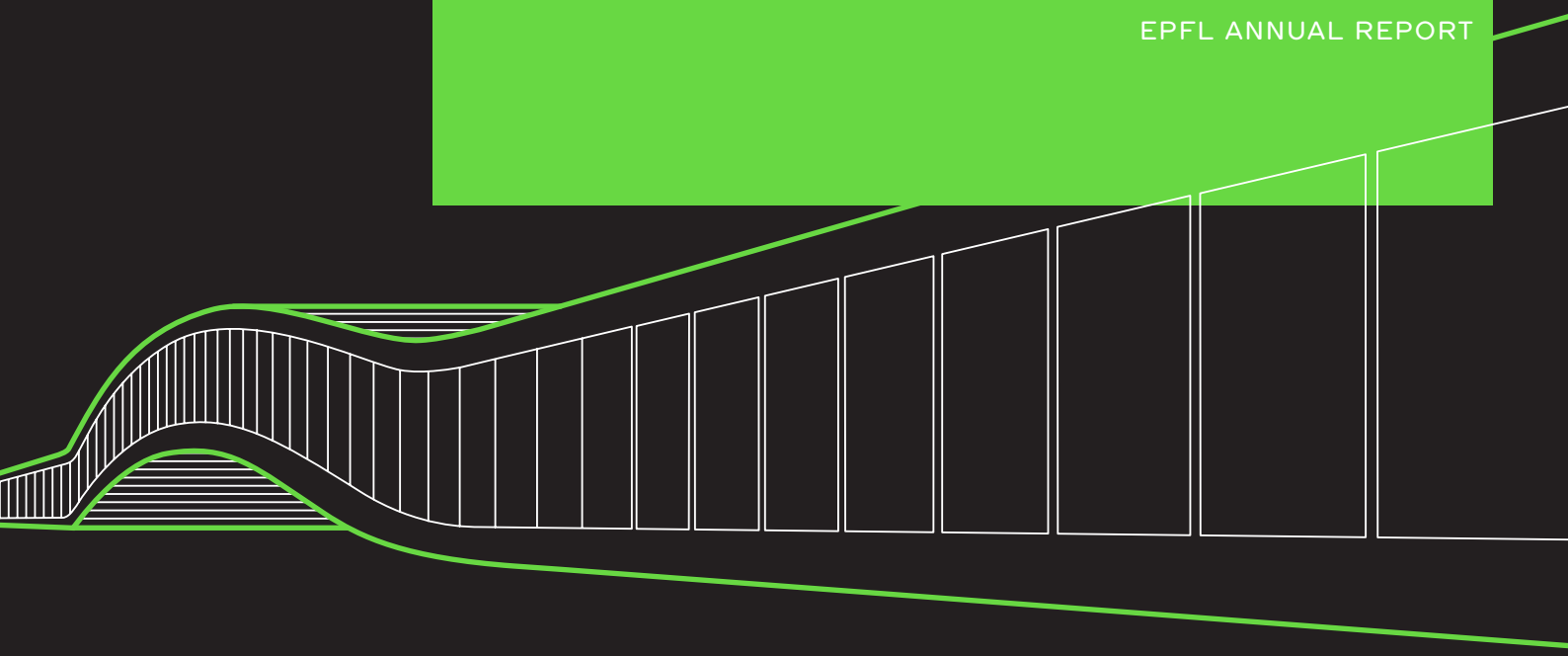
PANORAMA 010

EPFL ANNUAL REPORT



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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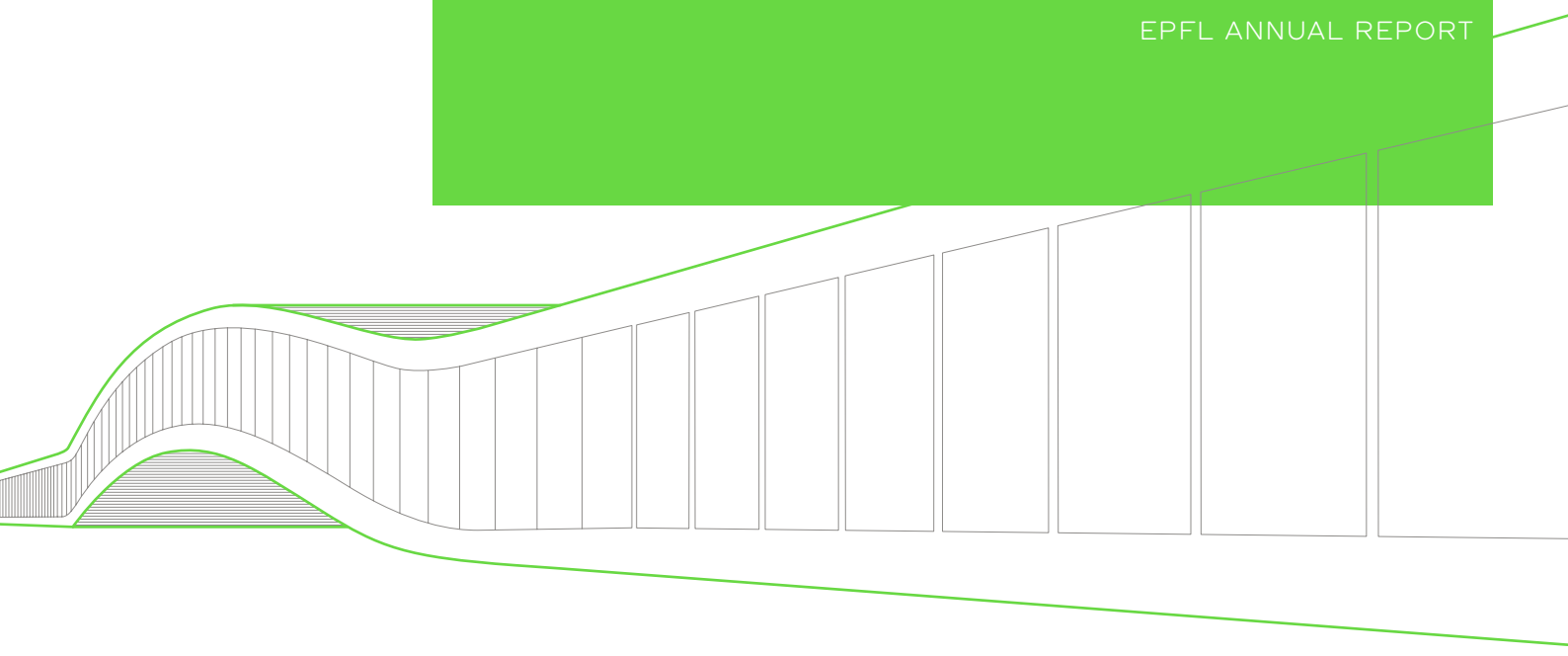


ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

During an evaluation of the ETH domain in late 2010, a group of international experts noted that the development of education was one of the most important tasks entrusted to institutions of higher learning. With the Rolex Learning Center and its open campus, EPFL is preparing to meet this challenge. In this context, it is imperative to pay very close attention to the experiences of our students. In fact, many research projects are developing new solutions to address global challenges; and EPFL's successes prove that it is one of the world's top institutions. The EPFL campus, which expanded in a spectacular fashion in 2010, is also testimony to the role that businesses play in this evolution. A visionary wind is blowing, one that will bring together research, economy and society. It gives impetus to new kinds of collaborations and creates jobs for tomorrow's Switzerland. I congratulate EPFL for this performance, and hope that this same wind continues to blow with a constant force, carrying the School with it and moving the people of Switzerland forward.

Fritz Schiesser
President of the ETH Board
Former State Councillor

The highlight of 2010 was undeniably the inauguration of the Rolex Learning Center (p. 36). Media worldwide lauded this architectural masterpiece, but this attention shouldn't overshadow the building's primary academic function or the success it has had with its users, which has gone beyond our wildest expectations. What is now recognized as an iconic Swiss building was designed down to the last detail to enable the free exchange of knowledge, and to offer our 7,762 students an exceptional learning environment. The Rolex Learning Center is a symbol of our desire to consolidate EPFL as a public institution for the 21st century: ambitious, entrepreneurial and Federal.

In another strong indication of our commitment to change, engineering students are now required to carry out an internship in a company (p. 10). At first glance this may seem like a small step; however, it has been extremely successful and attests to our commitment to educating highly capable scientists and engineers who will succeed in the professional world.

In parallel, in December 2010 two of the School's flagship projects, Guardian Angels for a Smarter Planet, co-directed with ETH Zurich, and the Human Brain Project (p. 53), were submitted to the EU as part of the Flagship FET program. If these two visionary projects are selected in 2012, they will receive up to a billion Euros in funding. This would be a fantastic opportunity for Switzerland to reinforce its status as a world leader in the field of research and development.

At the same time, the public's expectation of its universities is continuing to grow. The area of renewable energies is a good illustration – and citizens are aware that the first stage takes place in the laboratory. Our EFPL researchers have invented dye-sensitized solar cells and come up with audacious solutions in fields such as geothermal energy, hydrogen (p. 14) and CO_2 sequestration (p. 33). However, these technologies must make the transition from the lab into industry, and there are many challenges that must be overcome in order for this to happen. Our ''Innovation Square'' can play a leading role in this transfer and is currently undergoing a period of considerable growth (p. 34). EPFL's future lies here – at the interface between researchers and society, at the interface between present and future, and at the interfaces between scientific disciplines.

Patrick Aebischer
EPFL President

TEACHING

The fact that media attention is often focused on the School's research and major architectural realizations should not overshadow its primary mission: educating engineers and preparing young people for professional careers in an increasingly competitive and global job market. In October 2010, EPFL enrolled the largest class in its history – more than 1,600 new students (+8% Bachelor's, +32% Master's). For the first time ever, the School had more than 7,500 students under its roof. A significant increase in the number of applications at all levels (see EPFL in Figures chapter) attests to the growing attractiveness of the School.

What are these students choosing to study? In a sign of a renewal of the golden age of construction, or perhaps as an effect of the Rolex Learning Center, the number of students in Civil Engineering and Architecture has been increasing over the past few years, and this trend continued in 2010. However, discerning current trends in students' interests is often difficult since the system of subject choice is relatively complex.

It is for this reason that the educational offer at the Master's level is continually expanding; new programs have been put in place both in Lausanne and EPFL's Middle East campus. They are custom-designed so that EPFL graduates can tackle the global challenges of the 21st century while at the same time satisfying their thirst for knowledge.

The School also aims to be a model of innovative and effective education. The CRAFT Laboratory, whose mission is to invent and test new pedagogical methods, has set up a large-scale tutoring program to help students master the basic scientific disciplines.

EPFL graduates must also develop practical skills and prepare for professional careers, and the School now requires its students to carry out internships in companies as part of their education. This new development was well received in the business world, where companies are concerned with making future engineers aware of economic realities and the world of the marketplace.

ENGINEERING LIFE – A NEW GENERATION OF STUDENTS EMERGES

EPFL recently launched a new Masters program in Bioengineering, combining the Schools expertise in life sciences and engineering techniques. Along with Stanford and MIT, EPFL is now one of a select few to offer this kind of qualification.

Two EPFL faculties launched a new joint Masters course, combining life sciences and engineering to create a truly interdisciplinary program. Along with MIT and Stanford, the EPFL is one of the few universities in the world to offer a parallel education in both bioscience and advanced engineering techniques, with the focus on the design and discovery of new molecules and organisms.

Thanks to scientific initiatives such as the Human Genome Project, an expansive amount of new biological information is available. Classifying and analyzing this mass of information requires new, highly efficient, quantitative tools.

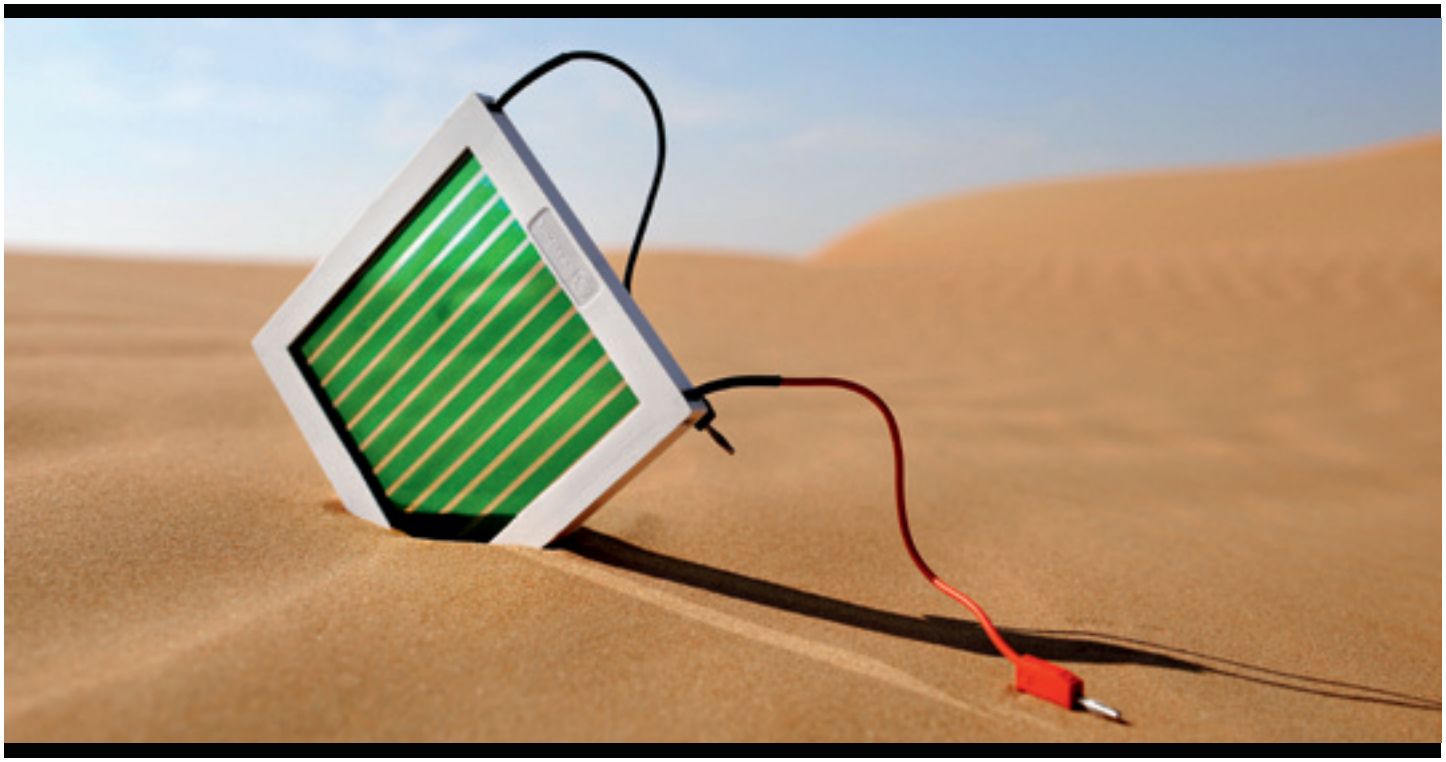
STUDENTS WILL BE ABLE TO APPLY THEIR KNOWLEDGE OF ENGINEERING TO CONCRETE PROJECTS CONDUCTED IN THE LABORATORY.

Biological research at EPFL often relies on engineering. For instance, micro-fluidic chip technology developed at EPFL now allows scientists to run thousands of experiments simultaneously, saving time and ensuring a higher level of precision. Another example is the School's participation in an international genetically engineered machine (GEM) competition. In 2009 students presented their research on light-sensitive proteins, which when activated by exposure to light, specifically induce the expression of a target gene. This "biological switch" could have important repercussions in the domain of bioreactors in which proteins could be activated or deactivated simply by placing a light bulb in the reactor.

The Masters in Bioengineering has been in place since 2007; however several new engineering classes were added to the curriculum in 2010, further extending EPFL's goal of multi-disciplinary approaches to education and research in the life sciences. The objective is to offer bioengineering students an in-depth education on the basics of biology, while simultaneously developing competitive skills in the field of engineering. They will then be able to integrate this knowledge through concrete projects conducted in the laboratory.

EPFL MIDDLE EAST OPENS A MASTERS PROGRAM IN RAS AL KHAIMAH

From 2010, students have been able to apply for a new scientific collaboration between Lausanne and the Emirate of Ras-al-Khaimah. EPFL Middle East, based in the United Arab Emirates, has opened registration for Switzerland's first ever Masters program on an overseas campus.



Energy Management and Sustainability (EMAS), a two-year Masters program, will start in September 2011 and earn students 120 credits. Participants will spend one year on campus in Lausanne, and then a second year in Ras Al Khaimah, UAE, to complete their training with onsite experiments in a desert climate. Students will benefit from the combination of EPFL's world-class research facilities in Lausanne and the opportunity to apply their knowledge in a region where sustainability has become a major concern.

The Masters program offers a broad-based qualification, including courses from various EPFL programs. The aim is to train a new generation of professionals who will be qualified to tackle critical issues in energy management and sustainability. This new curriculum was created to provide a unique interdisciplinary education with a focus on project management and internships. With this Masters degree, students will be capable of solving complex systems, such as smart electricity distribution networks, water distribution systems, environmental services and electronic networks that control energy consumption.

