bacteria that has the potential to prevent or alleviate Clostridium difficile infections, a diarrhoeal pathogen that is especially dangerous for the elderly. And they are devising a method to prevent salmonella infections in animals by feeding them special bacteria instead of antibiotics.

The researcher sees potential in such applications. In the event of illness, he would not think twice about supporting selective therapy with specific probiotic bacteria strains if the modes of action are studied scientifically. However, he is horrified by the notion of only seeing food as a mixture of pieced-together functionalities. "Food is also a source of great pleasure!" Special food for people with particular deficiencies is necessary, such as for people with bowel diseases. However, like most healthy normal citizens with a healthy lifestyle, he personally does not really need functional food. "We have got every opportunity to eat healthy, fresh and enjoyable food and I hope that this will also continue to be the case in the future." ■

Laboratory of Food Biochemistry (Laura Nyström):
www.ifnh.ethz.ch/lbc →

Laboratory of Food Biotechnology (Christophe Lacroix):
www.fbt.ethz.ch →

Video (Lacroix Group): Intestinal ecosystem – a model:
www.podcast.ethz.ch/podcast/channels/details?id=791 →

Climate research

Emission sharing

Fabio Bergamin

The extent to which industrial nations and developing countries will still be allowed to use cheap, climate-damaging technologies is hotly debated all over the world. Climate physicists from ETH Zurich furnish politicians with key data to base their decisions upon.

Reto Knutti is a popular expert when it comes to climate predictions. Some time ago, this ETH Zurich professor of climate physics revealed that the greenhouse gas CO_2 does not only influence the climate in the short term, but also for several centuries. And he was involved in the development of computer models that can be used to simulate climate changes and project them into the future.

However, he is not only interested in the search for increasingly comprehensive, accurate and reliable climate models, but also especially in the social dimension of global warming. How can the two-degree target be achieved that the international community has set itself? What amounts of greenhouse gases are we still allowed to emit worldwide? And how can this "emissions cake" be divided up fairly around the globe? With the aid of climate models, Knutti has been studying the various courses of action possible.

Calculating backwards

The size of the emissions cake, for instance, is not all that easy to determine, he says. For like most computer models, the climate models work by calculating effects from causes.

To put it simply, the climate model is a calculator that is fed with population figures, technologies used and the associated greenhouse gas emissions, all of which it uses to work out the temperature and amount of rainfall to be expected.

The question as to the maximum amount of greenhouse gases that the human race may emit to achieve the two-degree target, however, moves in the opposite direction: it aims to infer causes and decisions from the maximum effects tolerated.

Knutti likens the task to piecing together the wreckage of a plane crash. "It is extremely difficult to find the cause of the crash in a field of scattered aircraft debris", he says. "It's physically much easier the other way round, to calculate the flight path of the individual aircraft parts when a plane loses an engine in mid-air." Neither for a plane crash nor for climate modeling is it possible to run the calculator backwards. Instead, the scientists rely on diligence and computational power. For instance, their calculator – the high-speed computer Brutus at ETH Zurich – is run forwards ten thousand times to calculate different emission scenarios. Out of the ten thousand results, they select the ones that fit the two-degree target.

And based upon these, they are able to determine how large the emissions cake is. One figure regarding the size of this cake that is often quoted by experts is one billion tons of carbon dioxide equivalent. This is roughly the same as ten years of emissions from 42,000 coal-fired power stations, each with a power output similar to that of the Gösgen nuclear power plant.

"However, it depends a lot on how sure you want to be," says Knutti. The billion tons of carbon dioxide equivalent apply if you want to achieve the two-degree target with a probability of two thirds. If you want to aim for greater certainty, the emissions have to be limited to a far greater extent.

Half the cake eaten

At a rough estimate, we and the previous generations since the construction of the first coal-fired power stations in the mid-nineteenth century have already given off around half of these emissions. In other words, half the cake has already been eaten.

"The interesting thing now is how to divide up the remaining half fairly," says Knutti. Is it fair to split it equally among all the people in the world? Or should the industrialised countries leave what's left to the developing countries? After all, it was the industrialised nations who emitted the most CO_2 in the past, and they have more of the economic clout necessary to overcome the energy transition. The community of states remains divided over the issue. Burden-sharing is the main bone of contention at every international climate negotiation. Knutti is well aware that it is an ethical question that cannot be answered definitively by science. However, he does admit that climate physics can quantify and compare the effects of the different proposals from the individual countries.

Western Europe needs to cut down

Last year, together with his postdoc Joeri Rogelj and the Zurich-based consultancy firm Infras, Knutti compared different political proposals on burden-sharing. The study clearly reveals that the two-degree target can only be achieved if the industrialised countries reduce their greenhouse gas emissions much more than the developing countries are able to in the short term: Western Europe, for instance, needs to slash its emissions to at least a fifth by 2050 in all the scenarios studied.

