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Switzerland.

Science-Switzerland, February – March 2023

News on Swiss science, technology, education and innovation

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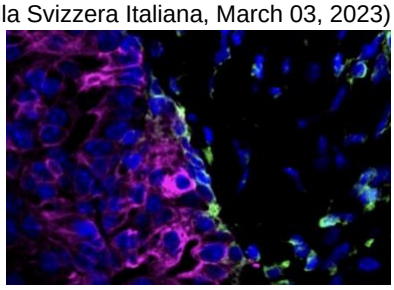
Fighting Prostate Cancer through Immune Cells' Aging Mechanism

(Università della Svizzera Italiana, March 03, 2023)



Researchers from the Institute of Oncology Research (IOR) and the University of Padova have made a groundbreaking discovery that could lead to potential new treatments for prostate cancer. They identified a subset of neutrophils in the tumor microenvironment that promote tumor growth and induce therapy resistance. These aged neutrophils could be targeted by immune-senolytics, offering a new approach to treating cancer and age-related diseases such as Alzheimer's and Parkinson's.This research effort was led by Prof. Andrea Alimonti and Prof. Arianna Calcinotto. The first author of the publication is Nicolò Bancaro.
/web/2023/00-230303-34

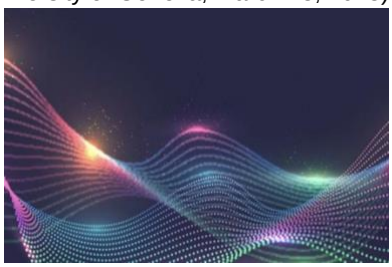
Superconductivity for Sustainability: New Superconducting Link for HL-LHC

(CERN, March 07, 2023)

Scientists at CERN have successfully integrated a flexible cryostat and a series of high-temperature superconducting magnesium diboride cables to create an innovative electrical transfer line for the High-Luminosity Large Hadron Collider (HL-LHC) triplets. The new "Superconducting Links" will transfer a DC current of about 120 kA at 25 K (-248 °C), a temperature higher than conventional superconductors. It requires helium gas to be cooled down, but since that gas is needed in any case to cool current leads, this is done at no extra cost, with the link serving as both an electrical and helium transfer line. This new type of superconducting transmission line has potential outside accelerator technology and could be used to deliver electricity in big cities or connect renewable energy sources to populated areas.
/web/2023/00-230307-a3

Shining a Light into the ‘‘Black Box’’ of AI

(University of Geneva, March 23, 2023)



An international team of researchers from the University of Geneva, the Geneva University Hospitals, and the National University of Singapore has developed a new method for evaluating the interpretability of artificial intelligence (AI) technologies. The method aims to decipher the basis of AI reasoning and possible biases, shedding light on the opaque workings of so-called “black box” AI algorithms, especially in sectors such as medicine and finance, where AI-powered decisions can influence the health and lives of people, and lead to enormous loss of capital. The method also helps increase the trust that can be placed in AI-powered diagnostic and predictive tools by providing transparency into how they work and what influences their results.
/web/2023/00-230323-95

1. Policy

Switzerland Strengthens Scientific Cooperation with Israel

(Swiss Academies of Arts and Sciences, February 23, 2023)

The Swiss Academies of Arts and Sciences and Israel Academy of Sciences and Humanities have signed a Memorandum of Understanding to promote scientific cooperation and encourage exchanges. The agreement was signed by Marcel Tanner and David Harel at the House of the Academies in Bern, in the presence of high-ranking guests, including ambassadors and directors of research institutions. This comes after Israel President Yitzchak Herzog and Swiss Federal President Ignazio Cassis signed a Memorandum of Understanding between their respective national research funding agencies.
/web/2023/01-230223-d5

UN Commission on the Status of Women: Switzerland's Contribution on Digitalization

(admin.ch, March 06, 2023)

Switzerland is emphasizing the significance of digitalization for gender equality at the 67th session of the United Nations Commission on the Status of Women, which opened on March 6th, 2023 in New York. The delegation's focus is on promoting access to technology and innovation for women and girls while guarding against cyber violence. President Alain Berset led the Swiss delegation and spoke at the CSW and UN Security Council on women, peace and security. The Gender Equality Strategy 2030, adopted by the Federal Council in 2021, is the first comprehensive national strategy on gender equality implemented in Switzerland. It notably includes the development of digital tools for analyzing equal pay.
/web/2023/01-230306-44

2. Education

Children and Researchers Envision a Sustainable World

(Empa, March 02, 2023)

Swiss researchers from Empa and the St. Gallen University of Teacher Education are collaborating with primary schoolchildren to develop visions for a sustainable future and compile them into an illustrated children's book. The project, named "Co-creating a Circular Future," aims to combine children's creativity with expert knowledge to create a tangible vision of a sustainable circular economy. The resulting children's book will depict not the world of yesterday, but today. The book will be developed in joint workshops in spring and could generate new impulses for research.
/web/2023/02-230302-8b

