PANORAMA 014

ANNUAL REPORT

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

PANORAMA 2014

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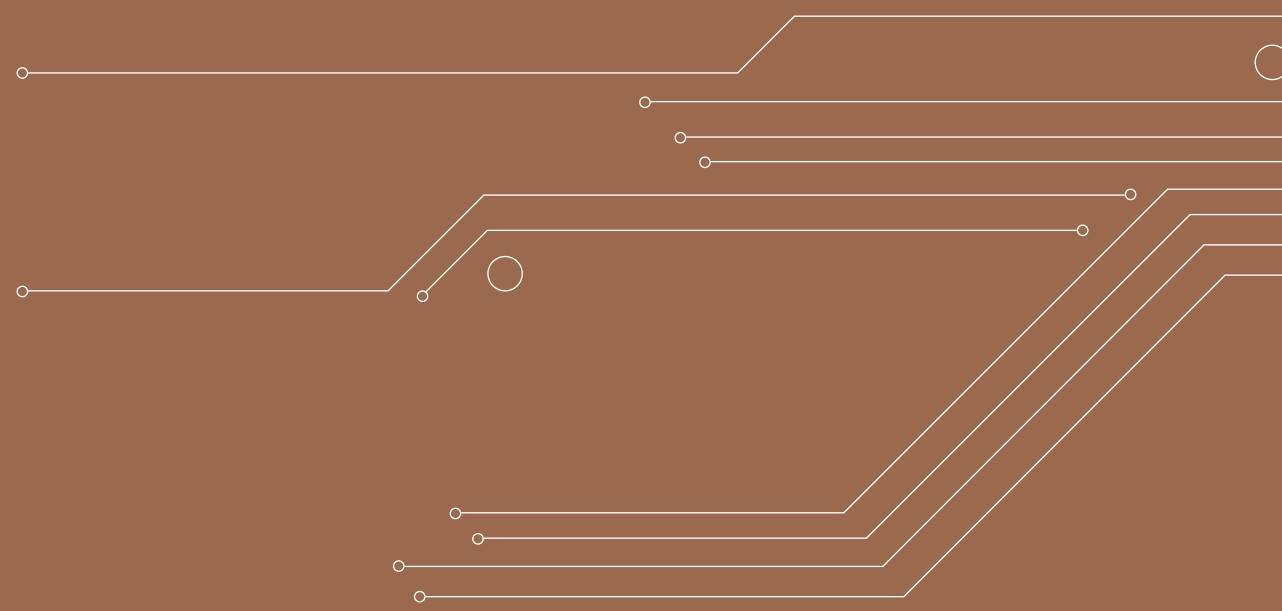


A WORD FROM THE PRESIDENT

PATRICK AEBISCHER
President

2014 was a banner year for EPFL. The School's 10,000 students were joined by several hundred thousand individuals from around the world who signed up for one or more of EPFL's MOOCs. This new teaching tool is one component of the digital revolution that's taking place in higher education, a revolution in which EPFL is playing a pioneering role in Europe. This visibility is furthered by EPFL's remarkable progression in international rankings; the School is now recognized as one of the world's best institutions. From a research perspective, this excellence is illustrated by the number of articles published in the world's most prestigious scientific journals, as well as our researchers' ability to secure competitive grant funding at both the Swiss and European level. 2014 was also a record year for innovation and technology transfer; our start-ups won numerous awards and raised some 220 million Swiss francs in investment funding. The backdrop for this is EPFL's Innovation Park, home to 14 companies and more than 110 start-ups, a veritable innovation machine that is connected to the development of EPFL's regional campuses in the Cantons of Fribourg, Geneva, Valais and Neuchâtel. EPFL is now a multi-site institution, firmly planted in the heart of an open and dynamic region.

But 2014 was also a year of contrasts. The results of a Federal vote raised a number of fundamental questions regarding both this openness and the source of Switzerland's strength. These are times of uncertainty, but also of opportunity, for projects and new interactions in a world that remains resolutely global. EPFL intends to continue to move forward and develop in this context, ever conscious of the responsibility it bears to its region and country, taking on a leadership role for the benefit of society and future generations. This commitment and momentum are reflected in the pages of the annual report you hold in your hands. It's an annual retrospective and a message that's turned firmly towards the future. I wish you happy reading.

PHILIPPE GILLET
Vice-President for Academic Affairs

KARL ABERER
Vice-President for Information Systems

TEACHING

ANTICIPATING FUTURE CHALLENGES IN EDUCATION

Teaching, like research, is continually evolving, and it's an area in which innovation is extremely important. Times change, and teaching methods do as well. There are major shifts taking place in university education, and it is important to anticipate, encourage, and above all not suffer from them. We live in a global world, and problems we are confronting affect every person on the planet. Science and technology are called upon to come up with solutions, but they cannot do this effectively without strengthening ties with society as a whole. With this in mind, last year we launched a series of global issues courses; they have been taught for two consecutive years to nearly 1,800 first year students. The goal is simple: to teach, raise awareness, and think about issues from a global perspective.

Creativity and the imagination are also sparked through practical work. The Discovery Learning Labs are the physical outcome of a lengthy reflection on the subject. We are putting in place new laboratory infrastructures that will serve as platforms of exchange between students from different disciplines, labs for coursework, and prototyping workshops. The Discovery Learning Labs will give our students the opportunity to do hands-on work and test for themselves the principles they have learned in the lecture hall or online courses.

University education in developing countries is one of the global issues of our time. Our "MOOCs for Africa" initiative is an effort to take advantage of the dynamic and accessibility of online education to help students on campuses in these countries to benefit as much as we do from new educational tools. This is a way in which EPFL can contribute to the modernization and development of universities in Africa, so that they can better serve the higher and continuing education needs of local populations. This program includes pedagogical instruction, collaborative development of MOOCs and Internet connection for partner campuses.

Educating young people is part of daily life at EPFL, but it is critical that we look to the long term in order to prepare for what the future holds in engineering, architecture and science education. This also involves reaching out to secondary school students to encourage them to acquire the skills and knowledge that will be expected of them by employers and research laboratories. A working group led by Vice Provost for Education Pierre Vandergheynst is focusing on these issues that are vital for a world-renowned university institution.

DISCOVERY
LEARNING LABS

BOOSTING LABORATORY INSTRUCTION

THE GOAL OF THE DISCOVERY LEARNING LABS IS TO DEVELOP A FULL COMPLEMENT OF LABORATORY SESSIONS THAT WILL PROVIDE STUDENTS WITH A MORE COMPLETE EDUCATIONAL EXPERIENCE AND ENCOURAGE DIALOG BETWEEN DIFFERENT DISCIPLINES.

With the Discovery Learning Labs, EPFL aims to allow students to conduct labwork in state-of-the art lab spaces and put the theoretical knowledge they have acquired to the test via experiments and projects. And because no problem is 100% chemistry or 100% physics, the Discovery Learning Labs also have the goal of challenging students with complex problems and interdisciplinary projects similar to those they are likely to encounter in the professional world.

The Discovery Learning Labs are the outcome of a lengthy inquiry involving many of the School's key actors that sought to find solutions for the lack of time and space available for lab sessions in EPFL's educational offering. The project will take the next step in 2016 with the inauguration of a new Mechanical Engineering building that will include dedicated student lab session rooms. The building itself will be equipped with measurement systems, allowing students to conduct real-time experiments on the flow of users and consumption of resources.

IMPROVING ENGINEERING SKILLS BY BUILDING ROBOTS

THE SCHOOL OF ENGINEERING IS OFFERING ITS MASTER'S STUDENTS A SEMESTER PROJECT IN WHICH THEY MUST DEAL WITH THE REALITIES OF WORKING AS PART OF A GROUP. FIVE MULTIDISCIPLINARY TEAMS BUILD ROBOTS THAT COMPETE IN A FINAL TOURNAMENT.

The three-person teams must create a robot that can collect empty plastic bottles scattered on the ground. In an end-of-the-semester competition the best thought-out robot wins the day.

The game seems easy at first perusal, but putting one's knowledge to work in a joint interdisciplinary project is not always straightforward. Issues such as communication, time management, and differences in skills often arise. This is a foretaste of what students will learn to deal with in the professional world. The stakes are the same: understand how to establish a timeline for a project, respect deadlines, manage a budget and take into account all the aspects of the problem.

In this semester project, students come for the first time face to face with the difficulty of carrying a project to completion, from an initial idea to the final product. They must learn to work as part of a group, an exercise they may not be accustomed to. To add to the challenge, their teammates may be from different disciplines, as the teams are composed of students from mechanical engineering, electrical engineering and microengineering. An effort at communication thus becomes critical in carrying out a successful collaboration.

The project culminates in a friendly competition in which the robots perform in a 64 m^2 arena. A final moment of fun after four months of hard work.

▶ YOUTUBE.COM/EPFLNEWS

HOW CAN SENSORS BE PUT INTO A ONE-MILLIMETER-DIAMETER TUBE?

"LAB IN A TUBE" IS AN APPLIED RESEARCH PROJECT FOR MASTER'S STUDENTS. IN ONE SEMESTER THEY HAVE TO DESIGN A MICROSENSOR AND INCORPORATE IT INTO A TUBE THE SIZE OF A CATHETER. IT'S A UNIQUE OPPORTUNITY TO TAKE AN IDEA ALL THE WAY FROM PAPER TO REALITY.

The students come from materials science, electrical engineering, and biotechnology; some are studying engineering and others are enrolled in the life sciences; but they have one thing in common: they've all come together around a semester project that requires the skills and knowledge of every participant. They must design and build temperature and flow microsensors that are small enough to be inserted into a catheter.

The challenge of the project is not just miniaturizing the sensors and conducting the project from start to finish. Students must also learn to work as part of a group, manage available time and rapidly incorporate knowledge that they might not have been introduced to in the classroom. It's a valuable lesson, since situations like this often occur in academic research and industry.

Multidisciplinary teams of three students must select their materials, build the sensors in clean rooms, develop an electronic interface and install it on a flexible substrate. This semester project is a far cry from traditional projects, because it lets students tackle the entire thing on their own, from design to implementation. The teams have four months to present their innovative solutions – veritable mini-labs in a tube.

NEW GLOBAL ISSUES COURSES: AN INTRODUCTION TO INTERDISCIPLINARITY

THIS YEAR, ALL 1,800 PREPARATORY YEAR STUDENTS ENROLLED IN A SERIES OF NEW GLOBAL ISSUES COURSES. THE GOAL IS TO RAISE STUDENTS' AWARENESS OF CURRENT GLOBAL CHALLENGES VIA A NOVEL FORM OF INTERDISCIPLINARY TEACHING THAT COMBINES ENGINEERING AND THE SOCIAL SCIENCES.

Global issues are unique, because solving them is beyond the scope of any given country or organization. Climate change, epidemics and poverty are problems whose solutions require a coordinated scientific, technological, political and social response at the global level.

Classroom lectures were given by two instructors: one in the social sciences (UNIL) and one in engineering (EPFL). Using online educational materials, students acquired the skills needed to create and then present, as part of a group, a scientific poster. Understanding how to map out a project, sketch a socio-technical solution to a problem and work as part of a team are skills that will stand the students in good stead as they continue their education and enter the professional world.

COMPANIES ATTEST: INTERNS ARE WORTH THEIR WEIGHT IN GOLD

EVERY YEAR, HUNDREDS OF EPFL STUDENTS DO INTERNSHIPS IN COMPANIES AS PART OF THEIR GRADUATION REQUIREMENT. IT'S A WIN-WIN SITUATION FOR BOTH THE INTERNS AND THE COMPANIES THEY WORK FOR.

Companies don't hesitate to hire EPFL interns; far from being passive employees, students have proven to be valuable sources of creativity. From their perspective on the margins of the daily dynamics of the company, interns can bring a fresh viewpoint, sometimes unrealistic, but often one that leads to the discovery of an innovative solution.

Companies provide EPFL students with their first significant professional experience, which can then form the foundation of their curriculum vitae. In return, the companies benefit from this influx of freshly-educated gray matter. A successful internship encourages students to invest more energy into their studies. They are also often motivated by the opportunity to get a taste of the professional world, to begin the process of building up their resumés, and sometimes even landing their first job.

SEMESTER PROJECTS: STUDENTS GIVE RESEARCH A TRY

SMARTPHONES TACKLE A CRYPTOGRAPHIC SYSTEM

During her master's project in Computer Science, Ramasamy Gowthami helped create an Android app that connected a network of thousands of smartphones, allowing their users to join forces to test the security level of a current cryptographic code. Every system has a flaw that emerges after enough time has passed. This is why it's important to continually test and assess their limitations. Systems can be adjusted if they are no longer reliable, a task that is equally important as designing new and better systems.

RECYCLING HEAT TO BOOST POWER UNDER THE HOOD

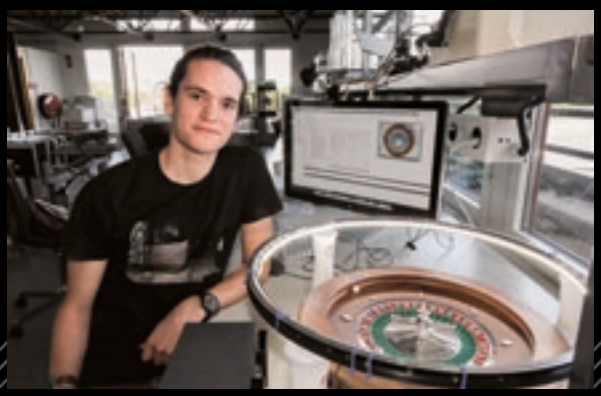
Despite the efforts of automobile manufacturers, nearly 70% of a typical car's fuel consumption is dissipated as heat into the environment. The temperature of this residual heat is too low for it to be converted usefully. For his semester project in Mechanical Engineering, Eliott Guenat studied the best way to recover it. The challenge was to be able to place heat exchangers and use microturbomachines. He showed that the heat could be recycled to reduce fuel consumption by between a quarter and a third.

SHIPBREAKING AND THE LIFE CYCLE OF STEEL

Thanks to an ENAC project, Civil Engineering students have for the first time been able to collect data on the world's largest shipbreaking yard: Alang, in India. Three laboratories worked together to tackle the same question from different angles: How does steel contribute to a region's prosperity? The research done by Majid Jaidi and Hugo Lakshmanan has shed light on the impact of this activity on urban, economic, societal, environmental and architectural development.

A DRONE THAT FINDS SURVIVORS USING THEIR SMARTPHONES

After a natural disaster, it's often difficult to locate victims in the rubble. Jonathan Cheseaux, from the Mobile Communications Laboratory, had the idea to use mobile phones to facilitate searches. When in wi-fi mode, phones emit data packets at regular intervals. A drone equipped with powerful antennas flies over the affected region, picking up these signals and locating the phones' owners on a map.



CAN YOU PREDICT WHERE A ROULETTE BALL WILL LAND?

Philippe Paccaud, a student in the Automatic Control Laboratory, attempted to answer this question. He built his own experimental platform made up of a roulette wheel, a computer and a camera that recorded the ball's movements and the position of the number zero as an anchoring point. In order to ensure a constant source of light, he mounted LED lights on the rim of an old bicycle wheel and suspended it over the roulette wheel. He recorded 1,000 runs. His result: there's no miracle equation, but rather a probability of estimating the zone of the roulette wheel in which the ball is likely to land.

TWO BOATS COMPETE IN THE SUMMER HYDROCONTEST

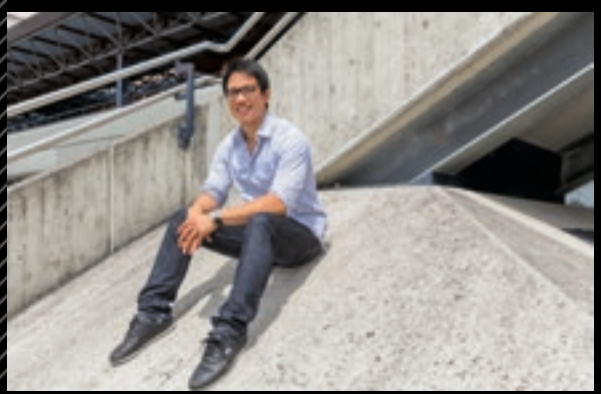
EPFL students participated in 28 interdisciplinary projects to build two watercraft that could be entered in an energy efficiency competition organized by Hydros, a company based at EPFL. In all, 12 universities from around the world sent teams that vied against one another on Lake Geneva. The boats had to navigate courses of 400 m and 600 m in record time. The objective was to raise young engineers' awareness of the issues and challenges – primarily energy-related – involved in the transport of goods by sea.

A SMART WRISTBAND FOR NIGHTTIME CYCLISTS

Five PhD students in the Electronics Laboratory have developed a wristband that flashes when cyclists reach their hands out to signal a change in direction. The device is composed of an accelerometer and a magnetometer, a kind of compass. When the cyclist reaches her hand out laterally, the sensors send their data to a microcontroller that triggers the LED lights. The wristband is equipped with small solar panels connected to a battery, so that it can function using nothing but sunlight. The "Intelligent Blinker" won a prize in a European contest.

QUENCHING A THIRST FOR KNOWLEDGE BY STUDYING A HEAD OF BEER

Pierre-François Conzelmann, a student in Mechanical Engineering, studied the formation of bubbles leaving the mouth of a beer bottle using an ultra-rapid camera. Knocking on the neck of the bottle generates a drop in pressure; this causes existing microbubbles to increase in size as CO_2 enters them. They then implode, breaking up into thousands of tiny new bubbles. Unlike sparking water, beer contains surfactants, molecules with both hydrophilic and hydrophobic parts, which stabilize the surface tension in each of the bubbles. This density of bubbles, coupled with the high pressure exerted by carbon dioxide at the top of the bottle, explains why even the smallest shock causes a large head of bubbles to form.



A DAM IN GIBRALTAR TO CONTROL RISING SEA LEVELS

For his Master's project, Ha-Phong Nguyen, a student in hydraulic constructions, designed a dam in the strait of Gibraltar to hold back the rising levels of the Mediterranean due to global warming. The young engineer tested several configurations before settling on a geometry that controls the water without interrupting the free movement of animal species. It's a work of art that could also harness the tides to produce electricity.

RESEARCH

2014 – A PRODUCTIVE YEAR FOR RESEARCH

To highlight some of 2014's research milestones, let's start by congratulating the 94 EPFL scientists who won prestigious ERC grants from the European Research Council. With these, EPFL joins the company of leading institutions including Oxford and Cambridge Universities and ETH Zurich. Six new research chairs were also sponsored in 2014, with 21 million Swiss francs in funding: the Defitech Chair (SUVA) in life sciences; two Gaznat Chairs in the Schools of Architecture, Civil and Environmental Engineering (ENAC) and Basic Science (SB); the Mobilière Chair in ENAC; and two Bertarelli Chairs in the School of Life Sciences.

EPFL is coordinator of the new National Research Centre (PRN) MARVEL – *Materials' Revolution: Computational Design and Discovery of Novel Materials*. With 18 million Swiss francs in funding for the 2014–2017 period, this ambitious program directed by EPFL professor Nicola Marzari is at the forefront of a scientific and technological revolution in which the development of future materials is based on simulations that incorporate quantum mechanics and ICT technologies. Scientists from ETH Zurich, EMPA, PSI, CSS, the Universities of Basel, Zurich, Fribourg, Geneva and Ticino (USI), and IBM are also involved in the program.

2014 was a banner year for research in energy storage, a critical area for the future of our society. Groundbreaking research was done on hydrogen, batteries, smart buildings and compressed air technology. Our special report on pages 20–21 presents a few of these projects. Without a solution for storing energy, renewables such as wind or solar will not be able to provide a continuous supply of electricity. It's in our universities that technological solutions are in the process of being developed.

EPFL is clearly one of the institutions that has progressed the most dramatically in the international rankings over the past ten years. And now, for the first time, EPFL is listed in the world top 100 in the Shanghai Jiao Tong – Academic Ranking of World Universities (96th), despite our small size and lack of Nobel Prize winners among the faculty. Ranked under 60 in 2006, this year EPFL joined the world top 20 in the QS-Ranking (17th in the world and 8th in Europe). This progress is also reflected in our Times Higher Education (THE) ranking: 34th overall at the world level, 12th in Engineering and Technology, and 2nd in the world among institutions with a history of less than 50 years. In parallel, EPFL ranks first in the world in the THE in terms of its international appeal. This progress is the culmination of a strategy of excellence and openness at the highest international level.

PHILIPPE GILLET
Vice-president for Academic Affairs

RESEARCHERS MANIPULATE OPTICAL FREQUENCIES TO IMPROVE DATA TRANSMISSION.

USING LIGHT FOR FASTER DATA TRANSMISSION

EPFL AND KIT SCIENTISTS HAVE SUCCEEDED IN TRANSMITTING DATA ON THE TERABIT SCALE WITH A SINGLE OPTICAL FREQUENCY USING MINIATURIZED OPTICAL FREQUENCY COMBS. THE DISCOVERY OPENS THE WAY FOR FUTURE ULTRA-RAPID COMMUNICATIONS SYSTEMS.

A continuous laser beam is composed of a single wavelength, in other words, a single color. But when this beam is trapped in a microresonator, it can be split into a series of equidistant spectral lines; this is known as an "optical frequency comb." Now, scientists at EPFL and the Karlsruhe Institute of Technology (KIT) have shown that optical frequency combs could allow simultaneous flow of data in optical cables. The finding has the potential to dramatically increase the speed of data transmission as well as prevent bottlenecks in data centers and communication networks.

Optical frequency combs are used as optical "rulers" for making very precise measurements in applications such as atomic clocks and high-precision spectroscopy. The scientists have now shown for the first time that a miniaturized optical frequency comb can be used for high-capacity data transmission.