The proposals examined also differed greatly from each other. If we wanted to divide up the greenhouse gas emissions per capita equally all over the world for the period from 1990 to 2100, the developing countries would be allowed to continue to emit greenhouse gases at a very high level until around 2050.

The industrialised countries, however, would have to become CO_2-neutral societies by 2035 – thus at an unrealistic speed – and would then have to have a negative CO_2 record for the rest of the century.

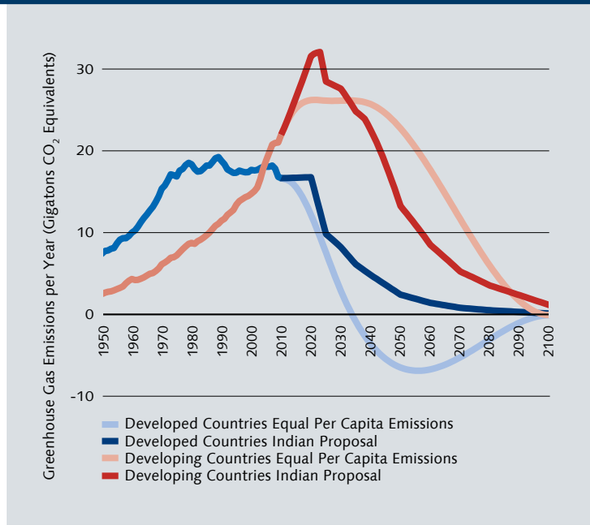
While this would only be possible with the massive use of CO_2-capture and storage (CSS) technologies, these are not yet viable in practice. Alternatively, the industrialised countries would have to buy emissions rights from the developing countries.

In 2008 the Indian government proposed a compromise that takes the historical responsibility of the industrialised countries and their economic clout into account, but is not as radical as the equal per-capita proposal. In their study, the scientists from ETH Zurich show that the developing countries would not have to take immediate action in this scenario, but would need to be just as resolute as the industrialised countries from 2020 onwards.

Hitherto undeveloped CSS technologies would also be pivotal for this if we want to achieve the two-degree target, as Joeri Rogelj has revealed in another study. This is especially the case if electricity is to be produced in future by means other than nuclear power. And what's more, vast areas would have to be reforested all over the world to achieve the target.

Regardless of the burden-sharing, Knutti and Rogelj's climate model calculations show that while there are many scenarios to achieve the two-degree target, they all have one thing in common: politicians need to act as soon and as resolutely as possible. ■

ETH Zurich's climate research:
www.iac.ethz.ch/research/index →



Carbon-fired power stations provide cheap electricity but emit considerable amounts of the greenhouse gas CO2. In order to achieve the two-degree target, industrialised and developing countries need to reduce their greenhouse gas emissions drastically.

The fifth IPCC report

This year and the next, the Intergovernmental Panel on Climate Change (IPCC) will be publishing a new assessment report. The sub-report on the scientific basis is due at the end of September 2013. A number of the main authors are researchers from ETH Zurich. Reto Knutti, a professor of climate physics, is the "coordinating lead author" responsible for the chapter on long-term prognoses, while ETH Zurich professors Jürg Beer, Ulrike Lohmann, Christoph Schär, Konrad Steffen and Martin Wild are also involved in the sub-report as lead authors.

Online exams are booming. In order to accommodate this surge, ETH Zurich is kitting out a lecture theatre with 170 computer stations in the semester break.

Online exams

Pioneering work in the classroom

Roland Baumann

Online exams carry advantages for everyone involved. ETH Zurich is a true pioneer in this field and is constantly expanding its range of services.

It's summertime. Most of us think of holidays and dolce far niente, but for students and lecturers alike it's a time of tension and peak activity, for it's exam time. Last August, ETH Zurich's students demonstrated the skills and knowledge they had acquired in the course of the semester in around 50,000 individual exams. But there was a difference this time: compared to the previous year, almost three times as many students did their exams on a computer.

Efficient test of relevant skills

Doing a written exam on the computer: an opportunity most of us would have jumped at, if computers were even around when we were at university, that is. The advantages are obvious: who hasn't wondered whether their handwriting was legible enough after a written exam? The fact that thoughts can be presented and organised much more clearly on the computer, however, is just one benefit, as Tobias Halbherr explains – he is responsible for online examinations in the Educational Development and Technology (LET) unit. "An exam's most important quality attribute is its validity; in other words, whether it assesses what it is actually supposed to assess. The use of the computer not only makes exams fairer because handwriting can no longer detract from the marks; it also makes them more valid, as online exams greatly simplify the design of suitable exam exercises."

Programming knowledge or mastering complex statistical procedures no longer has to be checked in theory, far removed from practice, such as by compiling handwritten pseudo-codes or answering multiple-choice questions. Instead, the students perform concrete tasks straight into the computer, in a form they can also expect to use later in their professional or research careers. Experts speak of competence-oriented examinations.