INTERNSHIP: TOTAL IMMERSION FOR FUTURE ENGINEERS

Once life in academia and its associated lab work is finished, many students have to face the reality of finding employment outside the University setting. In 2010, EPFL provided internships for 600 engineering Masters students to facilitate this transition.

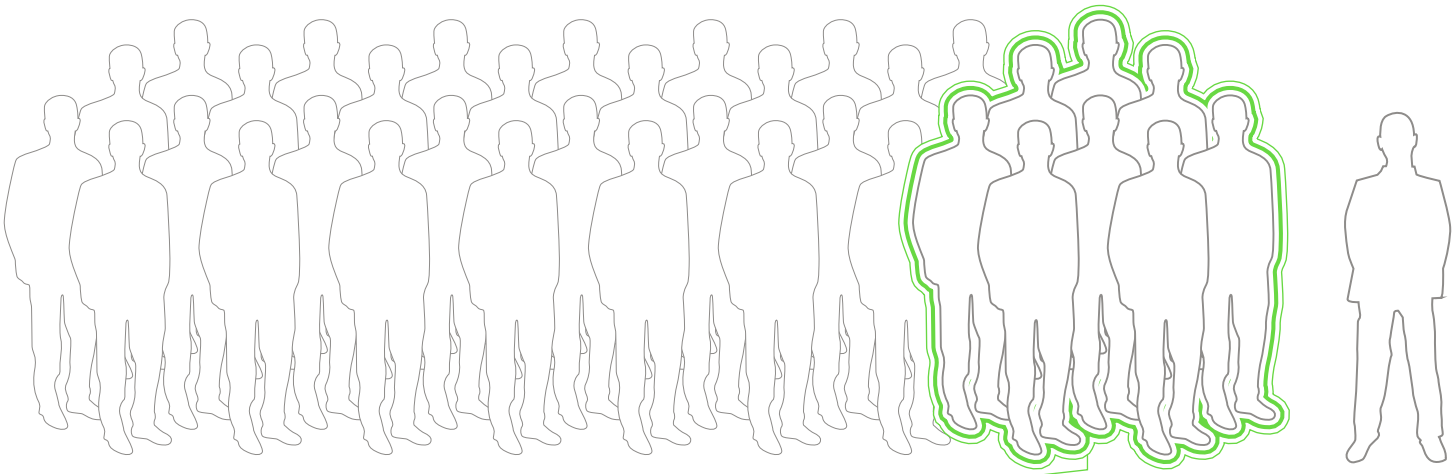
All students enrolled in an engineering program have to undertake an internship in a company as an integral part of their studies. Via the School, students have access to internship fairs that centralize the needs of renowned Swiss and international companies. They can use this platform to apply for internships varying from two to six months, during which time they carry out their Master's project in an atmosphere of total immersion in their chosen field of study.

This is an opportunity for students to develop the attitude and the ability required for their future profession. They have to face the challenges of working in a company, being part of a team and put their skills and knowledge into practice whilst learning how the corporate structure works. The company will define an internship subject related to the student's field of study, coach him/her and provide a stipend intended to cover expenses incurred during the placement.

EPFL's Career Center is a bridge between the School and the external world of work and supports future engineers as well as answering the needs of companies and young graduates. The Center has been coordinating internships since its inauguration in 2009. In 2010, 202 students benefited from the scheme, and in future years internships will be mandatory for over 600 future engineers.

THE TUTORIAL SYSTEM CONTINUES TO GO FROM STRENGTH TO STRENGTH

By definition, a university is a place where knowledge is shared and passed on. The CRAFT (Centre de Recherche et d'Appui pour l'Enseignement et ses Technologies), provides a vital supporting role.



The tutorial system facilitates the arrival and integration of first year students into their new environment. Students meet weekly in small groups of eight with the same tutor.

The tutorial system set up by the Research Center four years ago has developed considerably and facilitates the arrival and integration of first year students into their new environment. New students meet weekly in small groups of eight in which their assigned tutor takes them through analysis- or physics-based exercises. This represents a major shift from the teaching systems of the past where 30 to 50 students were gathered in a single room with only a few assistants.

Tutoring at EPFL is moving from strength to strength, a fact borne out by the level of student participation and positive feedback during CRAFT evaluations. Over the course of 2010, no less than 1,250 students benefited from 220 tutors in 11 different classes. The tutorials not only offer practical help through learning techniques, but also high quality coaching with a human dimension. This opens up new relationships on campus, a dynamic that seems to work for the students who often continue to work together on other subjects long after their tutoring is over.

CRAFT's mid-term objective is to allow students from any faculty the option of following an analysis or a physics course with this type of format.

RESEARCH

Recruitment of new scientists from the world's most prestigious institutions and success in raising grant funding from major scientific programs such as the European Research Council (ERC): the year 2010 strengthened EPFL's position in the upper echelons of international science and technology universities.

The scientific productivity in our laboratories highlights the diversity of research within the School: How will we commute in the future? What new approaches will medicine develop to combat disease? What happens 2,500 meters under the glacial Antarctic icecap?

Sometimes, research opens up interesting possibilities for technology transfer. For example, progress made in techniques for exploiting hydrogen, from production to storage, could play a role in the replacement of fossil fuels. Several researchers have also sketched out promising solutions for reducing the exponentially growing energy consumption of electronics and computer components.

Three-dimensional medical imaging is being called upon to revolutionize diagnostics, in order to better understand the evolution of disease and detect it as early as possible.

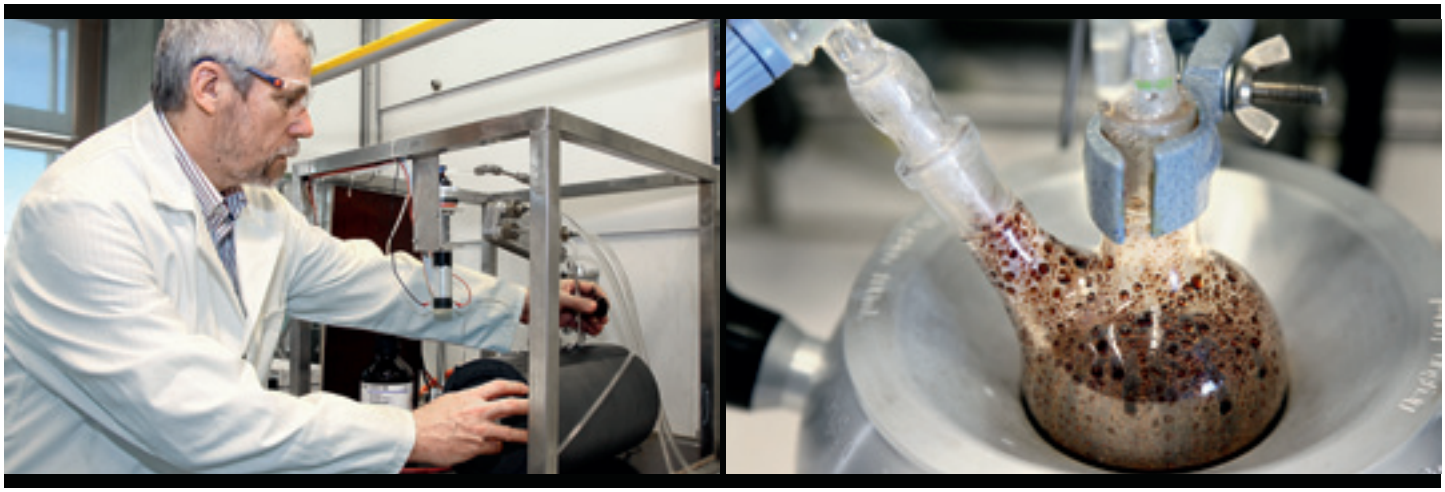
FILL UP WITH FORMIC ACID

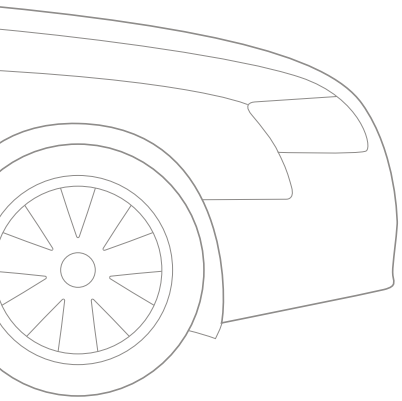
Do ants hold the key to the fuel of the future? Formic acid is a more efficient and safer way to store hydrogen and could therefore be an ideal way to store energy from renewable sources or to power the cars of the future.

Hydrogen is often referred to as the future replacement for fossil fuels. Despite being environmentally-friendly and efficient, it nevertheless has many drawbacks. Because it is extremely flammable, it must be stored in bulky pressurized cylinders. Scientists from EPFL and their colleagues at the *Leibniz-Institut für Katalyse* have found a way around these obstacles. Once converted to formic acid, hydrogen can be stored easily and safely. This is an ideal solution for storing energy from renewable sources like solar or wind power, or to power the cars of tomorrow.

Hydrogen is easy to produce from electrical energy, and thanks to a catalyst and the CO_2 present in the atmosphere, scientists have been able to convert it to formic acid. Rather than a heavy cast iron cylinder filled with pressurized hydrogen, they obtain a non-flammable substance that is liquid at room temperature.

In November 2010, EPFL laboratories produced the opposite reaction; through a catalytic process, the formic acid reverts to CO_2 and hydrogen, which can then be converted into electricity. A compact working prototype producing 2 kilowatts of power has been developed, and two companies have purchased a license to develop this technology: Granit (Switzerland) and Tekion (Canada).





Storing Renewable Energy

"Imagine for example that you have solar panels on your roof," says Gabor Laurenczy, professor at the Laboratory of Organometallic and Medicinal Chemistry and head of the Group of Catalysis for Energy and Environment. "In bad weather or at night, your formic acid battery will release the energy stored while the sun was shining." This method can return more than 60% of the original electrical energy and is extremely safe since the formic acid continuously releases very small amounts of hydrogen, "just what you need at the time for your energy consumption," says Professor Laurenczy.

Another advantage over conventional storage is that this method can store almost twice as much energy for the same volume of hydrogen. One liter of formic acid contains more than 53 grams of hydrogen, compared to just 28 grams for the same volume of pure hydrogen pressurized to 350 bars.

Finally, the researchers have developed a catalytic process using iron, which is readily available and inexpensive compared to "noble" metals such as platinum or ruthenium. As with all catalysts, the material is not degraded during the process.

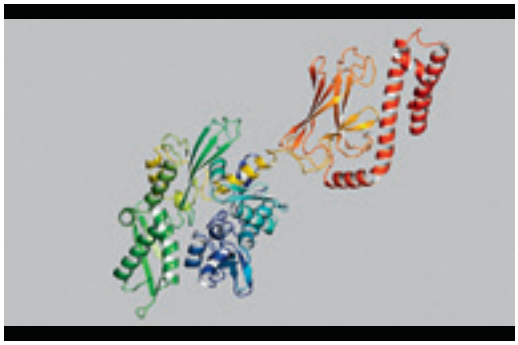
Formic acid at the pump

It is likely that this invention has the greatest potential in the automotive industry. Currently, the prototypes produced by some car manufacturers store hydrogen in conventional form, which entails problems such as risk of explosion, large volume pressurized tanks, difficulties in filling the tank quickly, etc.

The vehicles of the 21st century could well run on formic acid as this solution allows for safer, more compact hydrogen storage as well as easier filling at the pump – formic acid is liquid at room temperature. "Technically, it is quite feasible. In fact, a number of major automobile manufacturers contacted us in 2008, when oil prices reached record highs," says Gabor Laurenczy. "In my opinion, the only obstacle is cost."

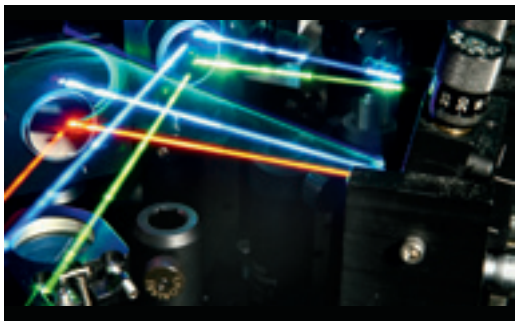
PROTEIN POLICE

Toxic proteins accumulate in neurons and are believed to cause neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease and multiple sclerosis. Other proteins called "protein police" are able to render them harmless.



A protein needs the right chemical composition and shape to do its job in a cell. After being manufactured, a protein undergoes a complex folding process that, if faulty, causes it to become useless or toxic. Paolo De Los Rios (EPFL) and Pierre Goloubinoff (UNIL) discovered that Hsp70, a naturally occurring "police protein", can unfold a toxic protein, allowing it to regain its correct shape and assume its function within the cell.

In neurodegenerative disorders such as Alzheimer's and Parkinson's diseases, or multiple sclerosis, these toxic proteins accumulate in the neurons. When "chaperones", proteins that carry out a kind of quality control in the cell, encounter toxic proteins one of three things happens: the cell dies; enzymes are released that destroy the malformed proteins; Hsp70 kicks in, allowing them to re-fold correctly. This last solution consumes 1,000 times less energy than enzymatic destruction, and therefore seems to be a much more effective option for the cell. This discovery could hold the potential for therapeutic clinical applications in the future.



A LASER SHEDS LIGHT ON THE CATALYTIC CONVERTER

Catalytic converters are used universally for the production of plastics, the conversion of natural gas into hydrogen, or the synthesis of margarine, but the best-known application remains the catalytic converter in the exhaust pipes of our cars.

One of the most frequently used types of catalysis involves a gas and a solid (heterogeneous catalysis). For example, in the catalytic converters in exhaust pipes, the harmful emissions are converted as they come into contact with a platinum or palladium surface.

EPFL researchers studied heterogeneous catalysis in which methane mixed with water vapor is converted into hydrogen and CO_2 when it comes into contact with a nickel surface. Using a powerful laser, chemists have been able to excite the methane molecules and orientate them. This increases the effectiveness of the reaction and speeds up the process by a factor of 1,000 to 10,000.

Conversion of methane is of great environmental interest. Used massively as fuel, burning methane releases a substantial quantity of CO_2. Converting methane on capture sites would enable the capture of CO_2 at source and the use of hydrogen as fuel, with only water as waste.

A GALAXY MAGNIFIED BY A QUASAR

Located between the Earth and a more distant galaxy, a quasar acts as a gravitational lens.

A galaxy can be 7.5 billion light-years away from Earth, yet it appears closer and brighter than it should be; this strange physics phenomenon is caused by quasars. A quasar is a huge mass situated between our planet and another galaxy, acting like a gravitational lens. The EPFL Laboratory of Astrophysics, with the cooperation of the California Institute of Technology (Caltech), was the first to observe this phenomenon.

SOME OBJECTS, SUCH AS STARS OR GALAXIES, ARE SO ENORMOUS THAT GRAVITY DEVIATES LIGHT RAYS PASSING NEARBY.

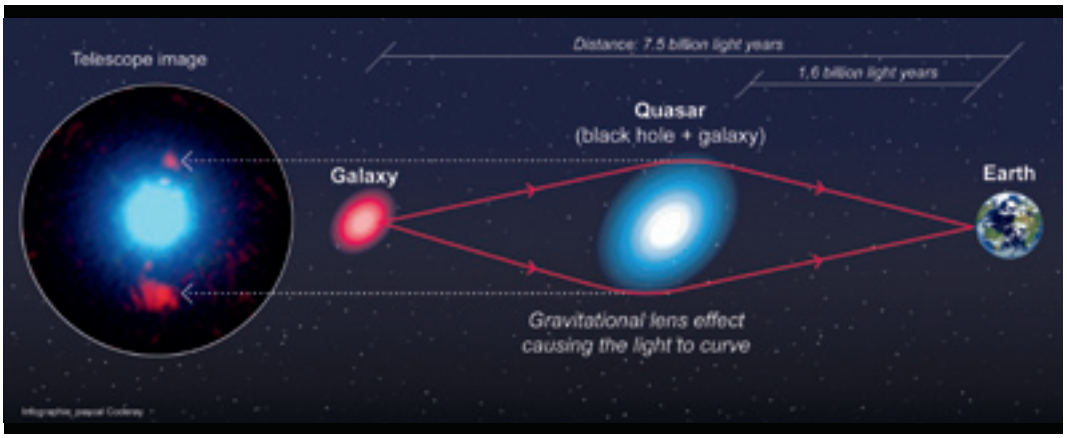
The phenomenon of gravitational lenses is quite common. Objects, such as stars or galaxies, are so enormous that gravity deviates light passing by. With a virtually perfect alignment of the stars and Earth, the furthest light source will appear brighter and amplified.

In astrophysics, gravitational lenses are a valuable tool, especially in the search for extra-solar planets and the study of stars and galaxies. More importantly, scientists can calculate the total mass of a galaxy by studying the way it deviates light from a distant object.

A world first

Astronomers have discovered about one hundred of these magnified quasars. However, it is the first time that the opposite phenomenon has been observed, whereby the quasar in the foreground multiplies the light from a distant galaxy. This interesting discovery provides an unprecedented opportunity to weigh the mass of the quasar as well as of the galaxy that's housing it.

Out of 23,000 quasars in the Northern hemisphere, only four seem to act as a gravitational lens. One of them was studied using the Keck telescope (Caltech) on Mauna Kea peak in Hawaii. The images will be soon be supplemented with high-quality photographs from the Hubble Space Telescope.



