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Science-Switzerland, April – May 2019

News on Swiss science, technology, education and innovation

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Swiss Universities Among Europe's Most Innovative

(Reuters, May 06, 2019)

In the Reuters ranking of the 100 most innovative universities in Europe 2019, Switzerland has 3 representatives in the top ten and 5 representatives in the top 100. EPFL comes in at an outstanding 5th rank. After advancing four spots, University of Zurich takes the 9th place, followed by ETH Zurich ranking 10th. Additionally, the Universities of Basel and Geneva were in the Top 100. Innovative projects and inventions, such as EPFL's self-repairing material, the rescue drones of University of Zurich or the digitally built DFAB HOUSE by ETH Zurich were factors contributing to the outstanding placement. The Reuters innovation ranking is published annually and aims to identify the institutions that are strongest in advancing science, inventing new technologies and influencing the industry.
http://swissinnovation.org/news/web/2019/00-190506-55

Third Highest R&D Intensity Globally

(Federal Statistical Office, May 14, 2019)

Switzerland is an innovation force globally. However, to be so innovative, a country has to invest in Research & Development (R&D). The Federal Statistical Office has published numbers on the R&D expenditures in 2017. In total, an amount of 22.6 billion US$ was dedicated to R&D activities, which is 2% more than in 2015. Even though their expenditures were curbed for the first time in 20 years, enterprises contribute the biggest part to research, followed by higher educational institutions. Contrary to enterprises, the latter increased their spending by 6% as compared to the last survey of 2015. Switzerland maintains a high R&D intensity, with a share of 3.4% of GDP being targeted into these activities. In international comparison, the alpine nation ranks third. Only South Korea and Israel invest a larger share of GDP into R&D.
http://swissinnovation.org/news/web/2019/00-190514-8f

Switzerland Most Competitive Country in Europe

(IMD, May 29, 2019)

Switzerland has been ranked Europe's most competitive nation and came in fourth worldwide in the annual global ranking of the Lausanne-based IMD Business School. Singapore came in on the first place after climbing up two ranks and is ahead of Hong Kong and the US who are place second and third respectively. Singapore's advanced technological infrastructure, the availability of skilled workforce and favorable immigration laws allowed this advancement. For Switzerland, the main reasons for ranking better are economic growth, the stability of the local currency and high-quality infrastructure. The alpine nation was ranked top for university and management education, health services and quality of life.
http://swissinnovation.org/news/web/2019/00-190529-f8

1. Policy

Towards Professorial Gender Balance

(University of Zurich, April 05, 2019)

The University of Zurich recently published new guidelines on professorial selection procedures in order to make the gender balance more equal and provide a level playing field. Being a professor comes with a great deal of responsibility towards the specific subject area as much as towards the university as a whole. Thus, the appointment procedure needs to happen carefully and thorough. Even though, women have caught up in other university-related fields - they build the majority among students and constitute 51.5% of PhD candidates - less than a fourth of all professorships are held by women. Plenty of reasons explain this gap, such as historical trends, education policy or gender roles. The new guidelines introduce a couple of measures

like allowing a maximum of two thirds of one gender in the appointment committee. The aim is to make the procedure more transparent and directly related to achievements.
http://swissinnovation.org/news/web/2019/01-190405-61

Open Access Publishing

(University of Zurich, May 10, 2019)

The open access movement is trying to enable open access to all academic publications. A couple of incumbent publishing houses like Wiley, Elsevier and Springer Nature dominate academic publishing. The prices they ask for have been increasing over time, generating significant profits for them. Over the course of the past years, the open-access movement has become stronger and the question of how academic publishing should be transformed rises. At the University of Zurich, a long-awaited panel discussion focused on this topic. The panel reached the conclusion that a quick transformation to a open model would liberate everyone from these houses' dominance. At the University of Zurich, 40% of all publications are freely available to the public, which is the highest share of all Swiss universities.
http://swissinnovation.org/news/web/2019/01-190510-e4

2. Life Science

DIY Disease Detection Using Photonics

(EPFL, April 02, 2019)

Using just a photonic chip and an ordinary camera, researchers at EPFL's BioNanoPhotonic Systems (BIOS) Laboratory have managed to count individual biomolecules in a small sample and determine their position. Their tiny yet powerful device – combining optics and smart image analysis – can even detect a graphene sheet a single atom thick. This pioneering technology is based on metasurfaces – sheets of artificial materials covered in millions of Nano-sized elements arranged in a special way. Optical sensors could one day play a key role in personalized medicine. A simple, compact device could enable us to monitor our level of health, identify trace amounts of undesirable biomarkers in our blood or saliva, and serve as an early-warning system for diseases. The research findings are published in Nature Photonics.
http://swissinnovation.org/news/web/2019/03-190402-a8

Who Should Go Gluten-Free?

(University of Zurich, April 02, 2019)

A gluten-free diet does not automatically mean a healthier one. With a gluten-free diet, one risks of eating more sugar, more fat and less dietary fiber than necessary. In addition, gluten-free products are not only unhealthier, but are often more expensive than conventional ones. Nonetheless, gluten can cause illnesses by some people. The most serious form of illness caused by gluten is celiac disease, an autoimmune disease affecting about one percent of the population. The good new is, that those affected can live symptom-free, as long as they are following a strictly gluten-free diet. Others, however, should follow a healthy balanced diet.
http://swissinnovation.org/news/web/2019/03-190402-bb

Positive Effects of Animal-Assisted Therapy for Brain Injury Patients

(University of Basel, April 09, 2019)

When experiencing severe traumatic brain injury, patients often have problems in their social behavior. They, for example, exhibit reduced emotional empathy or impaired emotional expression, which often leads to problems in social interactions. Psychologists from the University of Basel have undertaken the first study on what effects the integration of animals into therapy of brain injury patients has. The study found that the patients' social behavior was more active when an animal is present. For example, they expressed almost double the positive emotions and communicated more, both verbally and non-verbally. The animal-assisted therapy showed no negative emotions like anger or rage. The results indicate that animals could be used as therapeutic partners because they provide a stimulus for patients' engagement and motivation and improve social deficits.
http://swissinnovation.org/news/web/2019/03-190409-64

A New Tool to More Sensitive Malaria Detection

(University of Fribourg, April 10, 2019)

Researchers at the University of Fribourg have discovered a novel method to detect the presence of malaria parasites in blood samples. This discovery is being further developed into a diagnostic tool. This new tool could lead to more sensitive parasite detection and help reduce healthcare costs. The test is specifically designed to discover asymptomatic carriers at risk of transmitting the disease, who could hinder complete eradication of malaria. Initial testing has already taken place in Brazil. The project was given the third prize at the Ypsomed Innovation Fund's Innovation Award for research, development and technology transfer.
http://swissinnovation.org/news/web/2019/03-190410-84

Assessing Gait Characteristics in Older Adults

(EPFL, April 11, 2019)

Gait characteristics are sometimes regarded as the sixth vital sign in humans. A team of EPFL researchers is taking part in a major European project called MOBILISE-D aiming to design a device that can assess a person's gait more accurately. It has been proven that older adults who walk more slowly than one meter per second have more health problems on average. Conversely, people who have a good gait speed show greater cognitive function, develop fewer illnesses, suffer fewer falls and spend less time in hospital. Therefore, several specialist laboratories around the world, including the laboratory at EPFL are working together in order to develop a portable system that can reliably analyze people with a very slow gait speed.
http://swissinnovation.org/news/web/2019/03-190411-63

Injectable Implant Wins EPFL Start-Up Night

(EPFL, April 12, 2019)

22 entrepreneurs searching for venture capital were given 90 seconds to each pitch their projects to an audience of 250 EPFL alumni and investors during the Start-up Champion Seed Night. The winner was Amélie Béduer with her start-up Volumina Medical. With her injectable implant, the CEO of Volumina Medical won over the jury as well as the audience. The implant addresses the problem of natural repair of soft tissue, for example after a breast cancer surgery. By injecting it with a syringe, intervention and recovery time are reduced compared to more invasive treatment options. The product is currently in preclinical testing. The night was a success and gave the start-ups and entrepreneur visibility to a relevant audience. The aim of the annual event is to intensify ties between EPFL's graduates and the up-and-coming firms.
http://swissinnovation.org/news/web/2019/03-190412-1a

Decoding Breast Cancer Cells Points to New Treatment Option

(University of Zurich, April 15, 2019)

Every year more than 1.7 million women worldwide are diagnosed with breast cancer, with fatal outcomes for around half a million patients. Research is underway into novel therapeutic approaches that target cancer cells more precisely and activate the tumor-associated immune system. However, knowledge is lacking about the different cancer and immune cells present within a tumor, and how they differ from patient to patient. Using mass cytometry, researchers at the University of Zurich and from IBM Research have investigated the varying composition of cancer and immune cells from 140 patients. They have found that aggressive tumors are often dominated by a single type of tumor cell. If certain immune cells are also present, an immune therapy could be successful for a specific group of breast cancer patients.
http://swissinnovation.org/news/web/2019/03-190415-d9