Online exams also offer lecturers solid advantages as they can be graded much more efficiently: multiple-choice questions to test a basic grasp of facts and concepts can be corrected automatically and there is no need for any laborious deciphering of handwriting.

If tasks are marked by several examiners or experts, this can also be organised far more easily as exam papers can be forwarded to individuals for marking in one click and cannot get mixed up or lost. "Ultimately, the students also benefit from this administrative streamlining," stresses Halbherr. "The increase in efficiency leaves lecturers more time to assist with exercises, for instance."

International pioneer project

Around 30 online examinations with about 3,500 individual exams were conducted last semester – roughly seven per cent of all session and end-of-semester exams. While this might not initially seem like a lot, it can be regarded as a resounding success given the short amount of time since this option has been available to lecturers. Thomas Piendl, who has been involved in the development from the outset, takes stock: "When we launched the online exam project from scratch in 2007, not only did we have to create the technical basis for it, but also clarify all the legal, didactic and organisational issues."

The biggest challenge was to provide a technically reliable and cheat-proof environment. The centrepiece is the Safe Exam Browser (SEB), an open-source project whose development has been driven to a large degree by ETH Zurich. This secured browser works technically with the leading learning management systems of universities where the exams are conducted. Meanwhile, the browser is being used all over the world, in both universities and the private sector.

Once the technology was ready, the next step was to win over lecturers for pilot projects and draw up an online exam with them.

The first exams were a complete success and soon more and more lecturers got in touch to get in on the act. However, the resources were limited. After all, the computer rooms at ETH Zurich can only accommodate a total of 114 candidates. And the LET team, which offers help and support to the lecturers in putting together and conducting the exams, had also reached its limits. Investment was needed.

Expansion underway

Since last winter a lecture theatre has been kitted out with 170 computer stations in each semester break. Through a clever use of the rooms, this means that courses with over 550 students can now be examined online. At the same time, an expert was appointed a year ago in the form of Tobias Halbherr. After all, the potential is great: "For freehand sketches and writing down mathematical formulae, there is still no satisfactory electronic solution. Apart from that, basically every written exam stands to benefit from the switch to online," says Halbherr.

He sees great potential in third-party applications: "Already today, subject-specific programmes are being used in around half of all online exams, such as Matlab, which enables data to be analysed, algorithms developed and models produced. Other examples are a microscopy software program and an electronic herbarium." With increasing computational power, it will in future be possible to integrate further applications in online exams, such as CAD programs. And the LET is even working on an electronic solution for freehand sketches.

Support across the board

Halbherr and his colleagues advise the lecturers on the technical configuration, organisation and, if requested, on the didactics and marking of exams. They test the exam infrastructure and every single exam, and are also present during the exams themselves in case something goes wrong. Has that ever happened? "There have been a few minor technical hitches on individual computers, but nothing that we couldn't sort out on the spot," reports Halbherr. "Over 100 exams have been conducted so far and there has only been one incident that actually halted an exam – just one week ago, of all times!" The candidates had to retake the exam section in question. "Such retakes are a pain for everyone involved," concedes Halbherr, "but the important thing is that no one is put at an advantage or disadvantage." The concept of an exam repeat is certainly nothing new. In fact, it is all part and parcel of everyday life at the Examination Office with its tens of thousands of exams a year.

The final question is how online exams are received by those affected. "So far, online examiners appreciate the improved possibilities for configuring and conducting exams as well as the simplified processes. Word gets around, which means we are receiving more and more enquiries from lecturers who are interested in this exam form," Halbherr observes with satisfaction. As for the students in the pilot project, they were puzzled by the question. For them, this exam form was absolutely normal. ■

AVETH

"A doctorate develops your personality"

Lars Büthe is the new president of the Academic Association of Scientific Staff at ETH Zurich (AVETH). The association represents the interests of doctoral students, assistants and postdocs in university politics while encouraging networking among the scientific staff by organising a range of job-related and social events.

Interview: Florian Meyer

In June the Academic Association of Scientific Staff at ETH Zurich (AVETH) elected Lars Büthe as its new president. The 27-year-old German electrical engineer spoke to Globe about ETH Zurich's culture, about integration and the value of teaching.

Lars Büthe, you have been a doctoral student in the Electronics Laboratory for about a year now. Before that, you did a degree in mechatronics at the University of Erlangen-Nuremberg. What made you come to ETH Zurich?

One major factor was ETH Zurich's international reputation. Another was curiosity – I wanted to see something new. During the interview with Gerhard Tröster, the head of the institute, I soon realised that we had a similar grasp of how to approach a research project. Working as a doctoral student, I also have a great deal of independence and freedom in my choice of topic at ETH Zurich.

Your impressions of ETH Zurich are still fresh. What typifies the university for you?