EPFL DEEP DOWN IN ANTARCTICA

Setting up the world's largest neutrino observatory has taken the best part of ten years. Situated 2,500 meters underneath the Antarctic ice, IceCube is now decrypting the secrets of the universe through detection of its tiniest and most elusive particles.

Forty million neutrinos pass through the human body every second. They are so small that they almost never interact with the matter around us. And yet, being able to detect them would give us extremely valuable information about the universe. Consequently, the international scientific community decided to build IceCube, the Antarctica observatory with the goal of improving neutrino observation.

EPFL's Laboratory for High Energy Physics (LPHE), and in particular the lab's astrophysicists, took part in this fascinating adventure. In Antarctica, 86 bore holes of a depth of 2,500 m were drilled and equipped with 5,000 optical detection modules. Construction ended in December 2010.

IceCube uses the Cerenkov effect, the equivalent of the supersonic bang for light. The latter moves at a speed of about 300,000 km/s in space, but slower in material media. As a result, along a trajectory of charged particles, a luminous bluish flash is emitted. This flash is visible by detectors within a one-hundred meter range in the very pure ice of the South Pole and provides the means to measure the passage of a charged particle following interaction with a neutrino.

IN ANTARCTICA, 86 DRILL HOLES WITH A DEPTH OF 2,500 METERS HAVE BEEN EQUIPPED WITH 5,000 DETECTION MODULES

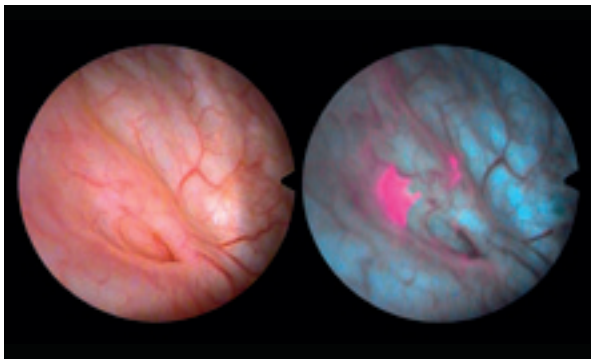
The Antarctic detector is colossal, measuring a staggering kilometer cube or a billion tons of ice. Nevertheless, the interaction of a neutrino with matter is such a rare occurrence that the researchers at IceCube can detect around 300 flashes per day, which is considered a record!

The detectors are located 2,500 m beneath the ice and getting them to this depth was no mean feat. A special drilling method using injection of pressurized hot water had to be developed in order to create a hole wide enough. In addition, the entire drilling process for each hole had to be completely within 2 days to prevent the borehole freezing over again.

With a detector as sensitive as IceCube, scientists at last hope to observe neutrinos from sources located beyond the Sun, and thus better understand the universe surrounding us. It particular they hope to determine the nature of dark matter and to at last understand the origin of cosmic rays.

EARLY DETECTION OF CANCER: THE FDA APPROVES PROCEDURE DISCOVERED BY EPFL RESEARCHERS

After chemical treatment, bladder tumors glow under fluorescent light and are therefore easier to detect and remove. Discovered at EPFL and put into clinical use by Photocure and GE Healthcare, this new procedure has now crossed the Atlantic following its approval by the US Food and Drug Administration.



EPFL researchers have established a procedure where cancerous tumors in the bladder become fluorescent and can be detected under blue light. The Food and Drug Administration (FDA) have now approved the technique, already in practice in Europe, for the American market. Under the name Cysview™, the product is commercialized by Photocure and GE Healthcare as the most efficient detection technique for early stage bladder cancer.

Bladder cancer is the fourth most common cancer in men and the eighth most common in women in the US. Extremely difficult to detect in its early stages, even to the trained eye of an urologist, the importance of increasing its detectability is paramount for the complete removal of the tumors which helps to delay recurrence.

Assisting diagnosis and surgical removal

Cysview™ is injected into the bladder and after penetrating the bladder wall is metabolized mainly by the malignant cells, causing them to produce a fluorescent compound. The doctor then examines the bladder interior with an endoscope camera equipped with a blue light and the tumors appear as easily-recognizable pink spots. The procedure is not only helpful in diagnosing cancer, it is also useful for the surgeon when removing these small tumors, as he can be assured that the tumor is completely removed when no fluorescence remains.

''With Cysview™, even a child can recognize these tumors,'' says Hubert van den Bergh, head of the project at EPFL, indicating the tell-tale pink fluorescent dots on the images taken in the clinic.

American experts have noticed a significant improvement with Cysview™, compared to standard white light cystoscopy. A fact that is also supported in Europe with Hexvix®, the European name for the product: experts have shown that the rate of recurrence of bladder cancer is significantly lower after treatment.

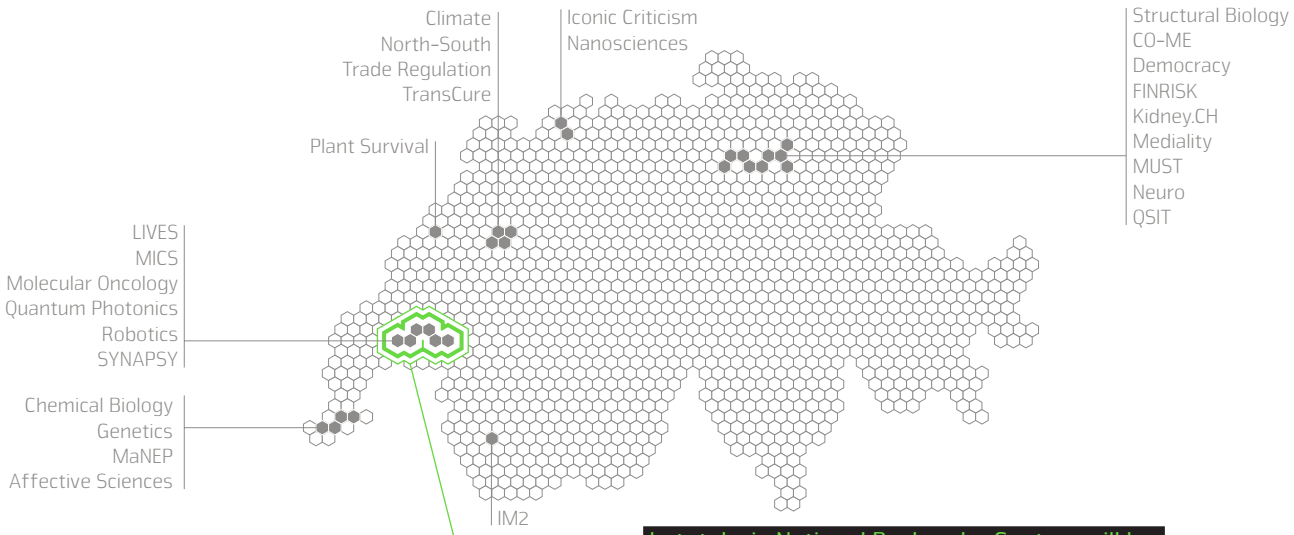
Application to other types of cancers

''In the future, similar procedures could be used, for instance for colon cancer or other tumors found in hollow organs,'' explains Hubert van den Bergh. EPFL's partner Photocure, owner of Hexvix®/Cysview™, is currently involved in developing this domain.

For the moment, this procedure is the only one of its kind approved by the FDA for use in the bladder. ''There is no other procedure as efficient on the market,'' insists Georges Wagnières, responsible for the technology transfer in this project at EPFL, ''and there is therefore significant potential.'' The approval by the FDA comes after more than a decade of development work by the scientists at EPFL and their academic partners from the University Hospital Center (CHUV), the University of Lausanne and Photocure.

NEW NATIONAL RESEARCH CENTERS

Three out of eight new National Research Centers are led by EPFL, with a total of ten centers based in the Lake Geneva Region (the Universities of Lausanne and Geneva and EPFL).



NCCR* "Robotics"

An intelligent and safe new generation of robots to assist humans in their daily tasks. Our ageing population needs technological help in order to retain independence and mobility. This NCCR is an ideal platform to create the synergies necessary for the development of robotics and to reinforce Switzerland's position in this field.

NCCR "Synaptic bases of mental diseases"

High level technology platforms in the fields of cerebral imagery, genetics and behavior. The primary objective is to study the exact cellular and molecular bases involved in the onset of psychological diseases. This NCCR is based on collaboration between researchers and clinicians of the Lake Geneva region (EPFL, UNIL, UNGE, CHUV and HUG) and groups from Basel. An important aspect of this NCCR is the creation of a training program for clinicians/researchers and the promotion of a new generation of psychiatrists with specific training in neuroscience.

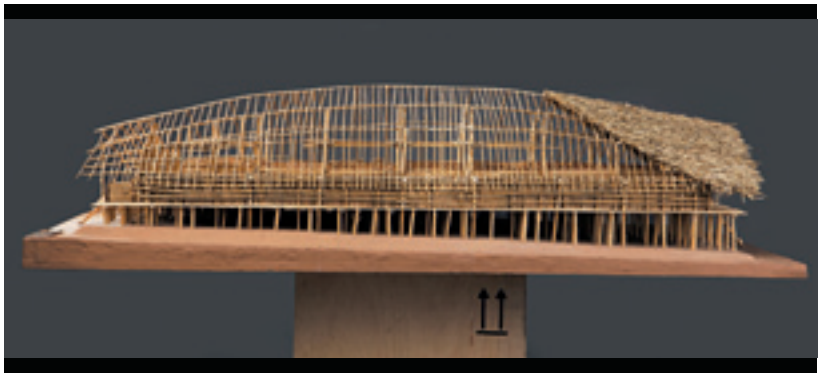
NCCR "Chemical biology"

Directed by UNIGE and EPFL, the objective of this NCCR is to use new chemistry techniques to study life. Using new diagnostic tools, scientists will explore cells in their environment. One objective is to focus on signaling pathways, a key player in the study of the mechanisms involved in the onset of certain diseases. Cellular membranes are another important area of investigation. Changes in their fatty composition could influence a patient's receptivity to treatment.

*NCCR = National Centers of Competence in Research

LESSONS LEARNED FROM TRADITIONAL ARCHITECTURE

In collaboration with the Vitra Design Museum, EPFL organized the exhibition *"Learning From Vernacular"*: a unique opportunity to bring the school's collection of scale-models back to life and to learn about construction techniques that are thousands of years old.



EPFL professor Pierre Frey, founder of the project, put together models and student projects collected over the years. Traditional dwellings are often examples of surprising ingenuity, efficiency and simplicity. For example, houses in the Swat valley in Pakistan sit on stone-filled gabions, or cages, providing the construction with greater resistance against the frequent earthquakes.

Videos, text and photographs are used to illustrate how each culture organized its space according to social or geographical needs. The exhibition took place in the Grand Chalet de Rossinière, in the Balthus Foundation exhibition room where the works of Carin Smuts (South Africa), Bijoy Jain (India) and Simon Vélez (Colombia) were displayed; a combination of contemporary architecture with traditional methods.

HUNTING FOR "KILLER APPS"

Killer apps are innovative applications, guaranteed to bring every start-up success and fortune if commercialized. They include innovative technologies that can be applied to hardware such as cell phones, televisions and computers.

Marc Gruber, director of the *Entrepreneurship & Technology Commercialization* Chair at EPFL, and his team of doctoral students analyzed over 140 different technology start-ups to better understand the key to successful development of killer apps.

They discovered that heterogeneity (a small team of three or four people with different backgrounds) is key to the development of winning killer apps. Their findings demonstrate that decisions made early on are fundamental and depend on a combination of the right personalities.

Steve Jobs, founder of Apple Computers, is an exception to the rule, having both the technological and commercial knowledge needed to make the visionary decisions leading to the development of successful killer apps. Culture also plays a key role in shaping entrepreneurship.

CAN WE LIMIT GLOBAL WARMING TO 2°C?

EPFL scientists are taking part in a new European project to evaluate various global warming scenarios by calculating the impact of climate change on our economy, agriculture and hydrology, and how to adapt in order to cope with this change. The challenge is to limit global warming to 2°C by the end of the century.

Scientists from EPFL's Economics and Environmental Management Laboratory (REME), will be collaborating with universities and institutes from the United Kingdom, Germany, Spain and Switzerland on the "Ermitage" research project. This is an opportunity for EPFL scientists to provide the European consortium with a model developed by Marc Vielle, called GEMINI E3. This program takes into account the economic perspective and demonstrates the evolution of fossil fuel consumption and greenhouse gas emissions until the year 2050. The researchers aim to calculate the cost of various climate control strategies on lifestyle and well-being, as well as the options available to adapt to climate change.

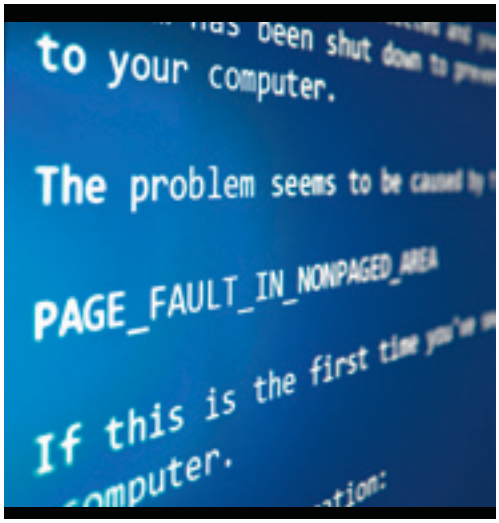
INDIVIDUAL COUNTRIES NEED TO ADAPT THEIR CLIMATE-RELATED STRATEGIES TO THEIR PARTICULAR SITUATION. THERE IS NO UNIVERSAL SOLUTION.

The objective of this three-year project is to use and combine the models created by the different teams to evaluate climate-related strategies and ultimately to limit the increase of the global temperature to 2°C.

Ronal Gainza Carmenates conducted a study on how best to include India, China and other emerging G20 countries, such as South Africa, Mexico, South Korea and Brazil in the process of reducing greenhouse gases. He concluded that each country must adapt its climate-related strategies to its situation. There is no single answer or miracle solution, and there is always a dilemma between what's ideal and what's feasible. On the other hand, costs and benefits associated with climate change are difficult to quantify with certainty in advance. If industrialized countries are to provide emerging countries with financial support, then neutral, reliable and independent monitoring institutions will need to be set up.

FINGERPRINTING COMPUTER BUGS

Cristian Zamfir and Professor George Candea of EPFL's I&C Laboratory recently developed a technique called "bug fingerprinting". This new tracking technique allows us to learn more about the origin and cause of a bug.



"Bug fingerprints" can be compared to a "trail of breadcrumbs" leading developers to the origin of a bug. They are a vital tool for maintaining efficient information technology in business and for tracking any problems, large or small, that the users may be faced with.

Zamfir and Candea noticed a discrepancy between the information available at the time of a software crash and what appears in the corresponding bug report, meaning that identifying the origin of the bug is difficult. That's where "bug fingerprints" can be useful, since they deliver information on how the bug occurred. This technique fills a gap in the information process and speeds up the debugging process.

3D SUPERCOMPUTER MODEL OF BLOOD FLOW PREDICTS HEART ATTACKS

EPFL's Laboratory of Multiscale Modeling of Materials has developed a flowing 3D model of the cardiovascular system. With it, we should be able to use predict the risk of coronary failure within the next two to three years.

Coronary failure, the lack of oxygen to the heart related to atherosclerosis, is among the main causes of death worldwide. In the same way that limescale can block water pipes, proteins carrying cholesterol are responsible for the formation of an atherosclerotic plaque, which gradually clogs blood vessels and prevents blood from circulating normally.

Thanks to the supercomputer Cadmos, it is now possible to model blood flow in 3D and in minute detail, up to a scale of 10 microns. This enables the flow of red blood cells, platelets and other microparticles to be visualized in detail, and to identify the places where harmful deposits may accumulate in advance. On a larger scale, Cadmus will also allow a novel, detailed study of the bloodstream. Thanks to this model, the coronary system of a patient can be mapped in only six hours.

THE GREEN AND DARK SIDE OF SILICON

Scientists at EPFL are exploring "dark silicon" as a way to reduce the power consumption of computers.

Datacenters in the US use the same amount of energy as all Swiss households put together, and all the predictions point to this phenomenon continuing to increase exponentially. EPFL's Parallel Systems Architecture Laboratory (PARSA) is working on a project to reduce the energy consumption of electronic chips by a factor of 100.

Dark computing opens up new perspectives. The idea is that instead of having a single processor that does everything, you would have a cluster of specialized circuits and chips composed of hundreds of cores, with energy supplied only to the cores that are in use, while the others remain deactivated.

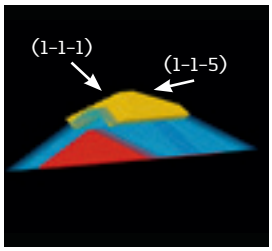
DATA CENTERS IN THE US ALONE HAVE AN ENERGY CONSUMPTION EQUIVALENT TO THE ENTIRE DOMESTIC CONSUMPTION OF SWITZERLAND

Currently, graphic circuits that specialize in display-related tasks are similar in concept. They are a good example of how dark computing will affect our future. Tomorrow, network, storage and research functions will have their own dedicated circuits, integrated in a single chip. The concept is especially interesting for servers. A datacenter represents an investment of millions of dollars and optimizing power consumption becomes a real economic challenge.