Journey To School Important For Children

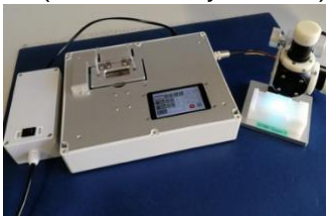
(University of Geneva, March 16, 2023)

Children who make the journey to school without an accompanying adult value the experience as a time of independence and socialization, according to an interdisciplinary study conducted by Zoe Moody, professor at Haute Ecole Pédagogique du Valais and researcher at the University of Geneva. The study, which gave children a say on the matter, found that the journey to school offers opportunities for informal and creative learning, conflict resolution, and the development of social skills. It suggests that giving children the opportunity to make the journey by themselves, and even offering a degree of flexibility, can be highly beneficial.
/web/2023/02-230316-07

3. Life Science

Microfluidic for Detecting SARS-CoV-2

(EPFL, February 02, 2023)



A research team led by Sandrine Gerber-Lemaire from EPFL, Igor Stefanini from SUPSI, and Francesco Bertoni from USI have developed a new microfluidics-based device that can detect the presence of SARS-CoV-2 in human saliva accurately, efficiently, rapidly, and on a large scale. The device uses a unique DNA/RNA duplex paired with microfluidics, and can pick up the virus' RNA even when extremely diluted in the test saliva. It distinguishes SARS-CoV-2 from other respiratory viruses, preventing false positives for other coronaviruses. Not only can this device be a game-changer in the fight against the COVID-19 pandemic, it is also very versatile and could be adapted to the detection of other viruses.
/web/2023/03-230202-33

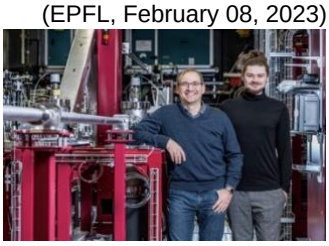
Artificial Intelligence Improves Efficiency of Genome Editing

(University of Zurich, February 02, 2023)

A team of researchers from the University of Zurich, led by Professors Gerald Schwank and Michael Krauthammer, have developed an AI tool that predicts the efficacy of genome editing repair options. The prime editing method, which edits only one strand of DNA rather two, offers great potential for treating genetic diseases; however, it requires a significant amount of time to optimize the guide RNA (pegRNA) to a specific target in the genome. With this new AI tool, the team was able to analyze a large data set of over 100,000 pegRNAs in human cells and determine which of their properties positively or negatively influence the prime editing process. This improves both the effectiveness and the accuracy of genome editing. The tool has already been tested successfully in human and mouse cells and is available to researchers.
/web/2023/03-230202-ef

How Age and Sex Influence Our Body Clock

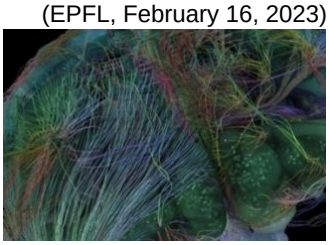
(EPFL, February 08, 2023)



A team of EPFL researchers, led by Felix Naef, has shed new light on how the human body clock, the circadian rhythm, is influenced by age and sex. They found that genes express themselves in specific tissues in rhythms that are not the same depending on the body's age and sex. They found that these rhythms were sex-dismorphic, especially in the liver's "xenobiotic detoxification", the process by which the liver breaks down harmful substances. They also found that as a body ages, its rhythm of gene expression decreases in the heart's arteries, which may explain why older people are more susceptible to heart disease. This information could lead to new ways of diagnosing and treating sleep disorders and metabolic diseases.
/web/2023/03-230208-2e

Blue Brain Project Update Sheds Light on Neuron Types

(EPFL, February 16, 2023)



Researchers from EPFL's Blue Brain Project, which aims to recreate a digital model of a mouse's brain, have published an updated version of their 3D digital atlas. The project, led by Professor Henry Markram, was originally presented in 2018, and their first model provided estimates on the composition of over 700 regions of a mouse's brain. This updated version now provides more refinement, in particular information on inhibitory neurons. This type of neuron dampens the firing of other neurons and plays an important role in information processing in the brain. The new atlas reveals that up to 20% of neurons in a mouse's brain play an inhibitory role. The updated atlas is publicly available and can be used for large-scale neural circuit simulations and other research purposes.
/web/2023/03-230216-46

New Realistic Model of Blood-Brain Barrier

(ETH Zurich, February 17, 2023)