ETH Zurich is very well structured and organised. The ratio of staff to doctoral students is decent here and, compared to other universities, ETH Zurich has substantial financial resources. And another thing I've noticed, but I'm not sure if it's typical of ETH Zurich or Switzerland…

What's that?

The amount of say you have here is much greater. On the university committees the professors, scientific staff, students and other staff members all discuss things on an equal footing. On the committees I know from Germany, your involvement depends very much on hierarchy. To put it bluntly, there might be twenty professors together with one student and one member of the remaining staff. What else can they do but nod in agreement?

What are the main points you aim to focus on as AVETH president?

Promoting young talent remains a priority for us. Both postdocs and doctoral students should receive more support in their career development and know what alternatives the university can offer them to a career in the private sector.

You mentioned the good staff-student ratio. What is your stance on the issue of whether doctoral students should be involved in teaching?

Personally, I think it's a good thing that doctoral students have to take on some teaching responsibilities. The way I see it, a doctorate is not only a research-based education but also an opportunity to develop your personality. Anyone who is actively involved in teaching can learn a lot about communication in particular.

Why?

If I run a team of tutorial assistants, that's personnel management. This qualification stands me in good stead if I apply in the private sector – perhaps just as much as great research results.

What are your teaching responsibilities?

Together with a colleague, I supervise a practical course with around 220 students. We have totally revamped it and given the experiments on digital circuitry a complete makeover. It has taught me how to organise myself during the doctorate, and also how to approach the students and communicate with them. For me, that's something that makes teaching worthwhile.

Does supervising the students leave you enough time for your doctoral thesis, though?

I can't speak for all the institutes and departments, of course, but this was certainly a reason for me to join ETH Zurich: the balance between teaching and research is just right here. ■

Connected

Scientifica

Zurich celebrates science

Already a week before Scientifica, flags in the centre of Zurich heralded the ETH Zurich and University of Zurich Science Days. And the theme of "Risk" also drew the broader public: well over 20,000 visitors flocked to the main building and the Polyterrasse to experience research at first hand.

International physics competition

Success for Swiss school students

At the 26th International Young Physicist Tournament in Taiwan, Swiss school students finished in a sensational third place behind the teams from Korea and Singapore. The Swiss team, comprising (2nd from left) Eric Schertenleib (Captain), Patrick Meister, Laura Guerrini, Alex Vanstonen and Florian Koch, together with team leader Daniel Keller (far right), was accompanied by the two physics teachers Samuel Byland and Daniel Keller and ETH Zurich professor Andreas Vaterlaus. The pupils come from the Rämibühl High School for Maths and Natural Sciences in Zurich and the Zurich International School.

Sustainable cities

Summer school in Singapore

What will sustainable cities of the future look like? The ETH Zurich Sustainability Summer School 2013 offered an opportunity to discuss this question in unique groups of students and experts from different disciplines, and to flesh out concrete proposals for solutions together. The programme was held at ETH Zurich's Future Cities Lab in Singapore.

Rössler Prize 2013

Hot on the trail of small RNA molecules

At the "Thanksgiving" event organised by the ETH Zurich Foundation, sponsor Max Rössler (left) presented the Rössler Prize to winner Olivier Voinnet, a professor of RNA biology at the Department of Biology. The laudatory speech was given by ETH President Ralph Eichler (right). With his research team, Voinnet studies functions of small interfering RNA molecules in the regulation of vital processes such as immune response. His research has yielded ground-breaking results that have turned scientific dogmas on their heads.

Chemical engineering

Medal for energy expert

The first ETH Zurich Chemical Engineering Medal goes to the renowned energy expert and Max Planck Director, Professor Ferdi Schüth (right). Professor Javier Pérez-Ramirez (left), the head of the ETH Zurich Institute for Chemical and Bioengineering, presented him with the award for his pioneering contributions to materials chemistry, heterogeneous catalysis and energy research. From now on, the medal is to be awarded annually.

ETH Zurich alumnus Christoph Regli

Bitten by the flying bug

Felix Würsten

Christoph Regli has flown many aircraft in his time, from homemade model aircraft to large cargo planes and military drones. This is all experience that stands him in good stead today when giving students at the Zurich University of Applied Sciences (ZHAW) a glimpse into the secrets of aviation.

Regli discovered his fascination with flying as a young student at ETH Zurich. This budding computer scientist, who liked to cut a daring figure diving from the high board in his spare time, began to build his own model aircraft – which, much to his dismay, he usually ended up crashing before too long. Despite these aeronautical mishaps, aviation had him firmly in its clutches. And so, after his second intermediate diploma in Canada, he decided to do a four-week intensive course to obtain a pilot licence. From then on, this meant that he could fly private flights over the Alps while continuing his degree studies.