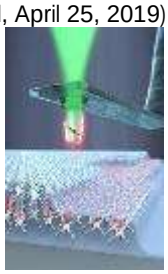
Faster Radiolabelling Antibodies for PET Imaging

(University of Zurich, April 23, 2019)

Medical diagnostics with PET imaging and targeted radioimmunotherapy both use radioactive antibodies that target cancer cells. Conventional methods for radiolabelling antibodies are time-consuming and difficult. They require multi-step procedures in which the protein is purified, coupled to a metal-binding chemical substance, isolated, stored, and then radiolabelled. The University of Zurich has developed a new method for radiolabelling antibodies. The novel approach uses UV light and through combining photochemistry and radiochemistry, the whole process can be done in less than 15 minutes. The research team has submitted a patent application for the technique and plans to develop the technology further in order to use it for other types of cancer.
http://swissinnovation.org/news/web/2019/03-190423-3e

New Insights Into van der Waals Materials Using Quantum Sensors

(University of Basel, April 25, 2019)



The use of atomically thin, two-dimensional van der Waals materials promises innovations in numerous fields in science and technology. Scientists worldwide try to find new methods of stacking different atomic layers to engineer materials with novel properties. Such atomically thin materials are held together by van der Waals forces. Recently, researchers from the University of Basel had a breakthrough by successfully measuring the magnetic properties of atomically thin van der Waals materials on the Nano-scale. Using a diamond quantum sensor, which are used to determine the magnetic properties of individual atomic layers of the material chromium triiodide in a quantitative manner, they were able to unveil an explanation for the unusual magnetic properties of chromium triiodide. These findings could help in the development of spintronics or ultra-compact magnetic memory media.
http://swissinnovation.org/news/web/2019/03-190425-3b

A Smart Watch to Manage Lymphoedema

(ETH Zurich, April 26, 2019)

The lymphatic system transports proteins, nutrients, waste products and immune cells through a fluid called lymph. When someone develops cancer, single or multiple lymph nodes are often colonized by cancer cells that form metastases. About ten percent of all cancer patients suffer from lymphoedema, which produces swelling in the legs, arms and breasts. The ETH Zurich start-up Dicronis – named after "diagnostic microneedles" – has developed an instrument called "Lymphit" for simple and early diagnosis of this condition. The device is a tiny transdermal patch of dissolving microneedles that patients stick onto their wrist for one minute. They

then wear an intelligent armband resembling a smartwatch for six hours. The young entrepreneurs behind the concept have been nominated for the ZKB Pioneer Prize.
http://swissinnovation.org/news/web/2019/03-190426-9e

Individual Nutrition Improves Effectiveness of Clinical Treatment

(University of Basel, April 26, 2019)

Nutrition is an important factor for recovery following an illness. A too small intake of protein and energy can pose some threats like increasing complications and even mortality rate. A study conducted by researchers from the University of Basel and the Aarau Cantonal Hospital has demonstrated that individualized nutrition improves treatment outcomes. The study used a randomized controlled study and examined the impact of nutritional support. Patients were divided into two groups of which one received the usual dishes from the hospital kitchen, whilst for the other group a nutritional plan was compiled by dieticians. After a month, individualized nutrition proved to achieve better supply of energy and protein and led to less complications. The researchers state that malnutrition is a modifiable risk factor and a specific diet can have a positive influence on disease progression.
http://swissinnovation.org/news/web/2019/03-190426-8f

Signaling Protein Snapshot

(Paul Scherrer Institut, April 26, 2019)

The interior of cells is protected against external influences through cell membranes. To receive information, however, special signaling pathways into the cells exist. Researchers at the Paul Scherrer Institute have found an important aspect of such pathways, which are important for all mammals because various vital processes like the regulation of the heartbeat are partly determined by them. There are three proteins that transmit information into the cell interior and the PSI research team was able to take a snapshot of one. They determined its structure at near-atomic resolution and thus, discovered how the protein can regulate itself. As the cells play a role in the development of cardiovascular diseases and certain tumors, learning more about the protein may help identifying drugs to inhibit such diseases.
http://swissinnovation.org/news/web/2019/03-190426-1e

MedTech Entering Operating Rooms

(University of Bern, April 29, 2019)

The joint Master's program in Biomedical Engineering of the University of Bern and the Bern University of Applied Sciences celebrates its tenth anniversary. It is a globally unique Master's with an obvious appeal: It is a fully English, specialist degree which allows students to identify unmet clinical needs thanks to its embedment in the medical school. Instead of developing technological solutions that are ideal from an engineering point of view, the course design puts clinical considerations first. Students graduate with profound knowledge of anatomy, physiology and clinical practice and additionally understand the issues with regulatory and ethical barriers to entry in the medical technology industry. In combination with the high-standard technical knowledge, the graduates are capable of recognizing clinical challenges before drafting technical solutions. This makes them valuable and sought-after by industry and academic institutions.
http://swissinnovation.org/news/web/2019/03-190429-a3

Childhood Determines Proneness to Disease

(University of Zurich, April 29, 2019)

Our immune systems build during childhood and this is also the time when susceptibility to disease is developed. Children who have multiple allergies usually suffer from chronic inflammatory diseases and psychiatric disorders in adulthood. There's evidence that younger birth years tend to develop allergies more frequently than people with older birth years. It is assumed that this is connected to better hygiene standards, changes in agriculture and urbanization and this is commonly referred to as hygiene hypothesis. Nowadays, immune systems come into contact with certain microbes only later in life which seems to have an adverse effect and increases incidence of chronic inflammatory diseases, mental disorders and allergies. In a study of Universities of Zurich and Lausanne, five classes of early immune-system programming were identified, and the study was able to confirm the hygiene hypothesis.
http://swissinnovation.org/news/web/2019/03-190429-99

Gene Therapy as a Last Chance

(University of Zurich, May 02, 2019)

Since the 1960s, immune system diseases can be cured with bone marrow transplants, however, this requires a donor with the right characteristics. In one thirds of cases, no suitable donor can be found. In these cases, patients' last resort is a gene therapy. Immunologist Janine Reichenbach conducts research into immune diseases and develops such gene therapies. This kind of therapy is still fairly new, and the first-generation trials had major side effects, like patients developing leukemia. Professor Reichenbach and her team have now developed second and third generations of the therapy and continuously improve them. The therapy uses a technique that adds corrective genetic sequences to the genome. Additionally, genome editing is being developed, which uses gene scissors to precisely target and correct genes in the genetic material. Gene editing might be the future when it comes to immuno-defects and other hereditary diseases.
http://swissinnovation.org/news/web/2019/03-190502-b9

Understanding the Regulation of Gene Expression

(University of Geneva, May 02, 2019)

Our biological traits are not only determined by genes themselves, but also by how, where and when they are expressed. Simply put, gene expression determines how a genotype becomes a phenotype - a biological trait. If this gene expression is controlled by various regulatory elements, what controls these? Researchers at the Universities of Geneva and Lausanne have examined these elements and their interaction with genes. To understand their function, the researchers built models that measure how genetic variation increases or decreases gene expression. By studying chromatin modification - that is how genomes are packaged - they gain new insights into why certain people have a higher susceptibility to develop certain diseases. This is a pioneering approach which could shape the future of precision medicine.
http://swissinnovation.org/news/web/2019/03-190502-96

Synergistic Interactions of Spider Venom Components

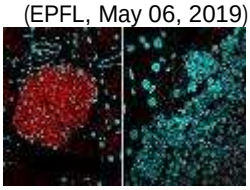
(University of Bern, May 02, 2019)

In past years, research into spider venom mainly focused on the neurotoxins. This involved understanding the paralyzing and toxic effect of individual components of the venom on arthropods and vertebrates. The findings were intended to be used for combating diseases of the nervous system. However, spider venom does not only consist of neurotoxins but of various other dangerous constituents. Researchers at the University of Bern have looked at how various substances present in spider venom interact with each other. They looked at the venom of the wandering spider "Cupiennius salei" and discovered multiple synergistic

interaction between the venom's components. Parts of it attacks muscles and nervous system, other components destroy internal tissue which enables the venom to spread, causing pain and inflammation. The researchers state that spider venom is a cocktail of substances that attack, paralyze and kill an organism in many different ways.
http://swissinnovation.org/news/web/2019/03-190502-c2

Biological Barrier to Restrain Cancer

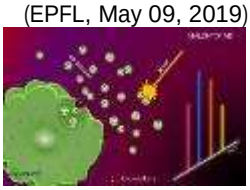
(EPFL, May 06, 2019)



An EPFL study that focused on pancreatic neuroendocrine tumors and breast cancer discovered a biological barrier preventing cancer cells from forming new tumors and from metastasizing. The team looked at activins, which are proteins involved in a number of important biological functions such as the regulation of the menstrual cycle, metabolism, immune response or endocrine function. The so-called activin B binds and activates a receptor called ALK7 which - when triggered - can cause various changes in the cell. The study revealed that activin B and ALK7 can form a barrier that prevents cancer cells from forming new tumors or metastasizing. It was furthermore discovered that the presence of ALK7 correlated with relapse-free survival of patients with various cancers. These findings are an important step towards understanding tumor biology and disease progression.
http://swissinnovation.org/news/web/2019/03-190506-04