Hardware installed by datacenters requires an enormous amount of data processing, even for a simple translation request via Google, for example. The procedure doesn't depend on grammatical analysis, but on the comparison of thousands of pre-existing translations that are stored, compared and sorted statistically. The same is true of many services, and as a result basic data management will therefore use more and more resources. If such a task were assigned to a specialized circuit it would require considerably less energy.

NOVEL NANOWIRES FOR A NEW ELECTRONIC GENERATION

EPFL'S Laboratory of Semiconductor Materials has developed a novel technology based on minute nanowires. This discovery has significant potential in the field of electronics.



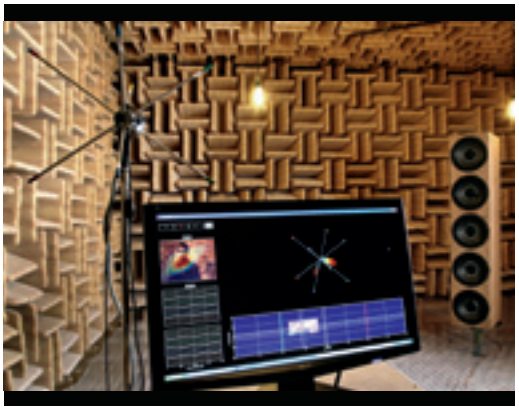
Gallium arsenide (GaAs) nanowires are extremely compact semiconductors that could form the building blocks for future generations of nanoelectronic devices, batteries or solar cells. Understanding the morphology, composition and structure of nanowires, as well as being able to form complex structures inside the wires, is key to developing these new devices.

These new nanowires are obtained using a method that guarantees the formation of high quality crystal structures. This new type of heterostructure will lead to the creation of highly efficient single-photon sources that will enable novel experiments in the field of quantum optics and the development of nanowire solar cells for third-generation photovoltaics.

RESEARCHERS DEFLECT SOUND WAVES

A device based on the negative refraction of sound could modify the trajectory of sound waves and allow them to move around physical obstacles.

Thanks to this development, sound from a loudspeaker could move around cathedral pillars and reach a person seated behind them without being modified. The noise of jet engines could be deflected towards the sky rather than the ground.



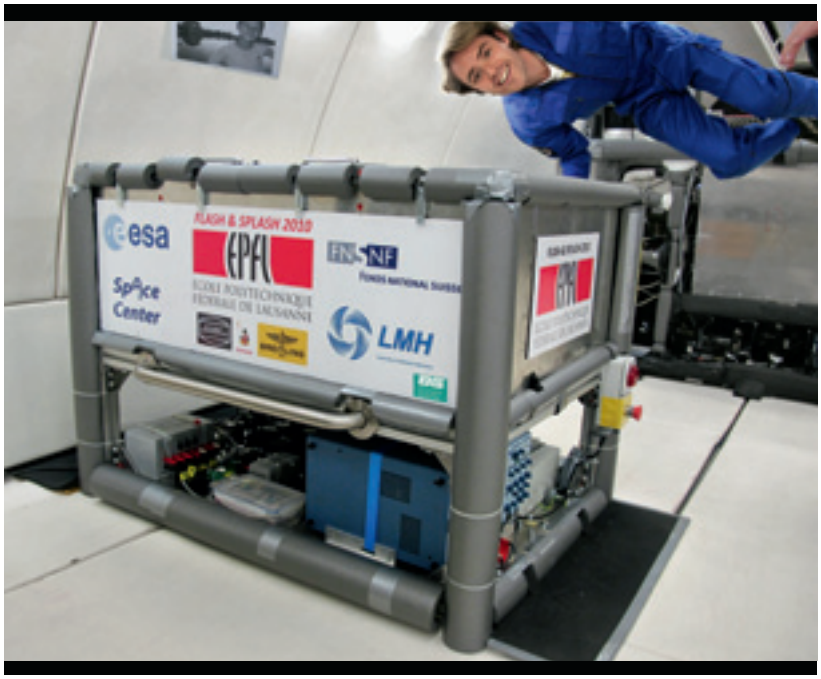
Researchers at EPFL's Electromagnetic and Acoustic Lab have managed to develop a technique that uses the principal of "negative refraction". Refraction is already well understood in the area of optics and explains why a straw in a glass of water appears bent at the point where it passes from one medium (air) to another (water).

Negative refraction of sound, studied by researchers at EPFL, does not occur naturally, but can be produced with artificial structures. For the first time, scientists in Lausanne have managed to create negative refraction of sound using a new prototype.

ZERO GRAVITY: THE QUEST FOR THE PERFECT BUBBLE

Minute bubbles can wreak havoc with the huge turbines in hydroelectric installations through a process called cavitation: one of the most complex and destructive problems hydroelectricity engineers face today. The bubbles form as the blades of the turbine accelerate, ejecting matter at supersonic speeds and gradually eroding components. To better understand cavitation, EPFL scientists boarded an Airbus A300, equipped to reproduce zero-gravity conditions for a few seconds. During this period the researchers model the formation of vapor bubbles with the aim of ultimately developing more resistant turbines.

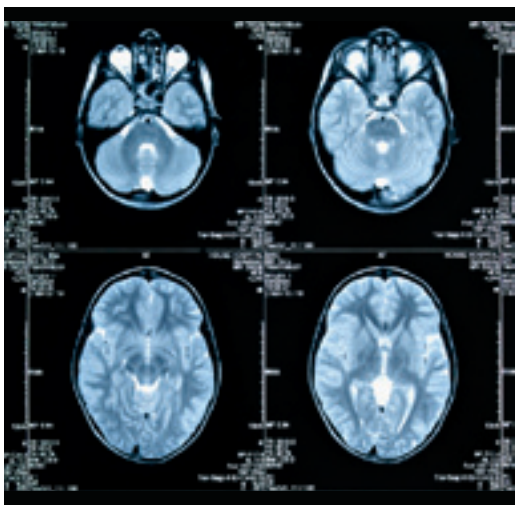
This should give scientists insight into why cavitation affects a particular model of turbine more than another, and to design them accordingly from the outset to limit this phenomenon.



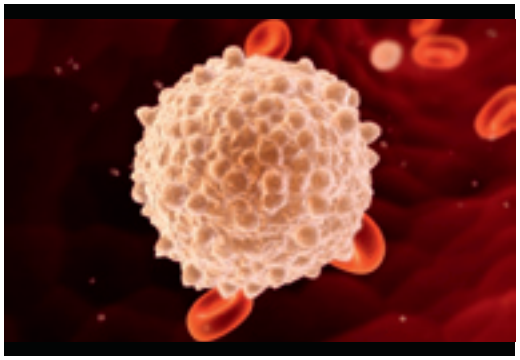
ALZHEIMER'S TRICKS NEUROPROTECTORS

Researchers have explored the relationship between the build-up of the Amyloid-Beta protein, associated with the formation of plaques, and impaired astrocyte function. Amyloid-Beta found in cerebral plaques in the brain of Alzheimer's patients may lead to neurodegeneration. However, in a healthy brain, astrocytes act as a protection system.

Pierre Magistretti, director of the Brain Mind Institute and the Center for Psychiatric Neurosciences at CHUV/UNIL together with Igor Allaman and post-doctoral fellows determined that Amyloid-Beta build-ups infiltrate astrocytes through their scavenger receptor and alter their function, leading to the death of surrounding neurons. If Amyloid-Beta build-up or activation of this receptor is impaired, astrocytes continue their normal protective functions.



TUMORS TRICK THE IMMUNE SYSTEM WITH CAMOUFLAGE



Melody Swartz, professor and head of EPFL's Laboratory of Lymphatic and Cancer Bioengineering (LLCB), has demonstrated that tumors mimic key features of lymph nodes to avoid being attacked by the immune system. This discovery underscores the role of the lymphatic system in cancer and may open up new possibilities for treatment.

Certain tumors secrete a protein that gives their external outer-layer the appearance of a lymph node. They then attract T-cells that will trick the body into thinking it is healthy tissue. As most tumors only progress once they have escaped the immune system, knowledge of this mechanism is an important step towards future cancer therapies.

AN INVASION OF "JUMPING GENES" MAY BE THE CAUSE OF REPTILE DIVERSITY

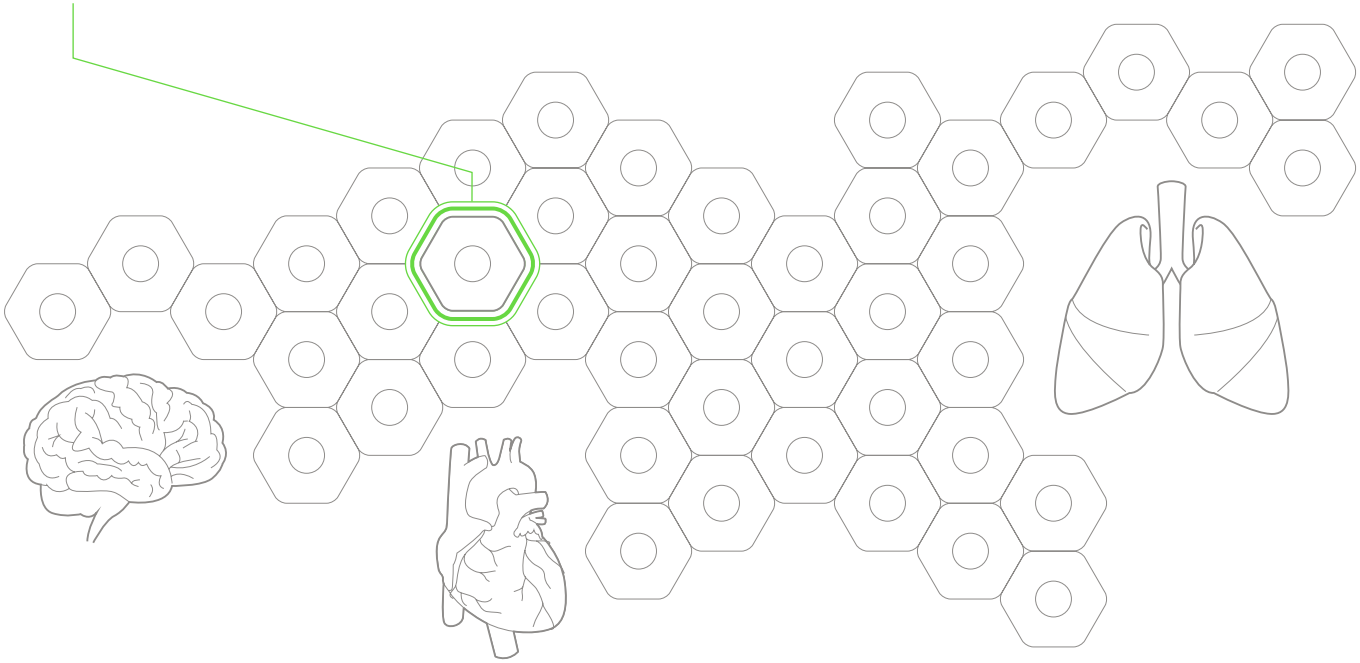
Squamates (snakes and lizards) are the most diversified reptiles, with a huge variety of morphological differences. Denis Duboule, Director of the National Centre of Competence in Research Frontiers in Genetics, and his team are trying to figure out how the "construction plan" of these animals has evolved and led to the formation of such drastically different organisms.

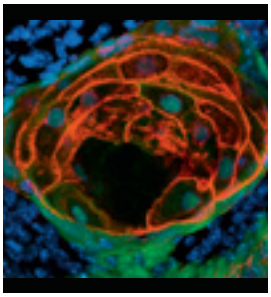
Biologists have discovered that segments of the genome containing Hox genes (genes that coordinate the formation of structures during embryonic life) were much longer in squamates than in the other reptiles. This is caused by an invasion of these regions by mobile DNA elements called transposons. These "jumping genes" are the real motors of evolution; their mobility providing a significant source of mutations.

CELLS CHANGING TRACK

Biologists have extracted cells from the thymus and transformed them into skin cells, a discovery that may have important ramifications for the field of organ regeneration.

Yann Barrandon and his team have managed to produce skin from stem cells originating from another organ. This method could potentially be reproduced with other tissues and open up possibilities for numerous applications including transplantation and organ regeneration.





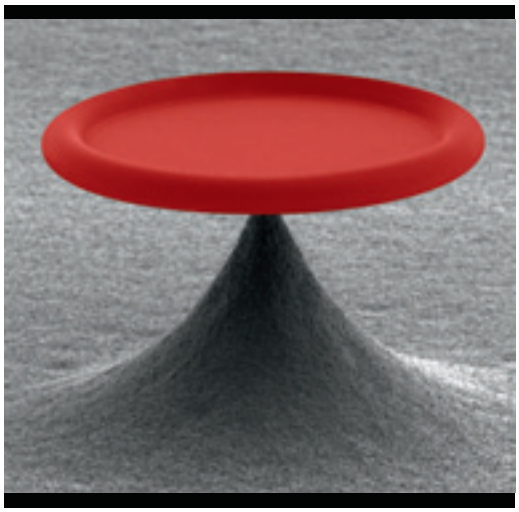
The ability to recreate organs from any cell can be considered as one of the "Holy Grails" of biology. An important step towards this goal has been made by scientists from EPFL, UNIL and the CHUV in collaboration with the University of Edinburgh in the UK, and recently published in *Nature*. The team isolated rat thymic epithelial cells and integrated them into cultures of skin cells to obtain surprising results. The epithelial cells taken from the thymus, an organ situated in the thoracic cage, differentiate from their original function to take on a novel role related to their new environment.

According to professor Yann Barrandon, head of the Laboratory for Stem Cell Dynamics, a chair shared by EPFL, UNIL and its teaching hospital (CHUV), the environment determines the cell-type via expression of different genes.

While in the thymus, the thymic epithelial cells teach T-cells to recognize and destroy bacteria and cancer cells, a key component of the immune system. Results show that when placed in different microenvironments, these cells have the ability to express genetic markers that are different to their original make-up. Until now, experiments using hair follicle stem cells to maintain hair and skin growth have met with limited results. The thymic stem cells have proven effective for up to a year after implantation: a major improvement to the three-week performance of bona fide hair follicle stem cells. These findings could create new opportunities in the field of organ transplantation and regeneration, and in particular for severe burn victims.

AN OPTICAL TRANSISTOR

A new technique using optics can reproduce the effect of a transistor and could lead to innovation in the telecommunications sector.



Professor Tobias Kippenberg and his team from the Laboratory of Photonics and Quantum Measurements at EPFL, along with the Max-Planck Institute of Quantum Optics, have discovered a novel way to couple light and vibrations. They built a device in which a beam of light traveling through an optical micro-resonator can be controlled by a second, stronger beam. Controlling and modulating the flow of light is essential in today's telecommunications-based society. The device, integrated onto a chip, acts as an optical transistor, in which one beam influences the intensity of the other.

A NEW DEVICE, INTEGRATED ONTO A CHIP, ACTS AS AN OPTICAL TRANSISTOR

Their optical micro-resonator has two characteristics. Firstly, it traps light in a tiny glass structure, guiding the beam into a circular pattern; secondly, the structure vibrates at well-defined frequencies.

When light is shone into the device, the photons exert a force called radiation pressure, which is greatly enhanced by the resonator. The increasing pressure deforms the cavity, coupling the light with the mechanical vibrations. If two beams are used, the interaction between the two lasers and the mechanical vibrations results in a kind of optical switch whereby the stronger control laser can turn the weaker one on or off as with an electronic transistor.

This novel effect called "OMIT" (optomechanically-induced transparency), could yield new applications in photonics. It could be possible to convert light signals into mechanical vibrations, which could lead to major innovation in the telecommunications industry. For example, novel optical buffers could be designed to store optical information for up to several seconds, releasing it when needed.

TECH TRANSFER

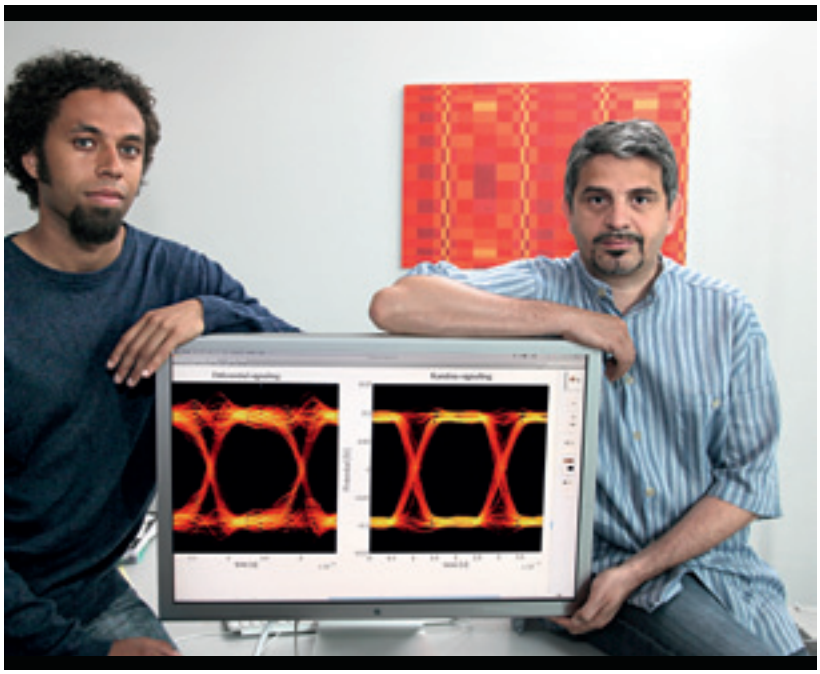
The School's 1000th invention has been patented, and Innovation Square, a business park on campus that's still under construction, continued to attract companies in 2010. Nestlé, Crédit Suisse, Cisco, Debiopharm – the big names are setting up shop here one after another. And with them come hundreds of jobs for Switzerland and new opportunities for us to participate in the avant-garde visions of these major industrial players.