Researchers at ETH Zurich, led by Mario Modena and Andreas Hierlemann, have developed a 3D blood-brain barrier model, which is more realistic than previous models and is suitable for exploring new treatments for brain tumors. The blood-brain barrier protects the central nervous system from harmful substances in the bloodstream. The researchers took those cell types that naturally make up the blood-brain barrier and combined them within a single platform to almost fully replicate the 3D cell structure found in the human body. They deposited transparent electrodes on glass coverslips on both sides of the barrier to measure its permeability, while simultaneously using high-resolution time-lapse microscopy to map changes. This new model will make it easier to detect which molecules stabilize the barrier and discover compounds and methods suitable for crossing it.
/web/2023/03-230217-f7

Using Light to Switch Drugs On and Off

(PSI, February 20, 2023)

Scientists at the Paul Scherrer Institute PSI, led by Jörg Standfuss and Maximilian Wranik, have filmed with record precision the action of a specific cancer drug on tumor cells, using the Swiss X-ray free-electron laser SwissFEL and the Swiss Light Source SLS. The movie opens up possibilities in the field of photopharmacology, as the drug filmed is photosensitive - it can be turned on or off with pulses of light. This works by adding a nitrogen "bridge" to the molecule, which contracts or elongates under light pulses. This changes the shape of the molecule, making it fit, or not, in depressions on the surface of proteins. The research team used the state-of the art facilities at PSI to film the behavior of the drug in the milliseconds after switching it off, in order to understand precisely how this lock-and-key mechanism dynamically reacts.
/web/2023/03-230220-06

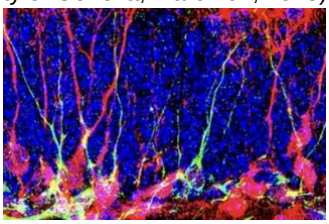
Where Do Tobacco Toxins Attack DNA?

(ETH Zurich, February 23, 2023)

Researchers at ETH Zurich, led by Shana Sturla, have developed a new method to precisely localize changes in DNA caused by chemical compounds in tobacco smoke, which are linked to lung cancer. The scientists focused on benzopyrene, a chemical produced when tobacco is burned that reacts with one of the building blocks of DNA. They used antibodies that bound to those building blocks to map exactly where in DNA the alterations took place. This knowledge helps in understanding how exactly that chemical causes lung cancer. The researchers believe that this approach could be used to determine the effects of other toxins on cells, making it easier to determine the safety of chemical substances without the need for laboratory animals.
/web/2023/03-230223-9c

Generating New Neurons in the Brain

(University of Geneva, March 01, 2023)



Scientists from the University of Geneva and the University of Lausanne have discovered a metabolic mechanism that can awaken dormant neural stem cells in adult and elderly mice, leading to the generation of new neurons in the brain. The researchers, led by Jean-Claude Martinou and Marlen Knobloch, found that mitochondria were involved in the activation levels of dormant neural stem cells. In particular, a protein complex, the mitochondrial pyruvate transporter, plays a role in this regulation. By blocking this protein complex, the team successfully activated dormant cells and generated new neurons in adult and elderly mice. This could open up treatment possibilities for conditions such as depression and neurodegenerative diseases.
/web/2023/03-230301-35

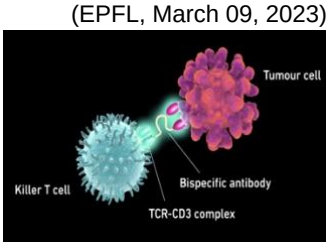
Internal Thermometer Tells Seeds When to Germinate

(University of Geneva, March 07, 2023)

Researchers from the University of Geneva have identified the internal thermometer of seeds, which is capable of delaying or even blocking germination when exterior temperatures are too high for the future plant. This mechanism allows fine regulation of the germination process, with a variation of only 1 to 2°C capable of delaying germination and increasing the chances of survival for future young plants. The researchers found that the albumen tissue inside the seed, which controls germination, is responsible for implementing the thermo-inhibition, revealing a new essential function for this tissue. This discovery could help optimize plant growth in the context of global warming. The study was led by scientists from the University of Geneva (UNIGE), including Luis Lopez-Molina, a professor at the Department of Plant Sciences, and Urszula Piskurewicz, a researcher at the same department and the first author of the study.
/web/2023/03-230307-26

Generating Protein Sequences With Deep Learning

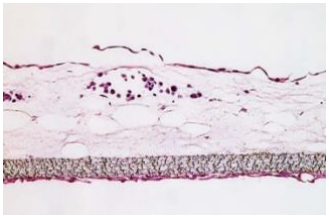
(EPFL, March 09, 2023)



Researchers from EPFL have developed a deep-learning neural network, MSA Transformer, which generates new protein sequences with similar properties to natural sequences. By predicting missing or masked parts of a sequence based on surrounding context, MSA Transformer can generate proteins from small families, where other models perform poorly. The MSA Transformer offers promising potential for protein design and could lead to the development of new proteins with specific structures and functions, enabling important medical applications in the future. This study was conducted by Anne-Florence Bitbol, Damiano Sgarbossa, and Umberto Lupo from EPFL's School of Life Sciences.
/web/2023/03-230309-7d