To do this, they incorporated a data transmission system into an optical microresonator designed and built in EPFL's Center for Micro-nanotechnology (CMI). Waveguides made of silicon nitride coupled the light and sent it into a circular cavity where it is stored. The high intensity of the confined beam, combined with the nonlinear effects of the nitride, generated a frequency comb known as a Kerr comb, whose widely spaced spectral lines matched the spacing of data channels required for communications. Using the frequency comb, the researchers could transmit data at the rate of 1.44 terabits per second over a distance of 300 km.

EPFL HACKS AN "UNBREAKABLE" CODE IN JUST TWO HOURS

IT TOOK EPFL EXPERTS ONLY TWO HOURS ON THE SCHOOL'S COMPUTERS TO BREAK AN ENCRYPTION PROTOCOL THAT HAD BEEN CONSIDERED A GOOD CANDIDATE FOR INTERNET SECURITY.

Without cryptography, none of us would dare send our credit card numbers out over the Internet. Security systems protect those numbers from being intercepted as they travel between buyers and sellers. These systems are understandably hackers' favorite targets, and thus they must be constantly tested and strengthened. In universities, research mainly focuses on cracking encryption protocols in order to be sure they're up to the task.

Most security systems used by banks and companies to encrypt data are based on very complex mathematical operations known as "discrete logarithms."

A team led by Arjen Lenstra studied a family of algorithms that are being proposed for the next-generation encryption keys. "We proved that it would only take two hours for EPFL computers to solve a problem of this kind, whereas it was believed that it would take 40,000 times the age of the universe for all computers on the planet to do it," explains postdoctoral researcher Thorsten Kleinjung.

Don't worry, though: since the encryption key had not yet been deployed, hackers won't be able to exploit the EPFL team's findings for their own malevolent ends. "Basically, we just eliminated this as a candidate for a successor to current algorithms," says Lenstra.

KEEPING YOUR SMARTPHONE DATA PRIVATE

TWO EPFL SCIENTISTS HAVE DEVELOPED AN APP THAT SECURES DATA SHARED OVER SMARTPHONES. ONCE IT HAS PASSED THE LEARNING PHASE, IT DECIDES FOR THE USER WHAT INFORMATION CAN BE SHARED.

Social networks and instant data sharing have revolutionized the way we communicate. Our smartphones can automatically record information such as our GPS coordinates and the activities we're engaged in. This data can easily be collected and analyzed, because personal data contained in our smartphones can be divulged via installed apps without our knowledge or consent.

Under the guidance of professor Jean-Pierre Hubaux, Igor Bilogrevic and Kévin Huguenin from EPFL's Laboratory for Computer Communications and Applications 1 (LCA1) developed the first semi-automatic data sharing system for smartphone instant messaging.

The intelligent software gradually "learns" as it is used, similar to voice and handwriting recognition software.

Dacosta and Huguenin are continuing their work by developing an app based on XPrivacy that controls other installed apps' access to private data on Android phones.

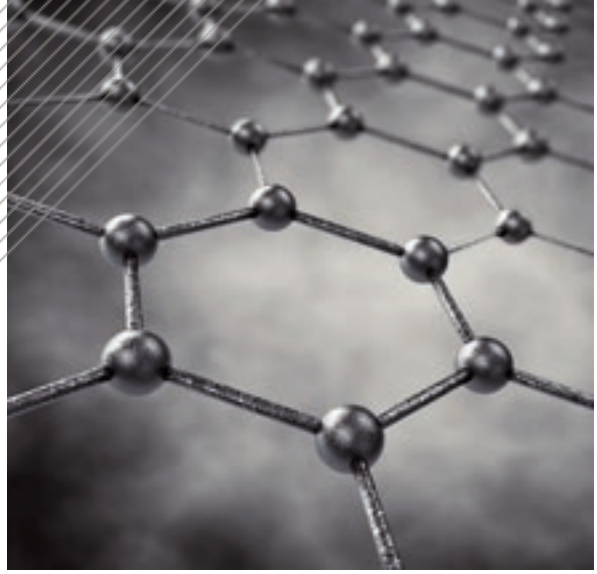
ENERGY-EFFICIENT ELECTRONICS FOR THE FUTURE

THE EUROPEAN E²SWITCH PROJECT IS FOCUSED ON DEVELOPING ELECTRONICS THAT USE VERY LITTLE ELECTRICITY. THE PROGRAM INVOLVES NINE PARTNERS – UNIVERSITIES, RESEARCH INSTITUTES AND COMPANIES – AND IS COORDINATED BY EPFL.

E²SWITCH's mission is to develop ultra-energy-efficient electronics based on tunnel FET technology that can operate with five times less voltage than is currently needed by chips in mobile phones. It's quite a challenge, particularly for future portable devices whose autonomy and range of use will need to significantly increase. EPFL is coordinating this new €4.3 million, 42-month European research program that includes the participation of six universities and research institutes as well as the companies IBM, CCS and SCIPROM.

"Our goal is to prepare the next generation of transistors that will be able to operate at less than 0.3 volts, ideally getting that down to 0.1 volt," explains EPFL scientist and E²SWITCH coordinator Adrian Ionescu.

Mobile phones will be the first devices to benefit from this kind of electronic optimization. But the technology's impact will reach much further afield. "At temperatures around 125-150°C, chips start to lose functionality. Our technology, however, not only uses less electricity, but it's also more stable over a larger temperature range, opening the door to more robust applications in automobile and aeronautical manufacturing," explains Ionescu.



A DESIGN GUIDE FOR FUTURE GRAPHENE CHIPS

EPFL SCIENTISTS HAVE INVENTED A "HOW-TO" GUIDE FOR BUILDING THE MOST EFFICIENT OPTICAL TERAHERTZ COMPONENTS POSSIBLE. THE PROCEDURE FACILITATES AND ACCELERATES THE TECHNOLOGICAL DEVELOPMENT IN THIS FUTURE FIELD.

Thanks to its amazing properties, graphene will form the basis of a new generation of smaller, faster and more efficient circuits. For example, if controlled in real time, this material can be used to design systems that can block electromagnetic radiation, producing digital information analogous to the 0s and 1s used in transistors. But up to now, it was impossible to predict in advance these graphene circuits' optimal efficiency. Two parameters influence performance: the quality of the graphene used (its structure at the atomic scale) and the circuit design (e.g. the other materials used in the circuit, its geometry, and so on).

Michele Tamagnone, a member of a team led by professors Julien Perruisseau-Carrier and Juan R. Mosig, has developed a theory that shows that the maximum theoretical efficiency of a system is uniquely a function of the quality of the graphene used in it. It is possible to approach that efficiency by altering the design, but it is impossible to increase it beyond this level. The researchers were thus able to develop a method to determine the optimal design to use with a given quality of graphene.

The EPFL group's research, published in the journal *Nature Photonics*, has in this way provided industrial partners and colleagues with a clear and useful guide to building optimized graphene circuits.

USING TECHNOLOGY TO ANALYZE THE SWISS VOTE

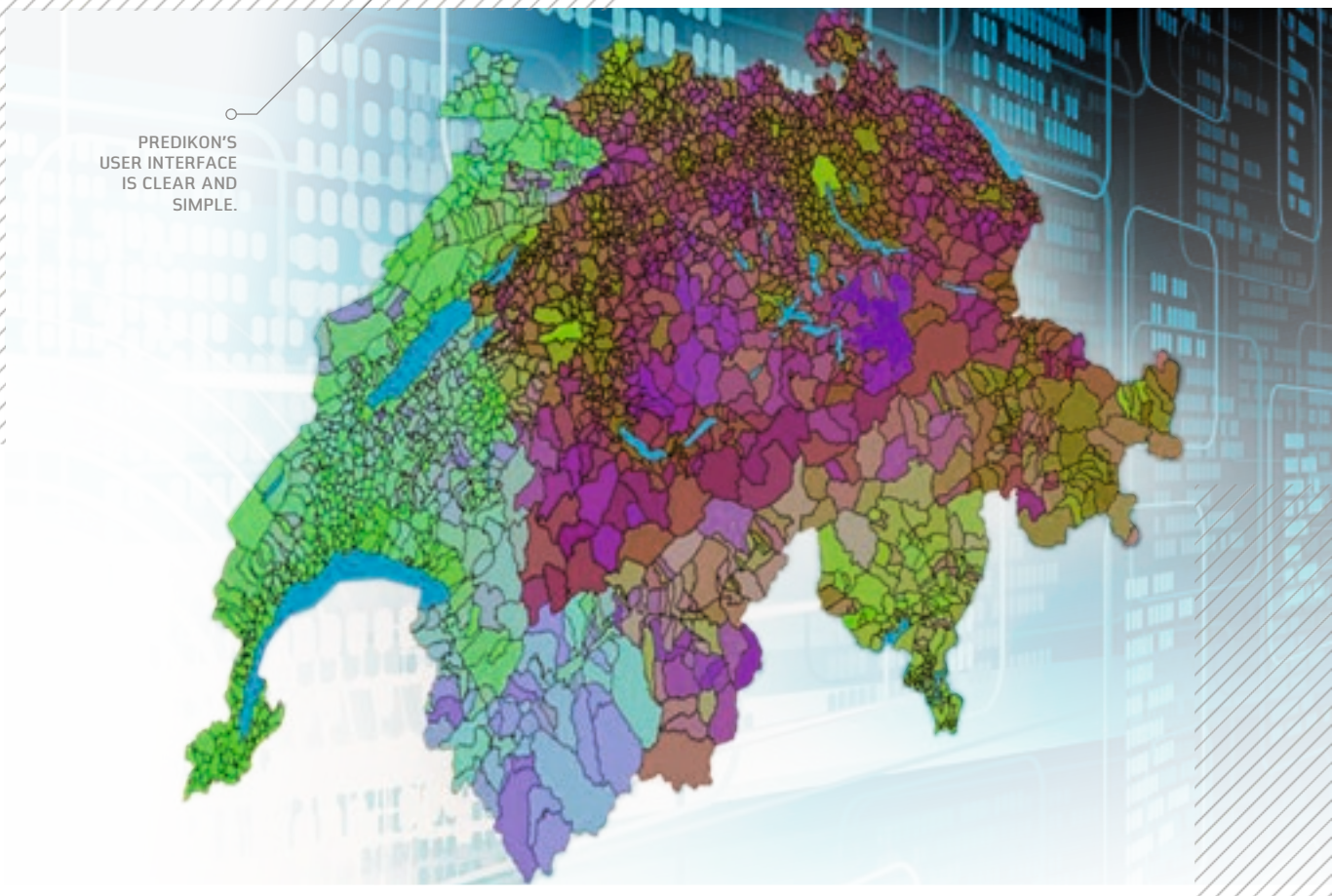
ARE POLITICAL PARTIES REALLY ALL THAT DIFFERENT FROM ONE ANOTHER? IS THE "RÖSTIGRABEN" A TRUE POLITICAL REALITY? EPFL SCIENTISTS HAVE APPLIED COMMON INFORMATION ANALYSIS METHODS TO SWISS VOTING DATA AND USED THE RESULTS TO MAKE AVAILABLE ON THE INTERNET A TOOL FOR ANALYZING AND PREDICTING BALLOT OUTCOMES.

The legendary Swiss democratic process yields a lot of data, such as district by district voting results and voting records from the National Council. In addition, there are the responses from candidates and voters to survey questions posted on the "Smartvote" recommendation website prior to the 2011 federal election.

Under the supervision of professors Matthias Grossglauser and Patrick Thiran, PhD students Vincent Etter and Julien Herzen in the Computer Communications and Applications Laboratory (LCA3) developed a web platform named predikon.ch that can predict the outcome of a federal ballot based on initial results or from surveys.

The name Predikon is a combination of the words "prediction" and "Ebikon" – the latter being the name of a town in Lucerne. Knowing how this town's 12,000 inhabitants voted, it turned out, was all that was needed to reliably predict the outcome of the vote for the entire country with more than 95% certainty.

Various voting phenomena can be visualized in detail on the platform, such as the very real existence of the so-called "Röstigraben" – an imaginary geographical line separating French-speaking from German-speaking Swiss – and the trend in the Italian-Swiss vote, which had been more or less aligned with the votes in the German-speaking population over the past 30 years but has largely moved to join the French-speaking vote just in the last decade.



PREDIKON'S USER INTERFACE IS CLEAR AND SIMPLE.

THE FUTURE OF RENEWABLES DEPENDS ON STORAGE

SEVERAL PILOT PROJECTS UNDERWAY IN EPFL LABORATORIES ARE FOCUSING ON THE ISSUE OF STORING RENEWABLE ENERGY, WHOSE SOURCES ARE OFTEN INTERMITTENT IN NATURE.

The wind doesn't blow every day, and the sky is never cloud-free all the time. To become a reliable source of electricity, renewables must overcome a major obstacle: their volatility. Solar and wind power often exhibit peaks in availability that don't necessarily correspond with peaks in demand.

Storing renewable energy is thus a critical issue. At EPFL, several labs are working on the problem and taking innovative approaches to solve it. Results so far look promising.

SUN, CHEAP MATERIALS AND HYDROGEN

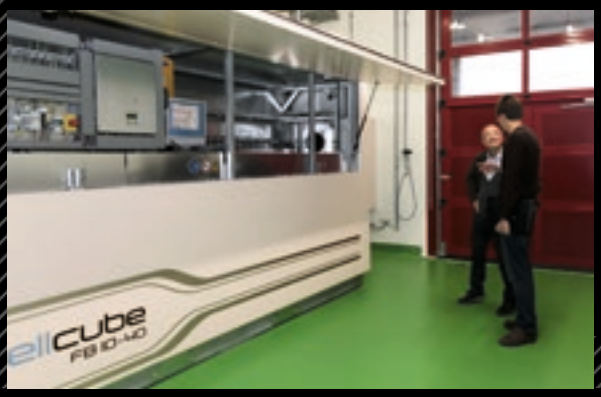
Michaël Grätzel's lab has succeeded in producing hydrogen from water and sunlight at a light-hydrogen conversion rate of 12.3%. They combined a pair of perovskite solar cells (a crystal based on readily available materials) and low-cost electrodes. The record is even more impressive considering it does not use rare metals.

NOVEL SOLUTIONS

Mario Paolone's lab is looking at innovative industrial solutions for storing solar power and redistributing it in an optimized way over the electricity grid. The heart of the device being developed by Leclanché is a novel lithium-ion battery, which works in conjunction with the Romande Energie solar park and EPFL's electricity grid.

ALGAE-BASED BIOGAS

Research at EPFL and the Paul Scherrer Insitute indicates that biogas derived from microalgae is becoming an increasingly promising alternative to fossil fuels. As part of the SunCHem project, researchers developed a process for growing micro-algae and efficiently converting it to synthetic natural gas, a biofuel that is fully compatible with the expanding natural gas network.



SERVICE STATIONS OF THE FUTURE

In a pilot project in Martigny, Hubert Girault's group is exploring a device that will store electricity in a "megabattery" and then release it as direct current. The megabattery is designed to serve as a bridge between electricity production (for example from renewables) and rapid transfer to a vehicle, which could be recharged in less than an hour.

COMPRESSED AIR

Under development at EPFL since 2002, compressed air energy storage is an ecological solution that facilitates the use of renewable energy sources. The technology is advancing rapidly: an installation that can absorb 10,000 watts of electric power and store it as compressed air is under construction as part of the HyPES project. Two additional 25 kW pilot installations will be built in 2015.

A NEW KIND OF SOLAR CELL

Scientists in Jacques-Edouard Moser's group have revealed the way in which new photovoltaic cells based on light-absorbing lead iodide perovskite semiconductors transfer electrons across their surface. This discovery indicates that these solar cells could revolutionize energy conversion and efficiency.

A VISIT TO VESTA CALLS INTO QUESTION HOW PLANETS ARE FORMED

USING A NUMERICAL SIMULATION AND DATA FROM THE DAWN SPACE PROBE, EPFL SCIENTISTS NOW HAVE A BETTER UNDERSTANDING OF THE STRUCTURE OF THE ASTEROID VESTA. THEIR FINDINGS CALL INTO QUESTION OUR MODELS OF HOW ROCKY PLANETS SUCH AS EARTH ARE FORMED.

Vesta is an asteroid that was born at the same time as the rest of our Solar system; it's 500 km in diameter and orbits between Mars and Jupiter. Scientists are keenly interested in it as one of the largest observable planet "embryos" with all the planetary elements of crust, mantle and core. NASA deployed a space probe named Dawn to accompany it in orbit for a year, between 2011 and 2012.

An international team of scientists, including researchers from EPFL, analyzed the data from the probe and concluded that the asteroid's crust was nearly three times thicker than their theories had previously predicted.

They studied the rocks on Vesta's surface and found no trace of olivine, one of the primary components of planetary mantles. They had expected to find large quantities of this mineral, because the asteroid had been subjected to a double meteorite impact at some point in its history. According to simulations, that impact event blasted Vesta's South pole to a depth of 80 km and scattered huge quantities of material across the surface.

The absence of olivine indicates that the crust of the asteroid is not 30 km thick, as the standard models had predicted, but more than 80 km. These discoveries about the mineral composition of Vesta's crust and mantle challenge models that describe the asteroid's formation, and consequently the formation of rocky planets in the Solar System including planet Earth.

▶ YOUTUBE.COM/EPFLNEWS

A SMALL SATELLITE THAT KNOWS JUST WHERE IT IS IN SPACE

THE MAIN OBJECTIVE OF CUBETH, A JOINT PROJECT BETWEEN EPFL, ETH ZURICH AND SEVERAL OTHER SWISS UNIVERSITIES, IS TO BUILD A SMALL SATELLITE THAT WILL BE ABLE TO CALCULATE ITS OWN POSITION, ALTITUDE AND ORIENTATION IN SPACE WITH UNPRECEDENTED PRECISION, PAVING THE WAY FOR CONSTELLATIONS OF NANOSATELLITES WITH INTER-SATELLITE COMMUNICATIONS CAPABILITIES.

After launching Swisscube in 2009, EPFL's Swiss Space Center (SSC) took on a new project, CubETH. Started in 2012, it is now directed by Anton Ivanov, project manager at eSpace. Like Swisscube, it is also a cubesat, measuring 10 cm on a side and weighing less than 1.5 kg. The device is a joint effort by EPFL, ETH Zurich and several Swiss universities, and is scheduled for launch no earlier than 2017.

CubETH's mission is to be a high-performance orbitographical tool capable of accurately measuring its own position, altitude, and spatial orientation. This would prepare the way for the deployment of constellations of cubesats, which could carry out complete Earth observations at precise moments in time. As in Swisscube, the project uses inexpensive technology – notably in the GPS sensors – that has been proven on land but has yet to be tested in space applications.

It also plays an important educational role. The satellite will carry on board programs that are the objects of dozens of student research projects and dissertations; for them it's an ideal opportunity to use a concrete project to learn more about space. In all, more than 70 students have already participated in the project.

ULTRAFAST ROBOTIC ARM CAN CATCH FLYING OBJECTS

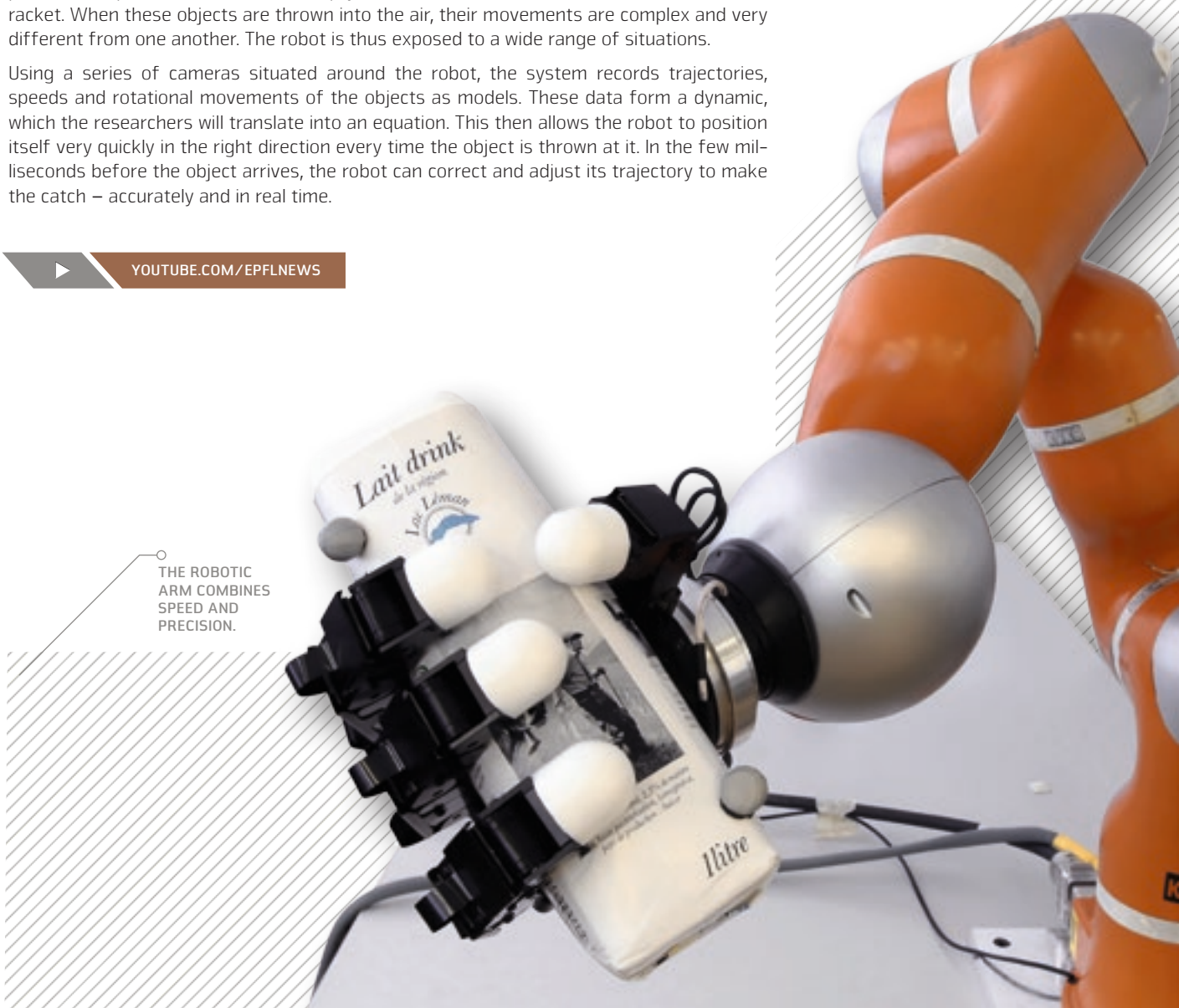
AN EPFL-DEVELOPED ROBOT CATCHES OBJECTS WITH COMPLEX SHAPES AND MOVEMENTS IN A FRACTION OF A SECOND. THE SCIENTISTS WHO DESIGNED IT TOOK INSPIRATION FROM THE WAY HUMANS LEARN: BY IMITATION AND OPTIMIZATION.