On the start-up front, the number of new companies founded decreased in 2010, possibly a sign of uncertain economic times or a consequence of the financial crisis. However, the total number of new start-ups at EPFL remains significant when compared with other major European universities. Thanks to the support and favorable conditions – the Science Park added the "Garage", a building for young start-ups – the number of young entrepreneurs is increasing on campus.

Other partnerships with companies and established organizations – for underground CO_2 sequestration, archiving the concerts of the Montreux Jazz Festival, or the real-time measurement of navigational data from a flying sailboat, for example – are testimony to the expertise of our professors and their teams. A true hub of knowledge, EPFL serves as a scientific reference point in the economic fabric of Western Switzerland and beyond. Whether it's in the form of commissioned projects or of long term partnerships, these collaborations play, and will continue to play, an increasingly important role in Switzerland's future.

KANDOU: EPFL'S 1,000TH INVENTION

Providing the world's computers with electricity requires a staggering 150 billion kWh per year, which equates to a monthly bill of several billion dollars. Reducing this consumption is clearly an economic and ecological challenge, and at least part of the solution could come in the form of Kandou, EPFL's 1,000th invention.



Invented by Harm Cronie and Amin Shokrollahi at EPFL's Algorithmics Laboratory, Kandou enables processors to communicate more rapidly with their peripherals (memory, printers, monitors), therefore consuming less energy. This is a small revolution in the world of computing, and the solution is mathematical.

Today, most electronic appliances are equipped with ultra-rapid processors that communicate with other processors or with other peripherals via electronic buses, or ''information highways''. These buses are made up of tiny wires that interfere with each other, creating parasites during signal transmission and limiting the full use of the processors' capacity. Over the last 10 years, the buses have been updated and rely on differential signaling with information now transmitted through pairs of wires. One message is transmitted in ''positive'' and the other in ''negative''. Each pair of wires receives more or less the same outside interference. By subtracting the ''positive'' from the ''negative'' information, disturbances are removed, while the intensity of the signal is doubled. This solution is effective, but it requires twice as much wire, which isn't always feasible.

Kandou is the mathematical solution to this problem. A bus based on the Kandou system codes the signal using an algorithm and then simultaneously transfers it onto all the wires. A decoder at the other end enables the recovery of the data, without interference and background noise.

This invention offers multiple benefits: The use of fewer wires means that devices can be smaller. At the same time, transmission speed of the signal can be increased and the electrical current in the wires reduced to save energy.

SOLUTIONS TO TRAP CO_2 UNDERGROUND

The storage of carbon dioxide (CO_2) emissions has become a major preoccupation for scientists. To face this challenge, EPFL has signed an agreement with Petrosvibri SA, to create a research chair at the EPFL for the study of long-term underground storage of CO_2.

Petrosvibri SA is managing a drilling project in the canton of Vaud to test for liquid or gas hydrocarbon reserves. It is estimated that there is a 15% chance that natural gas could be found in the region. The best-case scenario would be discovering enough gas to sustain Switzerland for the next twenty years. However, even if no stocks are found, the geological structure could be used for capturing carbon and integrated into a worldwide network for CO_2 storage.

LITTLE HOLES

The ''greening'' of gas engines has opened up new potential for Posalux, a company that specializes in micro-drilling of metal. To increase productivity, the company approached Professor Jacques Giovanola at EPFL's Mechanical Systems Design Laboratory.

Eighteen months later, EPFL came up with a working prototype combining electrical discharge and ultrasound machining. Posalux's current technology is based on electrical discharge machining in which the material is ''eroded'' by a series of rapidly produced sparks. The process is efficient but limited to materials that conduct electricity. Removal of the electrical current will enable them to work on non-conductive materials such as ceramic, glass and sapphire.

Posalux and EPFL are now working on a second project on solid non-conductive materials which Posalux could soon apply to fiber-optics as well as the medical and watch industries.

SCALA NOW IN DIRECT COMPETITION WITH JAVA

Thanks to an infusion of 3 million dollars in capital, EPFL professor Martin Odersky was able to launch Typesafe in spring 2011. With headquarters in the Ecublens Science Park, this company will launch Odersky's Scala programming language onto the Internet. Twitter, Foursquare, LinkedIn and the Guardian Online have already adopted this promising alternative to Java. Very similar, and perfectly compatible, Scala is simple to use and requires only about half the number of lines of code as Java. The principal investor in this round of financing, Greylock, based in Boston and the Silicon Valley, notably backed Facebook when the social networking site was first introduced to the public, and has been investing in LinkedIn since 2004.

MAJOR PLAYERS IN INNOVATION SQUARE

With the opening of Innovation Square, 2010 signaled a major period of growth in the new area on campus dedicated to partnerships with the private sector. Four buildings were finished over the course of the year, including one intended as an extension of the Science Park (PSE). The PSE now totals four buildings, and can accommodate 720 collaborators, the majority of which are start-ups.

BY THE END OF 2010, CLOSE TO A THOUSAND PEOPLE FROM 7 MULTINATIONAL COMPANIES AND MORE THAN 100 START-UPS WERE ALREADY SETTLED IN INNOVATION SQUARE.

Innovation Square has been overwhelmed by interest from multi-national companies wishing to set up shop in the heart of the Lausanne campus. **Logitech** and **Constellium** had already expressed their intention of joining in 2009, which they have now done, closely followed by **Cisco Systems** and **Debiopharm** in the Spring 2010.

For Cisco, an American specialist in computer networks with over 70,000 employees worldwide, setting up offices next to a European university was a first. In October, the engineers settled into their new space on an entire floor of the building. At the same time, Lausanne-based **Elca**, another company working in computer science, announced its intention to join.

For pharmaceutical group Debiopharm, the move is a confirmation of the company's position in academia in Western Switzerland. Headquartered in Lausanne, the developer of small molecule drug candidates has already signed various partnerships with EPFL and finances a research chair in oncology. It rents some 400 square meters of laboratory space.

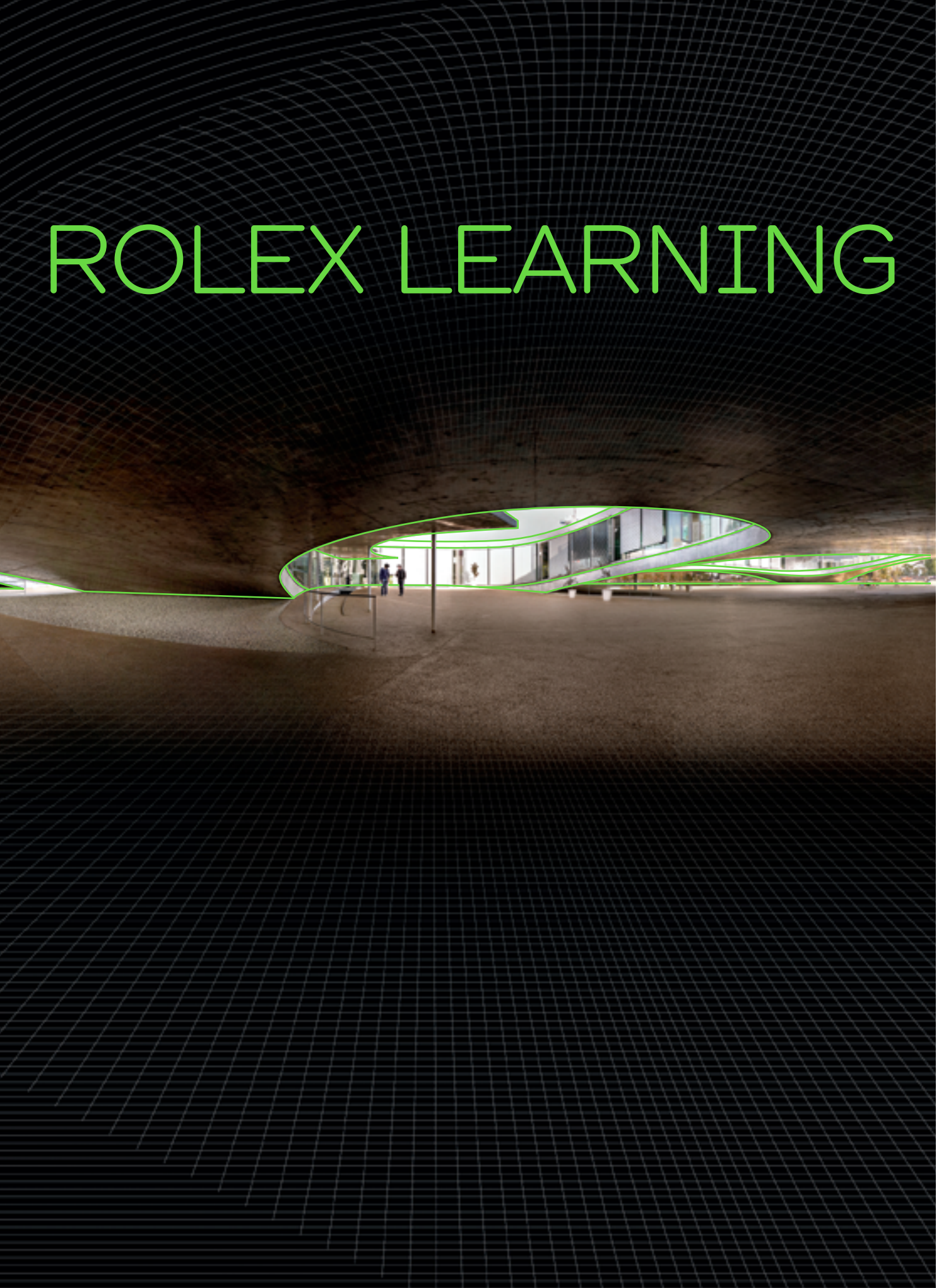
A 500 million Swiss franc investment from Nestlé

In July, **Credit Suisse** announced its intention to dedicate an entire building to the development of computer sciences for the banking sector, a move that should create 250 jobs. Two months later, on September 27, Vevey-based food giant **Nestlé** announced in the Rolex Learning Center that it was creating a new branch, ''Nestlé Health Sciences SA''. The company plans to invest 500 million Francs and to develop an entire building of Innovation Square.

The same week **Logitech** was in the limelight. One of EPFL's most well-known start-up companies and a world-leader in computer peripherals, Logitech inaugurated its ''Daniel Borel Innovation Center''. The Center, named after its founder, will take up an entire building.

By the end of 2010, close to a thousand people from seven multinational companies and more than 100 start-ups were already settled in Innovation Square. The facility could well reach its capacity of 2,000 people as early as 2012.

ROLEX LEARNING



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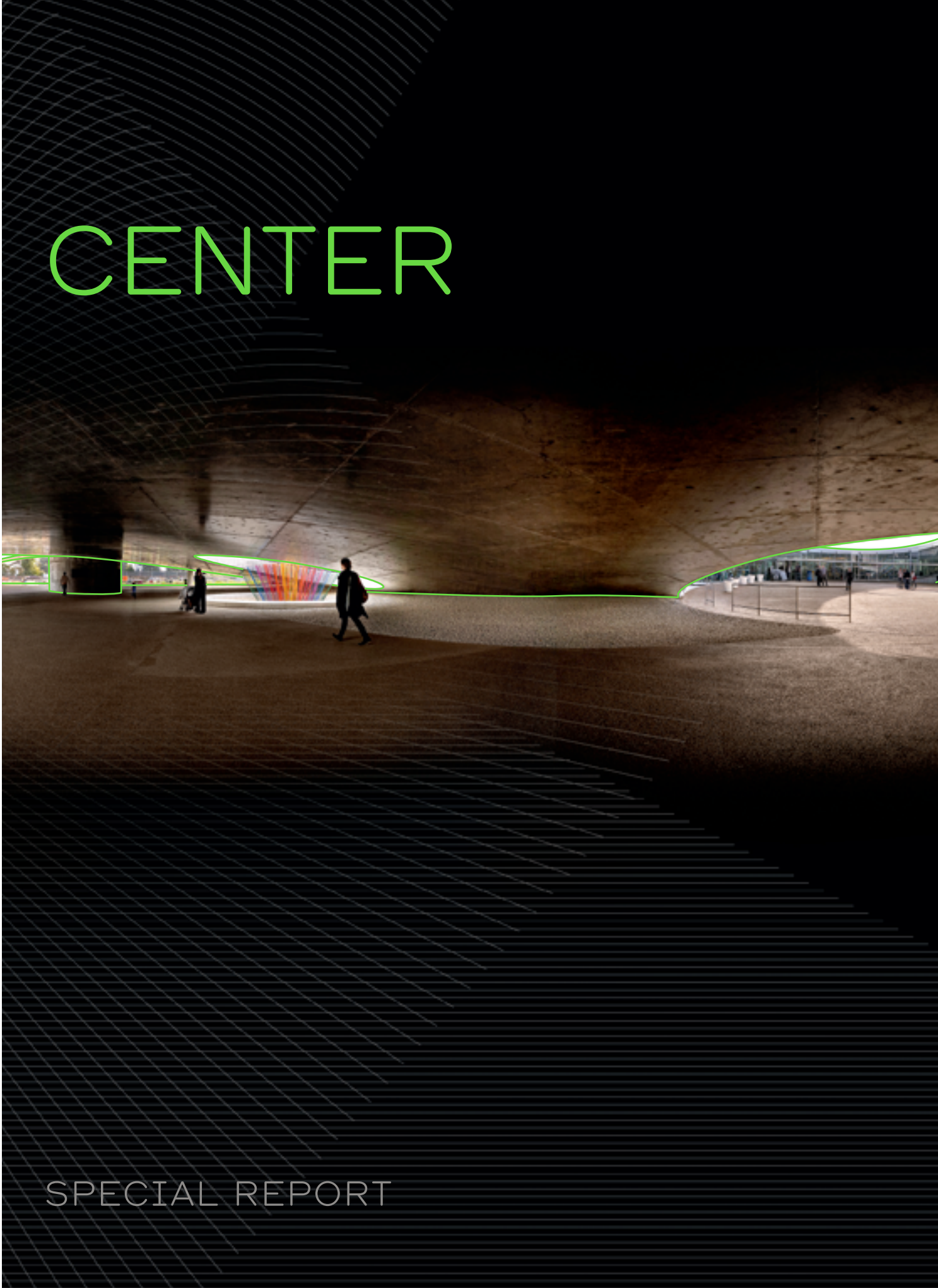


SPECIAL REPORT

FEBRUARY 22, 2010
THE ROLEX LEARNING CENTER OPENS ITS DOORS

On February 22, 2010 at 7:00 am, the Rolex Learning Center opened its doors to the public for the first time. The occasion was relaxed but with a distinct note of apprehension in the air – this was the moment of truth, the moment when its architectural and conceptual intentions would be subjected to the exacting judgment of its users. The building, which brings together EPFL's 12 libraries, a research center for new teaching technologies, offices, shops, and meeting spaces, was designed for and with EPFL students.

The first student crossed the threshold at 7:01 and went straight to one of the 800 workspaces without so much as a second look at his surroundings! This reaction was the biggest compliment that could have been paid to the architects, and was to be repeated constantly over the coming months. Far from the images depicted in the media, the building had passed the ultimate test and was a success in the eyes of its users. The "magic" of the place – the diversity of the spaces and atmospheres, and the peaceful beauty of the building itself – went far beyond all expectations. The study areas were soon filled to capacity and a scholarly atmosphere took over naturally, interrupted only by occasional sightseers who came to see what the international media fuss was all about. The heart of the campus was finally beating.

MARCH 29, 2010
THE ROLEX LEARNING CENTER ARCHITECTS WIN ARCHITECTURE'S "NOBEL" PRIZE

The news broke on March 29, 2010, just one month after the opening of the building. The Japanese architects of the Rolex Learning Center, Kazuyo Sejima and Ryue Nishizawa (Sanaa) had been awarded the prestigious Pritzker Prize, often referred to as the "Nobel" prize of architecture. This medal has been bestowed on many of the world's greatest architects, including Jean Nouvel, Norman Foster, Jacques Herzog, Pierre de Meuron and Peter Zumthor.

The Rolex Learning Center undoubtedly played a decisive role in the attribution of the award, and the architects immediately thanked EPFL President Patrick Aebischer for having given them this opportunity. This success would never have occurred without the support of the Confederation, sponsors, engineering firms and other companies that made this truly three-dimensional "bridge" a reality. Following on from the popular vote of success, this formal international recognition places Switzerland in the top ranks of architectural heritage and avant-gardism.