Communication Between Cancer Cells

(EPFL, May 09, 2019)



Exosomes are microscopic spheres or vesicles that are excreted by all biological cells. They contain information in the form of nucleic acids, proteins and markers. Researchers of EPFL have discovered that cancer cells communicate with each other through such exosomes. When the team analyzed blood exosomes of melanoma patients, they discovered large quantities of cancer cell markers. Whereas healthy cells excrete small quantities of exosomes, cancer cells produce much larger amounts, which is an indication of signaling and conveyance of cell-to-cell information. Until now, it was unknown that cancer cells communicate over long distances, and this intercellular communication may spread cancer by preparing tissue for metastasis. This is insofar a breakthrough as a simple blood test, rather than a biopsy, could indicate the presence of a tumor and its stage. Additionally, therapeutic responses may be predicted which could speed up the diagnostic process.
http://swissinnovation.org/news/web/2019/03-190509-51

Deciphering Genetic Programs

(University of Geneva, May 09, 2019)

The cortex is a complex brain region that allows us to perceive and interact with the world. A lot of different task are controlled in the cortex, which is mirrored in the diversity of neurons that compose it. During embryogenesis different neurons are generated by progenitor cells and these neurons then form circuits that control thoughts and movement. However, it was not known how these progenitors manage to generate specific types of neurons in the right place at the right time. By deciphering the genetic programs of neurons of the cerebral cortex, researchers at University of Geneva discovered the mechanisms controlling the genesis of cells. They found that "newborn" cells inherit genetic material from their mother cells but also develop their own programs during a maturation process. The researchers developed mathematical algorithms to reconstruct the generation of neurons, which could enhance the understanding of the origin of neurodevelopmental disorders.
http://swissinnovation.org/news/web/2019/03-190509-21

Inexpensive Drug Testing for Effects on Embryos

(ETH Zurich, May 14, 2019)

Before drugs are approved by authorities, they need to be tested to make sure they're safe for pregnant women and their unborn children. The rule is to test drugs on pregnant rodents and pregnant rabbits. Researchers at ETH Zurich have combined embryonic cells and liver cells in a new cell culture test. This combination allows to detect adverse effects that new medications may have on embryos early on in the drug development process. The entirety of the new test takes place on a single cell-culture chip. This chip is equipped with various compartments, which contain micro-tissue spheres, formed from human liver cells. This new method cannot replace the animal trials yet, however, it is simple, fast, and inexpensive. Therefore, researchers will be able to use it in the future to test a large number of candidates at an early development stage.
http://swissinnovation.org/news/web/2019/03-190514-9e

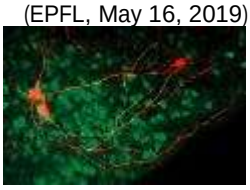
Nerve Cell Cooperation in Brain Controls Movements

(University of Basel, May 14, 2019)

No matter what movements we do, everything is controlled by different brain regions. One of which is the substantia nigra, a region that receives and distributes signals to orchestrate the execution of a movement, similar to a relay station. Until now, the substantia nigra has barely been examined, however, researchers at the University of Basel have recently investigated it anatomically, genetically and functionally. They found that it consists of different types of nerve cells of which they could identify two populations. One is responsible for initiating a motor movement, the other ensures the continuity of the movement. These findings are important as it shows that two nerve cell groups cooperate to enable a correct locomotion. Additionally, the research might have important indications in regard to Parkinson's disease. The research team will continue to identify further nerve cell populations and their motor function.
http://swissinnovation.org/news/web/2019/03-190514-33

Insular Cortex Causes Feelings of Pain

(EPFL, May 16, 2019)



If we hit a limb against a sharp object, we experience sharp pain. This pain teaches us to avoid the same situation in the future and is referred to as threat learning. Neuroscientists at EPFL have examined which part of the brain is responsible for this warning mechanism to other parts in order for the threat learning to work. They discovered an area of the brain, the insular cortex, that processes painful experiences and thereby drives learning from aversive events. During experiments with mice who have a similar insular cortex to mice, the researchers realized that if this region is switched off, the mice become virtually fearless. Their study suggests that neurons in the insular cortex cause the subjective feeling of pain and induce learning about the pain in other brain areas. In the future, this might be relevant for developing treatments for psychiatric diseases such as anxiety and post-traumatic stress disorders.
http://swissinnovation.org/news/web/2019/03-190516-43

Non-Invasive Treatment for Paraplegia Patients

(EPFL, May 20, 2019)

Every year, almost half a million of people globally are injured in traffic accidents or experience other trauma that damages the spinal cord. Many of these people's sensory and motor abilities in the lower limbs are lost after severe accidents. Researchers at EPFL in collaboration with Brazilian scientists have developed a new non-invasive therapy for people suffering from paraplegia. The treatment consists of functional electrostimulation, a body weight support system and a brain-machine interface for the rehabilitation. It was tested on two patients with chronic paraplegia of which one showed clear motor improvement. The approach

is innovative and multimodal and does not require invasive surgery. The patients train on simulators and become familiar with the interface. So far, the results showed both muscular improvement and progress in neurological functions.
http://swissinnovation.org/news/web/2019/03-190520-cd

Neuromorphic Computing for Vision

(EPFL, May 22, 2019)

Scientists at EPFL have invented a new way to real-time quantify glucose metabolism of cancerous tumors. Cancerous tumors can be made to bioluminesce according to the level of their glucose uptake. As this is similar to how fireflies work, the technique is referred to as firefly imaging technique. The new light probe is not radioactive and works on living organisms such as mice that carry the tumor cells. Cancerous tumors can be made to bioluminesce, like fireflies, according to the level of their glucose uptake, giving rise to a technique for quantifying metabolite absorption. The firefly imaging technique for sugar can be translated from cancer to many other metabolic diseases.
http://swissinnovation.org/news/web/2019/03-190522-86

3. Nano / Micro Technology / Material Science

First Fully Computer-Generated Genome

(ETH Zurich, April 01, 2019)

Researchers at ETH Zurich have for the first time built a bacterial genome solely with computer algorithms. Even though, the genome was physically built as a very large DNA molecule, the corresponding organism does not yet exist. The researchers synthesized 236 genome segments and subsequently pieced them together, however in the process they simplified the genome sequence without modifying the genetic information at the protein level. This method has the potential to fundamentally transform biotechnology. It could be used for the production of complex pharmaceutical active molecules or vitamins as well as for DNA vaccines. Despite the great potential, the researchers stress that a societal consensus should be sought on the purposes of the technology and on abuse prevention.
http://swissinnovation.org/news/web/2019/04-190401-28

Mimicking the Functions of DNA with new Metal-Organic Framework

(EPFL, April 08, 2019)

Chemical engineers at EPFL have synthesized a biologically derived metal-organic framework on which the hydrogen bonding that forms the DNA double helix can be mimicked and studied like never before. A team of chemical engineers at EPFL Valais Wallis have synthesized a new biologically derived MOF that can be used as a "nanoreactor". Studying their new MOF, the researchers found that thymine molecules diffuse within its pores. Simulating this diffusion, they discovered that thymine molecules were hydrogen-bonded with adenine molecules on the MOF's cavities, meaning that it was successful in mimicking what happens on DNA. As a result, the thymine molecules could be dimerized into a di-thymine product, which the scientists were able to be isolate – a huge advantage, given that di-thymine is related to skin cancer and can now be easily isolated and studied.
http://swissinnovation.org/news/web/2019/04-190408-26

Fiber-Optics Detect Quakes in Glaciers

(ETH Zurich, April 12, 2019)

Using fiber-optics, scientists from ETH Zurich found a method to efficiently measure glacier earthquakes. They conducted their first field tests on the Rhone glacier with a fiber-optic cable installed below the surface. Those cables can be used to measure vibrations by directing short laser pulses into the cable. If there are small changes along the cable, like an expansion due to seismic activity, the laser beam disperses in a specific manner. If there is no change, the signal remains the same. For control purposes, the researchers created small explosions in order to trigger measurable seismic waves. This proof of concept could imply that expensive seismometers can be replaced, and more data can be gathered with far less effort – an increasingly important asset in climate change research.
http://swissinnovation.org/news/web/2019/04-190412-ee

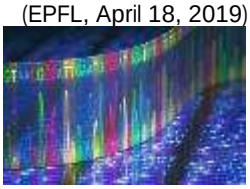
How Bacteria Exchange Information

(ETH Zurich, April 15, 2019)

A new research group at the Institute of Molecular Biology and Biophysics at ETH Zurich is studying proteins anchored in bacterial membranes. These molecular machines are responsible for taking up and translocating DNA from outside the bacterial cell to its interior, where the cell can then integrate it into its own genome. This DNA may originate from other, dead bacterial cells or from DNA that other bacteria have released. The net effect of this is that bacteria can harness the genetic information from others to potentially gain novel advantages in a given environment. The scientists want to establish how these DNA-uptake proteins function, so as to potentially inhibit DNA transfer in future.
http://swissinnovation.org/news/web/2019/04-190415-b3

The Role of Transposable Elements in The Genome

(EPFL, April 18, 2019)