However, it was only once he had completed his computer science degree at ETH Zurich that he began his training to become first a professional pilot, then an airline pilot allowed to fly large machines. "I'm glad I learnt something else other than merely obtaining my pilot licence," he says in retrospect. Today, as head of the aviation degree programme at the Zurich University of Applied Sciences (ZHAW) in Winterthur, he repeatedly hammers it home to his students that they should not just bank on becoming a pilot, but should rather add a second string to their bow. "Otherwise it can become difficult to find another job, if suddenly you are no longer allowed to fly for health reasons or if your company is grounded."

After obtaining his degree, Regli's first job was as a software engineer at the company Esec. However, as soon as he had acquired the necessary licences he pursued his passion and moved to Crossair, where he flew Saab 340 and Embraer 145 aircraft. He experienced the turbulent times at first hand when Crossair transformed into the new Swiss after Swissair was grounded. "It wasn't an easy time because there was a lot of tension between the pilot corps." Although Regli himself largely managed to keep out of the turf war, he was headhunted by Lufthansa, which needed pilots for its cargo company. "At last, this meant I could fly long-haul flights."

> "I always advise my students not to just bank on becoming a pilot."
> Christoph Regli

This career detour also taught him a lot from an administrative perspective. After all, he was still employed by Swiss, not Lufthansa, which had "loaned" him to the German airline via a recruitment agency. "My salary was in euros, my business expenses in Swiss francs and any overtime paid out in deutschmarks" he says, looking back. When he had to return to Swiss and short-haul flights after a year, he opted for another career change – not least out of consideration for his young family, which had had to contend with his long absences.

Not an easy decision, he admits. He still thinks about that period with a certain sense of nostalgia, even if he realises that the working conditions have since deterio-

Christoph Regli looks back with a certain sense of nostalgia on the time when he was allowed to fly long haul for Lufthansa.

Profile

rated for pilots. Not only do they have to complete more flying hours now; they increasingly have to comply with more regulations. "The fact that you are no longer allowed to leave the cockpit door open is a great pity as you hardly have any contact with the passengers as a pilot any more," says Regli.

After leaving Swiss, he sought a new job as a computer scientist, well aware of ETH Zurich's excellent reputation on the job market. Although he had not worked in the profession for five years and had only written smaller programmes for other pilots as a sideline for them to use on the mobile device "Palm", he immediately found an exciting position at the company Zühlke Engineering.

He was planning to stay there for longer, too – until 18 months later he stumbled across a job ad for the Federal Office of Civil Aviation (FOCA), which was looking for an expert in both aviation and computer science. Once again, Regli decided on a career change – and to his surprise was not greeted by the calm, unassuming authority he had been expecting in Berne, but by a dynamic office that constantly has to face up to fresh challenges. He initially joined the FOCA as a project leader in charge of monitoring the use of software in flight safety. After a year or so, however, he was promoted to section leader for flight safety and thus took on line responsibility for the first time (apart from his experiences as a military officer).

> "It's a pity that you hardly have any contact with the passengers as a pilot any more."
>
> Christoph Regli

Then, just as he had more or less settled into his new role and the workload had assumed more normal proportions, he was offered another job. One of his colleagues, a student at ZHAW who had just completed an internship at the FOCA, told him that the university in Winterthur was on the lookout for a new degree programme head and that he, Regli, would be perfect for the position. Sure enough, with his vast and varied experience, who could be better qualified than Regli to run a degree that teaches such a broad range of specialist knowledge?

However, anyone who wants to train as an aviation specialist in Winterthur needs to bring more to the table than merely a love of aeroplanes. "We train engineers here, which means our students also have to bone up on mathematics and physics." Regli especially finds the practical side of the programme exciting. "The students can also obtain a pilot licence at the same time," he says, "which means you can come out of the degree with two qualifications in three years." For this reason alone, ZHAW attracts many students who are looking to go on to work as pilots for Swiss. "Incidentally, we also enjoy close ties with the Swiss Air Force as it is mandatory for all professional air force pilots to have the Bachelor degree in aviation from Winterthur," explains Regli before adding with visible pride: "The German Armed Forces send budding air force pilots to our degree programme now, too."

He himself only manages to fly privately nowadays. "I have completed all the further training in the flight simulator and could work as a pilot again in principle. However, no airline would hire an old codger like me anymore!" That said, he still manages to chalk up some flight time in another field: as an air force pilot he is allowed to fly drones for the Swiss Army. "These aircraft are the future," he explains. As a drone pilot he is now gaining experience at the cutting edge of technology. This stands him in good stead, not just when he needs to refocus the degree course strategically as its programme head, but also when he trains young students himself as a lecturer.