MAY 27-30, 2010
THE INAUGURAL CELEBRATIONS DRAW 30,000 PEOPLE

On May 27, 2010, Federal Councilor Didier Burkhalter came to Lausanne to inaugurate the building, with an audience of political, media and corporate VIPs. The national television station broadcast its evening newscast from the central hall of the building, which has become a Swiss icon.

The "Objective Science" weekend, the final event of the Rolex Learning Center's opening week, capped off the festivities. An eclectic public of children, parents, and grandparents came to see the chef d'oeuvre and participate in more than 300 interactive science exhibits, from nanotechnologies to the 50th anniversary of the invention of the laser, from futuristic architecture to sports technology. The 2,000 places available in the robotics festival workshops were quickly taken, and multiple physics and chemistry demonstrations and films about the Blue Brain Project and the expansion of the universe kept the house filled the entire weekend. Honda's humanoid robot, ASIMO, was one of the star attractions, with its 36 degrees of freedom, highly developed motor skills, and its linguistic and perceptual capabilities. "Objective Science" brought the inaugural week of the Rolex Learning Center, which had attracted more than 30,000 visitors, to a successful close.

ONE YEAR LATER
EPFL'S LIBRARY TAKES STOCK: A MILLION VISITS IN ONE YEAR

From its opening in February 2010, EPFL's library has been an unprecedented success. One year later, an interim assessment shows that it has had more than one million visits and consultations (students, researchers, businesspeople, and outside visitors) and loaned out more than 80,000 items.

The building has settled into a comfortable rhythm, and the few early "teething problems" have been addressed. The final touches were completed in late summer 2010, and as the 2010-2011 academic year got underway, it became firmly anchored in the daily life of the 30,000 inhabitants of the EPFL-UNIL community. The building is open to the public from 7:00 am to midnight, seven days a week. Millions of documents are available for consultation, including dictionaries and encyclopedias, monographs, scientific journals, magazines, databases, along with all EPFL PhD theses and many diploma theses. The library also houses collections of rare books, topographical and geographical maps, science fiction books and DVDs, together with a series of Chinese books donated by the Embassy of the People's Republic of China in Switzerland.

A 3D CAMERA WITH 360° VISION

Inspired by the structure of a fly's eye, EPFL scientists have invented a camera that can reconstruct the surrounding environment in real time and without distortion.

DATA FROM 104 TINY CAMERAS CAN BE COLLECTED AND PROCESSED IN REAL TIME, AT A RATE OF 30 IMAGES PER SECOND.

This could be the ideal tool for teleconferences, video surveillance, movie making, and creating backgrounds for video games. Researchers from two EPFL laboratories have invented a revolutionary camera that can film with a 360° angle and reproduce three-dimensional images without distortion. A patent application has been filed.

The camera is a metallic hemisphere the size of an orange, containing 104 cameras similar to those used in mobile phones. Because they are so close together, their range of vision overlaps slightly. A second, miniature prototype has also been developed; it's about the size of a ping-pong ball and has 15 cameras. The user can choose to work the cameras simultaneously for a panoramic picture that covers a 360° angle, or individually to capture a particular angle.

This revolutionary device solves two major problems associated with traditional cameras: Firstly, the angle is no longer limited as the camera can film through 360° and in real time, and secondly, the depth of field is not affected thanks to its 3D capabilities.

The new camera was a collaboration between two groups: Professor Vandergheynst from the Signal Processing Laboratory 2 wrote the algorithms to calculate the distance between the camera and objects being filmed in order to reconstruct the images in 3D, as well as the algorithms that assemble the images taken by all the different cameras into a single panoramic image; Professor Yusuf Leblebici, from the Microelectronics Systems Laboratory, developed the material and electronic apparatus that make it possible to collect and process, in real time, the mass of data collected from the various cameras, at the rate of 30 images per second.

SOLAR PLANE'S INAUGURAL FLIGHT

Wednesday, April 7, 10:27am: Solar Impulse HB-SIA, a solar plane prototype conceived by André Borschberg and Bertrand Piccard, took off for her inaugural long-haul flight in the presence of the media and public gathered at the Payerne airfield.

Her architects watched from the ground, eyes fixed on the sky, as Solar Impulse soared above on her one-and-a-half hour maiden flight. There was no hiding their delight and pride at the culmination of six years of research, including a significant contribution from EPFL.

Other important milestones marked 2010, namely a non-stop 26-hour night flight which was achieved on July 7-8. On September 21, the solar bird with a wingspan of 60 meters flew over Lake Geneva to Geneva airport and headed home to Payerne the same evening. The next day, she took off from Zurich to accomplish a tour of Switzerland.

In October, the International Federation of Aeronautics awarded the project three world records in a new category of ''solar planes'', including absolute altitude (9235 m), altitude increase (8744 m) and length of flight (26 h 10 min. 19 sec.). In December, the plane received the European Solar Award.

All these achievements and recognition demonstrate that the principle of a solar plane is possible. They pave the way for the creation of HB-SIB, the prototype's big sister whose construction started in early 2011. Plans have already been made for a world tour in 2013 that will include stopovers.

LAKE GENEVA'S FLOATING LABORATORY

Launched in St. Sulpice in October, Hydroptère.ch will be used as a prototype to test the geometry and handling of foiling yachts in real-life conditions.

Following transfer by helicopter from Decision SA's yard, Hydroptère.ch finally touched water for the first time in the afternoon of October 8, in the tiny port of St Sulpice. It is the latest member of an elite family of foiling yachts that are literally designed to fly above the water at record-breaking speeds. In 2009 the mythical 50-knot barrier was smashed by the original Hydroptère.

The latest catamaran is designed to be a true test-platform, and has been purpose-built to study the performance of this particular breed of racing yacht. In particular, the team will be able to test new designs and geometry and to analyze the handling in real time.

Opting to test on Lake Geneva was a deliberate choice, as it offers a variety of conditions for testing. With the strong northerlies, known locally as the ''Bise'', waves of over one-and-a-half meters are not uncommon. Alain Thébault and his team will be able to fully test the versatility of their yacht, with the ultimate goal being to develop a Hydroptère maxi, capable of sailing around the world in 40 days.

The launch of Hydroptère.ch marks the culmination of several years of research by various EPFL laboratories who have been working closely together to develop this particular yacht design.

LEMOPTIX AND THE POCKET PROJECTOR

Lemoptix, an EPFL spin-off, together with the Maher Kayal Laboratory, have developed the projector of the future. Smaller than a credit card with a projection head of 1 cm^3, the device can be integrated into a laptop computer, a mobile phone, or an MP3 reader without jeopardizing the quality or intensity of the image. The size of the image can be adjusted by simply modifying the distance between the projector and the projection surface, yet the resulting image remains uniformly clear. Energy consumption of this device is 30% lower than current models on the market.

This micro-projector works by reflecting red, blue and green lasers onto tiny, one-millimeter thick, mirrors. The device, placed inside a small glass box of 3 x 4 mm, oscillates at such a high speed that the beam can scan a surface up to 20,000 times per second. This creates a color image with VGA resolution (640 x 480 px).

Initially, this beamer will be developed for industrial applications but it could eventually be more widely used by car manufactuters or in operating theaters.

A STAND-ALONE DRONE THAT DOESN'T MISS A THING

Set up in St-Sulpice, Sensefly produces and markets ultra-light drones capable of flying completely independently for 30 minutes and up to an altitude of 3,000 m.

''All you have to do is mark out the course you want to cover on a map. The software, designed in EPFL's Laboratory of Intelligent Systems and developed at Sensefly, does the rest by controlling the automatic pilot,'' explains Jean-Christophe Zufferey, CEO of the start-up created at the end of 2009. Even the wind, as long as it's not too strong, won't bother this flexible polystyrene drone, which also carries a GPS that automatically corrects its trajectory and speed.

Equipped with a compact digital camera, the ''Swinglet CAM'' kit is being commercialized by Sensefly. The user can determine the frequency of images to be taken and the motor is cut for two seconds at a time in order to limit the amount of vibration during filming. The whole apparatus can be carried in a suitcase. It is a particularly economical way to take aerial photos, and has generated widespread interest, ranging from large-scale agriculture to the Red Cross, who envisage equipping their exploration vehicles with devices of this type.

MONTREUX JAZZ FESTIVAL ARCHIVES DIGITIZED AT EPFL

The Montreux Jazz Digital project will digitalize video and audio archives of over 4,000 groups and artists who have played at Switzerland's most prestigious music festival.

The "Montreux Jazz Digital Project" has several musical and technological objectives: to file, digitize and index 5,000 hours of video, and the equivalent in audio; to manage the storage, security and protection of the digitized recordings, and access to them; to leverage this unique musical heritage using EPFL's cutting-edge research in the area of computing and audio-visual; to ensure optimal preservation of the recordings for future generations.

This extensive documenting and scientific project will make the digital archives available to scientists, students, musicians and professionals on the EPFL campus. Access to these archives should lead to new research options and opportunities for studying musicology, as well as research into sound and video.

EPFL Launches New Metamedia Center

The EPFL will use this rich heritage as a base to launch its MetaMedia Center: a center of excellence for the enhancement of media and the development of research in this field. Ten of the school's laboratories have coordinated their efforts for the benefit of research on the future of new media.

From its inception in 1967, the Montreux Jazz Festival has systematically recorded the concerts that have brought it world-wide recognition. Many of these archives are either contained on obsolete audio-visual media or are physically deteriorating. In addition, no back-up copies exist, which has prompted the Montreux Jazz Festival to find long-term solutions for managing the recordings. The number of recordings (5,000 hours, the equivalent of 4,000 bands and solo artists), the diversity of the musical styles they reflect, and the fact that no other festival in the world possesses such a heritage, means that these archives are a unique treasure, and without doubt one of the greatest collections of musical documents of the last 40 years.

OUTLOOK

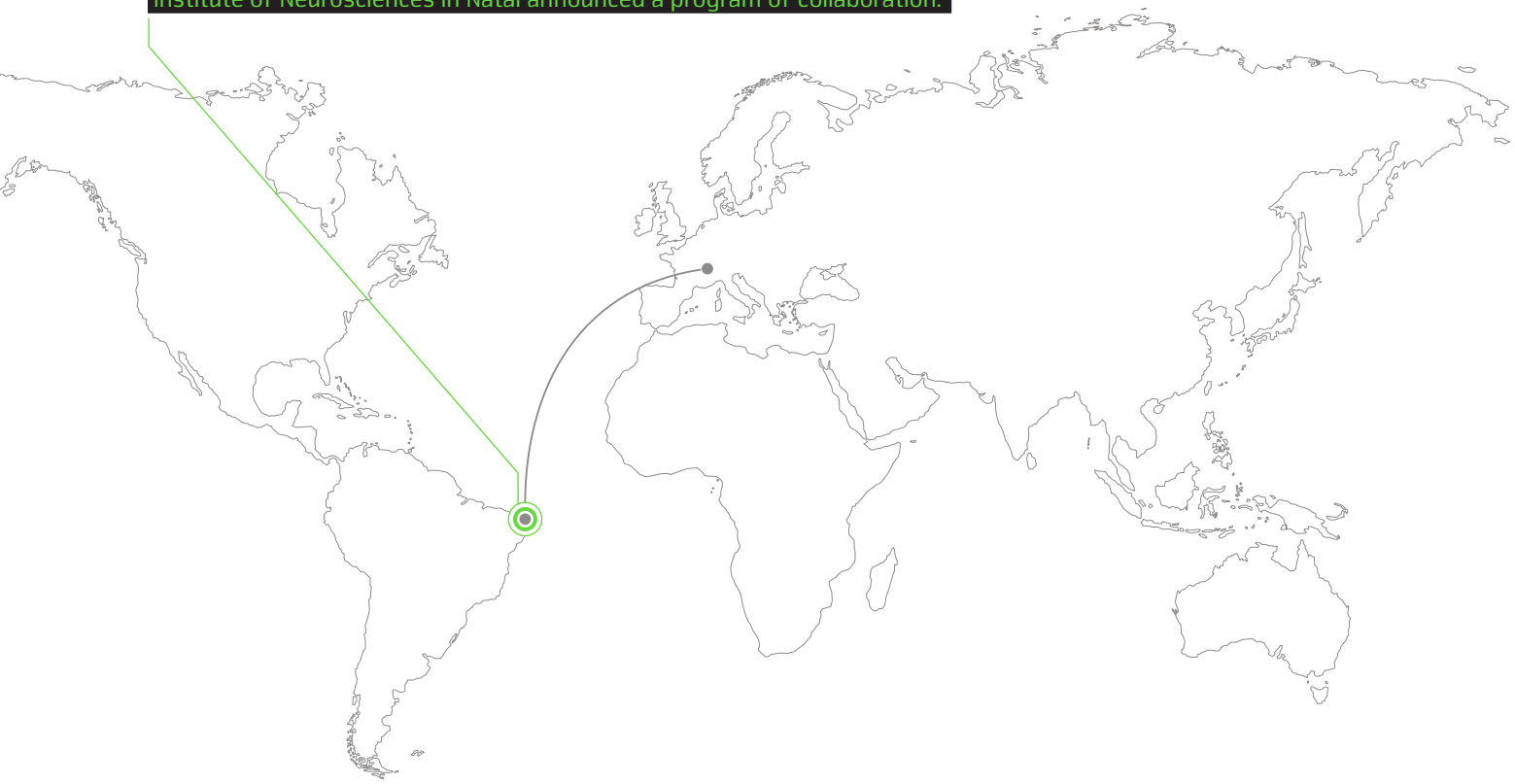
This year has been a remarkable one in terms of the international reach of our School. In addition to entering into partnerships with universities in Brazil and the United States and initiating the inaugural ceremony for Network of Excellence in Engineering Sciences of the French speaking Community (RESCIF), EPFL has submitted two extremely ambitious project proposals to the European Research Commission: *the Human Brain Project and the Guardian Angels for a Smarter Planet* (co-led with ETH Zurich). Since then, these two have cleared the first hurdle and have been selected as ''finalists'' and will compete for up to a billion euros in funding over ten years. Thanks to this double candidacy, which was reported by global media, as well as several important partnerships, the School's visibility on an international level was particularly good in 2010.

It was also a remarkable year in terms of the expansion and completion of several major building projects on the EPFL campus. It began with a bang, February 22, when the Rolex Learning Center was opened to students. This new ''totem'' of the School, a space dedicated to study and exchange, has been a huge success from the start, already in 2010 far outstripping occupancy predictions.

It was also during 2010 that the first Innovation Square buildings were occupied, while others were still under construction. Finally, as the year came to a close, the first preparatory excavations for the Swiss Tech Convention Center were started, paving the way for the organization of international scientific conferences at EPFL.

EPFL STRENGTHENS ITS SCIENTIFIC COLLABORATION WITH BRAZIL

Brazil and Switzerland have finalized an agreement for research in the areas of neurosciences, health, energy and the environment. In the presence of Federal Councilor Didier Burkhalter and Brazilian Minister of Education, Dr. Fernando Haddad, EPFL and the Lily Safra International Institute of Neurosciences in Natal announced a program of collaboration.



In August 2010, Federal Councilor Didier Burkhalter and EPFL President Patrick Aebischer took part in an official ceremony in Brazil with the Brazilian Minister of Education, Dr. Fernando Haddad and several other important members of the Brazilian scientific community. The ceremony symbolically marked an important step in the ongoing collaboration between EPFL and the Edmond and Lily Safra International Institute of Neuroscience of Natal (ELS-IINN) in Brazil, where EPFL Professor Miguel Nicolelis heads one of the most cutting-edge neuroscience research institutes in the Southern hemisphere.

The EPFL's collaboration with the Safra institute in Natal is a direct consequence of the Brazilian and Swiss Joint Research Program signed in September 2009. These research programs include neuroscience, health, energy, and the environment. As part of this agreement, EPFL and the Swiss government will donate the EPFL's former Blue Gene L supercomputer, which was replaced by the new Blue Gene P in 2009, to the Brazilian institute. This donation will allow the ELS-IINN to further develop its scientific mission.

The Blue Gene L will be updated by the ELS-IINN, according to current supercomputer standards and will be used in joint research projects with the EPFL. The project, funded by the Swiss and Brazilian governments, hopes to find a new potential therapy to treat Parkinson's disease and represents a new model of international collaboration.

HARVARD AND EPFL ANNOUNCE JOINT NEUROENGINEERING PROGRAM

A generous contribution from the Bertarelli Foundation enabled Harvard Medical School (HMS) and EPFL to establish a joint research and education program in the neurosciences. The Bertarelli Program in Translational Neuroscience and Neuroengineering is a collaborative exchange aimed at improving quality of life for people with neurological disabilities.

THE BERTARELLI PROGRAM IN TRANSLATIONAL NEUROSCIENCES AND NEUROENGINEERING IS A COLLABORATION THAT AIMS TO IMPROVE THE QUALITY OF LIFE OF THOSE AFFECTED BY NEUROLOGICAL DISEASES.

The nine million dollar donation was awarded by the Foundation co-president Ernesto Bertarelli, the Dean of Harvard Medical School (HMS) Jeffrey S. Flier, and EPFL president Patrick Aebischer, in the presence of the Swiss Federal Councillor Didier Burkhalter.