For a long time, base pairs that did not seem to belong to specific genes were called: junk DNA. But as it turned out, junk DNA is actually critical in coordinating and regulating the work of the genes. For example, there are sequences of DNA that jump around the genome and influence gene expression. These jumping units are called transposable elements and their number is estimated at over 4.5 million in a single genome. Now, scientists from EPFL have found that a family of proteins act as key facilitators by domesticating regulatory sequences embedded in the transposable elements themselves.
http://swissinnovation.org/news/web/2019/04-190418-ea

Bacterial Clones Show Individuality

(ETH Zurich, April 23, 2019)

Microorganisms, even though one of the simplest forms of life, are able to perceive their environment and can actively move within it. They can distinguish between food and harmful substances, thus are able to approach or steer away. ETH scientists conducted a study where the bacteria were confronted with a T-maze. At each branching, the bacteria had a choice of avoiding or approaching. With a special microfluidic system that the researchers developed, they were able to observe the movement of thousands of individual bacteria at an extremely small scale. It was found that even with genetically identical cells - namely clones - some were better, and some were worse at navigating the maze, which might be due to biochemical noise in every cell. That bacteria are also diverse and show individuality may help with issues like the bioremediation of oil spills.
http://swissinnovation.org/news/web/2019/04-190423-ef

Approaching the Quantum Ground State

(ETH Zurich, April 25, 2019)

ETH researchers have cooled down a nanoparticle to a record low temperature, thanks to a sophisticated experimental set-up that uses scattered laser light for cooling. With this experiment, the researchers are edging closer to a magical limit: the temperature at which nanoparticles pass into the quantum ground state. If this were reached, it would allow quantum experiments to be performed with relatively large objects for the first time. However, it will take a lot of work to get to that point. The measuring equipment is extremely sensitive and although this sensitivity makes life difficult for the researchers, there could be a practical application of precisely this factor. The system could be used to build an extremely sensitive accelerometer.
http://swissinnovation.org/news/web/2019/04-190425-3e

Using 60% Less Water and Producing 6 Times More Energy in Paper Production

(EPFL, April 26, 2019)

An EPFL researcher has developed a mathematical model for optimizing heat transfer in factories and dramatically reducing water and energy consumption. The model could, in theory, cut water use by 60% at a Canadian paper mill and allow the facility to produce as much as six times more power. The model facilitates a way to recycle lost heat and energy and to employ biorefinery technologies – combining turbines and organic fluids – to boost power production. As a test, the model has been applied to a Canadian paper mill. The result was, that that, in theory, it could cut the amount of water the firm used from 820 kg to 230-300 kg per second (a drop of around 60%). It could also allow the mill to produce more than six times as much electricity (from 3 MW to around 20 MW).
http://swissinnovation.org/news/web/2019/04-190426-62

Accelerating Fleming's Method

(ETH Zurich, April 29, 2019)

Over 90 years ago, penicillin was discovered by Alexander Fleming when he observed that mould could kill bacteria on a cell-culture dish. Nowadays, dozens of different antibiotics classes exist on the market and scientists are tirelessly searching for new antimicrobial agents as they are urgently needed. Even though there was much progress between Fleming's times and now, the method of detection remained the same: If a substance kills bacteria on a cell-culture dish, then it's an antibiotic. Researchers from the ETH Zurich have now modernized and miniaturized Fleming's method. While currently it takes up to one year to test 10,000 producers of substances, the novel approach will allow to examine millions of variants in just a few days. The scientists think about starting a spin-off to bring the method to the market.
http://swissinnovation.org/news/web/2019/04-190429-08

Stress-Indicating Polymers That Change Color

(University of Fribourg, April 29, 2019)

A joint research team from University of Fribourg and Hokkaido University in Japan have created a technique to customize the properties of stress-indicating molecules. Prior, the main approach to achieve polymers that change color when under mechanical load, was based on specifically designed sensor molecules with weak chemical bonds. These bonds would break under high mechanical pressure causing the color to change. A limitation is, that the bonds can also break upon exposure to light or heat, and this flaw reduces the applicability of the polymers. Addressing this problem, the research team devised a new sensor molecule where no chemical bond-breaking is taking place. The novel method consists of two mechanically interlocked parts which change color if pushed together or pulled apart. Such polymers could for example be used in monitors to send visual warning signals before a part fails.
http://swissinnovation.org/news/web/2019/04-190429-69

Generating Ultra-Fast Twisting Electrons

(EPFL, May 07, 2019)

Various phenomena which are to be found in space and on earth share a particular shape, namely the vortex. Such phenomena include stars spiraling around black holes, swirling cyclones, tornadoes, and dust-devils raging across countries. Particles moving in this manner are called "vortex beams" and they are relevant because they imply that the particle has a well-defined orbital angular momentum. This means that vortex beams provide new ways of interacting with matter. Physicists at EPFL have found a novel approach which uses light to dynamically twist an individual electron's wave function and hence allowing them to create ultra-fast electron vortex beams. This new technique could have fundamental implications for fundamental physics, quantum computing, future data-storage, and even certain medical treatments.
http://swissinnovation.org/news/web/2019/04-190507-df

New Material with New Quasiparticles

(Paul Scherrer Institut, May 07, 2019)

At the Paul Scherrer Institute (PSI), researchers have found a novel crystalline material that exhibits electronic properties that were unseen before. The crystal has aluminium and platinum atoms arranged in a special way, so that in the mind's eye they follow the shape of a spiral staircase. This special form results in new properties of electronic behavior for the crystal as a whole. This new kind of quasiparticles - states in material that behave in a certain way like actual elementary particle - was discovered experimentally for the first time, even though it was predicted in 1941 by physicists William Rarita and Julian Schwinger. Researchers are interested in new materials and the exotic behavior of electrons because some of them could be suitable for applications in the electronics of the future.
http://swissinnovation.org/news/web/2019/04-190507-ef

Analyzing the DNA of Food

(EPFL, May 08, 2019)

From the farm to our plate, food goes through various stages and places along the supply chain. For consumers it gets increasingly difficult to track the origins of the food and scandals like the horsemeat incident, prompted consumers to behave increasingly responsible. To approach this, researchers at EPFL have launched the Open Food Repo DNA initiative. The project aims at developing a system that enables consumers to sequence the DNA of processed foods and identify every single ingredient. To do so, they use techniques like high-throughput sequencing and DNA barcoding, a process which examines just small sections of an organism's DNA. Enabling consumers to perform genetic analyses of their food should enhance transparency of the food industry and make society get healthier nutrition.
http://swissinnovation.org/news/web/2019/04-190508-07

Toxins on Clothing Are a Potential Health Threat

(EPFL, May 15, 2019)

Clothing acts like a barrier that protects our bodies from physical and chemical hazards, however it also exposes us to particles and chemicals every day. This exposure comes with considerable health risks, which a professor at EPFL has now examined. Clothes can expose us to a multitude of potentially toxic chemicals and biological particles every day, some of which are removed by properly washing, drying and storing. However, other substances - for example nicotine residue or microbes from pets - are difficult to get rid of and may have negative health impacts. Additionally, the fabrics have changed quite significantly and nowadays contain various additives like anti-UV, water-repellents or antimicrobial ones. The research found that potentially toxic particles that stick to clothing and are carried around like herbicides can expose people to risks. The findings

suggest that new clothing-information regulations should be adopted, and clothes need to be washed regularly all-natural detergents.
http://swissinnovation.org/news/web/2019/04-190515-c0

4. Information & Communications Technology

Effectively Preventing the Spread of a Dangerous Virus through the Air Travel Network

(ETH Zurich, April 04, 2019)

Researchers from the ETH Zurich have investigated how network dismantling could help containing the global spread of viruses through air transport more cost-effectively. A protective measure, which is sometimes discussed, is to close certain airports and put them under quarantine. The ETH researchers attempted to break down various faulty networks into isolated subnetworks at the lowest possible total cost, in order to contain the spread of trouble and maintain the functionality of the overall network. Depending on whether it is a social, biological or technical network, the trouble can take the form of computer viruses, the flu, or criminals. The ETH researchers explored this scenario for Europe, North America and Asia as parts of the worldwide air traffic network. Their results show that the closure of medium-sized airports would affect only 6 percent of global air passengers, while closing the largest hubs would affect 25 percent.
http://swissinnovation.org/news/web/2019/05-190404-84

First Dual-Core Cell Computer of the World

(ETH Zurich, April 16, 2019)

Researchers from the ETH Zurich have integrated two CRISPR-Cas9-based core processors into human cells. This represents a huge step towards creating powerful biocomputers. A special variant of the Cas9 protein forms the core of the processor. In response to input delivered by guide RNA sequences, the CPU regulates the expression of a particular gene, which in turn makes a particular protein. With this approach, researchers can program scalable circuits in human cells – like digital half adders, these consist of two inputs and two outputs and can add two single-digit binary numbers. The researchers took it a step further: they created a biological dual-core processor, similar to those in the digital world, by integrating two cores into a cell. To do so, they used CRISPR-Cas9 components from two different bacteria.
http://swissinnovation.org/news/web/2019/05-190416-24