A Better Model for Understanding Ovarian Cancer

(University of Fribourg, March 16, 2023)



Researchers from the Adolphe Merkle Institute and three other Swiss institutions have developed a 3D model of human tissue to better understand how ovarian and peritoneal cancers spread. The multicellular model of the greater omentum has allowed the scientists to identify mechanisms that encourage cancerous cells to migrate towards the omentum, providing a more precise picture of the tumor microenvironment. The breakthrough could lead to more personalized therapies for patients with advanced stage cancers. This project was led by Professor Barbara Rothen-Rutishauser of the Merkle Institute's BioNanomaterials Group, together with colleagues, especially University of Basel Professor Viola Heinzelmann.
/web/2023/03-230316-a4

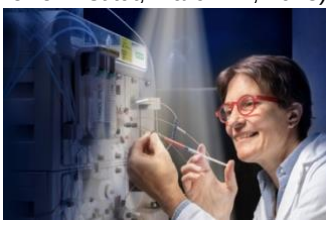
Is It Possible to Learn without a Brain?

(University of Fribourg, March 21, 2023)

A recent study by Prof. Simon Sprecher of the University of Fribourg has shown that sea anemones are capable of learning and adapting their behavior based on past experiences, despite having only a rudimentary nervous system and no brain. The research group conducted tests subjecting anemones to light and electric stimuli to create an association and found that those that had received the two stimuli simultaneously learned to retract their bodies as soon as the light pulse was emitted. This finding challenges the assumption that animals without a brain can only behave at the level of reflex and raises questions about how the ability to learn emerged in evolution.
/web/2023/03-230321-89

How Vision Begins

(Paul Scherrer Institut, March 22, 2023)

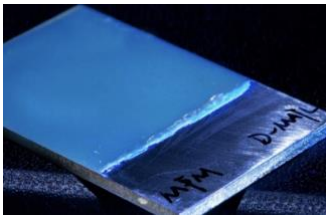


Researchers at the Paul Scherrer Institute (PSI) have identified the molecular processes that occur in the eye when light hits the retina. The process involves a protein in the retina, called rhodopsin, changing its three-dimensional form when it absorbs part of the light energy. The process happens in just a fraction of a trillionth of a second, and the transformation of the protein only takes a picosecond, making it one of the fastest natural processes in the world. The study used the SwissFEL X-ray free-electron laser to capture and analyze the process, as well as the X-ray free-electron laser SACLA in Japan, to perform the necessary measurements. The study was co-led by Gebhard Schertler and Valérie Panneels at PSI.
/web/2023/03-230322-c9

4. Nano / Micro Technology / Material Science

New Corrosion Protection That Repairs Itself

(ETH Zurich, February 21, 2023)



Researchers at ETH Zurich, led by Markus Niederberger, Walter Caseri, and Marco D'Elia, have developed a new plastic, Poly(phenylene methylene) or PPM, that can greatly improve and simplify corrosion protection. PPM can be sprayed as paint onto a surface, and then becomes solid. It indicates holes and cracks in the protective layer by failing to fluoresce, and it repairs any damage to itself without further external intervention. The polymer is also more sustainable than previous corrosion protection materials as it can be completely removed and recycled at the end of the product's life with only minimal material loss. The researchers have applied for a patent for their invention and are looking for an industry partner to further develop the product and to manufacture and distribute it on a large scale.
/web/2023/04-230221-c3

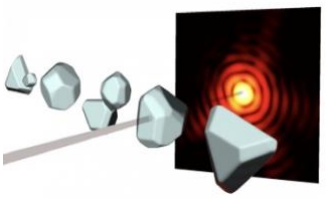
3D Printing Bone-Like Material

(EPFL, February 23, 2023)

Researchers from the Soft Materials Laboratory in the School of Engineering at EPFL, led by Esther Amstad, have developed a 3D-printable ink that then solidifies into a strong, lightweight bone-like material. The ink contains a bacteria that triggers a mineralization process in the printed “scaffolding”, which over the next few days produces a strong and lightweight mineralized bio-composite material that can be used across a broad range of fields. Dubbed BactoInk, the ink can be used to 3D-print virtually any shape which will then gradually mineralize over a few days. It could be used to repair cracks in vases or chips in statues; build artificial corals to help regenerate damaged marine reefs; or serve as a bone replacement in biomedicine.
/web/2023/04-230223-8a

3D-Snapshots of Nanoparticles

(ETH Zurich, March 03, 2023)



ETH researchers have developed a new technique to create 3D images of single nanoparticles using short and strong X-ray pulses. While X-ray diffraction has been used for over a century, the new method allows for more precise and detailed information to be gathered. It produces 3D images of single nanoparticles without imposing specific requirements or assumptions on the shape of the nanoparticle. It also captures it in free-flight, as opposed to on a surface. This opens up possibilities for making 3D-movies of dynamic processes at the nanoscale. The research was led by ETH professor Daniela Rupp, together with colleagues from the universities of Rostock and Freiburg, TU Berlin, and DESY in Hamburg.
/web/2023/04-230303-c9