Meanwhile, he says, both of his sons, who are eight and ten years old, are also hopelessly smitten with flying. They are always eager to help their father get everything shipshape for their private flights. "They both want to become pilots one day", he chuckles. "But I really hope that they also learn another decent profession as a backup." ■

About the person

Christoph Regli studied computer science at ETH Zurich and shortly afterwards worked as an airline pilot for five years. After a short foray into the world of computer science, he then became a project leader and subsequently section leader at the Federal Office of Civil Aviation. He has been running the aviation degree at the Zurich University of Applied Sciences in Winterthur since the autumn of 2011.

Anno

The advancement of women today: with its taster courses, the Department of Computer Science is looking to bring more female students to ETH Zurich.

1993

From changing tables to a top priority

Christine Heidemann

For the last twenty years, ETH Zurich has actively championed equal opportunities for women and men. While it was initially about very basic things such as baby-changing tables in public restrooms, nowadays the idea of equality resonates through all walks of life at the university. However, there is still plenty of work to be done.

The letter was bright yellow. The president mustn't fail to notice it. After all, women had gone unnoticed at ETH Zurich for long enough. For instance, there were only three female full professors at the university in 1990 – out of a total of around 300. It was high time something was done about it. From that moment onwards, Katharina von Salis, a dedicated advocate of women's rights, knew she had to take a stand on equal rights for men and women at ETH Zurich. So she wrote to the then President, Jakob Nüesch, asking him to meet her in person. Shortly afterwards, he pledged his support. That very same evening, von Salis – at the time a senior assistant and later an adjunct professor at the Geological Institute – decided to set up a women's contact point. That was in June 1991. Sixteen years later she was awarded the prestigious Ida Somazzi Prize for her tremendous services to the advancement of women at ETH Zurich and other Swiss universities.

However, the road there was long and arduous, the biggest milestone being the official founding of the Office of Equal Opportunities for Women and Men (SCG) at ETH Zurich on 1 October 1993. Silvia Wyler became the university's first equal opportunities officer, with von Salis standing by with advice and support. Together with various internal workgroups, the two of them compiled a comprehensive "Furtherance Programme 1996–1999" offering numerous measures for the betterment of women at ETH Zurich.

In 2008 the SCG was renamed "Equal – Office of Equal Opportunities for Women and Men." Nonetheless, its goal remains the same – even if a lot has happened since its foundation in 1993, as is confirmed by Renate Schubert, a professor of national economics and the incumbent ETH Zurich President's Delegate for Equal Opportunities.

Three waves of equality

"Equality at ETH Zurich has effectively come in three waves." It began with basic things such as baby-changing tables in restrooms, crèches and flexible working hours. Then the priority was bringing more female scientists to ETH Zurich. "And now, in the third wave, it is all about concrete, content-related issues, such as designing curricula in such a way as to make them more attractive for women than in the past," says Schubert.

When she looks back over the last twenty years, she feels somewhat "torn", as she puts it: on the one hand, it is a pity that the office is still necessary after such a long period of time – in other words, the problem has not yet been solved. On the other hand, twenty years is not all that long: "We should have started promoting women at ETH Zurich much earlier."

That said, nowadays ETH Zurich is not doing badly in terms of equality. Since Equal was incorporated into the President's Office in 2007 and thus declared a major priority at management level, the amount of attention it has attracted has increased. "Suddenly, we were no longer simply the ones responsible for the changing tables." Schubert also welcomes the fact that the position of gender delegate is held by someone – male or female – at the level of professor. As a result, the equal opportunities officer is closer to the professors who, as she puts it, "find it easier to communicate with people on the same level in the hierarchy if they have problems." This economist had already campaigned for women's issues in Germany during her postdoctoral degree at Darmstadt University of Technology. For instance, she organised various events and research projects on "women in economics". And she also wrote a book entitled Ökonomische Diskriminierung von Frauen – eine volkswirtschaftliche Verschwendung ("The Economic Discrimination of Women – an Economic Waste"). After all, it is economically unwise for companies to ignore the potential women offer. "We now know from various studies that teams composed of men and women achieve far more innovative results than purely single-gender teams."

A pioneer in gender-monitoring

How well ETH Zurich is doing in terms of equality has also been laid down in black and white since 2010 in the annual gender-monitoring report. This provides information on how many women hold which positions in the various departments, from the students to the staff and professors. Only very few universities boast this kind of monitoring, making ETH Zurich a pioneer in the field.

"On the one hand, gender-monitoring serves as a control instrument to check the strategic equality goals that have been set at ETH Zurich. On the other hand, it provides the data basis to gain more leverage to promote young female talent more effectively, to observe changes in the equality situation at ETH Zurich and to respond to them in future", explains the equal opportunities officer.

The report is published every October. Last year it revealed a very welcome trend: at least 60 percent of all assistant professorships at ETH Zurich are now held by women. It is a different story at professorial level, however. "Too many women still get lost by the academic wayside," says Renate Schubert. This so-called "leaky pipeline", the loss of women especially after their doctorate, must be fixed. "We want to make sure that the proportion of women, whether students or professors, is higher than in the past."