Machine Learning for Crime Prevention

(ETH Zurich, May 03, 2019)

When it comes to break-ins, depending on the time of the year, certain communities are more affected than others. Researchers at ETH Zurich have developed a machine learning tool to detect areas that are prone to break-ins and help the police decide where to deploy patrols. The software uses crime statistics and variables such as population density, season, daylight, infrastructure and location. Until now, such warning tools only worked in densely populated places as a lot of data is required. Despite imbalanced data, this new method makes accurate predictions even for sparsely populated areas by using ensemble learning and analyses of different algorithms. The tool is helpful for the police, however, it could be used in many other applications, for example the prediction of emergency calls or forecasts of real estate price development.
http://swissinnovation.org/news/web/2019/05-190503-78

5. Energy / Environment

Heatwaves' Negative Effect on Maritime Ecosystem

(University of Zurich, April 01, 2019)

In 2011, a heatwave caused the water temperature in Australia's Shark Bay to rise over 4 degrees above the annual average. This led to a significant loss of seagrass - an important determinant of the ecosystem. Recently, researchers from University of Zurich examined how the damages caused by the heatwave have affected dolphins. With long-term data of hundreds of animals collected between 2007 and 2017, they could show that dolphin's survival rate fell by 12% and female dolphins had less offspring after the heatwave - and the latter lasted until 2017. The scale of how negative the influence was, surprised the researchers. Most of all, it is unusual that the females' reproductive success still has not normalized. For the first time, a study has shown that heatwaves not only influence organisms at the lower end of the food chain but also at the top of it.
http://swissinnovation.org/news/web/2019/06-190401-cc

Heavy Pollution in Surface Water

(Eawag, April 02, 2019)

Eawag and Ecotox Center have published two studies showing that surface water in agricultural catchment basins are heavily polluted with plant protection chemicals. Come substances persist for months which poses the risk of chronic toxicity and might threaten the existing aquatic fauna and flora. In most of the samples collected between March and October 2017, more than 30 different active chemical compounds were detected and 145 substances in total. This is mainly attributable to all the insecticides, herbicides and fungicides but also a big mixture of other agents. Water quality criteria were exceeded in every tested basin for between 14 and 74 days. According to the researchers, a number of measures are required to control surface water contamination, such as replacement of certain substances, a general pesticide reduction and minimizing losses from agriculture.
http://swissinnovation.org/news/web/2019/06-190402-15

Analyzing Animal Behavior Using Wearable Sensors

(EPFL, April 03, 2019)

Researchers from EPFL and the University of Zurich have developed a model that provides a detailed picture of how animals behave in the wild. This might help better shape wildlife conservation efforts. The fieldwork was carried out at the Kalahari Research Centre. The team fitted sensor collars to meerkats, then recorded data and filmed the animals. After analyzing the recordings to identify different types of activity, the researchers developed a hybrid model, using biomechanical principles and the data collected in the field to train a machine-learning algorithm to recognize different patterns of behavior. The researchers' work marks the first step towards a standardized method for analyzing animal behavior from wearable accelerometer signals.
http://swissinnovation.org/news/web/2019/06-190403-93

Detecting Pollution with a Laser

(EPFL, April 04, 2019)

Researchers at EPFL have developed a simple laser source that can be used to detect pollution in the air, like greenhouse gases, or air molecules in a person's breath. The system uses a robust infrared laser, whose beam is directed through a tiny waveguide that alters the frequency of the light as it passes through. Adding a spectrometer, they were able to demonstrate the potential of the novel system. The team thus succeeded

in considerably reducing the size of such a system, which until now contained complex and damage-prone components. A further miniaturization could lead to easy-to-use on-chip detectors, the scientists say.
http://swissinnovation.org/news/web/2019/06-190404-c1

Melting Glaciers Cause Sea Levels to Rise

(University of Zurich, April 08, 2019)

In the past 60 years, glaciers have lost over 9,000 billion tons of ice which has caused the global sea levels to rise by 27 mm. An international research team under the lead of University of Zurich has recently discovered this fact. The main culprits are glaciers in Alaska, the Arctic regions as well as icefields in Patagonia. Due to their relatively small size, the European Alps, the Caucasus and New Zealand played a minor role, even though they were also subject to significant ice losses. A troubling finding of the study is that in the past 30 years, the global mass loss of glacier ice has increased significantly and accounts for around one fourth of the current increase in global sea levels. The study used satellite data on ice thickness changes and combined them with glaciological field observations to reconstruct how glaciers globally evolved over time.
http://swissinnovation.org/news/web/2019/06-190408-24

Man-Made Climate Change Contributes to Large-Scale Heatwaves

(ETH Zurich, April 09, 2019)

The heatwave of 2018 lasted from May to July, covered large areas of the northern hemisphere and caused destruction. A new study of ETH Zurich has now revealed that anthropogenic climate change contributed largely to the scale of the heatwaves. The research team looked at key agricultural regions and densely populated areas and by using model simulations, they were able to project the geographic extent of heatwaves in the future. Before 2010, no area as large has been affected by simultaneous heat, however, in the past years these occurrences have become more frequent. The finding suggests that as the planet becomes warmer, widespread heat become more likely. Without the climate change caused by humans, the area affected would be smaller. The researchers stress the importance of taking action as climate change will not stabilize itself and food safety will be jeopardized.
http://swissinnovation.org/news/web/2019/06-190409-09

The Oldest Ice on Earth May Reveal the Planet's Climate History

(University of Bern, April 09, 2019)

A European research consortium, involving the University of Bern, wants to drill a 1.5 million-year-old ice core in Antarctica. Analyzing the climate data stored in the ice should reveal how warm and cold periods alternate. For the EU project "Beyond EPICA – Oldest Ice", experts from 14 institutions in 10 European countries have combed the Antarctic ice sheet to find the ideal location to retrieve the oldest ice core on the Earth. Their choice is "Little Dome C", lying in one of Earth's most barren and lifeless places, 3,233 meters above sea level, and about 30 kilometers from the Concordia Research Station. If the EU approves phase two of the project, deep drilling work will start in November 2021, with the first results from the analyses available in 2025.
http://swissinnovation.org/news/web/2019/06-190409-41

Male Primates' Development of Sexual Traits

(University of Zurich, April 10, 2019)

In the animal kingdom, male primates are extremely competitive when it comes to reproduction. To achieve this goal, they invest in various sexual traits like body size, large testicles or showy ornaments. Evolutionary biologists at the University of Zurich have for the first time examined the relation between male primates' showy ornaments and their

testicles. They found that either the primates are nicely adorned or well-endowed, however, not both at the same time. Developing these traits is energetically costly, thus the extent of ornament comes at the expense of testicle size and sperm production. The study brought to light how primates maximize their reproductive success and indicates that a key point is energy requirement to maintain multiple sexual traits.
http://swissinnovation.org/news/web/2019/06-190410-78

Better Understanding the Mechanisms of Evolution

(University of Zurich, April 11, 2019)

Brassica rapa plants pollinated by bumblebees evolve more attractive flowers. But this evolution is compromised if caterpillars attack the plant at the same time. With the bees pollinating them less effectively, the plants increasingly self-pollinate. In a greenhouse evolution experiment, scientists at the University of Zurich have shown how much the effects of pollinators and pests influence each other. The study shows the importance of interactive effects in the evolution of diversity. If the combination of selective agents' changes, for example through climate change or a decline in pollinators, it can trigger rapid evolutionary change in plants. Consequently, the environmental changes caused by humans affect the evolutionary fate of many organisms.
http://swissinnovation.org/news/web/2019/06-190411-d1

Bacterial Survival in the Dead Sea

(University of Geneva, April 15, 2019)

The salinity in the Dead Sea is extremely high, making it one of the most hostile environments on the planet. Researchers at the University of Geneva have found how organisms can survive in the sediments of the Dead Sea at a depth of over 400 meters despite harsh conditions. By drilling a 400-meter-deep hole in the core of the sea and analyzing each layer of sediment, they made an interesting discovery. It was already known that archaea can be found in such an environment despite the unparalleled salinity, however, the researchers found that bacteria could survive there, too. They managed to acclimatize to the harsh conditions in becoming "necrophages", meaning they feed on the dead bodies of the archaea. The findings will enhance our knowledge of how life can develop in the most difficult conditions and provides leads for the detection of life on other planets.
http://swissinnovation.org/news/web/2019/06-190415-ba

Areal Remote Sensing for Forest Inventories

(EPFL, April 15, 2019)

Forests not only are a key component of the world's ecosystem and an indicator of Earth's health but also provide valuable resources. Therefore, it is crucial to monitor their development through forest inventories. However, on-the-ground inventories face various difficulties like being costly, laborious, dependent on the observer's perception and sometimes regions are not easily accessible. In Switzerland, the national inventory is only updated every decade once since 1985. A PhD candidate at EPFL has now developed a method using aerial remote sensing as a less expensive and more objective complement to on-the-ground inventories. The two main techniques used are airborne laser scanning to determine the three-dimensional structure of the forest, and hyperspectral imaging to identify the color of a tree canopy. The doctoral student stresses that his technique cannot substitute for on-the-ground inventories but serves as a help.
http://swissinnovation.org/news/web/2019/06-190415-f3

Cooling Against the Law of Physics?