The robotic arm can grab a variety of objects flying through the air in less than five seconds. Programmed by EPFL's Laboratory of Algorithms and Learning Systems (LASA), directed by Aude Billard, the platform is designed to test robotic solutions for intercepting moving objects.

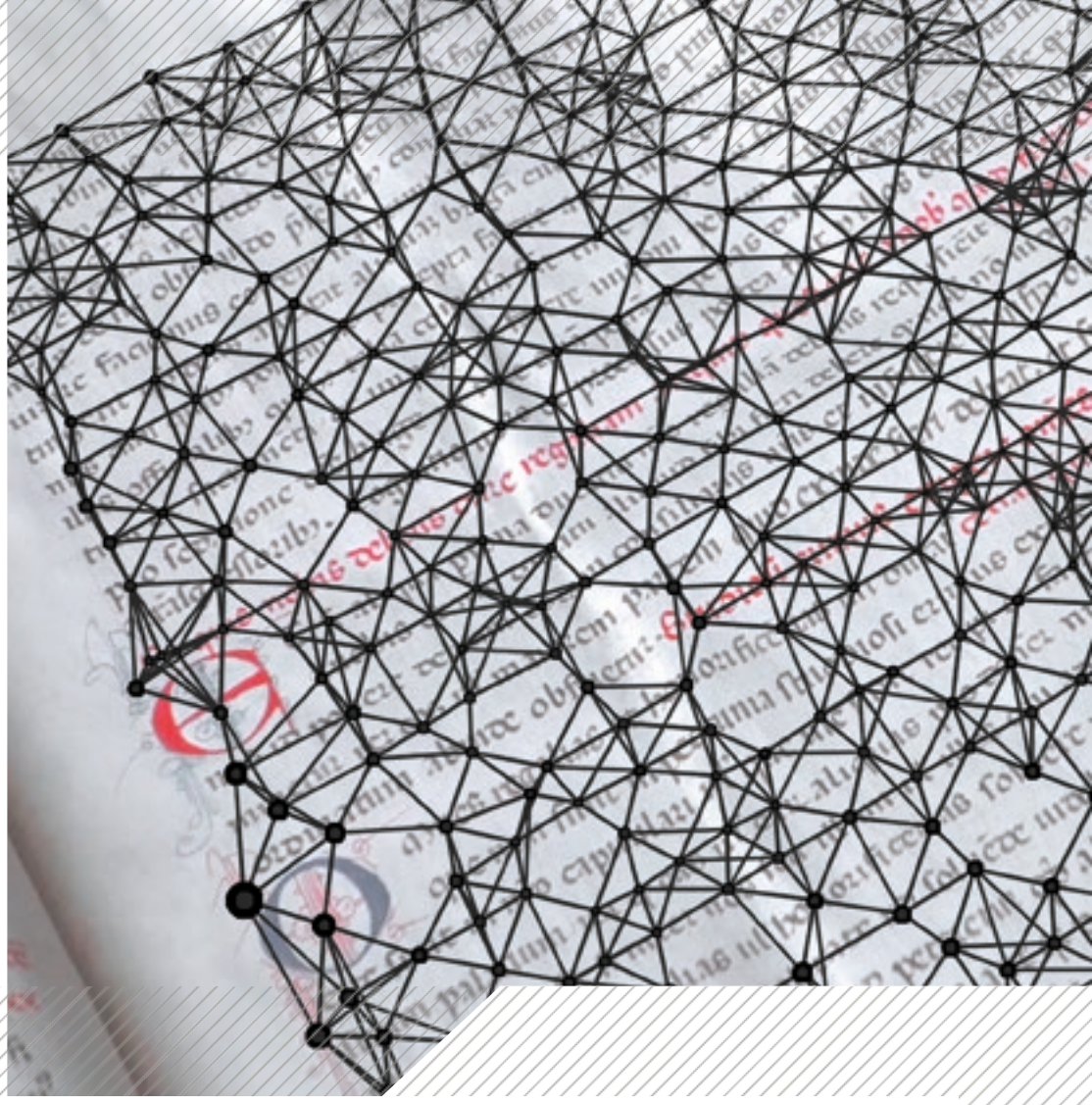
To achieve this rapidity, the researchers looked to how humans learn the same task: by imitation and optimization. In the first learning stage, objects are repeatedly thrown in the direction of the robot. Each time, the arm is manually guided to the target thrown at it. The process is repeated with a ball, an empty bottle, a half-full bottle, a hammer and a tennis racket. When these objects are thrown into the air, their movements are complex and very different from one another. The robot is thus exposed to a wide range of situations.

Using a series of cameras situated around the robot, the system records trajectories, speeds and rotational movements of the objects as models. These data form a dynamic, which the researchers will translate into an equation. This then allows the robot to position itself very quickly in the right direction every time the object is thrown at it. In the few milliseconds before the object arrives, the robot can correct and adjust its trajectory to make the catch – accurately and in real time.

▶ YOUTUBE.COM/EPFLNEWS



THE ROBOTIC ARM COMBINES SPEED AND PRECISION.



VENICE TIME MACHINE BLUEPRINTS ARE FINALIZED

EPFL, CA'FOSCARI UNIVERSITY AND THE ITALIAN STATE ARCHIVES HAVE BEGUN THE PROCESS OF DIGITIZING THE ARCHIVES OF VENICE, WHICH ARE SOME OF THE OLDEST AND MOST COMPLETE IN THE WORLD.

CHARACTER RECOGNITION ADAPTED TO ANCIENT TEXTS.

The Venice archives cover a thousand years of social, economic and cultural activity. The city's administration, astonishingly modern from the Middle Ages onwards, recorded details in reams of manuscripts and documents that can be used to retrace the history of this Mediterranean empire with extraordinary precision.

The Swiss and Italian researchers have begun digitizing this trove, organizing and processing the information contained in more than 80 km of shelf space. Eventually they plan to develop a tool that will be made available to historians around the world.

More than 100 scientists and students have labored unceasingly to put the project on solid footing. They sorted and arranged the archives as a function of format and established a workflow adapted to mass digitization.

The Venice Time Machine is supported by an international board of renowned experts from Stanford, Columbia, Princeton and Oxford. The Lombard Odier Foundation joined the project in 2014 as a funding partner.

A HINT THAT DARK MATTER REALLY DOES EXIST

EPFL SCIENTISTS HAVE PICKED UP AN ATYPICAL PHOTON EMISSION IN X-RAYS COMING FROM SPACE, AND SAY IT COULD BE EVIDENCE FOR THE EXISTENCE OF A PARTICLE OF DARK MATTER.

Could it be tangible evidence of the existence of dark matter in the universe? Researchers from EPFL and the University of Leiden in the Netherlands think they may have identified a particle of this hypothetical substance.

When physicists study the dynamics of galaxies and the movement of stars, they are confronted with a mystery. If they only take visible matter into account, their equations don't add up: the elements that can be observed are not sufficient to explain the rotation of objects and existing gravitational forces. There is something missing. From this they deduced that there must be an invisible kind of matter that does not interact with light, but does, as a whole, interact by means of the gravitational force. Called "dark matter", this substance appears to make up at least 80% of the Universe.

In this study, the scientists analyzed X-rays emitted by two objects: the Perseus galaxy cluster and the Andromeda galaxy. After collecting thousands of signals, they noticed an anomaly that appeared as a weak anomalous photon emission. Most interestingly, its distribution corresponded exactly to what scientists were expecting with dark matter. Further investigations in our own galaxy, the Milky Way, confirmed the observations. The signal comes from a very rare event in the Universe: a photon emitted due to the destruction of a hypothetical particle, possibly a "sterile neutrino".

▶ YOUTUBE.COM/EPFLNEWS

THE EFFECT OF A FASTER LIGHTRAIL SYSTEM ON THE ZURICH SUBURBS

THE ZURICH PUBLIC TRANSPORT SYSTEM WANTS TO IMPROVE DOWNTOWN ACCESS FOR PEOPLE LIVING IN THE GREATER METROPOLITAN AREA. SCIENTISTS DID A SIMULATION OF WHAT THIS WOULD ENTAIL IN TERMS OF URBAN EXPANSION.

Will better public transport to the suburbs result in urban sprawl? This is the question the Federal Transport Office commissioned a group of EPFL scientists to answer in the specific case of Zurich. The verdict: ''Yes, but. . .'' The canton itself is not likely to experience serious sprawl. On the other hand, neighboring cantons, whose zoning laws are less restrictive, could be much more adversely affected.

The Zurich public transit zone is planning to divide the canton's light rail system into two concentric zones. The project, named S-Bahn 2G, aims to provide all the stations in the external zone, then the internal zone with express trains to the city center. This will result in dramatically reduced transit times between the suburbs and downtown Zurich.

Changing public transport parameters (schedules, distance, time and cost) usually results in a measurable change in the flow of passengers and their choice of transit mode. By improving accessibility for far-flung districts, the researchers predict that the Zurich project will very likely result in changes in passenger behavior. But in addition to a measurable impact on urban planning, they predict it will also cause a redistribution in demographic growth.

RUSH-HOUR EMERGENCY LANE OPENING HAS PROVED ITS WORTH

AFTER FOUR YEARS OF USE, THE PARTIAL OPENING OF THE EMERGENCY LANE ON THE MORGES HIGHWAY HAS HAD SIGNIFICANT EFFECTS ON THE FLOW OF TRAFFIC. BUT SCIENTISTS SUGGEST THERE ARE STILL SOME WAYS TO IMPROVE THE SYSTEM.

Starting in January 2010, the emergency lane on a four-km stretch of the highway West of Lausanne, between Morges and Ecublens, has been temporarily opened to traffic. The goal was to allow for more fluid rush-hour traffic for the 82,000 vehicles that travel the A1 between Lausanne and Geneva every day.

Scientists from EPFL's Traffic Facilities Laboratory (LAVOC) evaluated the effectiveness and the impacts of the measure. The most impressive effect was the increase in flow – about 750 additional vehicles per hour over a total of about 6,000 vehicles – despite a reduction in speed limit from 120 km/h to 100 km/h. However, sometimes it takes just a few minutes of delay in the opening of the lane (which is triggered by a given traffic flow upstream) for a traffic jam to form. ''We're looking to integrate parameters other than just the flow rate to determine the lane opening; the distribution of traffic over the lanes or the difference in speed between the lanes,'' explains lab director André-Gilles Dumont.

The system has had a positive impact on accidents, as well, with a 25% reduction in the number of accidents between 2008 and 2013. ''If we want to reduce this even more, it's critical to inform drivers entering the highway that the emergency lane is open,'' adds Dumont. ''For example with better signaling before they enter the system.''

TOWARDS PROFITABLE AND EFFICIENT CARBON CAPTURE

A TEAM OF RESEARCHERS FROM EPFL, UC BERKELEY AND BEIJING HAVE DEVELOPED A MUD-BASED PROCESS THAT COULD REVOLUTIONIZE CARBON CAPTURE. THE NEW SUBSTANCE COMBINES THE SIMPLICITY OF LARGE-SCALE IMPLEMENTATION OF LIQUIDS AND THE PROFITABILITY AND ENERGY EFFICIENCY OF SOLIDS.

Carbon capture is the process of collecting and storing carbon dioxide (CO_2) emitted by factories and power plants in order to reduce overall greenhouse gas emissions. There are two existing methods for capture, one that uses powdered solids that ''adhere'' to the CO_2, and another that uses a liquid to absorb the gas. In spite of their potential environmental and energy benefits, these strategies are not ideal solutions due to the complicated engineering involved and their cost.

However, Berend Smit and his EPFL team, along with scientists from UC Berkeley and Beijing, have combined solids and liquids that can capture carbon and developed a sort of ''mud'' that takes advantage of the best of both worlds – the simplicity of large-scale implementation of liquids and the low cost and high energy efficiency of solids – resulting in an overall increase in energy efficiency. With the validation of their concept in hand, the research teams will now begin testing their mixture in the field.

A NEW CARBON-FRIENDLY CEMENT TO MEET FUTURE BUILDING NEEDS

AN EPFL-LED CONSORTIUM HAS DEVELOPED A NEW KIND OF CEMENT WHOSE CARBON FOOTPRINT HAS BEEN DRAMATICALLY REDUCED. FUNDING FOR ACCELERATING THE PROJECT HAS BEEN OBTAINED FROM THE SWISS AGENCY FOR DEVELOPMENT AND COOPERATION (SDC).

Even though it's one of the world's most ecological construction materials, the production of cement is responsible for nearly 10% of anthropogenic CO_2 emissions. A consortium led by EPFL has received more than 4 million Swiss Francs from the Swiss Agency for Development and Cooperation to accelerate work on a new kind of low-carbon-impact cement. Developed in partnership with the Indian Technology Institutes and a number of Cuban universities, this product based on a mixture of calcined clay and limestone could replace up to half of the Portland cement that is currently used, and reduce the CO_2 emissions from cement production by up to 30%. It could even result in reducing worldwide carbon emissions by the amount equivalent to the emissions of an entire country such as France.

Karen Scrivener, head of the project, explains that the efficiency of the new cement is due to its chemical composition. Named LC3 for "Limestone Calcined Clay and Clinker," the cement is made up of calcined clay and crushed limestone, two resources found abundantly in rock quarries around the world. The aluminates in the calcined clay interact with the carbonate in the limestone to create a less porous, stronger paste. Up to now, these materials have been used separately to replace only small amounts of a cement mixture. But when combined, they can constitute up to half of the components of the mixture without altering the quality and strength of the final product.

SEEING INTO THE FUTURE OF SWITZERLAND'S NUCLEAR WASTE REPOSITORIES

EPFL SCIENTISTS HAVE USED NUMERICAL SIMULATIONS TO TEST THE SAFETY OF NUCLEAR WASTE STORAGE REPOSITORIES.

Large quantities of highly radioactive waste are scheduled to be stored in Switzerland in a network of deep underground vaults, locked away behind three protective barriers. In an article in the journal *Acta Geotechnica*, Lyesse Laloui, head of EPFL's Laboratory of Soil Mechanics, describes the medium-term behavior of one of these barrier techniques, and shows that more attention needs to be focused on its design.

Metal canisters containing liquefied waste will be deposited on blocks of bentonite, an extremely absorbent and expansive material. Additional bentonite in the form of pellets will fill the remaining space between the canisters. Finally, the entire thing is buried beneath a half-kilometer of Opalinus clay, a very stable geological formation.

To study thermal, mechanical and hydraulic forces operating on the canisters, Lalouli's team developed a mathematical model representing the physical mechanisms involved, and then moved it forward in time to see how the situation would evolve in the future. They discovered that an asymmetrical expansion of the bentonite surrounding the canisters could, over the years, exert significant forces on the canisters. They suggest that these aspects need to be taken into account in the design of the canisters and the storage system.

What would happen if one of the canisters moved? According to Lalouli, the storage repository is designed well enough that it would remain safe even in this scenario. "With 500 m of bedrock separating the surface and the repository, which is located at the heart of an impermeable and stable geological formation, the movement of a canister would not be ideal, but the multiple barriers put in place will be sufficient to handle it."

SPEEDING TRAINS, FLYING BALLAST

RESULTS OF A STUDY ON BALLAST PROJECTIONS IN EXTREME WINTER CONDITIONS HAVE PROMPTED THE SWISS RAIL SYSTEM TO ADOPT MEASURES THAT WILL IMPROVE SAFETY NEAR TRAIN TRACKS.

What causes ballast – the stone bed on which train tracks are laid – to fly up into the air? The Swiss rail system (SBB) commissioned EPFL's Transportation Center to study the problem of flying ballast in extreme winter conditions. An analysis of this rare phenomenon confirmed that two criteria must be met: the trains must be traveling at high speeds, and specific winter conditions must be present. A combination of snow, wind and very low temperatures can lead to the formation of ice blocks on wagon undercarriages. These blocks can detach and fall onto the track. The shock of the block of ice falling on a piece of ballast can set the ballast in motion. The stones are thus projected into the air, where they can ricochet off the undercarriage or hit a wheel and fly further afield.

The researchers also tried to identify potential causes associated with the kinds of wagons used or their insulation. Track-related phenomena were also investigated; they found that the ice blocks can be dislodged when the wheels pass over "glued joints" (joints between two track sections) and junctions, thus triggering ballast projectiles.

There are several options for dealing with the problem: improving incident reporting, to better understand the evolution of the phenomenon; setting speed limits in conditions of heavy snow, and treating wagon undercarriages to prevent ice buildup.

COMPLETE MEDICAL ANALYSIS ON A CHIP

A NEW PORTABLE DEVICE DEVELOPED AT EPFL CAN SIMULTANEOUSLY TEST FOR A WIDE VARIETY OF PROTEINS IN THE BODY. THIS DIAGNOSTIC TOOL IS A SUBTLE COMBINATION OF OPTICS AND ENGINEERING.

Will it someday be possible to run a battery of medical tests without going to the doctor's office? EPFL's latest discovery seems to point in this direction. A team led by Hatice Altug, in collaboration with colleagues at UCLA, has developed a "lab on a chip" that can rapidly analyze up to 170,000 different molecules in a blood sample. It can simultaneously detect insulin levels, markers for cancer and Alzheimer's Disease and even certain viruses.

This 7.5 cm high, 60g device detects proteins not by analyzing the spectral properties of the light sent over the sample, but by scrutinizing changes in light intensity, making it possible to dispense with cumbersome spectrometers.

The sample is put onto a gold substrate pierced with varying arrays of extremely tiny holes. These nanoholes "capture" different proteins depending on where they end up in in the array. Light from a diode is shone through the holes, and changes in the light intensity indicate the number of proteins present. "Recent studies have shown that certain illnesses such as cancer or Alzheimer's are better diagnosed and false positive results avoided when several parameters can be analyzed at once," says Altug.

DETECTING ALLERGENS QUICKLY AND EFFECTIVELY

EPFL SCIENTISTS HAVE DEVELOPED AN EFFECTIVE METHOD FOR DETERMINING THE PROTEINS THAT CAUSE MILK ALLERGIES. THIS NOVEL APPROACH COULD ALSO BE USED TO DETECT OTHER ALLERGENS IN FOODS.

It's not easy to pinpoint the molecule responsible for a given food allergy. It currently involves a lengthy testing process, which often doesn't take into account rare or unexpected allergens. EPFL scientists have developed an ultrasensitive method that can quickly and effectively identify the exact proteins involved, even when they're present in very small quantities. This technique has been successfully tested in cases of cow's milk allergy.

Food allergies are quite common, affecting 6-8% of children and 3% of adults. They occur when the immune system mistakes a protein present in food as a threat and attacks it as it would a pathogen, producing antibodies in the process.

A team led by Hubert Girault has developed a method that uses a patient's own antibodies to precisely identify the offending protein. It uses a technique known as immunoaffinity capillary electrophoresis to isolate the antibodies in the blood, and then puts them in contact with cow's milk. The proteins that are causing the allergic reaction are progressively bound to the antibodies, while the rest are released. The bound proteins are then analyzed in a mass spectrometer.

This personalized method could help develop a more targeted treatment, and it could also be applied to other foods such as nuts and grains.

SMART KNEE PROSTHESIS CAN DIAGNOSE ITS OWN PROBLEMS

A GROUP AT EPFL HAS BEEN WORKING ON SMART JOINT REPLACEMENTS THAT CAN USE SENSORS TO DETECT FLAWS WELL BEFORE THEY BECOME PROBLEMATIC FOR THE PATIENT.

Nearly four million people undergo joint replacement surgery every year. Unfortunately, some of these patients experience persistent pain due to sealing or alignment problems, but doctors have no way to identify the causes.

EPFL scientists have developed sensors that can be integrated into the polyethylene component of the prosthesis and then used to conduct an interior diagnostic to detect misalignment, improve medical treatments and, in consequence, help patients avoid having to undergo additional invasive procedures.

Arash Arami, a scientist in EPFL's Laboratory of Movement Analysis and Measurement, has devoted part of his PhD thesis to the issue of misalignment in prostheses. He chose the knee, because it is a complex joint and one that is often damaged. He developed an algorithm to precisely calculate the micromovements in the prosthesis and used it to detect, via vibrations, any loosening. He implanted sensors into a prosthesis, installed it on a robotic knee simulator, and was able to show how the prosthesis reacted to the forces acting upon it.