The donation also includes an endowment of the Bertarelli Professorship in Translational Medical Science. The inaugural incumbent will be William Chin, MD, currently Executive Dean of Research at HMS, who will oversee the development of the new joint program. The program is intended to be a bridge between design of novel neurological devices at EPFL and clinical testing at HMS, with a bidirectional exchange between students and researchers from the two institutions. EPFL and Harvard Medical School already collaborate on translational neurobiological research, notably the visualization and simulation of the brain, headed by EPFL's Signal Processing Laboratory.

The Bertarelli Foundation already funds significant research in translational neurosciences at EPFL's Neuroprosthetics Center within the Institute of Bioengineering. EPFL Scientists are working to develop optogenetics, the use of light as a biological switch for gene expression, and to create second-generation implants for people with impaired hearing.

To encourage future collaboration, a Bertarelli Grant program has been established for research projects at the forefront of neuroscience and neuroengineering, which will bring together students and scientists from the two institutions. Results from novel coursework and research will be shared during a joint symposium to be held annually in Boston and Lausanne alternatively.

EPFL + ECAL LAB AWARDED THE DMY INTERNATIONAL DESIGN FESTIVAL BERLIN AWARD

"Give me more", EPFL + ECAL Lab's exploration of Augmented Reality, caused a sensation in Berlin in 2010, attracting crowds of several million as well as the attention of the festival jury.

An embroidered cushion whose motif transforms into dream-like animal forms, a mirror reflecting different states of our heart or children's drawings that spring to life: the principal of Augmented Reality is to bring objects to life through computer technology. The installations reflect EPFL+ECAL Lab's goal of using the power of Augmented Reality to create new media in which the content takes center stage.

Created in 2007, in collaboration with the Ecole Cantonale d'Art de Lausanne (ECAL), EPFL+ECAL Lab is an EPFL entity. Its mission is to foster innovation at the crossroads between engineering and design. EPFL's CVLab was created in 2002 and research focuses on Vision by Computer, a computer science that aims to emulate the way the human brain interprets images and our perception of the world via visual stimuli.

A FRENCH-SPEAKING CATALYST FOR TECHNOLOGICAL INNOVATION

RESCIF *(Réseau d'excellence des sciences de l'ingénieur de la Francophonie)* aims to bring together 14 French-speaking universities from developed and developing countries, using the French-speaking culture as a vehicle for technological innovation. The project promotes collaborative scientific programs focused on areas such as water supply, nutrition and energy management. These represent crucial research areas for countries in the Southern hemisphere whose economic growth and food safety are heavily affected by the challenges of climate conditions. RESCIF is one of three official initiatives supported by the Swiss government at the 13th Conference of Heads of State of French-speaking countries in Montreux.

Together with EPFL, RESCIF is composed of five other French-speaking Institutes of Technology from developed countries and eight French-speaking universities in emerging countries. In addition, RESCIF also plans to support the reconstruction of the State University and the Quisqueya University in Haiti, destroyed during the earthquake in 2010.

Common programs will aim to provide practical solutions for everyday concerns, such as the development of solar technologies for water treatment, or managing the pollution associated with urban development. RESCIF sees itself as a catalyst in such projects, making large-scale technological partnerships a reality, through the shared culture of the French language.

The RESCIF network:

- Université catholique de Louvain (Belgium)
- Institut international d'ingénierie en eau et environnement 2IE de Ouagadougou (Burkina-Faso)
- Ecole nationale supérieure polytechnique de Yaoundé (Republic of Cameroon)
- Ecole polytechnique de Montréal (Canada)
- Paristech (France)
- Ecole normale supérieure de Lyon (France)
- Institut polytechnique de Grenoble (France)
- Université d'Etat (Haïti)
- Université Quisqueya (Haïti)
- Université Saint-Joseph de Beyrouth (Lebanon)
- Ecole Mohammadia d'ingénieurs de Rabat (Morocco)
- Ecole supérieure polytechnique de Dakar (Sénégal)
- EPFL (Switzerland)
- Institut polytechnique d'Ho-Chi-Minh-Ville (Vietnam)

EPFL'S NEW CONFERENCE CENTER: UNIQUE IN EUROPE

In order to host the numerous congresses and seminars organized each year at EPFL, an ultra-modern and modular congress center is being built on the Northern part of the campus. The project includes housing facilities for 500 students as well as shops and services.

EPFL will soon have its own congress center, unique in Europe, capable of hosting the most prestigious international scientific congresses and conferences, thanks to ultra-modern and modular equipment. The project was designed by Richter Dahl Rocha & Associés Architectes SA, and they intend to create housing for 500 students, as well as shops and services. The project was made possible through a partnership between EPFL and HRS Real Estate SA.

Scientific congresses and conferences are an important part of any researcher's life. Today, research and scientific knowledge depend on the dissemination and exchange of knowledge between countries. The need for globalization is growing as researchers become more and more specialized, and publications and academic conferences play an ever increasing role in science. They are a form of continuing education, facilitating networking opportunities and potential future scientific collaborations.

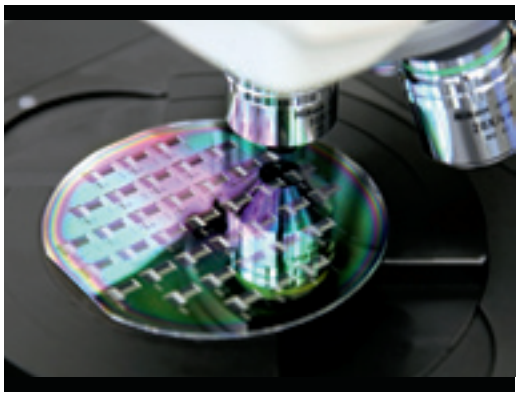
The project currently under construction on the Northern part of the campus is comprised of two buildings. The first, a conference center, with an overhanging roof and glass facades, will offer maximum flexibility for interior set-up. Thanks to an ingenuous hydraulic system that allows the floor level to be changed, along with retractable chairs, the auditoriums will be able to hold 450, 800, 1,300 or 3,000 seats and even a 2,300 m^2 banquet hall. The possibility of producing electricity using photovoltaic cells is currently under investigation.

The second building will serve as student housing (505 beds comprised of 180 studios and two- to six- room apartments), shops, restaurants and services such as a dentist, doctor, hairdresser and physical therapist. The two independent buildings surround a square on a raised platform, covering a South-facing ground floor courtyard.

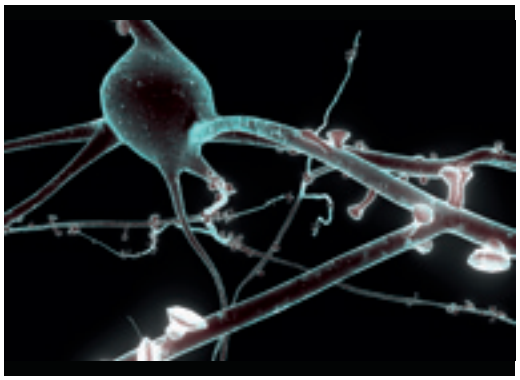
EFPL IS IN A LEADING POSITION IN THE EUROPEAN COMPETITION FOR FET FLAGSHIPS

The European Union is launching an ambitious program for scientific development. The FET Flagship projects will receive up to a billion Euros in funding. Among the six finalists are two EPFL-directed projects.

In December 2010, EFPL submitted two research project proposals to the EU, both of which qualified as pilots for the FET Flagship program. This initiative which aims to support technical innovation in Europe, resulted in twenty submissions from the best universities in Europe in 2010. Two EPFL-directed projects are among the six finalists: Guardian Angels, co-directed with ETH Zurich, is developing the electronics of the future – ultra-compact, autonomous, and affordable. The Human Brain Project will create the infrastructure needed to model the human brain, an undertaking that will have considerable medical and technological impact.



Guardian Angels aims to build electronic devices for human well-being and safety. Sensors, compact enough to be discreetly inserted into the fibers of clothing, will measure various internal and external parameters chosen by the wearer, such as temperature, stress, pollution, pollen, glucose levels or gases in the air. They will work using very little energy, fueling themselves with solar energy, piezoelectrical energy sources or thermal gradients. They will enable people to better manage their daily lives. Major companies such as Siemens, IBM, Intel and Infineon are backing this project, working side-by-side with the researchers.



The aim of the **Human Brain Project** is to put a unique infrastructure in place. By creating a model of the human brain, researchers will provide an exceptional tool with which to better understand this extremely complex organ. Among other things, it will provide a drug development platform destined for the pharmaceutical industry. Europe's best experts in neuro-inspired computer science are also associated with this project. They are counting on this program to use the knowledge gained on how the brain works to create the computers of the future. Some of the best universities in Europe are taking part in the project, namely Heidelberg, the Julich Calculation Center and TU München in Germany, the Wellcome Trust Sanger Institute in Great Britain, the CEA in France and the Karolinska Institutet in Sweden.

In summer 2012, the EU will make the final FET Flagships selection. The winning projects will receive up to a billion Euros in funding. With two finalists in the final six, EFPL is already in a strong position in this closely-fought European competition.

OUTLOOK

PERSONALIA

PROFESSORS NOMINATED IN 2010

Marilyne Andersen
Associate Professor of Sustainable Construction Technologies

Wanda Andreoni
Full Professor of Physics

Camille-Sophie Brès
Tenure Track Assistant Professor of Electrical and Electronic Engineering

Andreas Peter Burg
Tenure Track Assistant Professor of Electrical and Electronic Engineering

Nicolai Cramer
Tenure Track Assistant Professor of Organic Chemistry

Paolo De Los Rios
Associate Professor of Physics

Marc Gruber
Full Professor of Entrepreneurship and Technology Commercialization

Michael Gastpar
Full Professor of Communication Systems

Matthias Grossglauser
Associate Professor in Communications Systems

Oliver Hantschel
Tenure Track Assistant Professor of School of Life Sciences

Janet Hering
Full professor of Environmental Chemistry

Colin N. Jones
Tenure Track Assistant Professor of Mechanics

Vincent Kaufmann
Associate Professor of urban sociology and mobility analysis

Tobias Kippenberg
Associate Professor of Physics and Electrical Engineering

Christoph Koch
Full Professor of Computer Sciences

Stéphanie P. Lacour
Tenure Track Assistant Professor of Microengineering

Gábor Laurenczy
Adjunct Professor of Chemistry

Nicola Marzari
Full Professor of Materials Science

Miguel A. L. Nicolelis
Full Professor of Neurosciences

Alfredo Pasquarello
Full Professor of Theoretical Condensed Matter Physics

Marco Picasso
Adjunct Professor for Chair of Analysis and Numerical Simulation

Emmanuel Rey
Tenure Track Assistant Professor of architecture and sustainable construction technologies

Paolo Ricci
Tenure Track Assistant Professor of Plasma Theory

Sylvie Roke
Tenure Track Assistant Professor of Bioengineering at the School of Engineering

Vincenzo Savona
Associate Professor of Physics

Kristin Schirmer
Adjunct Professor of Environmental Toxicology

Olivier Schneider
Full Professor of Elementary Particle Physics

Kristina Schoonjans
Adjunct Professor of Metabolism

Matthias Seeger
Tenure Track Assistant Professor of Computer Sciences

Alessandro Spadoni
Tenure Track Assistant Professor of Mechanical Engineering

Melody Swartz
Full Professor of Biological Engineering

Urs von Gunten
Full Professor of Drinking Water Treatment

Jieping Zhu
Full Professor of Organic Chemistry

THANK YOU TO ALL OUR DONORS

EPFL would like to sincerely thank all donors for their tremendous commitment to science, education and development. In 2010, they have contributed extensively to the quality of research, teaching and life on campus.

DONORS 2010

Audemars Piguet SA
Digitization of the Montreux Jazz Festival archives.

—

The Asterion Foundation
The Asterion Chair in Neurosciences,
the Euler Program for mathematically gifted children

—

Mrs. Sylviane Borel and Mr. Daniel Borel
The WISH Foundation for the promotion of women in science

—

Constellium
The Constellium Chair in Materials research

—

Debiopharm SA
The Debiopharm Chair in Oncology

—

The Defitech Foundation
The Defitech Chair in Non-Invasive Brain-Machine Interaction

—

Mrs. Julia Jacobi
The Julia Jacobi Chair in Photomedicine

—

KPMG SA
Partners of Venturelab for the promotion of entrepreneurship

—

Pierre Landolt and Associates; Banque Landolt & Cie
The Landolt Chair in Innovations for a Sustainable Future

—

The 1796 Foundation; Associates of Lombard Odier Darier Hentsch
Funds computers available for students
and visitors of the Rolex Learning Center

—

Mr. Charles Maillefer
The Euler Program for mathematically gifted children

DONORS 2010

Merck Serono SA
The Merck Serono Chair in Oncology, The Merck Serono Chair in Neurodegenerative Diseases, The Merck Serono Chair in Drug Delivery

—

Nestlé SA
The Nestlé Chair in Energy Metabolism

—

The Novartis Foundation
Scholarships for Masters courses in the Life Sciences

—

Mr. Frederick Paulsen
Summer School and scholarships for Russian Masters students

—

Petrosvibri SA
The Petrosvibri Chair in CO_2 capture

—

Banque Pictet & Cie
The Euler Program for mathematically gifted children

—

La Poste
Chair in Management of Network Industries

—

The Sandoz Family Foundation
The Sandoz Family Foundation Chair in Neural Coding and Neuroprosthetics

—

Swiss Finance Institute
Supports seven Chairs in Financial Engineering

—

Swissquote SA
The Swissquote Chair in Quantitative Finance

—

The swissUp Foundation
The swissUp Chair for the Promotion of Women Professors

EPFL IN FIGURES

OVERVIEW OF BACHELORS, MASTERS AND DOCTORAL CANDIDATES

Bachelors candidates

	Total Bachelors candidates	Total new matriculations (Bachelors years 1, 2 & 3)*	% candidates matriculated
Autumn semester 2009–2010	2133	1586	74 %
Autumn semester 2010–2011	2402	1666	69 %
Autumn semester 2011–2012	2776	*in 2011*	

*excluding students retaking a year

Masters candidates

	Total new Masters candidates	Total new matriculations (Masters years 4 & 5)**	% new matriculated candidates
Autumn semester 2007–2008	873	223	26 %
Autumn semester 2008–2009	1298	287	22 %
Autumn semester 2009–2010	1757	375	21 %
Autumn semester 2010–2011	1848	397	21 %

**students with a non-EPFL Bachelors degree (excluding retakes)

EPFL Doctoral candidates

	Total Doctoral candidates	Total Doctoral matriculations	% matriculated Doctoral candidats
2007	1324	515	39 %
2008	1512	584	39 %
2009	2339	656	28 %
2010	3033	584	19 %

2010 – STUDENTS BY FIELD AND STUDY LEVEL

	Bachelors	Masters	Doctorants	Continuing Education	Total
Basic Sciences (SB)	785	299	465		**1549**
Mathematics	230	65	79		**374**
Physics	314	119	243		**676**
Chemistry	241	115	143		**499**
Life Sciences (SV)	340	132	232		**704**
Engineering (STI)	950	494	640		**2084**
Materials Science	121	66	117		**304**
Mechanical Engineering	354	116	98		**568**
Microengineering	327	142	201		**670**
Electrical Engineering	148	170	224		**542**
Computer and Communication Sciences (IC)	493	287	261		**1041**
Communication Systems	191	114	72		**377**
Computer Science	302	173	189		**664**
Architecture, Civil and Environmental Engineering (ENAC)	1391	420	254	52	**2117**
Environmental Engineering	272	98	74		**444**
Civil Engineering	306	120	94	7	**527**
Architecture	813	202	86	45	**1146**
Management of Technology (CdM)		84	49	134	**267**
Management of Technology		39	39	134	**212**
Financial Engineering		45	10		**55**
Total	3959	1716	1901	186	**7762**

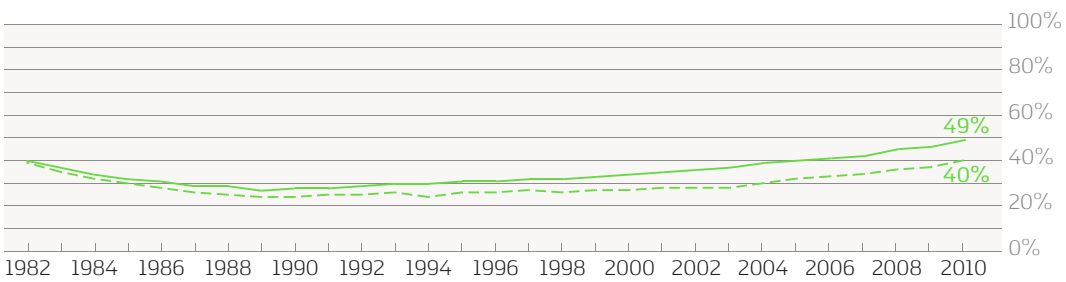
Bachelors & Masters students
5675

STUDENT BODY

Evolution of the number of students by faculty**

	Faculties*						
	SB	SV	STI	IC	ENAC	CdM	**Total**
2000	866		1438	1221	1374		4899
2001	1019		1479	1349	1333		5180
2002	1139	5	1564	1398	1395	72	5573
2003	1332	148	1692	1387	1417	92	6068
2004	1375	280	1724	1267	1536	146	6328
2005	1338	364	1693	1171	1524	149	6239
2006	1287	468	1705	1068	1629	179	6336
2007	1290	550	1699	962	1651	193	6345
2008	1400	603	1780	925	1794	244	6746
2009	1472	643	1920	932	1938	257	7162
2010	1549	704	2084	1041	2117	267	7762