(University of Zurich, April 19, 2019)

The second law of thermodynamics implies that - if no extra energy is added - heat can flow only from a warmer to a colder object, and not the other way around. But a recent experiment conducted at the University of Zurich seems to contradict this law of physics: The researchers managed to cool a small piece of copper from over 100 degrees Celsius to significantly below room temperature without an external power supply. "Theoretically, this experimental device could turn boiling water to ice, without using any energy," said lead scientist Prof. Andreas Schilling. But he also clarified that a large-scale application of the technique is still far away. The reason are restrictions on the thermal oscillating circuit used for the experiment. And no: We don't have to overthink the fundamental laws of physics. The entropy of the whole experimental system still increased with time – in line with the second law of thermodynamics.
http://swissinnovation.org/news/web/2019/06-190419-44

New Procedure Supersedes Laboratory Animal Testing

(Eawag, April 25, 2019)

In 2017, over 7,500 ecotoxological tests were done on fish in order to determine the acute toxicity of water samples and other chemical compounds. Such tests are done with the aim of protecting humans, animals and the environment. For years now, Eawag has been trying to find alternatives to fish experiments and one such alternative is using gill cell line of rainbow trout. For the first time now, a toxicity test with cultured gill cell lines from fish has been ISO-certified. For the researchers who spent years on refining this method, the certification - which serves as standard reference for researchers in tests - comes as a huge breakthrough. The procedure is cost-effective, saves time and does not require laboratory animals.
http://swissinnovation.org/news/web/2019/06-190425-e9

Unprecedented Solar Hydrogen Production Using Sunlight

(EPFL, April 29, 2019)

For the purpose of reducing our dependence on fossil fuels, hydrogen will play a key role. It can be produced sustainably by using solar energy to split water molecules and the resulting energy can be stored or converted into electricity. The main issue revolves around cost aspects as it requires expensive and rare materials to collect and convert the energy. Scientist of EPFL experimented with concentrating solar irradiation to produce a larger amount of hydrogen over a given area at a lower cost and developed a photo-electrochemical system. In conjunction with concentrated solar irradiation and thermal management their device turns solar power into hydrogen with a 17% conversion rate and unparalleled power and current density. The developers are now planning to market their product and will do so through a spin-off company called SoHHytec.
http://swissinnovation.org/news/web/2019/06-190429-48

3D Printed Corals to Save Maritime Ecosystem

(ETH Zurich, May 09, 2019)

Due to climate change, coral reefs suffer significantly and are deteriorating quickly. This poses various problems as reefs are part of the maritime ecosystem and an important breeding ground for one fourth of all fish species. Their disappearance threatens global fishing, on which globally millions of people rely. Additionally, many species of corals reproduce by releasing sperm and eggs into the water, which then settle on a suitable substrate and develop into young corals. Problematic with dying reefs is that they become overgrown by macroalgae, which inhibit corals from settling. A researcher at ETH Zurich plans to use ecologically sound 3D printed structures to restore degraded reefs and build artificial ones. The aim of the whole project is to

repopulate dead coral reefs with the artificial structures. Strategically planned reefs can protect coastlines and develop into self-supporting habitats over time.
http://swissinnovation.org/news/web/2019/06-190509-52

Vaccinating the Microbiota of Plants

(University of Fribourg, May 09, 2019)

When plants are attacked by a disease, they are naturally capable of attract certain protective bacteria in order to defend themselves. A group at the University of Fribourg plans to make use of this mechanism for a research project, funded with USD 413,000 by the Gebert Rüf Foundation. The scientists will try to "vaccinate" plants by stimulating the plant's natural selection of beneficial bacteria, which increases their natural resistance to diseases. In the future, the discovery of an effective treatment would allow the replacement of chemical fungicides with bacteria naturally selected by the plants.
http://swissinnovation.org/news/web/2019/06-190509-eb

Deep-Sea Fish Detect Bioluminescent Signals

(University of Basel, May 09, 2019)

Vertebrates have color vision thanks to the interaction of photopigments in the cone cells of the retina, which all react to a certain wavelength of light. This kind of vision is possible in daylight, however during the night, vertebrates usually only detect light particles with their rod cells which only contain a single type of photopigment rhodopsin. On the other hand, in the deep sea some fish species exist that detect various wavelengths of light in almost total darkness. They are endowed with different genes that enable them to detect bioluminescent signals from light-emitting organs. An international research team led by University of Basel have recently discovered these genes for the light-sensitive photopigment rhodopsin and published a paper. According to the research team, it appears that the deep-sea fish have developed these multiple rhodopsin-based vision independently of each other and that they are especially to detect bioluminescent signals.
http://swissinnovation.org/news/web/2019/06-190509-f7

Method to Recover Phosphorus from Wastewater

(EPFL, May 13, 2019)

Treatment plants for wastewater produce a discharge which is known as sludge. In earlier days, the sludge was disposed of as fertilizer, however, this was prohibited 10 years ago in Switzerland because of the presence of various pollutants in the effluents. This caused a new way of dealing with the discharge: It is dried and then burnt, which is not optimal as a lot of phosphorus lost this way. So far, there was no method of recycling the phosphorus, which is an essential compound for various biological processes. However, now an EPFL spin-off called TreaTech has developed a system which can turn sludge from wastewater treatment plants into mineral salts and recover the phosphorus. Additionally, the spin-off is able to produce biogas from the discharge thanks to a method called thermal gasification. The next step is to adapt the system for use in other applications like industrial wastewater.
http://swissinnovation.org/news/web/2019/06-190513-3f

A Map of the Global Phytoplankton Distribution

(ETH Zurich, May 16, 2019)

Phytoplankton are a fundamental basis of the marine food chain, and – producing more oxygen than all the world's rainforests combined – they form a key element of life on this planet. With 10,000 to 20,000 different species, the diversity of phytoplankton is extremely rich. Although many species have been identified, the question of when and

where they occur is largely unexplored. Now, a team of researchers from ETH Zurich and the Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, modelled the distribution of over 530 different species of phytoplankton on the basis of around 700,000 water samples from across the oceans. To their surprise, they found that the polar seas present greater diversity than the mid-latitude oceans, probably due to strong currents and the seasonal changes. The new model could also be used to predict how the diversity of phytoplankton develops under changing temperature conditions.
http://swissinnovation.org/news/web/2019/06-190516-b2

Aircraft Engine Emissions Affect Lungs

(University of Bern, May 16, 2019)

Worldwide, roughly 7 million people die annually from air pollution, according to the World Health Organization. One influence is airborne particulate matter, which has proven to negatively affect human health. Aircraft turbine engine particle emission have - in times of increasing air traffic - become an important part of pollution. Other particles like emissions from heating system and road traffic have been investigated thoroughly in the past years, however air traffic less so. In an innovative experiment conducted by University of Bern, researchers investigated the effect of exhaust particles from aircraft turbine engines on human lung cells. They found that the cell-damaging effect from exposure to particles generated by the combustion of gasoline, diesel and kerosene fuel are comparable for similar doses and exposure times.
http://swissinnovation.org/news/web/2019/06-190516-c9

Species' Mutual Dependencies Cause Co-Extinctions

(University of Zurich, May 28, 2019)

Climate change threatens biodiversity on a global scale. Many plant and animal species have mutual dependencies, thus, to forecast the future it is not useful to consider species in isolation, even though this is a widely spread practice. Species are part of a vast network. An international team of ecologists with evolutionary biologists from the University of Zurich have investigated 7 pollination networks in different areas of Europe to see how exactly plants and insects interact. They found that if the interactions between species are taken into account, the overall number of species threatened with extinction rises. Even some species that have a low risk of extinction as a consequence of climate change, face a high risk of extinction due to their dependencies. Networks can be fragile and prone to coextinction cascades, according to the researchers.
http://swissinnovation.org/news/web/2019/06-190528-61

6. Engineering / Robotics / Space

Capturing and Destroying Space Debris

(EPFL, April 05, 2019)

The world's first satellite was launched roughly 60 years ago and ever since, space has become cluttered with garbage. Mostly in the area between 100 km and 2,000 km above the Earth's surface the problem is acute. There are estimates that around one million pieces of 1 cm in size are flying around. CleanSpace - a spin-off start-up of EPFL - has made cleaning up space their business model. However, capturing space debris is more difficult than one would expect and requires extreme aptness. Their satellite identifies garbage with an ultra-precision system involving lasers. Then it carefully approaches the piece, yet without touching because this could move it out of reach again. Finally, the satellite captures the junk with a net and - by dragging the garbage down through earth's atmosphere - causes it to burn up. Before launching the satellite, the engineers have to make sure everything is spot-on because once it's been released, there is no way to make adjustments or repairs.
http://swissinnovation.org/news/web/2019/07-190405-85

Five New Planets Discovered After 20 Years

(University of Geneva, April 17, 2019)