Researchers Call for Better Nanowaste Management

(University of Fribourg, March 06, 2023)

Researchers at the University of Fribourg have called for the establishment of technical and legally binding guidelines for managing nanowaste, which is an emerging safety concern worldwide. In an article published in Nature Nanotechnology, the researchers highlight the need for risk assessment, categorization, labeling, collection, storage, transport, recycling, and elimination of nanowaste. They advocate for increased awareness and action to manage nanowaste, along with the explicit inclusion of nanowaste management in multinational agreements to protect human health and the environment. The authors caution policymakers to avoid double standards that would hinder the replacement of more hazardous conventional chemicals with less harmful and degradable nanomaterials.
/web/2023/04-230306-ae

Nanoscale Objects with Shape Memory

(ETH Zurich, March 09, 2023)

Researchers at ETH Zurich have achieved a shape-memory effect on objects that are only a few nanometers in size for the first time. These objects could have a range of applications, from tiny robots to medical utilization. Led by Salvador Pané and Xiang-Zhong Chen, the researchers, including lead authors Donghoon Kim and Minsoo Kim, used two different oxides, barium titanate and cobalt ferrite, in thin layers. The tension between the two oxides generates a spiral-shaped twisted nanoscale structure which is highly elastic, resilient, and allows flexible movements, making it useful for manufacturing tiny machinery and robotic devices on the nanoscale. This achievement opens up possibilities for applications in flexible electronics, soft robotics, and nanorobots that could stimulate cells or repair tissue within the body.
/web/2023/04-230309-ff

3D-Printed Insoles Measure Sole Pressure Directly in the Shoe

(Empa, March 14, 2023)

A team of researchers from ETH Zurich, Empa and EPFL have developed a 3D-printed insole with integrated sensors that can measure the pressure on the sole of the foot directly in the shoe during various activities. The custom-made insoles, produced in just one step using a single 3D printer, use various inks developed specifically for this application. The sensors placed in the insole give a precise and accurate pressure map of the foot during activities, which then allows a physiotherapist to create custom insoles for everyday use. The insole could be used by athletes or in physiotherapy to measure training or therapy progress. The project was co-led by Gilberto Siqueira and Danick Briand, with collaboration from Lausanne University Hospital (CHUV) and orthopaedics company Numo.
/web/2023/04-230314-35

Sculpting Quantum Materials For The Electronics Of The Future

(University of Geneva, March 20, 2023)

An international team of researchers has designed a quantum material that allows the fabric of space inhabited by electrons to be curved on-demand. The team, including scientists from the universities of Geneva, Salerno, Utrecht, and Delft, used an advanced system to fabricate the material on an atomic scale, allowing for particular electronic geometrical configurations that can be controlled on-demand. The material's unique properties could be used in next-generation electronic devices, including optoelectronics, and could open up new avenues in exploring high-speed electromagnetic signal manipulation and developing new sensors.
/web/2023/04-230320-b1

5. Information & Communications Technology

Chromo-Encryption Method Encodes Secrets With Color

(EPFL, February 14, 2023)

EPFL researcher Olivier Martin and PhD Student Hsiang-Chu Wang have developed a new method of cryptography called "chromo-encryption". By combining silver nanostructures with polarized light, the researchers have been able to yield a range of colors which can be used to encode messages. This method is more secure as each color code is not unique and the chance of guessing the correct code sequence is smaller. The nanostructures' reaction to polarized light is a chiral response, reflecting the polarized light in a different direction than the excitation – which means that decrypting the message through the wrong polarization also yields a nonsense message. The researchers believe that this combination of nanotechnology and human visual perception has potential for both artistic applications and encryption techniques.
/web/2023/05-230214-b6

Revolutionary Approach to Electronics for Ultra-Fast Data Exchange

(EPFL, February 20, 2023)

Researchers from EPFL, led by Elison Matioli and Mohammad Samizadeh Nikoo, have developed a new approach to electronics that consists in using sub-wavelength metastructures to engineer semiconductor devices with better performance without relying on aggressive downscaling. The researchers used this approach to modify a semiconductor made from gallium nitride and indium gallium nitride. The metastructures allowed for an unprecedented degree of electronic control, which could enable a new class of terahertz devices that operate significantly faster than current electronics. The researchers demonstrated data transmission of up to 100 Gbps at terahertz frequencies, which is 10 times higher than the current 5G network. This technology could change the future of ultra-high-speed communications.
/web/2023/05-230220-d3

Novel Computer Components Inspired by Brain Cells

(Empa, March 07, 2023)