Five EPFL laboratories are working together with the Orthopedics department of the Lausanne University Hospital in a project funded by Nano-Tera to help industry produce smart prostheses.

A NEW METHOD FOR SAFER DIAGNOSTIC MEDICAL IMAGING

A COLLABORATIVE EFFORT BETWEEN EPFL, CNRS, ENS LYON, CPE LYON AND ETH ZURICH HAS LED TO THE DEVELOPMENT OF A NOVEL METHOD THAT CONSIDERABLY IMPROVES THE CAPABILITIES OF MEDICAL IMAGING WHILE ENSURING SAFER PROCEDURES FOR PATIENTS.

Medical imaging is a critical tool in diagnostics today, thanks to such imaging techniques as MRI (magnetic resonance imaging) and CT (computerized tomography) scanning. However, due to the nature of living tissue, the technique is still limited in terms of image resolution and quality. EPFL scientists, working together with colleagues from CNRS, ENS, CPE Lyon and ETH Zurich have developed a way to enhance the signal intensity from imaged body tissues using a new generation of hyperpolarization agents.

Hyperpolarization agents are substances that are used to improve image quality. They are injected into the patient, and then specific molecules in them can be tracked as they travel through the body. The downside is that these fluids are potentially toxic.

The new hyperpolarization agents developed at EPFL by teams led by professors Geoffrey Bodenhausen and Lyndon Emsley, called HYPSO, are both safe and effective, however. The scientists tested their method on various imaging markers, including pyruvate, acetate, fumarate, pure water and a simple peptide. Because the HYPSO are physically retained during dissolution, this technique produces pure solutions of hyperpolarized markers, free of any contaminant. The protocol is thus simpler and *a priori* safer for the patient. In addition, because they dramatically improve signal quality, these hyperpolarization agents have the potential to be used with a broad range of molecules.

FASTER, MORE EFFECTIVE WOUND HEALING

EPFL SCIENTISTS HAVE DEVELOPED A PROCEDURE DERIVED FROM GROWTH FACTORS THAT BOOSTS THE BODY'S NATURAL WOUND HEALING PROCESS. IT COULD LEAD TO THE DEVELOPMENT OF NEW REGENERATIVE MEDICINE TREATMENTS.

When the body is wounded, a healing process is initiated, orchestrated by molecules known as "growth factors." The regenerative role of these molecules makes them of interest in emergency situations, for example to heal wounds more quickly and to avoid excessive blood loss and further health complications.

The use of growth factors in drug development has not so far led to clinical regeneration that is better than the natural process. But now, a group led by Jeffrey Hubbell has developed a method that improves their effectiveness.

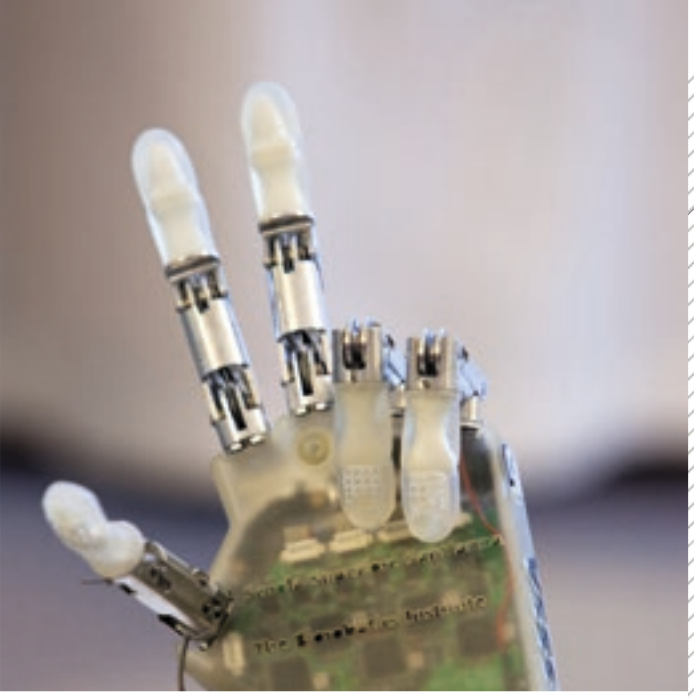
Growth factors work by attaching proteins to the "extracellular matrix," a structure that supports organs and tissues. The stronger this bond is, the more effective the growth factor – and thus the healing process – will be. The researchers identified a factor, known as PlGF-2, that bonded particularly strongly. By isolating the sequence of DNA responsible for the bond and fusing it into the DNA of three other weaker growth factors, the bonds of the weaker factors became 100 times stronger, meaning they could be used in lower doses to be effective.

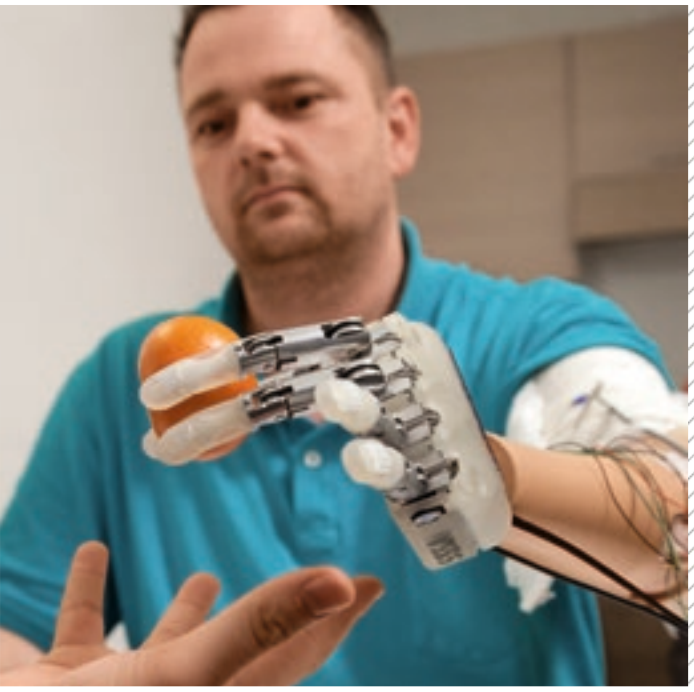
BOOSTING MEMORY WITH LACTATE

SCIENTISTS IN EPFL'S LABORATORY OF NEUROENERGETICS AND CELLULAR DYNAMICS HAVE DECODED THE MECHANISM BY WHICH A GLUCOSE DERIVATIVE ACTIVATES RECEPTORS INVOLVED IN MEMORIZATION.

Neurons have long held the limelight in our understanding of how the brain operates. But it turns out they aren't the only stars in the show; neighboring star-shaped cells known as astrocytes are also gaining increasing respect for the critical role they play in memory and learning. Scientists from EPFL's Laboratory of Neuroenergetics and Cellular Dynamics have decoded the molecular mechanics involved: the lactate produced by astrocytes accelerates the memorization process. This result opens up new possibilities for treating cognitive and memory disorders, as well as psychiatric conditions such as depression.

Focusing their attention on the molecular mechanism, the researchers discovered that lactate provides more than just energy. It also modulates the activity of a certain kind of glutamate receptor (NMDA receptor), the primary neurotransmitter in the nervous system. This kind of glutamate receptor is involved in the memorization process, and the researchers found that lactate gives them what amounts to a turbo-boost. "Glutamate lets you drive in first gear; with lactate, you can shift into fourth and travel at 100 km/h," says Pierre Magistretti, leader of the research team and also affiliated with the National Centre for Competence in Research Synapsy.





SENSORS ON THE PROSTHESIS COMMUNICATE WITH THE PATIENT'S NERVOUS SYSTEM.

BIONIC HAND RESTORES AMPUTEE'S SENSE OF TOUCH

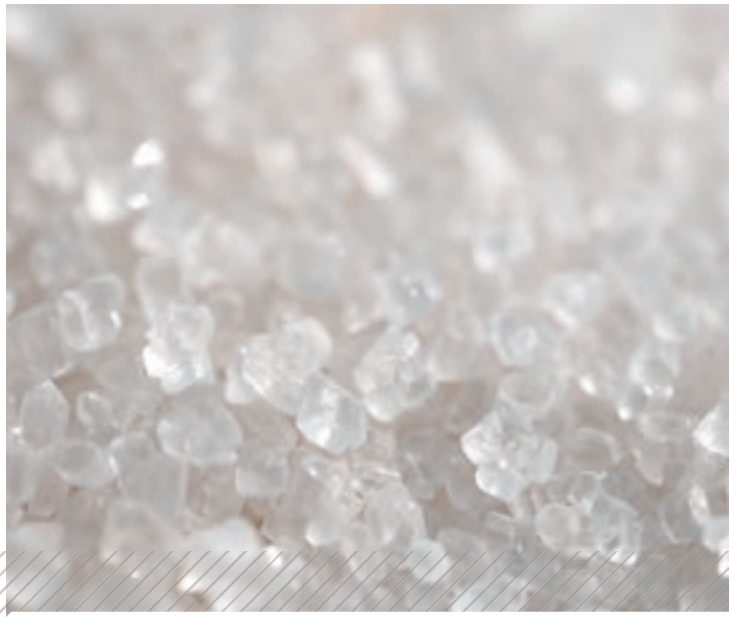
A PATIENT WHOSE LEFT HAND HAD BEEN AMPUTATED WAS ABLE TO REGAIN THE SENSE OF TOUCH WITH A PROSTHESIS CONNECTED TO PERIPHERAL NERVES IN HIS UPPER ARM. HE WAS ABLE TO GRASP OBJECTS IN A NATURAL MANNER AND IDENTIFY THEIR TEXTURE WHEN BLINDFOLDED.

Nine years after his accident, Dennis Aabo Sørensen became the first amputee to regain the sense of touch. He owes this success to an experimental prosthesis equipped with a sensory system connected to the peripheral nerves in his upper arm. Thanks to this device, he is able to once more feel the objects that he touches.

Developed by Silvestro Micera from EPFL's Center for Neuroprosthetics and the Scuola Superiore Sant'Anna in Pisa, Italy, the prototype was tested in the Gemelli Hospital in Rome. The research is the culmination of the European LifeHand 2 project, a collaboration beween Italian, Swiss and German hospitals. The work was published in the journal *Science Translational Medicine*.

Micera and his research group fitted their prosthetic hand with sensors that reacted to the tension in artificial tendons. The system transformed that tension information emitted when the patient manipulated an object into an electrical signal.

The electrical signals in themselves are not something that the nervous system can interpret. The researchers developed a series of algorithms to convert them into a language analogous to nerve impulses. Then those signals were transmitted to electrodes grafted onto peripheral nerves in the patient's upper arm, and his sense of touch was restored.



CANCER CELLS CAN USE SUGAR TO FUEL THE FORMATION OF METASTASES.

CANCER: SUGAR AND METASTASIS

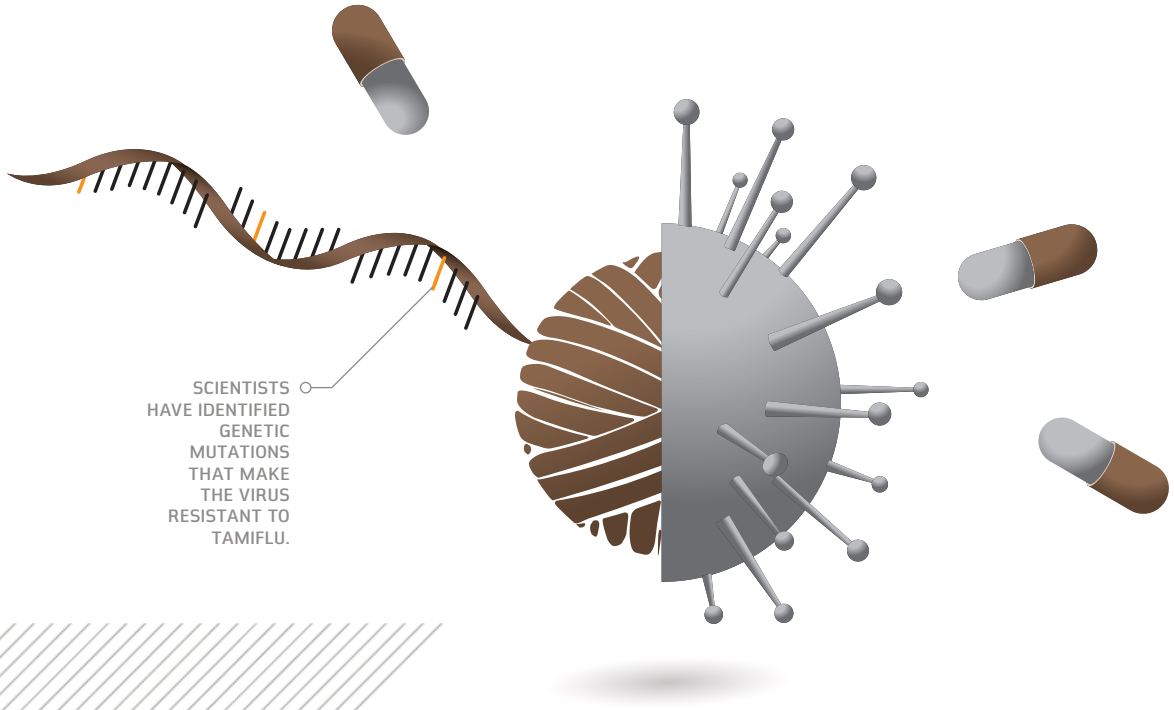
SOME CANCER CELLS ARE CHARACTERIZED BY BOTH THEIR HIGH SUGAR UPTAKE AND THEIR ABILITY TO MOVE THROUGH THE BODY. EPFL SCIENTISTS HAVE SHOWN THAT THE TWO PHENOMENA ARE CONNECTED.

Some cancer cells are highly mobile and tend to not form coherent masses. This so-called ''mesenchymal'' behavior is suspected to be involved in the formation of metastases.

A team led by Etienne Meylan has shown that the mesenchymal behavior is related to cancer cells' appetite for sugar. They also proved that the intensity of the phenomenon significantly influenced patients' chances for survival. The discovery, published in the journal *Cancer & Metabolism*, opens up new potential targets for future therapies.

The scientists experimented using non-small-cell lung cancer, and showed that a protein known as GLUT3, which is responsible for meeting the cell's sugar needs, was spontaneously produced when the cell adopted mesenchymal behavior.

They also showed that patient survival depends in large part on the quantity of GLUT3 produced in their cancer cells. They believe that it will one day be possible to design a toxic molecule that could specifically bond with GLUT3 and destroy the cancer cell from within.



SCIENTISTS HAVE IDENTIFIED GENETIC MUTATIONS THAT MAKE THE VIRUS RESISTANT TO TAMIFLU.

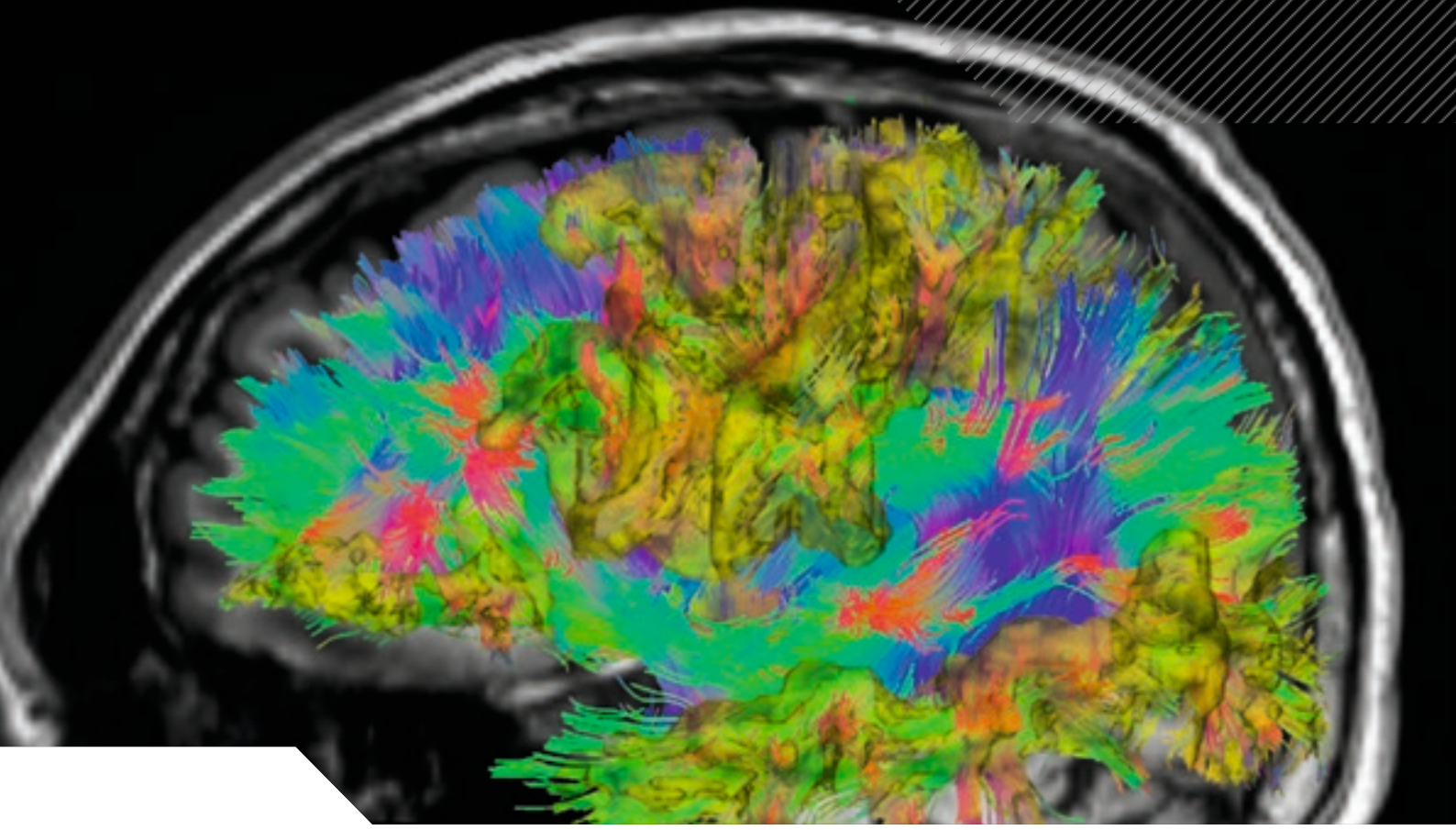
DECODING THE GENOME OF THE TAMIFLU-RESISTANT FLU VIRUS

EPFL SCIENTISTS HAVE IDENTIFIED NEW MUTATIONS THAT COULD MAKE TAMIFLU, ONE OF THE ONLY FLU TREATMENTS AVAILABLE ON THE MARKET, INEFFECTIVE.

The flu virus develops resistance very quickly. Reproducing at a rate of several generations a day, it quickly accumulates genetic mutations. As a result, it has a good chance of evolving counterattacks to antiviral treatment. To efficiently identify these infinitesimal variations in the virus' genetic code, the researchers created complex statistics-based software that they then shared freely with the entire scientific community. They used the software to comb through the immensity of the viral genetic code to find only those mutations that were suspected to cause resistance with at least 99% certainty.

The researchers' work revealed some newly discovered mutations that could potentially allow the virus to develop resistance while at the same time maintaining an elevated reproductive rate. They think it is thus possible that a flu strain would evolve that's both extremely virulent and Tamiflu-resistant, particularly if we make the same mistake that was made in 2008-2009 and use Tamiflu on a large scale. The risk is thus very real, and it's important to continue the investigation if we want to continue to count on Tamiflu as a viable treatment for the flu.