Renate Schubert, the President's Delegate for Equal Opportunities at ETH Zurich.

And the key is to start early: "In the next few years, we especially want to make the curricula more attractive for women and to pay greater attention towards including gender aspects in research projects." The new Department of Health Science and Technology (D-HEST) is a flagship in this respect, combining basic scientific and technical knowhow with issues of applied science. "Women especially find these issues interesting. Women want to solve problems that people have," Schubert says.

However, the growing percentage of women, the professor concedes, is making some male colleagues nervous. They believe that the quality of ETH Zurich could suffer under too much female power. Consequently, Equal still has its work cut out to convince them. It should be noted that Equal is an equal opportunities office for men, too. This autumn, for instance, the seminar "Fatherhood and a career" will be held for the second time. So here's to another twenty years of Equal? "Hopefully not," laughs Schubert. "But there will be a need for the office for some time yet." ■

"Equal" in numbers

June 1991: Katharina von Salis establishes the first women's contact point for women at ETH Zurich.

October 1993: The Office of Equal Opportunities for Women and Men (SCG) is founded, with Silvia Wyler as the first equal opportunities officer and Katharina von Salis as an advisor.

August 2000–December 2005: Brigitte Manz-Brunner and Carla Zingg run the office on a job-sharing basis.

May 2006–August 2008: Luzia Lehman and Carla Zingg take over the helm.

Late 2007: The office is anchored in the President's Office of ETH Zurich.

Late 2008: Renamed "Equal – Office of Equal Opportunities for Women and Men" with Renate Schubert as the new ETH Zurich President's Delegate for Equal Opportunities.

ETH alumni also now have their own local chapter in the former British Crown Colony of Hong Kong

International Chapters

Global presence

Felix Würsten

The goals pursued by ETH alumni international chapters are to facilitate contacts amongst alumni on a local level, to nurture contacts with ETH Zurich and to actively seek interaction with other alumni organisations. Several new chapters have been set up abroad in recent months. This strengthens the presence of the ETH Alumni Association in locations that are important for ETH Zurich as well.

Two ETH students staged the biggest attraction in the Central Park Zoo in New York. They enthralled guests at the Swiss National Day celebrations with their Ballbot "Rezero", a robot that moves around not on wheels but on a single ball.

They developed this futuristic-looking device in a focus project together with fellow students. The young scientists had been invited by the ETH Alumni Chapter of New York to its very first big event.

Strong US presence

The New York Chapter is the most recent addition to the ranks of ETH alumni in the USA. The successful establishment of new chapters in the Bay area around San Francisco and in Boston was followed by the launching of the third US group in New York at the end of April. It aims to promote networking amongst alumni. The establishment of the new US Chapter had originally been scheduled for October 2012.

But Hurricane Sandy caused serious devastation in greater New York and that put an end for the time being to the alumni's plans. The second time round they were more successful. In the presence of Ambassador François Barras and ETH President Ralph Eichler, the two board members Anna Torriani und Werner Kaufmann welcomed over 60 alumni and guests to the founding ceremony at the Swiss Consulate. The fact that representatives of the alumni organisations of Yale, MIT and EPFL were also in attendance was particularly pleasing. "The new US Chapter would like to cooperate closely with these associations in the future and to stage joint events", explains Daniel Schaufelberger, Head of Relations of ETH Alumni North America.

The New York Chapter joins a whole series of new alumni groups that have been established abroad in recent months. Not just in North America, where ETH alumni now have a Head of Relations in Daniel Schaufelberger, who is responsible for coordinating activities on a national level. In South America, too, there is an association of former students of ETH Zurich. Under the guidance of Christian Holzmeister, a new chapter was also founded in early 2013 in the Brazilian metropolis of São Paulo. So ETH graduates now have contacts in Latin America, too, with whom they can get in touch as the need arises.

Networking as a goal

Networking with other ETH graduates is very important for the international alumni groups. Anyone who has studied at ETH Zurich and is now living and working abroad will find that the international chapters offer an ideal platform to engage with other alumni – be it to broaden a business network or build up personal relations.

This social aspect plays a key role for alumni groups in the Far East, too. ETH alumni have been active there for many years in the important locations of Singapore, Shanghai, Beijing and Tokyo. This summer their ranks were swelled by two more metropolises. In Hong Kong a new chapter was established in February. Ulrich Geissler, who was actively involved in the founding of the new chapter, explains that "our goal is to promote relations between ETH Zurich and its alumni here in Asia, and to foster an exchange with partners in this region that is surging ahead economically."

The Hong Kong Chapter, too, is keen to make contact with other alumni organisations, for instance with alumni from the University of Zurich or the University of St. Gallen. A second new chapter in Asia, founded in April, has secured ETH alumni access to yet another, economically attractive country: with its Seoul Chapter, the association of former students is now represented in South Korea.