Researchers from Empa, ETH Zurich, and the "Politecnico di Milano" are developing a new type of computer component based on halide perovskite nanocrystals that can process large amounts of data in an energy-efficient way. The component, called a memristor, is designed to mimic the structure and functionality of the human brain, combining data storage and processing. The memristor is easier to manufacture than its predecessors and can perform complex computations that resemble processes in the brain. While the technology is not yet ready for deployment, the team of researchers, among which Rohit John, Maksym Kovalenko, Daniele Ielmini, and Alessandro Milozzi, hope to develop alternative architectures that can perform certain tasks faster and with greater energy efficiency.
/web/2023/05-230307-69

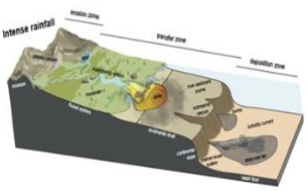
High-Performance Single-Photon Detector

(University of Geneva, March 13, 2023)

Researchers from the University of Geneva and its spin-off ID Quantique have developed single-photon detectors that have a detection rate 20 times faster than existing detectors. This was achieved by integrating fourteen short nanowires, instead of one long one, in the detector, lowering the cooldown time and increasing the number of photons that can be detected in a short amount of time. The breakthrough innovation will have significant applications in quantum cryptography, as information encoded into a photon and securely shared via fiber optic cables can now be received at a much faster rate than before. The nanowire sensors used in the detectors are no more complex to produce than existing models on the market, making them highly accessible.
/web/2023/05-230313-82

New AI Model Transforms Research On Metal-Organic Frameworks

(EPFL, March 14, 2023)



Researchers from EPFL and KAIST have developed a transformer-based AI model, named MOFtransformer, that can significantly improve the understanding of Metal-Organic Frameworks (MOFs), a class of porous crystalline materials with potential applications in energy storage and gas separation. The pre-trained model can suggest the characteristics and properties of a hypothetical MOF with far less data than conventional machine-learning methods. This makes it faster and more comprehensive to study MOFs and paves the way for the development of new MOFs with improved properties for hydrogen storage and other applications. The project was led by Professor Berend Smit from EPFL.
/web/2023/05-230314-74

6. Energy / Environment

Greener Alternative for Aviation Fuel

(PSI, February 16, 2023)

The Paul Scherrer Institute and the Swiss start-up Metafuels are collaborating on a project to produce sustainable aviation fuel. They are currently working on the construction and operation of the first pilot plant for this new technology on the PSI campus. The research team aims to produce high-quality synthetic kerosene relying on water, renewable electricity, and sustainably sourced carbon dioxide - either from direct air capture or from non-food biomass. This synthetic kerosene presents multiple advantages in the race to make air travel greener, in particular the fact that switching to sustainably-produced fuel would require no infrastructure change, to the contrary of both hydrogen or battery-based solutions. The pilot plant will take the form of two container modules to be installed on the PSI campus and integrated into the existing infrastructure.
/web/2023/06-230216-8f

New Technology Revolutionizes the Analysis of Old Ice

(University of Bern, February 16, 2023)

Researchers from the University of Bern and Empa have developed a new technique to measure greenhouse gas concentrations in ice cores more accurately. This novel method will be used on the oldest ice cores ever drilled, with the EU project “Beyond EPICA”: 1.5 million-year-old ice from Antarctica that will yield data on temperature, atmosphere composition, and carbon cycle then. The new method consists in jointly measuring carbon dioxide, methane, nitrous oxide, and the carbon isotope composition of CO2. The ice sample needed for this technique is only one centimeter thick, yet it allows for high accuracy in measurement. This is particularly important, as the ice cores will have up to 20,000 years of climate history compressed into just one meter of ice.
/web/2023/06-230216-c1

Producing Bioplastics From Wastewater

(Eawag, February 21, 2023)

A team of researchers from eawag, led by Antoine Brison and Nicolas Derlon, is investigating the possibility of harvesting the carbon in wastewater to produce bioplastics. This recovers important resources and makes progress towards a circular economy. They investigated and optimized the process in three steps: the extraction of carbon from the wastewater, the fermentation of this carbon into volatile fatty acids, and the selective growth of bioplastics-producing bacteria in the substrate. They ultimately achieved a 70% conversion rate of wastewater biomass to bioplastic. While this technological development is promising, it would not be sufficient to replace the current demands for petrochemical plastics. Moreover, there may be a strong lack of social acceptance in using bioplastics produced from wastewater.
/web/2023/06-230221-dd

Breeding Insects with Food Waste

(University of St. Gallen, March 02, 2023)

Swiss start-up SmartBreed (Patrik Bertschi, Christoph Bertschi) is developing breeding facilities for black soldier fly larvae and mealworms as a source of protein for animal feed. The insects feed on by-products of the food industry, such as unsold food from the retail trade and vegetable waste, before being processed into powder for use in livestock feed. The locally produced insect protein could reduce Switzerland's dependence on imported soya, which causes CO2 emissions and puts natural areas under pressure. SmartBreed offers small, affordable and quickly built breeding facilities that can be integrated to food processing facilities or biogas plants, cutting down on delivery emissions. They hopes to receive an exemption to test insect protein as livestock feed from mid-2023.
/web/2023/06-230302-10