SCHIZOPHRENIC BRAINS TAKE DIFFERENT PATHS

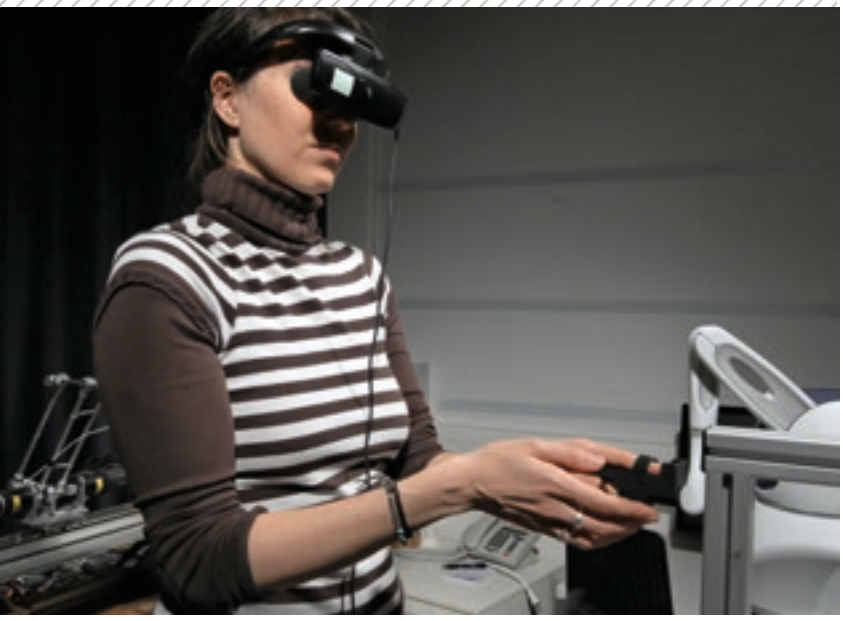


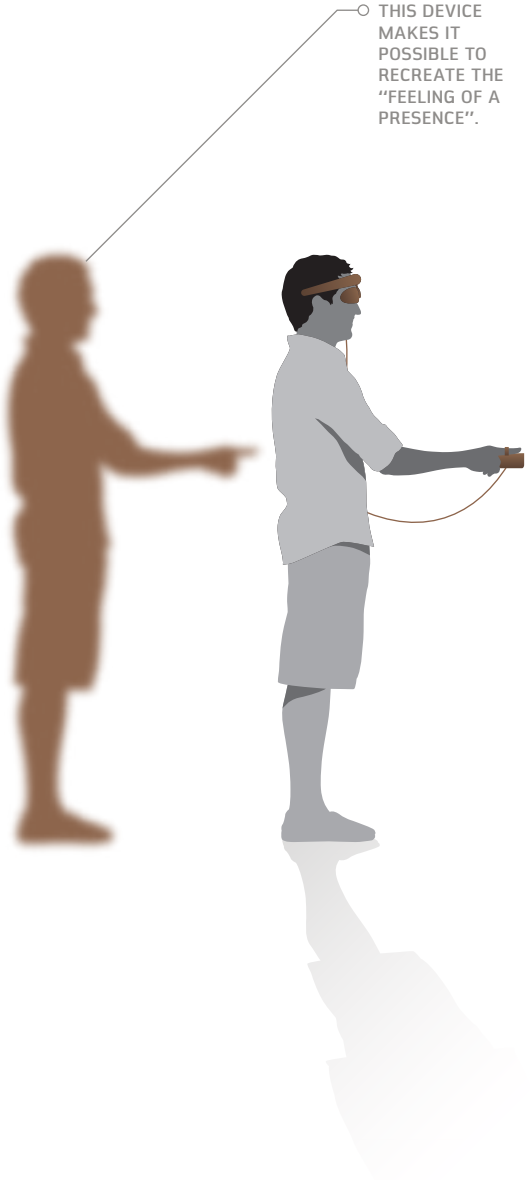
AN ANALYSIS OF STRUCTURAL CONNECTIVITY IN THE BRAINS OF 16 SCHIZOPHRENICS REVEALS REDUCED CONNECTIVITY IN REGIONS AFFECTED BY THE DISEASE.

The brain of a person suffering from schizophrenia doesn't have the same kinds of neuronal connections as the brain of a healthy individual. This observation was made by scientists from EPFL's Signal Processing Laboratory 5 in collaboration with the x-ray diagnostic and interventional radiology department and the psychiatric service of the Lausanne University Hospital (CHUV). They compared the topography of brain regions and connections of 16 schizophrenic patients with the same regions in 15 healthy individuals.

''The problem with schizophrenia is that is doesn't cause localized lesions, but rather affects several brain regions and their connections,'' explains EPFL scientist Alessandra Griffa. To identify them, the researchers used a specialized imaging technique known as diffusion spectrum magnetic resonance imaging (DSI), which calculates the diffusion of water molecules in the brain's white matter and uses this to map the fiber bundle trajectories between various cortical areas.

Comparisons between healthy and schizophrenic brains show for the first time that 26 different regions are affected in the latter. This means that about 30% of the nodes in the brain networks of schizophrenics are compromised. The affected regions include the frontal-parietal zone, which is often involved in cognitive processing. These observations could reveal one of the principal mechanisms of the disorder.





THIS DEVICE MAKES IT POSSIBLE TO RECREATE THE "FEELING OF A PRESENCE".

NEUROSCIENTISTS AWAKEN GHOSTS IN THE BRAIN

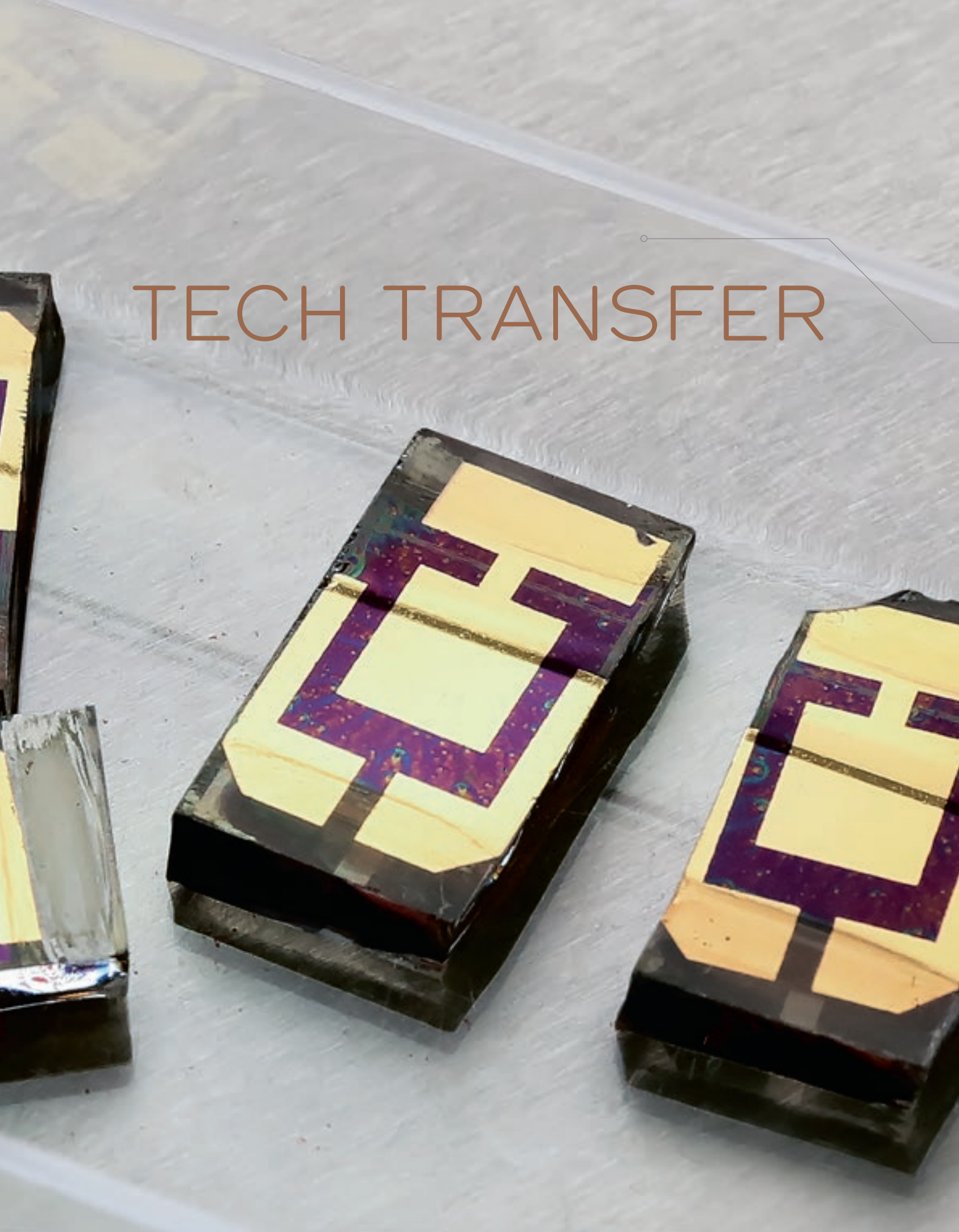
PATIENTS SUFFERING FROM NEUROLOGICAL OR PSYCHIATRIC DISORDERS OFTEN DESCRIBE THE STRANGE "FEELING OF A PRESENCE." THIS ILLUSION HAS BEEN REPRODUCED IN THE LABORATORY IN HEALTHY SUBJECTS.

Invisible but present. Dozens of testimonials from mountain climbers, explorers, and survivors, by widows and patients suffering from neurological or psychiatric disorders, describe the strange "feeling of a presence."

A team lead by Olaf Blanke, director of EPFL's Centre for Neuroprosthetics, has lifted the veil on these ghosts. They were able to recreate, in the laboratory, the illusion of a presence, providing at the same time a simple explanation for its occurrence. The researchers showed that this "feeling of a presence" is due to an alteration of "sensorimotor" brain signals, which are involved in generating self-awareness by integrating information from our movements and our body's position in space. In their experiment, they interfered with the sensorimotor input of participants in such a way that their brains no longer identified such signals as belonging to their own body, but instead interpreted them as those of someone else.

Aside from explaining a phenomenon that is common in many cultures, the research has potential in helping us understand symptoms of schizophrenia. Such patients often suffer from hallucinations or delusions associated with the presence of an alien entity. Many scientists attribute these perceptions to a malfunction of brain circuits that integrate sensory information in relation to our body's movements.

TECH TRANSFER



In 2014, EPFL start-ups raised more than 220 million Swiss francs in private investment funding. Importantly, the lion's share of this, 185 million Swiss francs, was injected into the development of technologies that originated in EPFL laboratories. These numbers are not just another indication of the excellence of our scientific research. They also demonstrate that we're able to carry out an extremely complex mission: to make sure that the inventions of our scientists don't just gather dust in the School's laboratories, but find their way to the public, thanks to a thriving local ecosystem that brings scientists, young entrepreneurs and mutinationals together along the shores of Lake Geneva.

You will also have an opportunity to discover that our School doesn't hesitate to invent new forms of technology transfer when the need arises. Biologists, for example, have established the IM4TB Foundation to get an extremely promising anti-tuberculosis treatment onto the market – an area spurned by big pharma as not sufficiently profitable. Their initiative has already met with considerable success. The Foundation used a social and particularly innovative business model to develop industrial partnerships. Eventually, this initiative will benefit hundreds of thousands of individuals suffering from resistant strains of tuberculosis.

Technology transfer is a true process of alchemy. At the intersection of the academic and industrial worlds, we have to develop common ground and a shared vocabulary, while respecting one another's specific strengths. We must also be constantly reinventing our methods. Innovation is found not just in the final product, but also in the often winding path that's taken in its development.

ADRIENNE CORBOUD FUMAGALLI
Vice-President for Innovation and Technology Transfer

TUBERCULOSIS: EPFL CREATES A FOUNDATION TO LAUNCH AN ANTIBIOTIC

EPFL HAS CREATED A FOUNDATION TO LAUNCH AN ANTIBIOTIC TO TREAT TUBERCULOSIS THAT WAS DEVELOPED IN ITS LABORATORIES IN A EU-FUNDED PROJECT. THIS SPECIFIC ORGANIZATIONAL FORMAT HAS MADE IT POSSIBLE TO BRING ON BOARD A CORPORATE PARTNER TO HELP TAKE ON THE FIGHT AGAINST THIS DEVASTATING BUT UNPROFITABLE DISEASE.

Scientists from EPFL and the AN Bach Institute in Moscow have discovered an extremely promising treatment for tuberculosis, which is especially effective against the multi-resistant strains of the pathogen that are on the rise in Eastern Europe. When taken in combination with other drugs, the molecule, PBTZ169, can vanquish even the most intransigent strains. Following the conclusion of the EU project, the researchers created the IM4TB Foundation, whose mission is to make the new treatment available on the market.

This unusual step was taken because in the case of tuberculosis the usual tech-transfer model doesn't work well; drug development costs are far higher than potential profits, so pharmaceutical companies are typically uninterested. But with its new Foundation, EPFL has been able to form a partnership with the Moscow-based company Nearmedic. A resurgence of resistant TB is occurring in the former Soviet bloc countries, and this is why the partners are committed to making an effective and affordable treatment available to the population.

Nearmedic has more than 2,000 employees in Russia and around the world. The company is known in particular for its system of diagnosing multi-resistant tuberculosis strains. The licenses it has bought from EPFL will be largely used to finance iM4TB's activities, and the Russian company will benefit from data produced by the Foundation as well as exclusive rights in the Commonwealth of Independent States.

RETRAINING THE IMMUNE SYSTEM: AN EPFL START-UP RAISES CHF 33 MILLION

ANOKION IS DEVELOPING A METHOD FOR RETRAINING WHITE BLOOD CELLS THAT HOLDS PROMISE AS A METHOD FOR FIGHTING AUTOIMMUNE DISEASES SUCH AS MULTIPLE SCLEROSIS. PRIVATE INVESTORS HAVE INJECTED MORE THAN CHF 33 MILLION INTO THE YOUNG COMPANY.

What do multiple sclerosis, type 1 diabetes and seasonal allergies have in common? All these conditions are caused by an abnormal reaction of the immune system in which white blood cells either attack their own host or overreact to external stimuli. Anokion, a start-up company in EPFL's Innovation Park, is in the process of developing an extremely promising technology for combating immune disorders like these. Clinical trials are due to begin in 2017.

The potential applications of the technology go well beyond autoimmune disease, as well. Many drugs that are composed of proteins, notably those used to treat hemophilia or various cancers, have been taken off the market because they trigger immune reactions. These side effects could be counteracted by Anokion's technique. A group of investors in the pharmaceutical sector recognized the technology's potential, and injected 33 million Swiss francs (€ 27 million) into the young company.

Anokion's technology is derived from research done in the laboratory of professor Jeffrey Hubbell at EPFL. In 2012, the lab was able to fully cure mice suffering from type 1 diabetes. The results, published in the *Proceedings of the National Academy of Sciences*, attracted considerable attention.

THE SWISS ARMY KNIFE OF MEDICAL ANALYSIS

A PORTABLE SYSTEM DEVELOPED BY QLOUDLAB PROVIDES A FAST, MOBILE METHOD FOR ANALYZING PHYSIOLOGICAL SAMPLES AND IMPROVING PATIENT TREATMENT.

There are many portable analysis systems available to patients and health care professionals that can be used to make diagnoses or help administer treatments. The most familiar is the blood glucose meter that diabetics use to monitor the amount of sugar in their blood. Other portable analysis devices also exist, but they are often not capable of analyzing more than one parameter, so patients end up having to buy several devices and this can get expensive. To solve this problem, Qloudlab, a start-up based in the Microengineering Laboratory, is developing a portable, internet-ready device that can carry out many different medical tests.

Qloudlab's device has a unique, modular structure that uses smartphones and tablets as a user interface. The system is composed of a central device that can be connected to a large number of analysis modules. Each module is dedicated to a specific analysis, and is compatible with single-use tests (bought in drugstores or online). The modules are mainly made up of the sensors needed for the analysis, making them cheaper than their market equivalents. Qloudlab is still in its early stages and is currently focusing on obtaining certification and setting up manufacturing for a limited number of modules in order to release the system for sale sometime in 2016.

EPFL START-UPS SET INVESTMENT RECORD

EPFL START-UPS RAISED MORE THAN CHF 220 MILLION IN PRIVATE CAPITAL IN 2014, MORE THAN TWICE THE AMOUNT OF THE PREVIOUS YEAR. THE NUMBER OF COMPANIES FOUNDED ALSO DOUBLED.

EPFL start-ups raised more than CHF 220 million in venture capital in 2014. It's an all-time record, even though 2013 had been an excellent year with more than CHF 110 million in investments on the books. The more than half a billion francs in private venture capital raised since 2010 is a testament to the potential investors see in these young companies.

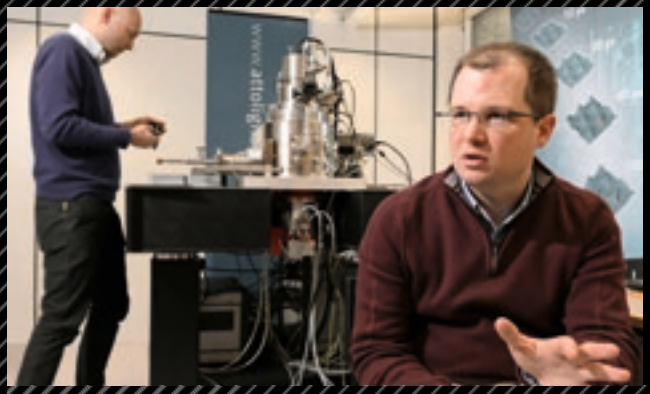
EPFL spin-offs – companies formed to commercialize discoveries or inventions from the School's laboratories – have earned the lion's share of these investments, 185 of the CHF 220 million raised in 2014. The CHF 35 million remaining are earmarked for start-ups that, although not developing technology developed at EPFL, have set themselves up in the Innovation Park to take advantage of EPFL's dynamic campus and the proximity to scientific expertise and opportunities for collaboration.

The number of start-ups created has also doubled from 12 in 2013 to 24 in 2014. The previous record was set in 2009, with 20 new start-ups. "A true start-up culture is emerging at EPFL and in the region," explains Hervé Lebret, head of EPFL's Innogrants seed funding program. "Private venture capital is often considered Switzerland's Achilles' Heel with regards to innovation, but this current trend is very promising."

OSMOBLUE: This young start-up is developing a procedure that should soon be able to produce electricity from excess heat (>30) emitted from garbage incinerators, oil refineries and data centers. Connected on one side to the heat source and on the other to the electric grid, this modular system could eventually be incorporated into existing structures, near air conditioning systems.

SENSEFLY: The drone developed by this Laboratory of Intelligent Systems spin-off is equipped with a miniature autopilot and a high definition camera. It can map construction sites and natural and urban landscapes, monitor sites for companies and help with crop management. The start-up, which added French company Parrot as majority shareholder in 2012, is continuing its development in the Lausanne region.

MINDMAZE: The device developed by this EPFL spin-off taps into neuroplasticity to help patients recover after a stroke. It uses virtual reality in an individualized process that involves engaging and stimulating exercises.



ATTOLIGHT: A small revolution in nanoscale observation, the tool developed by this EPFL spin-off films moving electrons using a combination of an ultrafast laser and a scanning electron microscope. It enables quality control for computer chips, LED and photovoltaic cells. The device is generating intense interest in Asia, where most of these components are manufactured.

EASY-ASSEMBLY SOLAR LAMP FOR DEVELOPING COUNTRIES

LEDSAFARI'S SOLAR LAMP IS A SAFE, EFFICIENT, AND INEXPENSIVE ALTERNATIVE TO THE OIL LANTERNS TRADITIONALLY USED BY MORE THAN A BILLION PEOPLE AROUND THE WORLD.

The oil lanterns used by 1.6 billion people around the world are toxic and can represent up to 20% of the budget for families who are already living in poverty. Govinda Upadhyay, a PhD student in EPFL's Solar Energy and Building Physics Laboratory, had the bright idea of developing a lamp that's stripped down to the bare necessities, but still effective. It is easily assembled, requiring materials that are locally available, apart from the solar collectors, which are ordered from abroad. After charging for 5-6 hours, it can provide 4-5 hours of light.

The concept has been proven to work, because the start-up's founder and his team have already traveled to various parts of India, Rwanda, Tanzania, Uganda and Kenya to share their discovery. More than 500 people have built their own lamps, thanks to the workshop set up by the company, and benefited from the health and financial advantages of using them. ''The start-up also shares other concepts, such as sustainable development, energy, and some information about electricity, for example, during the training sessions. It's important that the locals learn the skills themselves, that this is not just something imported from richer countries that's just as quickly abandoned. They thus become local entrepreneurs when they sell the lamps or teach others how to build them,'' explains Upadhyay.

THE OSCILLATOR THAT COULD REVOLUTIONIZE MECHANICAL WATCHES

FOR THE FIRST TIME IN 200 YEARS, THE MECHANICAL WATCH HAS HAD A MAJOR TECHNOLOGICAL BREAKTHROUGH THAT COULD LEAD TO TIMEPIECES THAT ARE MORE PRECISE, MORE AUTONOMOUS AND TOTALLY SILENT. EPFL SCIENTISTS HAVE DEVELOPED A CONTINUOUSLY TURNING OSCILLATOR THAT COULD REPLACE THE MOST COMPLEX MECHANISM IN TRADITIONAL MECHANICAL WATCHES.

An EPFL team has developed a unidirectional continuous oscillator that could become the new time basis for mechanical watches. This would revolutionize the functional principle behind these watches, which has remained unchanged since the turn of the 19th century. It could lead to the production of more precise, more autonomous and completely noiseless watches.

The new oscillator, named IsoSpring, makes it possible to bypass a complicated mechanism in traditional watches: the escapement. Mechanical watches traditionally depend on a system of gears whose movement leads to alternating oscillations of the balance wheel and the motion of the hands. The interface between these gears and the balance wheel is the escapement, a kind of anchor that moves back and forth. It continues to represent the most difficult challenge to engineers, because its efficiency is very limited. Every time it changes direction, the entire gearing mechanism stops and then starts up again – this causes the familiar ticking sound, and also wastes energy.