Last but not least, the network of ETH graduates enlarged its ranks in Germany, too, this summer. The German country grouping had already been set up as a supra-regional chapter a few years ago. Over the course of time, however, it emerged that alumni in Germany are interested in an exchange not only on the national but also on the local level. That's why two further chapters have been established to facilitate the nurturing of local contacts.

In June, more than 40 ETH alumni in Munich raised their glasses to toast the new alumni chapter in Bavaria. The founding members were quick to forge a link to ongoing research at ETH. Prior to the festivities, two particle physicists reported in stimulating presentations about the complicated search for the Higgs boson, in which scientists from ETH Zurich are also playing a decisive role. Finally, the series of new national groups was rounded off by a second German group. At the beginning of September another local chapter was launched in Frankfurt am Main.

This means that ETH graduates in this region also have a stimulating platform where they can engage in regular interaction and share experiences with like-minded people. ■

Find out more about the alumni chapters at:
www.alumni.ethz.ch/association/country_groups →

A successful advertising campaign

ETH Alumni has demonstrated an impressive dynamic, not just on the international level. In Switzerland, too, the network of alumni is steadily growing. Only recently, a new specialist group for computer-aided sciences was founded. It brings together the graduates from this discipline and enlarges the existing range of specialist groups. The Alumni Association of ETH Zurich now has more than 17 associations and groups that facilitate a direct exchange within the same discipline.

It is not only the new groups that are developing in a positive manner. The same is also true of the existing groups. An advertising campaign aimed at graduates in greater Zurich drew their attention to the alumni offerings. The local group in Zurich succeeded in attracting 300 new members. This important alumni grouping now represents over 1,500 graduates.

Alumni life

Agenda

Alumni business events

Urs Rohner
Chairman of the Board of Directors at Credit Suisse
11 November 2013

Networking aperitif from 5:30 p.m. Event begins at 6:45 p.m.
ETH Zurich, main building, Dozentenfoyer
Register at:
www.alumni.ethz.ch →

Alumni events

Literature brunch
Reading by Lukas Hartmann
22 September 2013, 10:00 a.m.
ETH Zurich, main building, Dozentenfoyer

Leading, delegating and motivating
Careers training with Gerhard W. Grieb
11 October 2013, 8:30 a.m.–5 p.m.
ETH Alumni Pavilion

ETH Alumni MBA Event 2013
Information on MBA providers, straight from the horse's mouth
7 November 2013, 7 p.m.
ETH Zurich, main building, Dozentenfoyer

Personal skills management
Careers seminar with Prof. Barbara Sieber-Suter
8 November 2013, 8:30 a.m.–4 p.m.
ETH Alumni Pavilion

Power and leadership
Careers training with Thomas Nast
19 November 2013, 8:30 a.m.–5 p.m.
ETH Alumni Pavilion

The Bernese author Lukas Hartmann has regularly featured on the Swiss bestseller lists with his books. On 22 September 2013 he will be reading extracts from his works at the alumni literature brunch.

An alumni's insight into …
… working in the consumer goods industry
26 November 2013, 6:30 p.m.–8 p.m.
ETH Alumni Pavilion

Exhibitions

"Eher fahre ich in die Hölle als in die Ehe„
Special exhibition to mark the 60th anniversary of the first performance of Max Frisch's play "Don Juan oder Die Liebe zur Geometrie"
Until 31 October 2013
Max Frisch Archive,
ETH Zurich, main building, H floor
www.mfa.ethz.ch →

Earth in Our Sights
Observing Earth from space
Touring exhibition on new methods and findings from remote sensing satellites
10 June 2013–23 February 2014
FocusTerra, Sonneggstrasse 5, Zurich
www.focusterra.ethz.ch →

Shadow Journeys
Etchings by Peter Bräuninger
21 August–18 October 2013
Collection of Prints and Drawings
ETH Zurich, main building, E53
www.gs.ethz.ch →

Alumni Symphony Orchestra

15th concert, autumn 2013

Johannes Brahms (1833–1897)
Piano Concerto No.1 in d minor, op. 15

Jean Sibelius (1865–1957)
Symphony No.1 in e minor, op. 39

4 October 2013, 7:30 p.m.
Dreispitz, Kreuzlingen
6 October 2013, 7:30 p.m.
Zurich Tonhalle, great hall
www.alumniorchester.ch →

ETH Zurich round table on climate

What conclusions can we draw from the UN climate report 2013? Where is climate research going? How is its acceptance in society and among politicians? What about its implementation? At the event "ETH Klimarunde 2013", researchers open the doors to the ivory tower and offer a glimpse into the origins and discussion of the UN report.

3 October 2013, 3:30 p.m.–7 p.m.,
ETH Zurich, main building
www.c2sm.ethz.ch/klimarunde2013 →

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