Feasibility of Sustainable Plastics Economy

(ETH Zurich, March 06, 2023)

A new study led by ETH Zurich shows that a circular plastics economy is feasible within planetary boundaries. The study, led by Prof. André Bardow together with Prof. Gonzalo Guillén Gosálbez and colleagues from RWTH Aachen University and the University of California, looked at the value chains of the 14 most common types of plastics and found that at least 74% of plastic would need to be recycled to achieve this. The remaining maximum 26% of plastics could be sourced using carbon capture and utilization or from biomass. The study also states that manufacturers should have a wider understanding of their responsibility and that plastic products must be better aligned with the circular economy.
/web/2023/06-230306-e1

Securing Power Supplies Without Fossil Fuels

(ZHAW, March 08, 2023)

Switzerland could secure its power supply without the need for new fossil fuel power plants. These are the results of a study led by Jürg Rohrer, Professor at ZHAW. The study reviewed reports that led to the government's decision to procure new fossil fuel plants to secure the power supply in winter. The analysis argues that a mandatory storage hydropower reserve combined with a more rapid expansion of renewable electricity production and efficiency measures would be the best solution for a secure electricity supply in Switzerland. This would make fossil reserve power plants obsolete, and the 1.4 billion Swiss francs needed to build them would be better invested in renewable electricity production. The analysis highlights the importance of legally required and monitored hydroelectric power reserves to ensure additional winter power production is not sold on the market.
/web/2023/06-230308-3c

Well-to-Wheel Impact of Liquefied Biomethane

(Ostschweizer Fachhochschule, March 09, 2023)

A joint study conducted by the Swiss Federal Office of Energy, retailer Lidl Switzerland, and logistics company Krummen Kerzers, has shown that using liquefied biomethane (LBG) in heavy-duty transport can reduce up to 74% of CO2 emissions from trucks. The well-to-wheel analysis, led by Prof. Dr. Elimar Frank of the OST - Ostschweizer Fachhochschule, not only examined direct emissions from truck operation but also emissions from fuel production and transportation. This allows for a direct comparison with the CO2 emissions from diesel. The study concluded that replacing diesel engines with LGB could reduce CO2 emissions by up to three-quarters. However, there are regulatory hurdles, limited production capacities, and higher costs compared to liquefied natural gas (LNG), hindering the widespread use of LBG in Switzerland.
/web/2023/06-230309-bc

Extreme Nighttime Pollution in New Delhi Air Explained

(Paul Scherrer Institut, March 13, 2023)

A joint study by researchers from PSI and the Indian Institute of Technology Kanpur has uncovered the unique mechanisms that cause fog to build up at night in the New Delhi atmosphere. This smog is formed due to the fumes emitted from burning wood at night. Its fumes contain countless chemical compounds that condense and clump together to form particles up to 200 nanometers across, creating the characteristic haze that blankets the city. These findings, which required four years of data collecting and analyzing, provide insight into the unique chemical processes that occur in the atmosphere of the Indian capital, which has the world's highest levels of air pollution. Four groups from the Laboratory for Atmospheric Chemistry at PSI collaborated on it, headed by Imad El-Haddad, Lubna Dada, André Prévôt, and Claudia Mohr.
/web/2023/06-230313-3d

Where Should Wind Turbines Be Constructed In Switzerland?

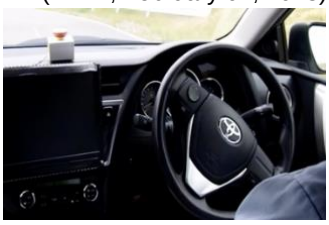
(ETH Zurich, March 20, 2023)

A new study conducted by researchers at ETH Zurich explores the distribution of wind turbines in Switzerland and the effect of a relaxation in spatial planning requirements on their placement. Current requirements forbid the use of crop rotation areas for wind turbines; meeting renewable energy goals would thus require turbine expansion in the Alps. The study, led by Professor Adrienne Grêt-Regamey and lead author Reto Spielhofer, shows that windy crop rotation areas in western Switzerland have the greatest potential in the country for generating wind power. If these areas were used for wind energy, 200 fewer wind turbines would be required in the Grisons and Valais mountains. Policymakers in Switzerland aim to accelerate wind power production to meet the country's energy goals for 2050.
/web/2023/06-230320-e7

7. Engineering / Robotics / Space

EPFL-JTEKT Collaboration Develops Interactive Autonomous Driving System

(EPFL, February 01, 2023)