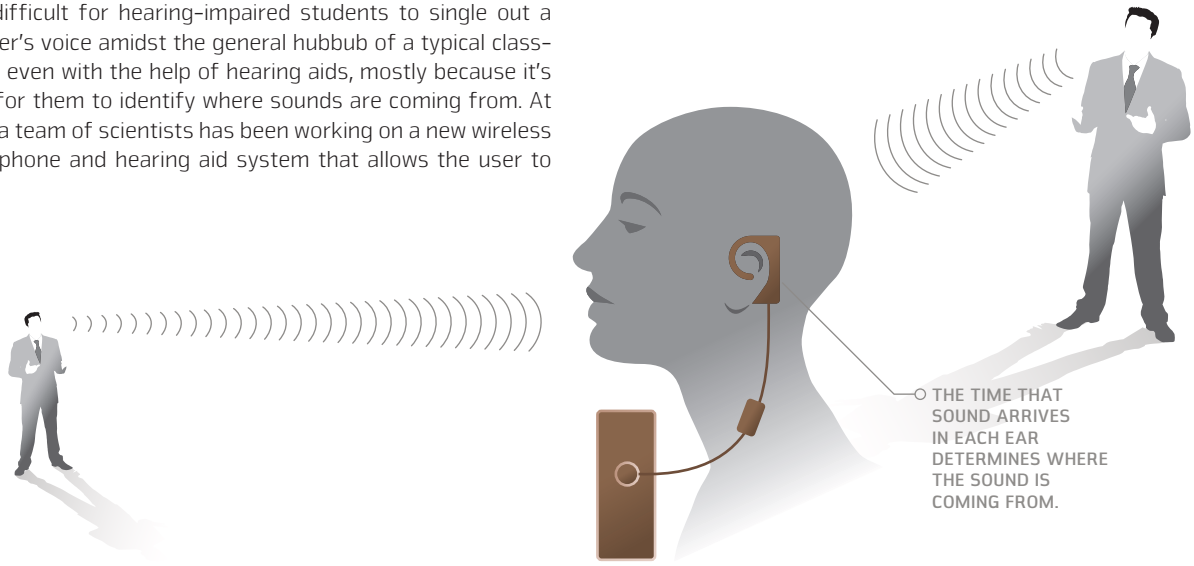
With the new continuous oscillator, the hiccupping mechanical mechanism can be bypassed and replaced with a smooth system that combines precision and compliant mechanisms. ''Our prototype currently weighs four kilos, but we're already working on miniaturizing it. There's enormous interest from the watchmaking industry,'' says Simon Henein, Patek Philippe Chair professor and head of EPFL's Instant-Lab.

HELPING THE HEARING-IMPAIRED SITUATE A SPEAKER

NEW WIRELESS MICROPHONE SYSTEMS DEVELOPED AT EPFL WILL ALLOW HEARING-IMPAIRED INDIVIDUALS TO IDENTIFY WHERE A SPEAKER IS LOCATED EVEN WHEN THEIR EYES ARE CLOSED. THIS INVENTION WILL HELP THEM HEAR BETTER IN CLASSROOMS AND LECTURE HALLS.

It is difficult for hearing-impaired students to single out a teacher's voice amidst the general hubbub of a typical classroom, even with the help of hearing aids, mostly because it's hard for them to identify where sounds are coming from. At EPFL, a team of scientists has been working on a new wireless microphone and hearing aid system that allows the user to identify the location of a speaker who's wearing a microphone. Two prototypes have been built in partnership with the Fribourg company Phonak Communications.

The idea is to alter the sound transmitted by the hearing aid in order to artificially recreate the natural hearing sensation. "The built-in microphones in the hearing aid get the sound the moment it arrives, which is different for each ear," says Hervé Lissek, head of the acoustics group in EPFL's Electromagnetics and Acoustics Laboratory. "We record both the sound received off the microphone, which is offset, and the sound transmitted via radio waves, which is homogeneous in both ears. This information allows us to deduce, via an algorithm, the position of the speaker and then to alter the sound accordingly." The technique will be particularly useful when there are several speakers in a classroom.



STATISTICS TO HELP WIN MATCHES

A NEW SYSTEM DEVELOPED BY PLAYFULVISION PROVIDES REAL-TIME STATISTICS ON ATHLETES AND BALL MOVEMENTS DURING A GAME. ALREADY USED BY PROFESSIONALS, IT WILL SOON BE AVAILABLE TO SPORTS TEAMS IN A VERSION FOR GOPRO CAMERAS.

Having real-time statistics on movement and speed of players and the ball, or even the strike angle, is valuable information that can help improve a team's performance. "These data allow us to better evaluate key moments in a match," says Georges-André Carrel, coach of the University of Lausanne's volleyball team. "For example, we can see which player receives the ball, what he does with it, what angle he uses and thus organize our defensive strategy."

This innovation is based on three algorithms developed in EPFL's Computer Vision Laboratory. The system identifies players by their number and jersey color. "The main challenge was to be able to continuously recognize players, even when they were grouped," explains company founder Horesh Ben Shitrit.

PlayfulVision's new tool is already being used by the International Volleyball Federation (IVBF). In addition to being both innovative and inexpensive, it's also fully automated and easy to set up. In the professional version, six cameras are installed around the field or court and connected to a computer. PlayfulVision's first product, the Volleyball Tracking System, was successfully used in the 2014 world volleyball championships in Poland and Italy.

A CONTACT LENS FOR DETECTING GLAUCOMA

EPFL SCIENTISTS HAVE HELPED DEVELOP A CONTACT LENS THAT CAN DETECT THE ONSET OF GLAUCOMA. CLINICAL TRIALS ARE CURRENTLY BEING CARRIED OUT IN THE LAUSANNE UNIVERSITY HOSPITAL (CHUV).

Glaucoma, caused by elevated pressure in the eye, is the second leading cause of blindness in the world after cataracts. Painless and invisible, this insidious disease is often diagnosed too late for doctors to be able to do anything about it, when the optic nerve has already been irreversibly damaged.

In the canton of Neuchâtel, the start-up company Tissot Medical Research (TMR) commissioned EPFL and the HE-Arc to develop a single-use contact lens that could continuously measure intraocular pressure over a 24-hour period. This lens would be a boon for specialists, enabling them to track glaucoma day and night.

Most ophthalmologists can only test for glaucoma during regular eye exams. Peaks in pressure, however, typically occur at night or early in the morning. Tissot Medical Research's smart contact lenses take measurements over a 24-hour period, every time the eye blinks. Small antennas placed on glasses worn by the patient collect the data, which is then transmitted through wires to a small portable case. The patient can thus go about his regular activities while carrying the device.

Not satisfied with just detecting glaucoma, the new smart contact lens will also be able to participate in its treatment by measuring biomechanical properties of the cornea. It is scheduled to be commercially available by the end of the year.

THE MONTREUX CASINO AS IT WAS IN BYGONE DAYS

WHAT WAS IT LIKE TO ATTEND A CONCERT IN THE HISTORICAL VENUE OF THE MONTREUX JAZZ FESTIVAL BEFORE IT WAS BURNED TO THE GROUND IN DECEMBER 1971? AN EPFL EXHIBIT RECREATES THE EXPERIENCE IN BOTH SOUND AND IMAGE.

On December 4, 1971, the Montreux casino burst into flames in the middle of a Frank Zappa concert; as a result, the Montreux Jazz Festival lost its primary concert hall. Now an exhibit made up of a screen and multiple loudspeakers makes it possible for Jazz Festival visitors to experience the atmosphere of the Festival's earliest years. Its code name is I.AM, for "Immersive Archives of Montreux Jazz."

The artisan of this sensory voyage is Dirk Schröder, a scientist in EPFL's Audiovisual Communications Laboratory (LCAV). He developed a 3D computer simulation named Reflektor that can be used to reproduce in real time the propagation of sound in a given space as a function of multiple parameters, including materials, spatial layout and furnishings, and reverberation off various surfaces and people. Architects will soon be using Reflektor software as an acoustic design tool.

Using Festival archives digitized and conserved by EPFL, Schröder was able to transform this reproduction into a total audiovisual experience: installed in a small room, surrounded by 16 speakers and two subwoofers playing over 17 different musical channels, visitors will experience the Festival as if they were still in the seventies.

SEEING THE SIGHTS WITH A CUSTOMIZED TOUR GUIDE

THE NEW COMPANY EDSI-TECH HAS RELEASED AN APP THAT LETS TOURISTS KNOW WHEN THEY ARE IN THE VICINITY OF AN INTERESTING SITE, SUGGESTS ITINERARIES AND PROVIDES STATISTICS TO TOURISM PROFESSIONALS. THE APP ADAPTS TO USERS' PREFERENCES, AND IMPROVES THE LONGER IT IS USED.

It sits in a pocket, keeps quiet when you just want to admire the view, and doesn't nag you to hurry up in order to keep to a schedule. The new custom tourist app is a valuable source of information that adapts itself to meet your needs. It's actually among a series of applications released by EDSI-Tech and already in use by several tourism organizations, including the tourist office for the Canton of Vaud. The user is notified when he or she is in the vicinity of an interesting site. This app, a new genre of guidebook, takes into account operating hours and periodic nature of certain events, but does not include any commercial advertising or promotional material.

But the real novelty brought by the MyCity system, which the apps are based on, is in personalization via algorithms developed in collaboration with EPFL's Media Lab. The system does this by first collecting some user data during the registration process, and then refines itself bit by bit based on choices made as the app is used. The company has developed several options for learning user preferences, including consultation of various descriptive pages about attractions or comparison with other similar user profiles. Itineraries can also be suggested that correspond to a user's interests. The multilingual mobile app is available online and on the latest versions of iOS and Android.

Data from the system is collected anonymously and made available to tourism professionals to help them improve what they have on offer.

OUTLOOK

ANDRÉ SCHNEIDER
Vice-President for
Resources and Infrastructure

A YEAR OF OPENINGS

Despite the results of the February 9 vote, 2014 was a year of opening up for EPFL. First, in the various Swiss cantons: the inauguration of Microcity Neuchâtel, which will include ten chairs dedicated to innovation in microengineering and nanotechnology; in Sion, where EPFL Valais Wallis inaugurated a mobility laboratory; in Fribourg with the Smart Living Lab, an excellence center to be housed in an avant-garde, sustainably designed building, where 80 employees will participate in research focusing on the technological, social and legal aspects of sustainable construction; and finally, in Geneva, where major progress was made in the Campus Biotech infrastructures, including those slated to house teams from the Human Brain and Blue Brain projects, who moved in at the end of 2014.

Our new conference center, the Swiss Tech Convention Center, was inaugurated in April 2014, and is establishing itself as one of the most modern and well-equipped convention centers in the world. Its promising beginning has strengthened EPFL's position as a central player in the European science community. Thanks to the SwissTech Convention Center, EPFL hosted 139 events in 2014, an average of 4.5 lectures per week and more than 85,000 visitors. And in addition, the combination of this conference center with student housing and shops has created a new gathering place on campus. This spirit of opening is also being manifested by the participation of EPFL and the cantons of Vaud, Valais, Fribourg, Geneva and Neuchâtel in creating a national innovation park. This hub in Western Switzerland will bring Switzerland the international visibility it deserves in the area of innovation.

All these exciting developments haven't distracted us from our commitment to environmental responsibility; in 2014 we also created a commission to establish measures in line with the 2050 energy efficiency strategy and objectives as defined by the ETH Board and the Swiss Confederation. In this context we adopted an energy master plan that aims to reduce EPFL's overall energy consumption by 30% and the energy used for heating/cooling by 60% with the percentage of active renewable energy at 100%. This new commission has also decided to exclusively use 100% recycled paper on campus.

TECHNOLOGIST, THE NEW EUROPEAN SCIENCE MAGAZINE

EPFL HAS PARTICIPATED IN THE CREATION AND LAUNCH OF A NEW EUROPEAN SCIENCE MAGAZINE. *TECHNOLOGIST* IS THE FRUIT OF A NOVEL PARTNERSHIP BETWEEN INDEPENDENT JOURNALISTS AND A UNIVERSITY CONSORTIUM. IT IS AVAILABLE IN THREE LANGUAGES AND IN 20 COUNTRIES.

A new science magazine is hot off the presses; with 45,000 copies in French, German and English, *Technologist* is fully embracing its European roots. It is the fruit of an unusual partnership between a team of independent journalists and four leading European technological universities: The Ecole Polytechnique Fédérale de Lausanne, the Technische Universität München, the Technical University of Denmark and the Eindhoven University of Technology.

In the area of science, the popular press tends to favor and circulate information from English-speaking institutions. Citizens of European countries, however, need to know about the latest discoveries and research taking place on the European continent.

Technologist's goal is to help fill the cultural and linguistic gap and give European science the attention it deserves in the media landscape. It was officially launched in June 2014 at the EuroScience Open Forum (ESOF) in Copenhagen.

A NEW FOOD CENTER CREATED AT EPFL

EPFL HAS INAUGURATED AN INTERDISCIPLINARY RESEARCH CENTER DEDICATED TO FOOD AND NUTRITION. AT THE INTEGRATIVE FOOD AND NUTRITION CENTER (CNU), EXPERTS FROM RESEARCH AND INDUSTRY WILL JOIN THEIR EFFORTS IN THE STUDY OF FOOD.

Producing and distributing quality food at a global scale is one of the challenges that the international community must meet in the coming years. In order to contribute to finding innovative solutions in this area, EPFL has created a new interdepartmental center, the Integrative Food and Nutrition Center (CNU).

Under the leadership of Francesco Stellacci, the center aims to act as an interface between EPFL scientists and industry researchers, in order to facilitate technology transfer and the development of transdisciplinary projects for all the stages of the food value chain. The CNU will also be involved in securing institutional funding for its projects and for creating start-up companies.

The center will have multiple areas of research, from improving means of production, reducing food waste, to developing new foods that can help treat certain kinds of disease, for example.

WESTERN SWITZERLAND CREATES A DECENTRALIZED INNOVATION HUB

EPFL AND THE CANTONS OF VAUD, VALAIS, FRIBOURG, GENEVA AND NEUCHÂTEL HAVE JOINED THEIR FORCES IN AN EFFORT TO CREATE A FUTURE NATIONAL INNOVATION PARK, WHOSE EXPRESSED AMBITION IS TO BRING SWITZERLAND THE GLOBAL VISIBILITY IT DESERVES.

Created from the desire of the Federal Parliament, the National Innovation Park (PNI) has the vocation of strengthening Switzerland's position in the world's roster of scientific and technological innovation, via the creation of parks housing companies, start-ups and all the actors involved in the innovation process.

On June 20, 2013, the Swiss Conference of Cantonal Directors of the Public Economy (CDEP) named the two Federal technology institutes, EPFL and ETH Zurich, as "hubs," or hearts of the Swiss network, along with a few other sites including Projekt NIP Park Innovaare in the canton Argovie, and the Parc d'innovation suisse de la région Suisse du Nord-Ouest, directed by three cantons, Basel Country, Basel City and Jura. The Confederation may also choose additional sites. The Federal Parliament will ratify the definitive PNI organizational structure in 2015.

In addition to its principal campus in Lausanne, home to an existing innovation park where 1,700 people are working, four other decentralized sites are being developed in Neuchâtel (Microcity), Sion (Energypolis), Fribourg (Bluefactory) and Geneva (Campus Biotech). The sites in the decentralized hub correspond to the areas of economic and scientific excellence of each of them.

EPFL plays a central role in this ecosystem of science and innovation; it is also nourished by the presence of four universities, Switzerland's largest university of applied science, two university hospitals and renowned research institutes such as the CSEM.

REACHING OUT REGIONALLY

NEUCHÂTEL: MICROCITY

May 8: Inauguration of the building. May 10: Open day welcomed 4,000 visitors; 500 children participated in workshops. 10 laboratories and almost 200 microtechnology professionals (primarily from the watchmaking and solar energy industries). Synergies with the Swiss Center for Electronics and Microtechnology (CSEM) and the Neode science park. July: Federal Council "field trip."

GENEVA: CAMPUS BIOTECH

July: John Donoghue, one of the world's most renowned neuroscientists, was selected as director of the Wyss Center for bio- and neuroengineering. October: First teams moved in. December: Scientists from the Human Brain Project and EPFL's Center for Neuroprosthetics progressively moved in. End of December: 600 scientists are now working in the Campus Biotech.

SION: ENERGYPOLIS

May: An energy prototype is installed in Martigny. July: Creation of a mobility lab, in partnership with the Swiss Post. November 21: Annoucement of the creation of a new Defitch Chair in clinical neuroengineering and human-machine interactions. December 19: Inauguration of the Industry 17 building. In early 2015, 150 employees will move in.

FRIBOURG: SMART LIVING LAB

March 11: Signing of a convention between EPFL and the State of Fribourg that sets out the deployment of EPFL and the creation of the Smart Living Lab at the heart of the future blueFACTORY innovation park. June: Formation of a team of students from EPFL, HEIA-FR and UniFR, the Swiss living challenge, to partipate in the international Solar Decathlon competition. September 1: First EPFL employees move to Fribourg. October 9: Representatives officially celebrate the launch of the Smart Living Lab. By January 2015 there will be 8 people working in Fribourg on the development of the future building that will house the Smart Living Lab.


NEUCHÂTEL:
MICROCITY
Micro and nanotechnologies
FRIBOURG:
SMART LIVING LAB
Technology for construction and sustainable architecture
LAUSANNE
GENEVA:
CAMPUS BIOTECH
Bio- and neuro-engineering (Wyss Institute), Human Brain Project, Center for Neuroprosthetics
SION:
ENERGYPOLIS
Industrial energy, green chemistry, biotechnology, bioengineering

GETTING GIRLS TO PROGRAM

TO SPARK GIRLS' INTEREST IN COMPUTER SCIENCE AND COMMUNICATION SYSTEMS, THE IC SCHOOL AND EPFL'S EQUAL OPPORTUNITIES OFFICE ARE OFFERING A WORKSHOP IN WHICH GIRLS CAN CREATE AN APP.

The first edition of the app-creating workshop for local girls age 13–15 took place in August 2014. The goal: to create a "chat" app for mobile phones. They learned that an app like WhatsApp can transmit up to 64 billion messages a day, and the workshop gave them a better understanding of the technical, design, and information security challenges involved.

One of the most popular activites of the week was a visit to the EPFL group doing immersive virtual reality research. The group's objective is to develop technologies to integrate virtual reality in real time, using avatars, for example. Participants experienced the "Cave", an installation that records users' reactions to virtual environments. The research draws not only upon computer science, but also psychophysics.

The girls were also able to try out 3D printing and meet an engineer who works at Google. The 2014 workshop was an unqualified success, and will certainly be repeated in 2015.

URBAN BIODIVERSITY: TALKING ABOUT TOADS

IN ORDER TO BETTER UNDERSTAND THE GENETIC DIVERSITY OF URBAN FLORA AND FAUNA, SCIENTISTS ARE ASKING CITY DWELLERS TO SHARE INFORMATION ON A NEW WEBSITE.

Cities are teeming with wildlife. Most of these creatures are invisible, hidden in parks, backyards, or other out of the way places. And yet we know very little about how they are affected by urban development. Genetic diversity is essential for the long-term survival of organisms. It allows plants and animals to adapt to difficult situations such as disease, climate change and the arrival of new predators. When streets, buildings and other urban infrastructures are built, animals are isolated into smaller and smaller groups. At what point does this threaten genetic diversity?

In the context of the Urbangene project, EPFL scientists decided to study the issue by focusing on three species, including the common toad. And to help locate these amphibians' habitats in the greater Geneva area, they have called upon residents to share what they know.

Participants provide information on ponds, which are the toads' natural habitat, via a website and a Facebook group (urbangene.epfl.ch). With the property owners' permission, the researchers will then visit each of the sites to search for toads, and take DNA samples from cells inside specimens' mouths. The genetic data will be mapped and used to conduct a more extensive analysis.

IN 2014:
139 PRESENTATIONS
85,000 VISITORS
4.5 TALKS PER WEEK

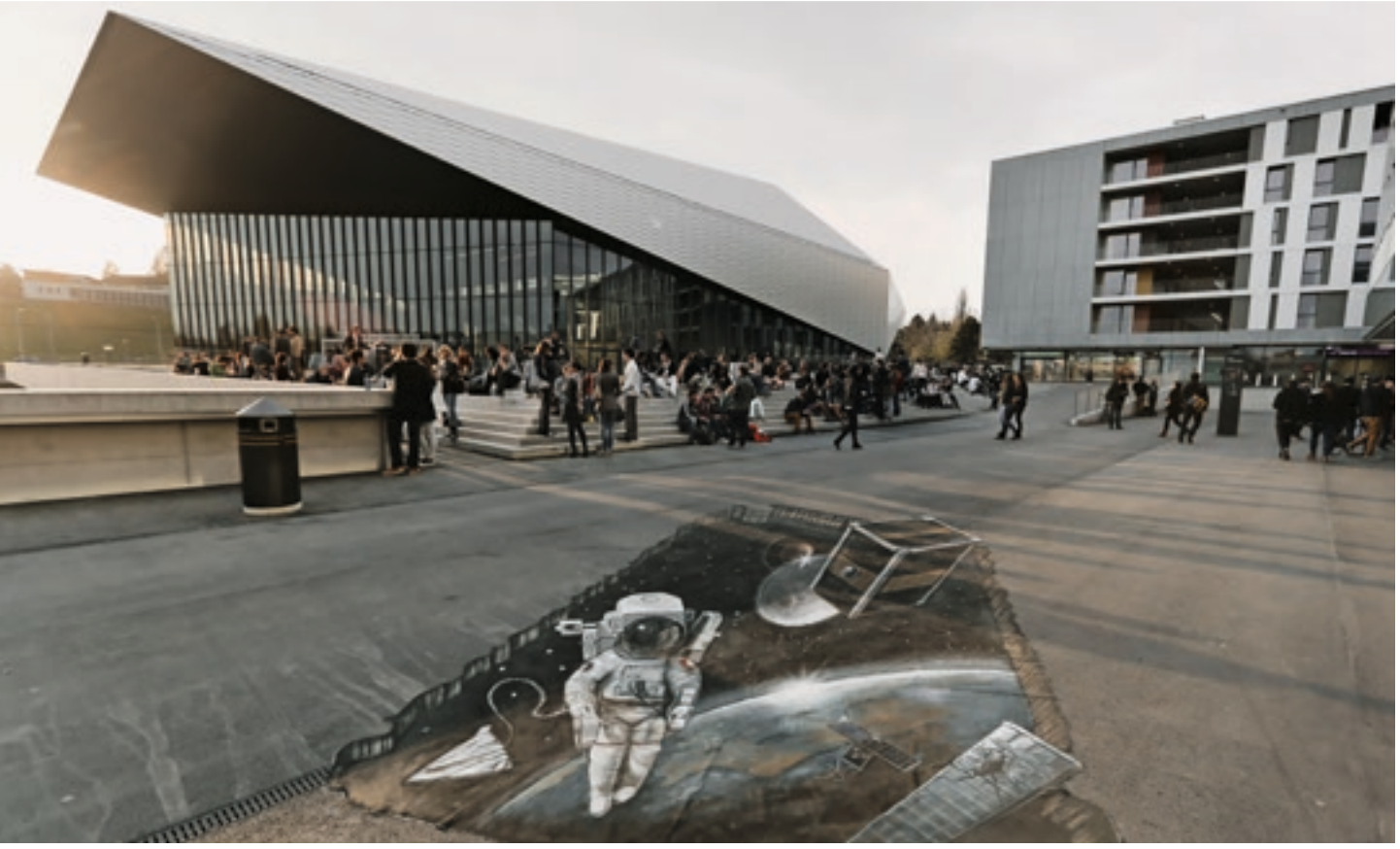
A NEW CONVENTION CENTER AT EPFL

THE SWISSTECH CONVENTION CENTER – SETTING THE TONE FOR CONFERENCES OF THE FUTURE

Inaugurated on April 3, 2014, the SwissTech Convention Center is one of the world's most modern and well-equipped conference centers. With it, EPFL reaffirms its position at the heart of European science and technology.