Since 1995, more than 4000 exoplanets have been discovered. To confirm the presence of a planet, it is necessary to wait until the planet has made at least one revolution around its star, which can take days or decades. The EULER telescope of the University of Geneva is dedicated to search these exoplanets and measure such revolutions around stars. After 20 years of regular observation, a team of astronomers from University of Geneva has discovered five new planets with periods of revolution of 15 to 40 years. Such planets are especially important for astronomers because they are poorly known but highly relevant to explaining the formation and evolution of planets. The new discoveries increase the list of planets with a rotation period longer than 15 years to 26, and - more importantly - provide new targets for direct imaging.
http://swissinnovation.org/news/web/2019/07-190417-49

The InSight Mission

(ETH Zurich, April 24, 2019)

Four months after landing on Mars, the InSight probe has already transmitted promising signals. According to researchers at ETH Zurich's Marsquake Service, at least one of the tremors can be interpreted as a quake. InSight is a Mars lander designed to give the Red Planet its first thorough checkup. It is the first outer space robotic explorer to study in-depth the inner space of Mars. Studying Mars' interior structure answers key questions about the early formation of rocky planets in our inner solar system. The lander uses cutting edge instruments, to delve deep beneath the surface and seek the fingerprints of the processes that formed the terrestrial planets. The InSight mission is part of NASA's Discovery Program.
http://swissinnovation.org/news/web/2019/07-190424-40

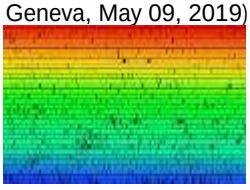
Producing Metallic Micropieces by 3D Print

(ETH Zurich, April 30, 2019)

Nowadays, almost everything can be printed using 3D printers. The variety goes from artificial organs, bone tissue, artificial corals to entire houses. Especially when it comes to printing microscopic pieces, the method manages to produce pieces that cannot be achieved by any other technique. Up until now, printing metallic micro-structures has been a huge challenge for additive manufacturing, however, a research team at ETH Zurich has developed a new technique which makes exactly that possible. It allows to make micrometer-sized objects that are made of different metals. Currently, copper, silver and gold have been tested, but the team wants to include magnetic materials in the future. The application of the method ranges from semiconductors, over photosensors to integrated circuits and more.
http://swissinnovation.org/news/web/2019/07-190430-79

Exoplanet with Rare-Earth Metals

(University of Geneva, May 09, 2019)



The planet KELT-9 b orbits around a very hot star 650 light years away from Earth and is the hottest exoplanet we know to date, with an atmosphere that reaches 4,000 degrees C. In such heat, all elements are almost completely vaporized, and molecules are broken apart into atoms. A team of astronomers from the universities of Bern and Geneva used a spectrograph - mounted on a telescope - to discern the chemical composition of the atmosphere of KELT-9 b. Together with signatures of gaseous iron, titanium, and vaporized sodium, magnesium and chromium, they were also able to detect the rare-Earth metals scandium and yttrium for the first time. These substances are scarce on Earth and have never before been measured in the atmosphere of an exoplanet.
http://swissinnovation.org/news/web/2019/07-190509-1b

7. Physics / Chemistry / Math

Unfreezable Water

(University of Zurich, April 09, 2019)

The absolute zero temperature is -273 degrees Celsius. Water, and most other substances, freeze long before that. During the freezing process, water molecules change from an unorganized structure into a regular, rigid lattice structure. A group from the University of Zurich and ETH have now identified a way to prevent water from doing so. Even at extremely low temperatures it can thus retain the characteristics of a liquid. The scientists did so by using fat molecules, which they arranged to form a network of connected channels measuring less than one nanometer across. Those tiny spaces don't let water form ice crystals, and therefore the molecules remain disordered even at -263 degrees Celsius – which is only 10 degrees above absolute zero. This technique could for example be used to prevent freezing damages in samples of delicate biomolecules.
http://swissinnovation.org/news/web/2019/08-190409-1f

Novel Method Developed to Measure Quantum Fluctuations

(ETH Zurich, April 10, 2019)

In quantum physics the vacuum is not empty, but rather steeped in tiny fluctuations of the electromagnetic field. Until recently it was impossible to study those vacuum fluctuations directly. Researchers at ETH Zurich have developed a method that allows them to characterize the fluctuations in detail. They used a detector consisting of a crystal in which the polarization of a light wave can be rotated by an electric field. In this way, that electric field leaves a visible mark in the shape of a modified polarization direction of the light wave. Two very short laser pulses are now sent through the crystal in two different points and at slightly different times, and afterwards their polarizations are measured. From those measurements, the spatial and temporal correlations between the instantaneous electric fields in the crystal can be calculated.
http://swissinnovation.org/news/web/2019/08-190410-af

The Slowest Ever Atom Decay

(University of Zurich, April 24, 2019)

Located in the Italian Gran Sasso mountains and sealed off from any radioactivity interference, the XENON1T detector, a cylindrical tank filled with 3,200 kg of liquid xenon, is usually used to search for dark matter particles. Using this detector to a different end, a research team with astrophysicists from the University of Zurich have managed to observe an extremely rare process: the decay of the Xenon-124 atom. The half-life of this atom (the time span after which half of the radioactive atoms originally present in a sample have decayed away) is 1.8 x 10 to the power of 22 years. Looking at the age of the universe itself, 1.4 x 10 to the power of 10 years, this process is the rarest ever to be directly seen in a detector.
http://swissinnovation.org/news/web/2019/08-190424-13

Using Potassium Bromide in the Production of Graphene

(University of Basel, April 29, 2019)

Graphene is often produced via a chemical reaction on metallic surfaces in a process known as chemical vapor deposition. For use in electronics, the graphene has to be transferred onto insulating substrates in a multistep process, during which there is a risk of damage and contamination. In order to obtain defect-free, pure graphene, it is therefore preferable to decouple the graphene electrically from the metallic substrate and to develop a method that allows easier transfer without damage. Researchers at the University of Basel have been investigating ways of incorporating molecules between the graphene layer and the substrate and have shown that potassium bromide is ideally suited to this. The results have been published in the journal ACS Nano.
http://swissinnovation.org/news/web/2019/08-190429-e0

8. Architecture / Design

Cork Taint Sensor

(University of Fribourg, April 10, 2019)

It is always a disappointment when a good wine is corked. Usually, the cork releases relevant molecules into the wine, which often come from the fungicide's treatment of the oak tree. Researchers at the University of Fribourg have developed a sensor that can find even slight traces of cork taint, the most common wine fault. With a sponge-like, supramolecular grid, these molecules can be identified and if they are found in the beverage, an optical marker becomes visible. The device could also be used for the detection of explosive substances or to find traces of pesticides and herbicides in fruit and vegetables.
http://swissinnovation.org/news/web/2019/09-190410-f8

9. Economy, Social Sciences & Humanities

Combining Linguistics and Biology to Solve the Enigma of Language

(University of Zurich, April 11, 2019)

The new Center for the Interdisciplinary Study of Language Evolution (ISLE) at the University of Zurich brings together linguists and natural scientists, as well as anthropologists, psychologists and philosophers, to answer key questions like how animals communicate and how humans acquire language. Comparing widely differing communication systems used by humans and animals may even solve the great enigma of how human language originated and evolved – or how it may develop in the future. The interdisciplinary research team undertakes joint research projects, organizes international workshops and develops new, innovative research methods. ISLE will be rolling out a Master's study program in evolutionary linguistics featuring joint courses in linguistics and biology in Fall Semester 2019.
http://swissinnovation.org/news/web/2019/10-190411-df

Learning Ability Influenced by Economic Factors

(University of Geneva, April 16, 2019)

Researchers from the University of Geneva in collaboration with the University of Amsterdam and the ENS Paris investigated confidence bias in a learning context through a system of monetary punishment and reward. They demonstrated that we become more confident in our choices when learning to seek rewards than when learning to avoid losses. However, this confidence rapidly evolves into over-confidence, which leaves us thinking that we are better than we actually are. Learning in a loss context mitigate these errors of judgment. Moreover, the prospect of monetary gains makes us less flexible, while the fear of losing money preserves our ability to adapt.
http://swissinnovation.org/news/web/2019/10-190416-1c

Dealing with Traumas Through Steeling and Inner Powers

(University of Zurich, April 24, 2019)

Myriam Thoma, a psychologist at University of Zurich, is researching how people deal with stressful and traumatic situations. For that purpose, she began investigating how former Verdingkinger fared through the course of their lives and how they dealt with traumas. Verdingkinder refers to children that were taken away from their families, used as cheap labor and often emotionally neglected, beaten and sexually abused. Thoma found that many of them suffered from depression and anxiety disorders, however, some of the victims were able to cope with their negative experiences almost unharmed. It seems that inner strength, mental support, kindness experienced by a third party and a change of location determined resilience. Some even developed special abilities because having survived a crisis can release inner powers - this is referred to as "steeling". These findings might reinforce positive psychology which aims at promoting strengths that lie within people to constructively cope with crises.
http://swissinnovation.org/news/web/2019/10-190424-f4

The Dynamics of Schadenfreude

(University of Zurich, April 24, 2019)