Foreign students

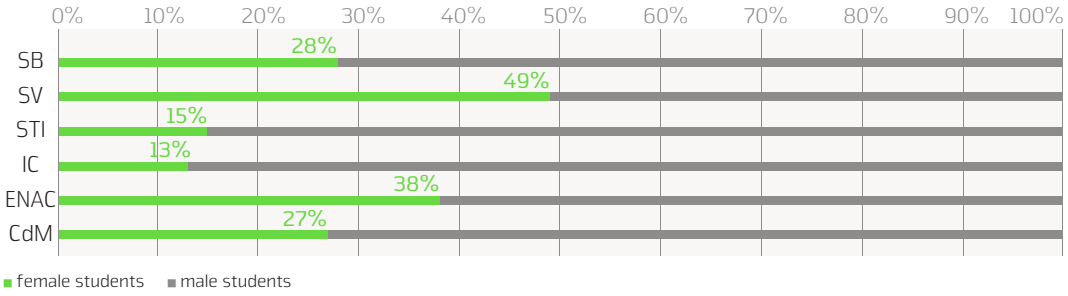


-- % foreign students (including those resident in Switzerland) pursuing degrees (bachelor's/master's)
— % total foreign students (including those resident in Switzerland)

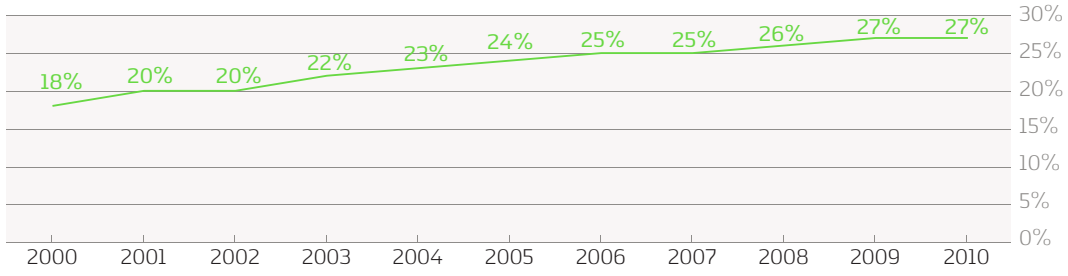
*SB = Basic Sciences
SV = Life Sciences
STI = Engineering
IC = Computer and Communication Sciences
ENAC = Architecture, Civil & Environmental Engineering
CdM = Management of Technology

Women at study**

Proportion of students by faculty*



Evolution of women students (%)



Evolution of women students (number per faculty)*

	SB	SV	STI	IC	ENAC	CdM	Total
2000	195		141	122	425		883
2001	262		162	159	432		1015
2002	303	3	188	157	474	15	1140
2003	348	60	223	169	497	26	1323
2004	355	111	251	162	542	42	1463
2005	364	151	230	164	542	36	1487
2006	342	200	248	147	579	51	1567
2007	355	242	235	123	580	55	1590
2008	391	285	262	112	652	84	1786
2009	415	308	283	122	722	70	1920
2010	435	345	314	131	803	71	2099

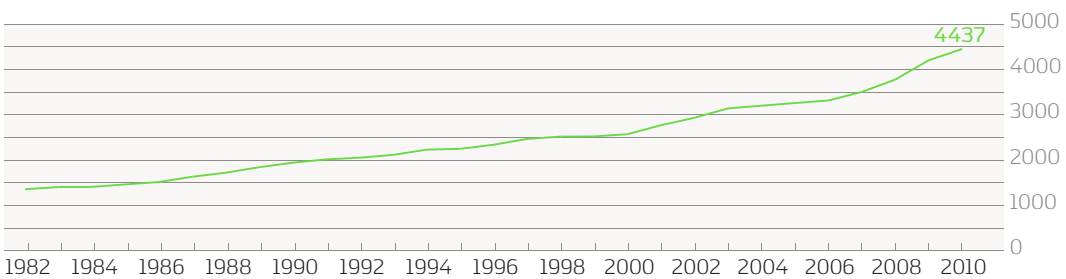
** Bachelor, Master and Doctoral

PERSONNEL

Personnel at EPFL (full-time equivalents)

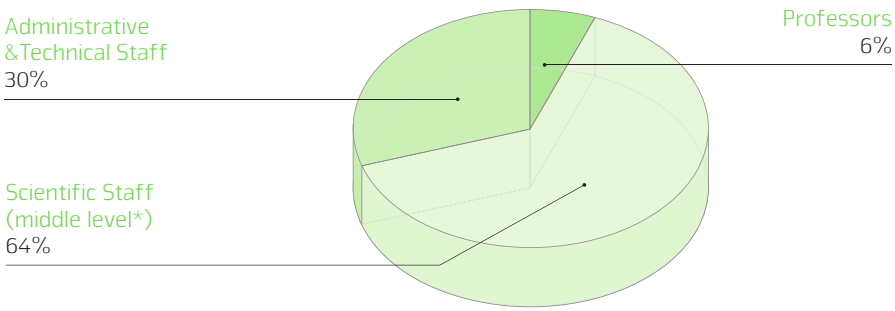
	Total
Basic Sciences (SB)	**1041.1**
Mathematics	**162.1**
Physics	**526.5**
Chemistry	**352.5**
Life Sciences (SV)	**657.3**
Engineering (STI)	**1161.4**
Materials Science	**213.1**
Mechanical Engineering	**293.1**
Microengineering	**416.5**
Electrical Engineering	**238.7**
Computer and Communication Sciences (IC)	**419.5**
Communication Systems	**165.4**
Computer Science	**254.1**
Architecture, Civil and Environmental Engineering (ENAC)	**534.0**
Environmental Engineering	**159.6**
Civil Engineering	**196.9**
Architecture	**177.5**
Management of Technology (CdM)	**70.1**
Management of Technology	**41.2**
Financial Engineering	**28.9**
Central services	**553.8**
Total	4437.0

Total Personnel at EPFL (full-time equivalents)



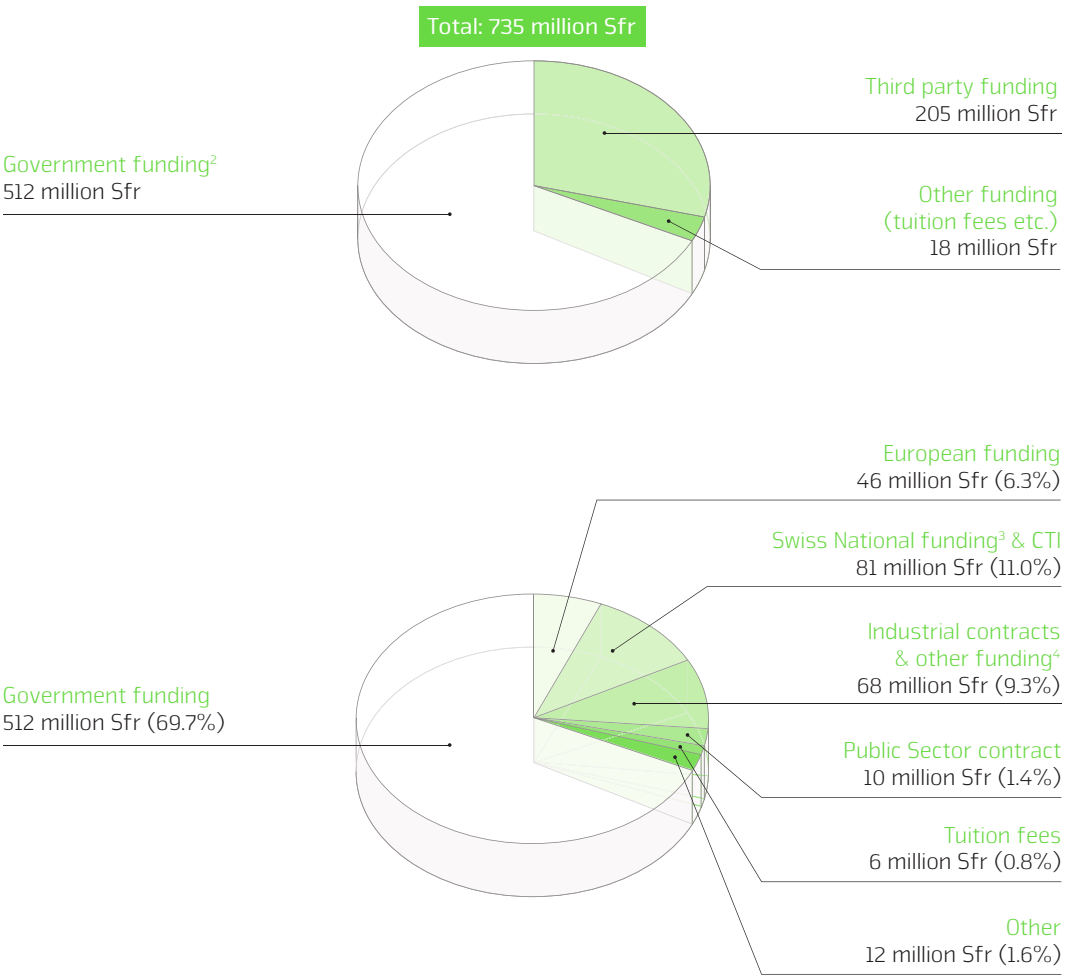
Personnel by category (full-time equivalents)

	Total	Government funded	Third party funded (public & private)
Professors	**273.8**	254.8	19.1
Professors	**162.1**	159.4	2.7
Associate Professors	**44.0**	44.0	0.0
Tenure Track Assistant Professors	**56.7**	50.3	6.4
Swiss National Fund Assistant Professors	**11.0**	1.0	10.0
Research Scientists and Lecturers	**2826.1**	1221.6	1604.5
Adjunct Professors	**52.0**	51.4	0.6
Senior Scientists	**65.4**	60.5	5.0
Assistants (incl. PhD students)	**1718.1**	604.5	1113.6
Scientific Collaborators (incl. Postdoctorates)	**990.5**	505.3	485.3
Administrative and Technical Staff	**1337.1**	1149.0	188.1
Administrative Staff	**702.6**	580.8	121.8
Technical Staff	**634.6**	568.2	66.4
Total	**4437.0**	2625.3	1811.7
		59.17 %	40.83 %



*Adjunct Professors, Senior Scientists, Assistants & Scientific Collaborators

EXPENDITURE 2010[1]



[1] Total expenditure including construction (including Federal Office for Buildings and Logistics [FOBL] allocation)
[2] Expenditure covered by the ordinary budget and internal sources of income (tuition fees, services, financial revenue etc.)
[3] Including NCCR and NanoTera/Systems project funding
[4] Sponsoring, foundations, commited and reserved funds, congresses, continuing education etc.

EXPENDITURE 2010 (kSfr)

	Personnel	Runing costs	Invest-ments	**Total**	Third party funding
Basic Sciences (SB)	119,805	18,870	13,902	**152,577**	49,956
Mathematics	21,807	2,817	321	**24,945**	4,708
Physics	63,918	9,553	9,691	**83,162**	28,962
Chemistry	34,079	6,500	3,891	**44,470**	16,285
Life Sciences (SV)	66,683	21,853	6,298	**94,834**	36,437
Engineering (STI)	122,483	22,543	6,928	**151,955**	66,340
Materials Science	22,942	4,149	1,661	**28,752**	10,237
Mechanical Engineering	30,594	6,443	1,304	**38,341**	16,115
Microengineering	45,125	6,943	2,512	**54,581**	24,974
Electrical Engineering	23,822	5,007	1,451	**30,281**	15,014
Computer and Communication Sciences (IC)	43,632	5,927	1,608	**51,167**	15,073
Communication Systems	19,017	2,382	371	**21,769**	5,442
Computer Science	24,615	3,546	1,238	**29,399**	9,631
Architecture, Civil and Environmental Engineering (ENAC)	61,732	10,777	1,860	**74,370**	20,519
Environmental Engineering	16,403	2,993	1,078	**20,474**	5,820
Civil Engineering	22,532	3,758	599	**26,889**	9,164
Architecture	22,797	4,026	183	**27,007**	5,535
Management of Technology (CdM)	10,229	1,982	12	**12,223**	3,057
Management of Technology	6,054	1,585	0	**7,639**	2,521
Financial Engineering	4,175	398	12	**4,585**	537
Central services	83,587	86,857	6,172	**176,616**	13,909
Construction (separate balance sheet)			21,538	**21,538**	
Total (excluding construction)	508,150	168,810	36,782	**713,742**	205,291
Total expenditure	508,150	168,810	58,320	**735,280**	205,291

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

International Academic Ranking

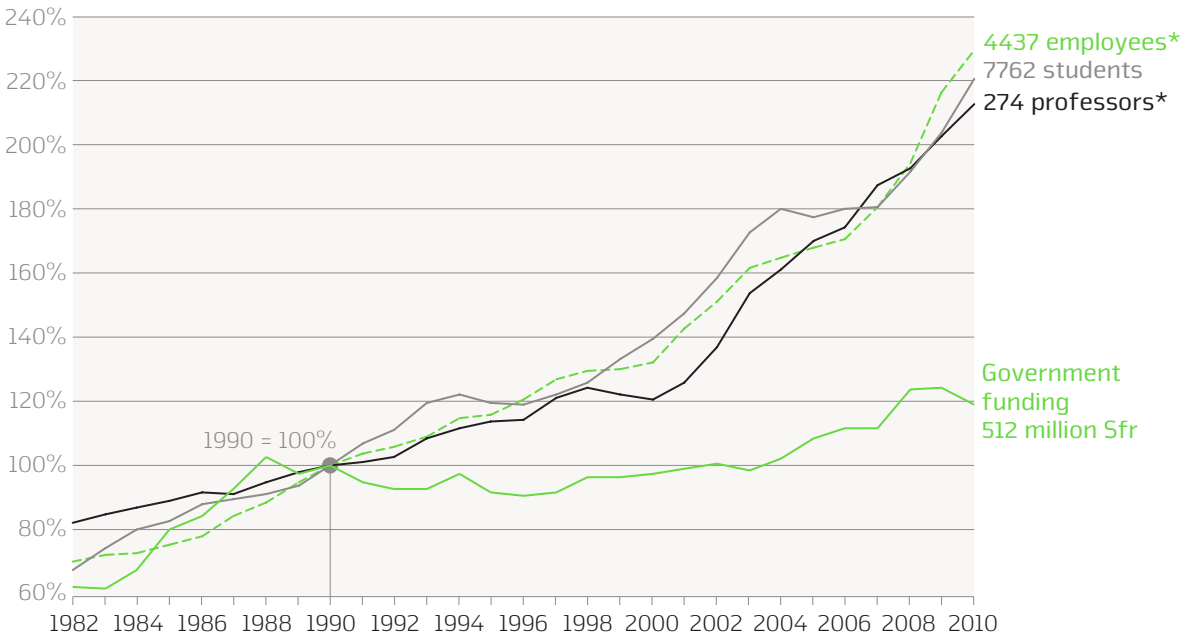
European Ranking
(World Ranking)

	2007	2008	2009	2010
QS/Times Higher Education – Global	**42** (117)	**14** (50)	**12** (42)	**8** (32)
QS/Times Higher Education – Engineering & Technology	**9** (47)	**8** (44)	**9** (44)	**6** (31)
Shanghai Jiao Tong – Engineering, Technology & Computer Science	**3** (28)	**2** (18)	**1** (15)	**2** (20)
Leiden ranking Crown Indicator – Top 250		**2** (40)		**1** (15)

Leiden 2008 covers 2003–2007
Leiden 2010 covers 2004–2009

	Patent registration	Licensing	Start-ups created
Basic Sciences (SB)	**7**	**10**	**1**
Mathematics	0	1	0
Physics	3	3	1
Chemistry	4	6	0
Life Sciences (SV)	**7**	**3**	**0**
Engineering Sciences and Techniques (STI)	**26**	**16**	**7**
Materials Science	3	3	0
Mechanical Engineering	4	1	3
Microengineering	9	9	3
Electrical Engineering	10	3	1
Computer and Communication Sciences (IC)	**6**	**12**	**4**
Communication Systems	1	2	2
Computer Science	5	10	2
Architecture, Civil and Environmental Engineering (ENAC)	**1**	**3**	**1**
Environmental Engineering	1	2	1
Civil Engineering	0	1	0
Architecture	0	0	0
Central services	**0**	**1**	**1**
Total	**47**	**45**	**14**

SUMMARY AND KEY FIGURES



2010 IN FIGURES

7,762 students

47 patents registered

14 start-ups created

2nd European Institute (ARWU** Shanghai ranking) Engineering, Technology & Computer Science

46 million Sfr European funding

2,718 scientific publications

1 million visitors to the Rolex Learning Center

1,200 events organized on campus

*Full-time equivalent
**Academic Ranking of World Universities

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Project: Mediacom EPFL
Design: Alternative, Geneva
Photos: Alain Herzog / 360-pano.ch / Lionel Flusin - Montreux Jazz Festival Foundation / Thierry Parel / iStockphoto
Print: Courvoisier-Attinger, Arts graphiques SA, Suisse

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