The SwissTech Convention Center (STCC) is one of the few conference centers in Europe that's located on a university campus. It offers its visitors the very latest in technological equipment. It's unique, in particular, thanks to its extreme modularity. The main auditorium can transform automatically from a 3,000-seat amphitheater into a 1,800-square-meter banquet hall in just 15 minutes. There are also a number of intermediary configurations. The ground floor can be turned into a number of separate workspaces, over a total floor area of 1,500 square meters. One of the building's facades is covered with 300 square meters of colorful transparent "Grätzel" photovoltaic solar cells (named after their creator, EPFL professor Michael Grätzel).

Nearly 30,000 people came to the Open House, held the weekend after the inauguration and organized around the theme "Science and Illusions." In 2014, the SwissTech Convention Center hosted 139 lectures, an average of 4.5 talks per week, and more than 85,000 visitors, as well as public events such as the first edition of the Planète Santé exhibition.



PERSONALIA

PROFESSORS NOMINATED OR PROMOTED IN 2014

YVES BELLOUARD
Associate Professor of Microengineering in the School of Engineering (STI)
(EPFL Neuchâtel, Microcity) [1]

SANDRINE GERBER
Adjunct Professor (SB)

DIRK GRUNDLER
Associate Professor of Materials Science in the School of Engineering (STI)

ELISON MATIOLI
Tenure Track Assistant Professor of Electrical and Electronic Engineering (STI)

MOHAMMAD KHAJA NAZEERUDDIN
Adjunct professor (SB)

JIŘÍ VANÍČEK
Associate Professor in Theoretical Physical Chemistry (SB)

TOM BATTIN
Full Professor of Ecohydraulics (ENAC)
EPFL Valais Wallis in Sion

BRUNO CORREIA
Tenure Track Assistant Professor of Bioengineering (STI)

CATHERINE DEHOLLAIN
Adjunct Professor (STI)

ELISA ORICCHIO
Tenure Track Assistant Professor (SV) [3]

DANIEL GATICA-PEREZ
Adjunct Professor (STI)
Senior Researcher in EPFL's IDIAP Institute in Martigny

DIEGO GHEZZI
Tenure Track Assistant Professor of Bioengineering (STI)
(Campus Biotech, Geneva) [2]

KATHRYN HESS BELLWALD
Associate Professor in Life Sciences and Mathematics (SV) (SB)
(Campus Biotech, Geneva)

KAREN MULLENERS
Tenure Track Assistant Professor of Mechanical Engineering (STI)

IDAN SEGEV
Adjunct Professor
(Campus Biotech, Geneva)

OLEG YAZYEV
Tenure Track Assistant Professor of Theoretical Physics (SB)

CLÉMENCE CORMINBŒUF
Associate Professor of Theoretical and Computational Chemistry (SB)

MATTEO DAL PERARO
Associate Professor of Life Sciences (SV)

BART DEPLANCKE
Associate Professor of Life Sciences (SV)

WENDY QUEEN
Tenure Track Assistant Professor of Chemical Engineering (SB)
EPFL Valais Wallis in Sion

SB: BASIC SCIENCES	IC: COMPUTER AND COMMUNICATION SCIENCES
SV: LIFE SCIENCES	ENAC: ARCHITECTURE, CIVIL & ENVIRONMENTAL ENGINEERING
MES: ENERGY MANAGEMENT AND SUSTAINABILITY	CDM: MANAGEMENT OF TECHNOLOGY
STI: ENGINEERING	CDH: COLLEGE OF HUMANITIES

SABINE SÜSSTRUNK
Full Professor of Communication Systems (IC)

JOHN P. DONOGHUE
Adjunct professor, part-time; Director of Wyss Center for Bio- and Neuro-engineering (Campus Biotech, Geneva)

EDOUARD BUGNION
Adjunct Professor (IC)

ANNA FONTCUBERTA I MORRAL
Associate Professor of Materials Science and Engineering (STI)

LYNDON EMSLEY
Full Professor in Chemical Physics (50% SB)

ANDREAS ZÜTTEL
Full Professor of Chemical Physics (SB)

DAVID ATIENZA ALONSO
Associate Professor of Electrical Engineering (STI)

GEORGE COUKOS
Adjunct Professor (external) at EPFL (SV)

LYESSE LALOUI
Full Professor of Geoengineering and CO_2 Storage (ENAC) [4]

JOACHIM STUBBE
Adjunct Professor (SB)

PIERRE VANDERGHEYNST
Full Professor of Electrical Engineering (STI)

ERIC HOESLI
Adjunct Professor (CDH)

GAÉTAN DE RASSENFOSSE
Tenure Track Assistant Professor of Science and Technology Policy (CDM)

TAMAR KOHN
Associate Professor of Environmental Chemistry (ENAC)

JÉRÔME WASER
Associate Professor in Organic Chemistry (SB)

ANDREA ABLASSER
Tenure Track Assistant Professor (SV)

AUDE BILLARD
Full Professor of Microtechnology (STI)

NICOLA HARRIS
Associate Professor (SV)

MATTHIAS LÜTOLF
Associate Professor (SV)

[1] Richemont Chair in multiscale manufacturing technologies
[2] Medtronic Chair in Neuroengineering
[3] ISREC Chair in Translational Oncology
[4] Petrosvibri Chair in Geoengineering and CO_2 Sequestration

DONORS 2014

DONOR APPRECIATION

EPFL wishes to thank the following individuals, companies, and foundations who have concluded new partnerships or joined the School's donor circle in 2013 and 2014. Through their exceptional commitment to science, education and development, they have contributed to the quality of research, studies, and life on campus.

BERTARELLI FOUNDATION
Campus Biotech; Chair in Translational Neuroengineering; Chair in Neuroengineering

DEFITECH FOUNDATION
Chair in Clinical Neuroengineering and Human-Machine Interaction

GAZNAT SA
Chair in Carbon Dioxide Chemistry; Chair in Geo-Energy

LOGITECH EUROPE SA
Digitalization and promotion of Montreux Jazz Festival Archives

FONDATION LOMBARD ODIER
Venture Fund: Venice Time Machine, Development Office

LOTERIE ROMANDE
Digitalization and promotion of Montreux Jazz Festival Archives

MEDTRONIC EUROPE SÀRL
Chair in Neuroengineering

RICHEMONT INTERNATIONAL SA
Chair in Multi-scale Manufacturing Technologies

ROLEX SA
Under One Roof Art-Science Building

SWISS MOBILIAR
Chair in Urban Ecology and Sustainable Living and related projects

HANS WILSDORF FOUNDATION
Campus Biotech; Center for Translational Molecular Imaging

WYSS FOUNDATION
Campus Biotech – Wyss Center for Bio- and Neuroengineering

We also thank the following donors for their continued support and trust:

CHAIRS

BERTARELLI FOUNDATION

GROUP OF DONORS ADVISED BY CARIGEST SA

CONSTELLIUM

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SWISSUP FOUNDATION

PROJECTS

Digitalization and promotion of Montreux Jazz Festival Archives

AMPLIDATA

AUDEMARS PIGUET SA

ERNST GÖHNER FOUNDATION

LOGITECH EUROPE SA

FONDATION LOMBARD ODIER

LOTERIE ROMANDE

MONTREUX SOUNDS SA

MR. VASILIEV SHAKNOVSKY

EPFL Middle East

GOVERNMENT OF RAS AL KHAIMAH

We would like to thank donors to the following programs:

Euler Courses for Gifted Students: Mr. Barry Chasemore Gates; Prof. Kathryn Hess Bellwald; Mr. Charles Maillefer; NCCR; Prof. Jacques Rappaz; Mr. Jacques de Saussure; Mr. Dmitry Skorcheletti; Mr. Dan Stoicescu; SwissMAP.

Excellence Scholarships: Novartis, Debiopharm; Russian Consulate; PWC; Werner; UPC Cablecom.

Doctoral and post-doctoral scholarships: Axa, Pierre-François Vittone Fund.

Innogrants: Innovaud (Fondation pour l'Innovation Technologique); CA Technologies.

Research grants funded by foundations: American Institute for Cancer Research; Association de la Suisse Romande et Italienne contre les Myopathies (ASRIM); Brain & Behavior Research Foundation; CARIGEST; CHDI Foundation; Fondation Chercher et Trouver; Fondation De Préfargier; Fondation Leenaards; Fondation Panacée; Fondation Pierre Mer; Fondation Raoul Follereau; Fondation Rita Puccini; Fondation Roger De Spoelberch; Fondation Sens de la Vie; Fondation Strauss; Fondation Suisse de Recherche sur les Maladies Musculaires; Fondazione Cariplo; Fondazione San Salvatore Lugano; Fondazione Teofilo Rosi di Montelera; Foundation for the Third Millenium; Gebert Rüf Stiftung; Google; Hans Eggenberger Stiftung; Hasler Foundation; International Foundation for Research in Paraplegia (IRP); ISREC; Juvenile Diabetes Research Foundation (JDRF); Max-Planck-Institut; Muschamp Foundation; Fondation Novartis; OPO Stiftung; RAM Foundation; Swiss Network for International Studies; Swiss Official Chronometer Control; Swiss Vaccine Research Institute; Swissbridge; Velux Stiftung.

DR HONORIS CAUSA 2014

FRANÇOISE BARRÉ-SINOUSSI

THREE KEY FIGURES IN THE WORLD OF SCIENCE WERE AWARDED WITH HONORIS CAUSA DEGREES IN THE 2014 MAGISTRALE GRADUATION CEREMONY.

Françoise Barré-Sinoussi, virologist, in recognition of her discovery of the AIDS virus with Luc Montagnier, which was awarded a Nobel Prize in Medicine in 2008, and for her untiring efforts to understand the virus, to develop a vaccine and for her engagement in humanitarian work in the struggle against this disease.

Cynthia Barnhart, in recognition of her excellence in the field of operations research, which significantly influenced transportation systems and for her unflagging commitment to the scientific community, with particular emphasis on promoting the careers of young researchers and women, in her role as MIT's first female president.

Hansjörg Wyss, in recognition of his exceptional leadership, his success in the medtech industry, and his visionary philanthropic activity in service of biomedical research with human applications.

ORGANIZATION

EPFL PRESIDENCY

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PRESIDENT

ANDRÉ SCHNEIDER
VICE-PRESIDENT OF PLANNING AND LOGISTICS

PHILIPPE GILLET
VICE-PRESIDENT OF ACADEMIC AFFAIRS

ADRIENNE CORBOUD FUMAGALLI
VICE-PRESIDENT OF INNOVATION AND TECHNOLOGY TRANSFER

KARL ABERER
VICE-PRESIDENT OF INFORMATION SYSTEMS

SCHOOLS

SB
Basic Sciences

- Mathematics
- Physics
- Chemistry

SV
Life Sciences

- Bioengineering
- Neuroscience
- Global Health
- Cancer

STI
Engineering

- Electrical Engineering
- Mechanical Engineering
- Materials Science
- Microengineering
- Bioengineering

IC
Computer & Communication Sciences

- Computer Science
- Communication Systems

ENAC
Architecture, Civil & Environmental Engineering

- Architecture
- Civil Engineering
- Environmental Engineering

COLLEGES

CdH
College of Humanities

- Humanities and Social Sciences
- Area & Cultural Studies
- Digital Humanities

CdM
Management of Technology

- Management of Technology
- Financial Engineering
- Technology and Public Policy

EPFL IN FIGURES 2014

QUICK FACTS

RESEARCH

350
LABORATORIES

3342
SCIENTIFIC PUBLICATIONS
(ISI WEB OF SCIENCE REFERENCED)

94
ERC GRANTS (2007 TO 2014)
FOUR FROM SNSF IN 2014
(COMPENSATORY MEASURES)

TEACHING

13
BACHELOR PROGRAMS

24
MASTER PROGRAMS

TECH TRANSFER

14
R&D UNITS
IN THE INNOVATION PARK

220
MILLION CHF START-UP
FUNDING IN 2014

12.7
START-UPS PER YEAR
SINCE 1997 (AVERAGE)
(24 CREATED IN 2014)

CAMPUS POPULATION (NUMBER OF INDIVIDUALS)

STUDENTS

- 5124 BSc
- 2594 MSc
- 2032 PhD
- 171 postgraduate

PERSONNEL

- 1122 administrative staff
- 675 technical staff
- 3495 research & lecturers (including assistants)
- 338 professors

CAMPUS TOTAL POPULATION

13,815

(1736 PHD STUDENTS ARE COUNTED ONLY ONCE IN THE TOTAL)

- 152 preparatory maths students

- 1702 Innovation Park staff

STUDENT BODY

OVERVIEW OF BACHELORS, MASTERS AND DOCTORAL CANDIDATES

1590
BSc & CMS matriculations

- 2948 candidates
- 1933 admissions
- 1590 matriculations

261
MSc (external) matriculations

- 1898 candidates
- 548 admissions
- 261 matriculations

495
PhD matriculations

- 3841 candidates
- 881 admissions
- 495 matriculations

GROWTH IN BUDGET (KCHF) AND STUDENT NUMBERS

1982

- 2360 students
- 163,142 KCHF budget*

1997

- 4302 students
- 354,395 KCHF budget*

2014

- 9921 students
- 616,077 KCHF budget*

* Direct government funding

STUDENTS BY FIELD AND STUDY LEVEL

	BACHELOR	MASTER	DOCTORAL	CONTINUING EDUCATION	TOTAL
Basic Sciences (SB)	1002	429	489		**1920**
Mathematics	342	123	78		**543**
Physics	381	158	213		**752**
Chemistry and Chemical Engineering	279	148	198		**625**
Life Sciences (SV)	477	247	254		**978**
Engineering (STI)	1395	708	670		**2773**
Materials Science & Engineering	159	104	126		**389**
Mechanical Engineering	571	221	116		**908**
Microengineering	518	199	176		**893**
Electrical Engineering	147	184	252		**583**
Computer and Communication Sciences (IC)	753	392	273		**1418**
Communication Systems	240	144	96		**480**
Computer Science	513	248	177		**938**
Architecture, Civil and Environmental Engineering (ENAC)	1497	627	291	48	**2463**
Environmental Engineering	203	153	91		**447**
Civil Engineering	432	200	101		**733**
Architecture	862	274	99	48	**1283**
Management of Technology (CdM)		156	55	123	**334**
Management of Technology		69	39	123	**231**
Financial Engineering		87	16		**103**
Energy Management and Sustainability (MES)		35			**35**
Total	5124	2594	2032	171	**9921**

Bachelors & Masters students

7718

STUDENT BODY

A DECADE OF GROWTH BY FACULTY*

6328
STUDENTS IN 2004

SB 1375
SV 280
STI 1724
IC 1267
ENAC 1536
CdM 146
MES 0

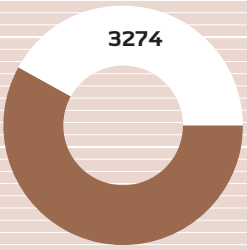
9921
STUDENTS IN 2014

SB 1920
SV 978
STI 2773
IC 1418
ENAC 2463
CdM 334
MES 35

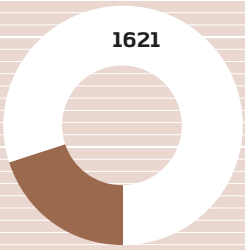
* SB: Basic Sciences
SV: Life Sciences
STI: Engineering
IC: Computer and Communication Sciences
ENAC: Architecture, Civil & Environmental Engineering
CdM: Management of Technology
MES: Energy Management and Sustainability

STUDENTS FROM OUTSIDE SWITZERLAND (EXCLUDING SWISS RESIDENTS)

Bachelor + Master
42%



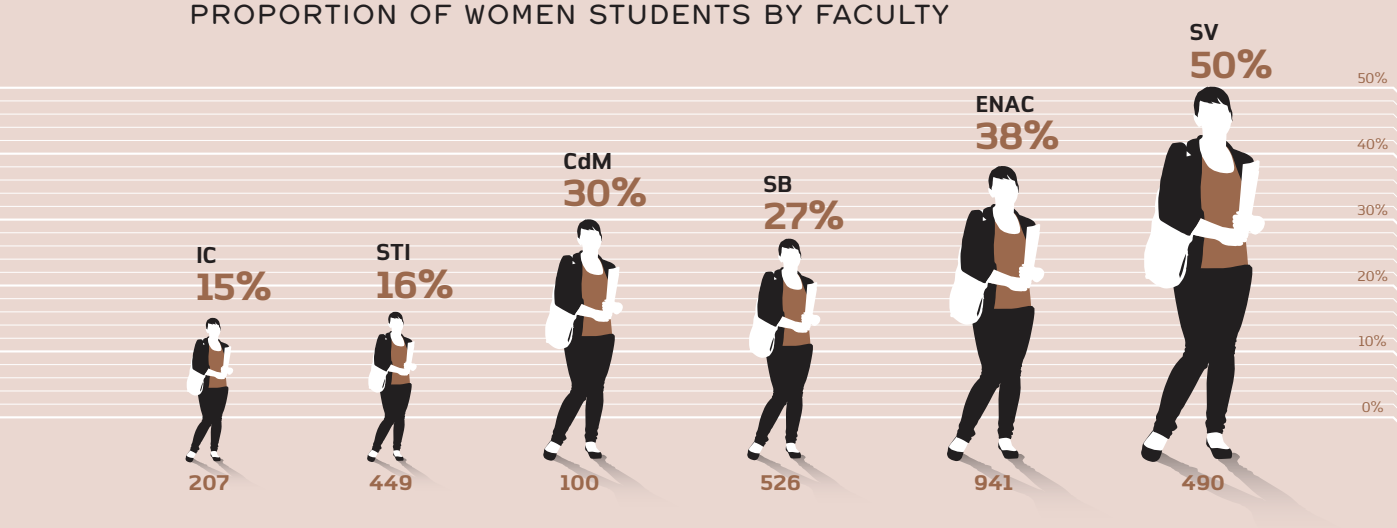
Doctoral
80%



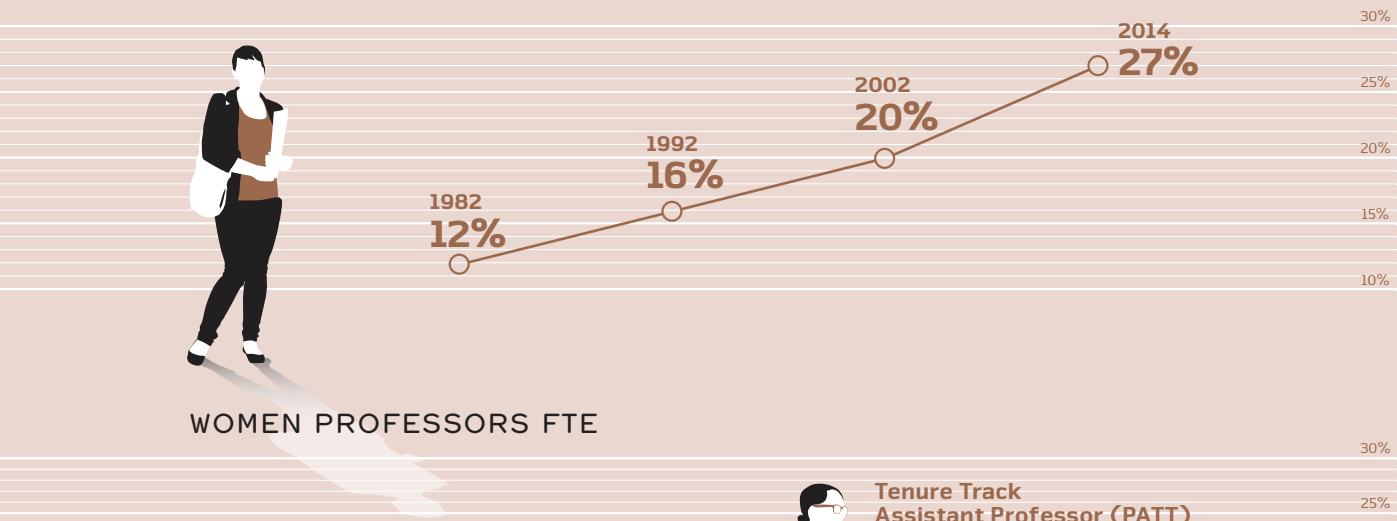
Bachelor : 2048 – 40%
Master : 1226 – 47%