In a working environment, if one person is reprimanded, co-workers can either react with empathy or with schadenfreude. A new study at University of Zurich examined the dynamics and the emergence of schadenfreude. They found that it occurs primarily in highly competitive working environments. Employees who stand out and, thus, endanger the occupational advancement of others, are often met with resentment, and their mistreatment evokes schadenfreude. The feeling can also lead to a vicious circle: If the mistreatment of a person seems justified to others, the observers sometimes start unfair treatment and - in the most extreme cases - ill-treatment can become the norm in the working environment. To prevent it, an inclusive working climate and team-based incentives should be established.
http://swissinnovation.org/news/web/2019/10-190424-5f

Cannabis Consumption will Increase

(University of Zurich, April 25, 2019)

Countries such as Canada and Uruguay have introduced new paradigms to regulate sale and consumption of cannabis. The same debate is ongoing in Switzerland; however, fears of health issues and wrong incentives evolve around the topic. Researchers from the Universities of Zurich and Basel have conducted a representative study on cannabis consumption and came to the conclusion that one in two Swiss people will have smoked weed by 2045, should there be no change in legislation. They estimate that the percentage of active cannabis users rises from 2.7% to 3.4% in the same time. Furthermore, an ever-increasing number will probably turn to the black market, where THC concentrations have risen over the past

years and thus, health risks might have increased. In a controlled market, on the other hand, THC concentration could be regulated. The researcher suggest trial projects to explore alternative regulatory approaches.
http://swissinnovation.org/news/web/2019/10-190425-9b

Knowledge Loss Poses Danger to Indigenous Communities

(University of Zurich, May 02, 2019)

For indigenous communities in South America, knowledge about plants, animals and their surrounding ecosystem plays a crucial role. However, most of this knowledge is passed on verbally and not written down anywhere. Ecologists at the University of Zurich have recently analyzed comprehensive information about palm trees' importance in various regions and made the information available through a network. At the same time, the team discovered that a loss in biodiversity and knowledge about the use of various plants poses a threat to the survival of indigenous communities. With simulations, it was found that a further decrease in understanding certain plants could potentially have an enormous impact on cultural diversity. The study concludes that when it comes to ecosystems and the service they provide, the focus was too single-sided on biological aspects and has neglected the cultural factors.
http://swissinnovation.org/news/web/2019/10-190502-f9

Program to Integrate Foreign Researchers

(EPFL, May 10, 2019)

Coming to Switzerland and socializing can be hard for some foreign students and researchers. The ConneXion program aims at facilitating connections and fostering friendships between foreigners and Swiss people. It was launched by the chaplain of EPFL, Alexandre Mayor, and pairs foreign researchers with locals to have lunch or dinner and do fun activities. The program doesn't require local residents to be connected to EPFL, however, they need to have been living in Switzerland for a couple of years and introduce the foreigner to the country. Alexandre Mayor mentions that integration in Switzerland can be difficult and in combination with the stress caused by the studies or research, can even result in anxiety. Therefore, he started the program to help them adapt to their new environment.
http://swissinnovation.org/news/web/2019/10-190510-c1

10. Start-ups / Technology Transfer / IPR / Patents

First Unicorn Originating for ETH Zurich

(ETH Zurich, May 17, 2019)

ETH Zurich has its first unicorn spin-off startup. After another round of capital investment, the universities' spin-off startup GetYourGuide is now estimated at roughly two billion Swiss francs. It is thus, the first unicorn - a startup with an estimated value exceeding one billion dollars prior to an IPO - originating form ETH Zürich. Only very few other Swiss companies enjoy this exclusive status. GetYourGuide is an online travel platform where people can book leisure and touristic activities, tours and tickets to attractions.
http://swissinnovation.org/news/web/2019/11-190517-3e

11. Calls for Grants/Awards

Call: Young Scientists Mobility Grants with MENA Countries

(University of Applied Sciences Western Switzerland, January 03, 2019)

The State Secretariat for Education, Research and Innovation (SERI) has commissioned the HES-SO as Leading House for the Middle East and North Africa (MENA) region. The following countries have been identified as priority countries for the first phase: Egypt, Lebanon, Morocco, Palestine, Qatar, Tunisia and the United Arab Emirates. The mobility grants can be awarded to young scientists who hold a bachelor's or master's degree but no PhD yet, and with not more than 6 years of professional research experience. The call is open for activities in all scientific disciplines and fields of research. Activities may include field work and/or an internship in relation to the applicant's research project. The applicant's mobility visit should have a minimum duration of 4 weeks and the amount not more than CHF 5,000 per grant. Applications will be accepted until December 31, 2019.
http://swissinnovation.org/news/web/2019/13-190103-8c

Call: Unconventional Ideas

(Swiss National Science Foundation, May 12, 2019)

he SNSF is launching its new funding scheme Spark. With this innovation, the SNSF will be focusing more strongly on daring research approaches and ideas that show potential. The aim: risk-taking projects should also have a chance to receive funding. The new funding scheme Spark fills a gap in the SNSF's funding portfolio. Spark is designed to enable research projects that are based on a promising and original idea. The new scheme will be open to researchers regardless of their experience and track record. Researchers are encouraged to take risks. Even unclear or negative results add to existing knowledge. The submission deadline is July 17, 2019.
http://swissinnovation.org/news/web/2019/13-190512-23

Call: Team-Oriented Cross-Border Research

(Swiss National Science Foundation, May 12, 2019)

SPIRIT facilitates knowledge exchange between Swiss researchers and researchers in selected partner countries of low and middle income. Funding is awarded to research projects with clearly defined goals that are submitted by excellent research consortia from two to four countries. Researchers from all disciplines can apply for a SPIRIT grant; the topics are chosen by the researchers themselves. The grants contribute to the education of researchers in all participating countries. Special focus is given to equal opportunities and the promotion of women scientists, as well as to raising awareness of gender-specific questions. The submission deadline is December 31, 2019.
http://swissinnovation.org/news/web/2019/13-190512-86

Call: Young Talents in Scientific Research

(Swiss National Science Foundation, May 30, 2019)

The Agora scheme aims to promote the spread of knowledge, as well as the exchange of views and perspectives about scientific research. It therefore encourages projects involving two-way processes - with interaction and listening - which generate dialogues between researchers and the public. Grants of between CHF 5,000 and CHF 200,000 are awarded for both small communication formats and large-scale initiatives with more far-reaching goals. The submission deadline is September 01, 2019.
http://swissinnovation.org/news/web/2019/13-190530-cf

Call: Investigator-Initiated Clinical Studies

(Swiss National Science Foundation, May 14, 2019)

The SNSF is launching a call for targeted funding of investigator-initiated clinical studies that are outside the industry focus. The special programme for Investigator Initiated Clinical Trials (IICTs) of the Swiss National Science Foundation supports clinical studies on documented but under-researched medical needs. Though important for patients, these study topics remain outside the industry focus. The IICT programme does not provide support for non-randomized and uncontrolled studies. Letters of intent can be sent to the SNSF by e-mail until 1 July 2019 at 17:00 Swiss local time. The deadline for submitting proposals on mySNF is November 01, 2019 at 17:00 Swiss local time. The SNSF recommends drawing up the study protocol with help from local clinical trial units.
http://swissinnovation.org/news/web/2019/13-190514-3b

Call: Young Talents in Clinical Research

(Swiss Academy of Medical Sciences, January 03, 2019)

Medical doctors engaged in clinical research are faced with many challenges, including the lack of time, particularly during medical training, and the scarcity of funding for research projects. There is currently no system-inherent support in Switzerland for young doctors starting out in clinical research. With the «Young Talents in Clinical Research» program, the SAMS and the Gottfried and Julia Bangerter-Rhyner Foundation therefore contribute to improving the quality of clinical research in Switzerland. Medical doctors working in Switzerland, having obtained their medical degree no more than five years before the submission deadline can apply for a beginner grant. In a subsequent step, grantees can submit a proposal for a project grant provided that they have obtained their medical degree no more than 8 years before the submission deadline. The launch of next call will be in March 2019 with the next submission deadline being June 30, 2019.
http://swissinnovation.org/news/web/2019/13-190103-23

Upcoming Science and Technology Related Events

Venture Leaders China
June 25 – July 5, 2019
https://is.gd/aoiyan
Startups, AR, Tech
Hong Kong, Shenzhen, Shanghai

Smart Health 2019
June 25, 2019
https://is.gd/jpBwhC
Health & Wellbeing, Diagnostics
Zurich

Update on the CRISPR IP Saga
June 27, 2019
https://is.gd/nsDwxt
Gene Editing, CRISPR
Basel

Biointerfaces International
August 25-27, 2019
https://is.gd/13c9Ck
Conference, Science
Zurich

Café des Sciences
June 20, 2019
https://is.gd/Cil7Rh
Bio Engineering, BioTech
Shanghai

Chemspec Europe 2019
June 27, 2019
https://is.gd/obwssa
Fine & Speciality Chemicals
Basel

Conference of Science Journalists
July 1-5, 2019
https://www.wcsj2019.eu/
Good, Fair, Critical Reporting
Lausanne

ETH Industry Days
September 4, 2019
https://is.gd/mLvgZ4
Research, Industry, Spin-Offs
Zurich

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Science-Switzerland Back Numbers: www.swissinnovation.org/Science-Switzerland