WOMEN ON CAMPUS

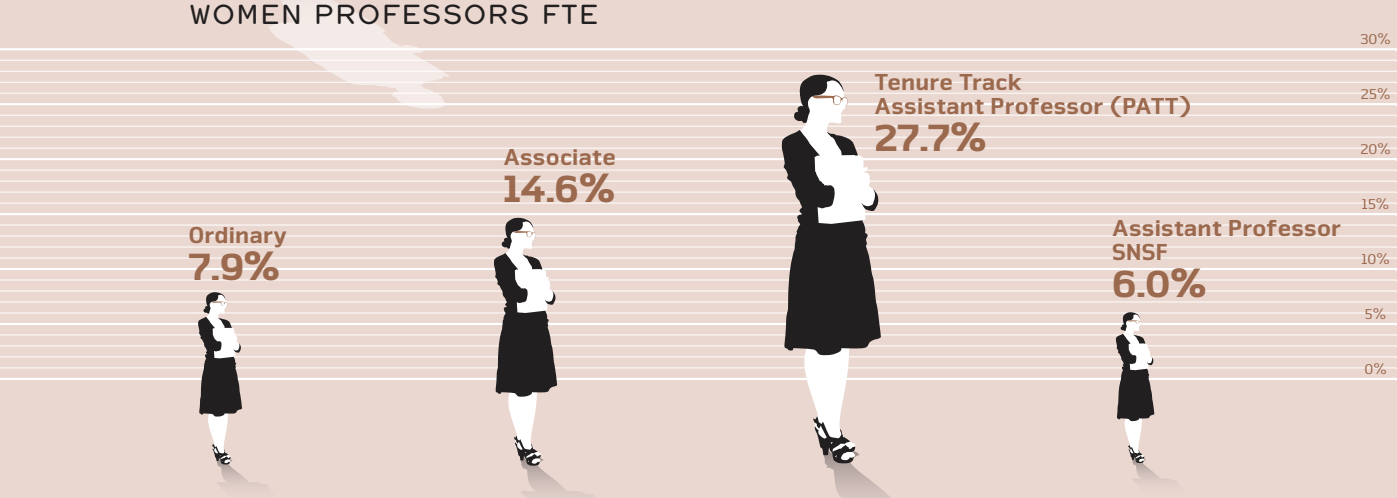
PROPORTION OF WOMEN STUDENTS BY FACULTY



GROWTH IN THE PERCENTAGE OF WOMEN STUDENTS



WOMEN PROFESSORS FTE



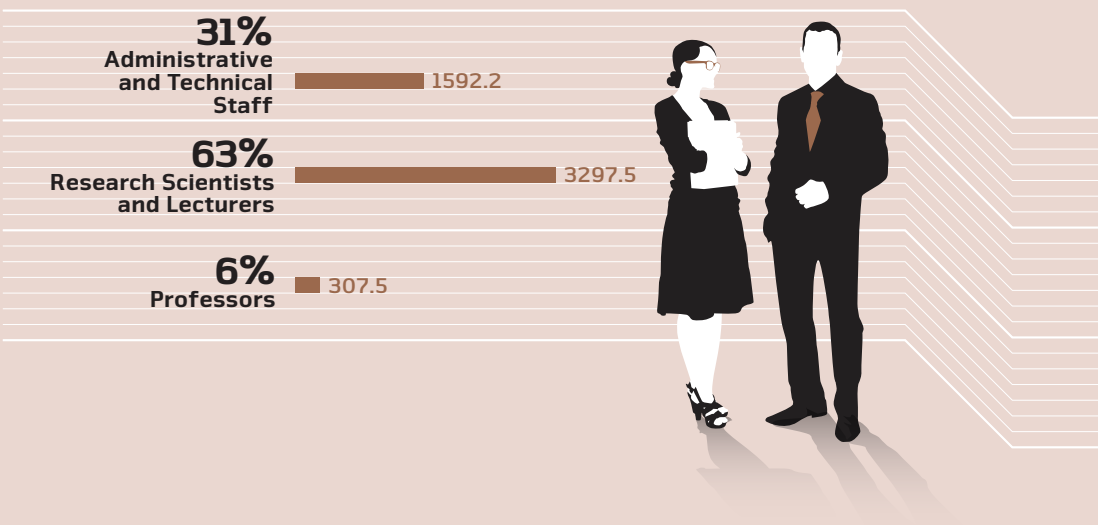
PERSONNEL

EPFL PERSONNEL BY FACULTY AND DEPARTMENT (FULL-TIME EQUIVALENTS)

	TOTAL
Transdisciplinary Units (ENT)	**117.9**
Basic Sciences (SB)	**1181.4**
Mathematics	194.2
Physics	545.4
Chemistry	441.9
Life Sciences (SV)	**724.5**
Engineering (STI)	**1281.9**
Materials Science	228.2
Mechanical Engineering	266.0
Microengineering	461.2
Electrical Engineering	326.5
Computer and Communication Sciences (IC)	**472.6**
Communication Systems	185.6
Computer Science	287.0
Architecture, Civil and Environmental Engineering (ENAC)	**620.3**
Environmental Engineering	204.8
Civil Engineering	201.0
Architecture	214.5
Management of Technology (CdM)	**95.7**
Management of Technology	60.6
Financial Engineering	35.0
Central services (including CdH)	**703.0**
Total	5197.2

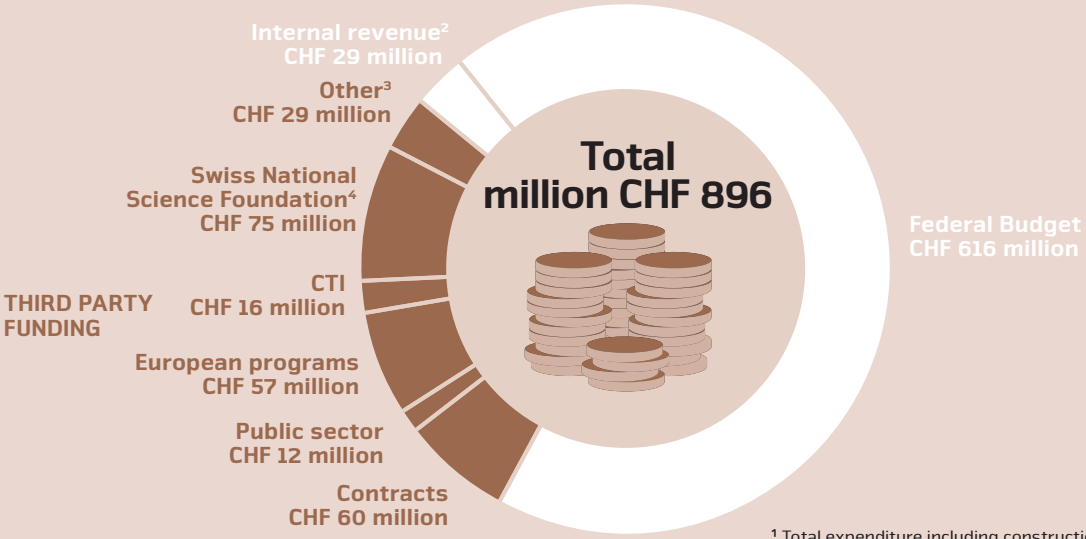
PERSONNEL BY CATEGORY (FULL-TIME EQUIVALENTS)

	TOTAL	GOVERNMENT FUNDED	THIRD PARTY FUNDED (PUBLIC & PRIVATE)
Professors	**307.5**	291.2	16.3
Professors	**175.9**	173.9	2.0
Associate Professors	**63.9**	63.9	0.0
Tenure-track Assistant Professors	**57.7**	52.8	4.9
SNSF Assistant Professors	**10.0**	0.6	9.4
Research Scientists and Lecturers	**3297.5**	1475.6	1821.9
Adjunct Professors	**48.9**	46.9	2.0
Senior Scientists	**75.8**	71.8	4.0
Assistants (incl. doctoral students)	**1944.6**	707.4	1237.2
Scientific Collaborators (incl. postdocs)	**1228.3**	649.5	578.8
Administrative and Technical Staff	**1592.2**	1399.0	193.1
Administrative Staff	**959.0**	858.0	101.0
Technical Staff	**633.2**	541.0	92.2
Total	**5197.2**	3165.8	2031.4
		60.9%	39.1%



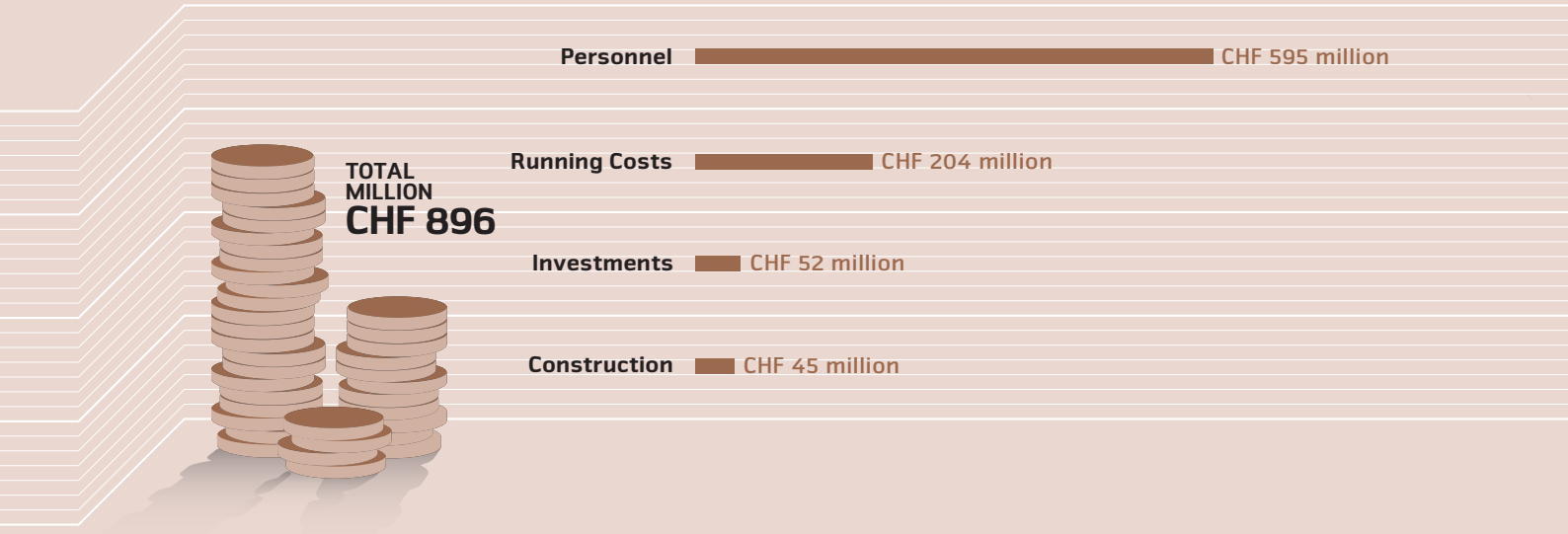
FINANCES*

ANNUAL EXPENDITURE BY FUNDING SOURCE[1]



[1] Total expenditure including construction (including Federal Office for Buildings and Logistics [FOBL] allocation)
[2] Tuition fees, services, financial revenue etc.
[3] Sponsoring, foundations, commited and reserved funds, conferences, continuing education etc.
[4] Including NCCR and NanoTera/SystemsX project funding

EXPENDITURE BY SECTOR



*Figures correspond to EPFL budgetary accounts which may differ from those issued by ETH financial accounting. This is due to account closing differences with no monetary impact.

ANNUAL EXPENDITURE 2014 (KCHF)

	PERSONNEL	RUNNING COSTS	IINVEST-MENTS	**TOTAL**	THIRD-PARTY FUNDING
Basic Sciences (SB)	135,029	20,211	12,995	**168,235**	53,590
Mathematics	25,196	2282	34	**27,512**	5432
Physics	66,448	10,610	9378	**86,436**	27,261
Chemistry	43,385	7319	3583	**54,287**	20,897
Life Sciences (SV)	76,985	21,492	5897	**104,374**	38,129
Engineering (STI)	133,449	25,434	11,986	**170,869**	70,131
Materials Science	25,055	5692	3151	**33,898**	12,092
Mechanical Engineering	27,863	4434	1741	**34,038**	12,910
Microengineering	49,183	8655	5930	**63,769**	26,959
Electrical Engineering	31,348	6652	1164	**39,163**	18,170
Computer and Communication Sciences (IC)	49,541	6300	957	**56,798**	17,600
Communication Systems	19,589	2203	124	**21,916**	5882
Computer Science	29,952	4097	833	**34,882**	11,718
Architecture, Civil and Environmental Engineering (ENAC)	69,450	11,509	1798	**82,757**	21,020
Environmental Engineering	21,985	3680	753	**26,418**	7350
Civil Engineering	21,380	3637	958	**25,975**	8165
Architecture	26,086	4192	87	**30,364**	5505
Management of Technology (CdM)	13,714	2396	12	**16,122**	4881
Management of Technology	8515	1,731	6	**10,252**	3476
Financial Engineering	5199	665	7	**5870**	1405
Central services (including EPFL Middle East)	103,655	110,681	18,370	**232,707**	31,976
Transdisciplinary Units	13,060	6153	98	**19,311**	8122
Construction (BBL)	0	0	44,473	**44,473**	5473
Total	594,883	204,176	96,586	**895,645**	250,922

RESEARCH

INTERNATIONAL RANKING

EUROPE

4th
QS
(Engineering)

5th
Times Higher Education
(Engineering)

7th
QS Global

3rd
AWRU/Shanghai
(Engineering)

2nd
Leiden

7th
Times Higher
Education

WORLD

10th
QS
(Engineering)

12th
Times Higher Education
(Engineering)

17th
QS Global

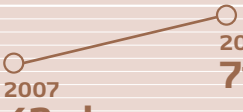
19th
AWRU/Shanghai
(Engineering)

21th
Leiden

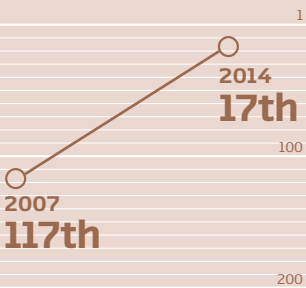
34th
Times Higher
Education

PROGRESSION IN QS GLOBAL RANKING

EUROPE



WORLD

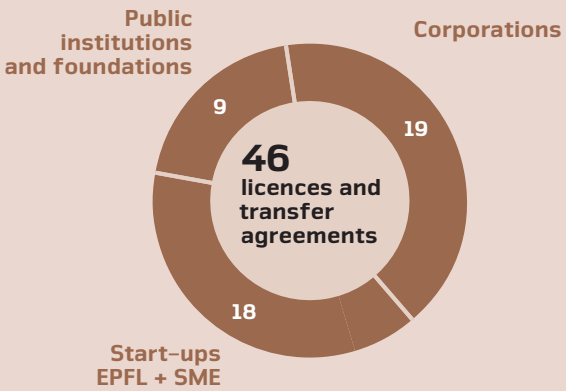


TECH TRANSFER

TECHNOLOGY TRANSFER BY FACULTY

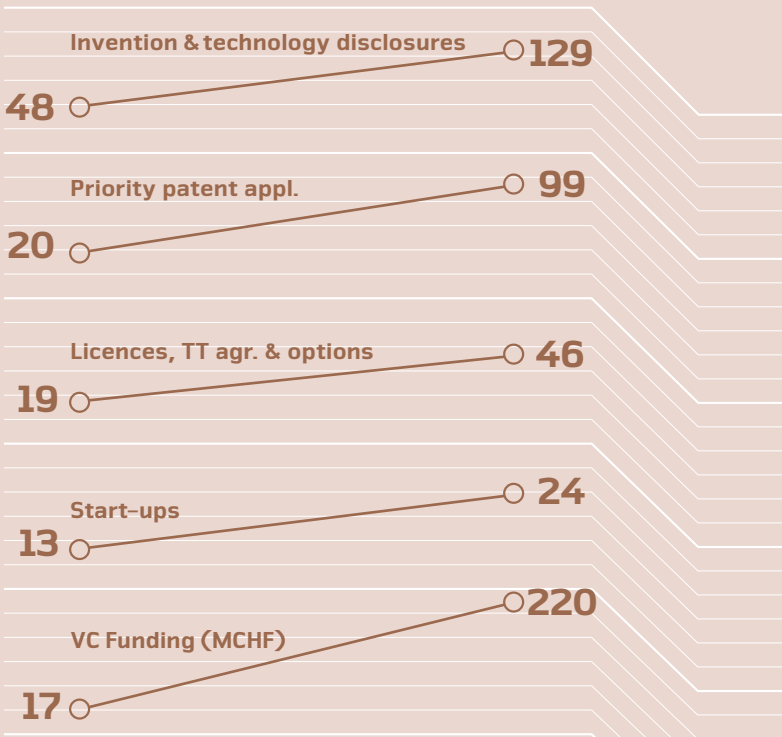
	INVENTION & TECHNOLOGY DISCLOSURES	PATENT REGISTRATION[1]	LICENSING	START-UPS CREATED
Basic Sciences (SB)	**26**	**19**	**7**	**3**
Life Sciences (SV)	**23**	**14**	**10**	**3**
Engineering (STI)	**64**	**51**	**22**	**9**
Computer and Communication Sciences (IC)	**13**	**13**	**6**	**3**
Architecture, Civil and Environmental Engineering (ENAC)	**3**	**2**	**1**	**3**
Management of Technology (CdM)	**0**	**0**	**0**	**1**
Central services	**0**	**0**	**0**	**2**
Total	129	99	46	24

[1] priority applications



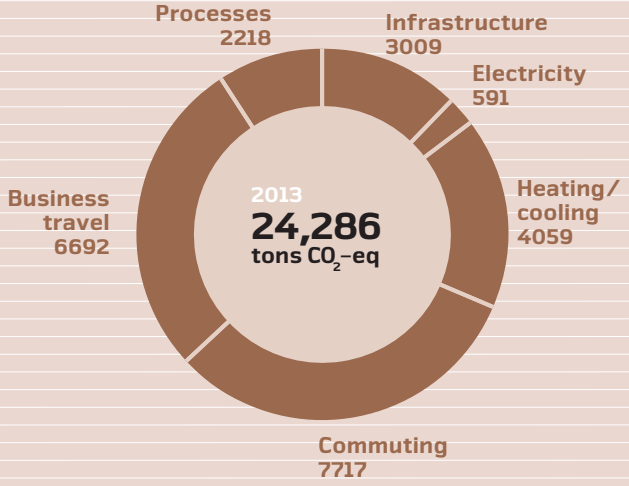
33 CHF million
Industrial contracts managed by the TTO in 2014

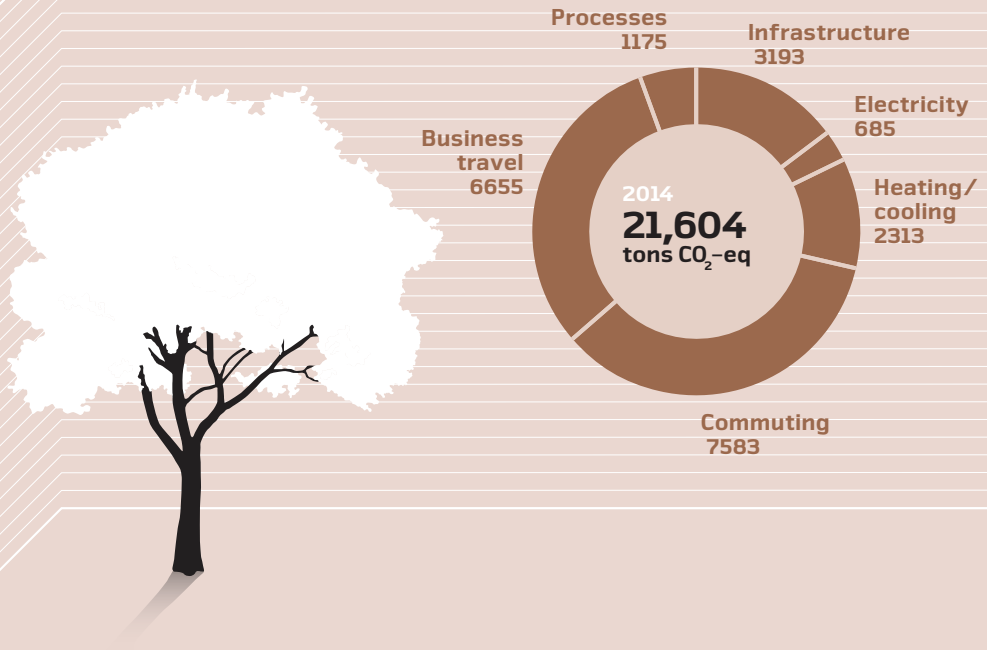
GROWTH IN TECH TRANSFER (1999-2014)



SUSTAINABILITY

TOTAL CO_2-EQ EMISSIONS* (CAMPUS)





* CO_2 balance based on a Life Cycle approach established with the EPFL spinoff Quantis.
The reduction in emissions is in large part due to the diminished use of fossil fuel in the winter of 2014, which was unusually warm.
Data missing for 2014: Campus Biotech, Geneva.

ENERGY CONSUMPTION

	2013	2014
ELECTRICITY (MWh)		
Total electricity purchased EPFL	**77,574**	**77,755**
Total electricity purchased EPFL Vaud	81,314	79,720
Total electricity purchased EPFL Neuchâtel	356	1482
Electricity sold to third parties	-4096	-3447
OIL (MWh)		
Total oil purchased (academic)	**7064**	**1471**
GAS (MWh)		
Total gas purchased (academic)	**16,060**	**12,030**

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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