Researchers from Ecole Polytechnique Federale de Lausanne and JTEKT Corp. in Japan have developed a haptic-based autonomous driving system called "collaborative steering." The system aims to increase safety and efficiency while engaging human drivers, reducing the risk to over-rely on automation. It distinguishes between 4 modes of human-robot interaction: cooperation, co-activity, collaboration, and competition, and adjusts which to use depending on the situation. The system was tested on a JTEKT test course in Japan and showed potential for increasing comfort and reducing driver effort. The software-based system can be integrated into standard cars and does not require special equipment. EPFL and JTEKT have been collaborating since 1998.
/web/2023/07-230201-e6

EPFL-Made Computer Launched Into Space

(EPFL, February 01, 2023)

Bunny, an onboard computer designed by the EPFL Spacecraft Team, was launched into space on January 31st. This marks the first space launch since 2009 of EPFL technology. EPFL Spacecraft, a team of students working on the CHESS mission to build and launch two miniature satellites in 2026, was approached in April 2022 by Italian aerospace company D-Orbit with an offer to fly a computer aboard their ION satellite carrier in an experimental mission due January 2023. They had less than a year to adapt, test and validate Bunny, their onboard flight computer, which will control and operate the satellite. The insights from this trial mission will be invaluable for the CHESS satellites, providing feedback to improve the computer's design.
/web/2023/07-230201-c3

Four Classes of Planetary Systems

(University of Geneva, February 14, 2023)

Researchers from the Universities of Bern and Geneva have classified planetary systems into four types, allowing scientists to study them as a whole and compare them with other systems. In our solar system, rocky planets orbit close to the sun while gas giants move in wide orbits. However, that is not always the case, and other systems most often only feature planets of similar sizes and masses. The team developed a classification into four system architectures: similar, ordered, anti-ordered and mixed. Factors including the mass of the gas and dust disk and the abundance of heavy elements in the star contribute to a system's architecture; for example, small, low-mass disks and stars with few heavy elements create "similar" type architectures. This bridges the billions-year gap between initial conditions of planetary formation and final architecture.
/web/2023/07-230214-55

Unique Staircase Manufactured Using 3D-Printed Formwork

(Empa, February 28, 2023)

NEST, the research and innovation building of Empa and Eawag, has successfully tested a 3D-printed formwork staircase designed to resemble a human spine. The staircase is made of ultra-high-strength fiber-reinforced concrete material that has been prestressed with an innovation from the Empa spin-off re-fer. The staircase's design was created by the ETH Zurich chair for Digital Building Technologies. The staircase was produced using 3D printed formwork, allowing for greater precision and the creation of more complex shapes. The material used for the formwork was chosen for its sustainability, enabling its reuse for multiple steps. The staircase is part of NEST unit STEP2, which focuses on circular economy, digital and industrial fabrication, building envelope and energy systems innovations.
/web/2023/07-230228-09

Balancing With Only One Reaction Wheel

(ETH Zurich, March 03, 2023)

Robotics specialists from ETH Zurich have developed a new cube-shaped robot, the One-Wheel Cubli, that can balance on its pivot and compensate for external disturbances using only a single reaction wheel. Unlike its predecessor, which required multiple reaction wheels, the One-Wheel Cubli is equipped with a balancing pole, allowing it to stabilize in both directions simultaneously. The pole increases the inertia along one of the tilt axes, which causes a difference in the time-scales of the tilt dynamics. This allows for control of both axes using a single reaction wheel. This new development, led by ETH Zurich professor Raffaello D'Andrea, could have implications for future robot designs and applications in various industries.
/web/2023/07-230303-dc

Soft Worm-Like Robot

(University of Fribourg, March 13, 2023)

Scientists at the Adolphe Merkle Institute (University of Fribourg) and Case Western Reserve University (USA) have developed a soft, worm-like robot capable of moving through tiny spaces and on any surface. The robot's modular body is made almost entirely of soft polymers, enabling it to navigate uneven terrains and constricted spaces that other robots cannot. The device is assembled from bilayer actuators, which reversibly change their shape when heated and cooled, respectively, allowing for precise movement control. While the robot's movements are currently slow and require considerable energy, researchers believe that future improvements in bending actuators could enhance performance without changing the design.
/web/2023/07-230313-0e

Robotic System Offers Hidden Window Into Collective Bee Behavior

(EPFL, March 23, 2023)

EPFL researchers have developed a groundbreaking robotic system that can be easily integrated into honeybee hives. The system, composed of thermal sensors and actuators, measures and modulates honeybee behavior through localized temperature variations. It provides a non-intrusive way to study bee colonies during winter, when they are sensitive to cold, and even prolong their survival by mitigating colony collapse. The system sheds light on previously unseen behaviors, opening new avenues for biological research, and has great potential for different scientific or agricultural applications. It was developed by a joint research team from the Mobile Robotic Systems Group in EPFL's School of Engineering and School of Computer and Communication Sciences (Rafael Barmak, Francesco Mondada, Rob Mills), and the Hiveopolis project at Austria's University of Graz.
/web/2023/07-230323-8e

8. Physics / Chemistry / Math

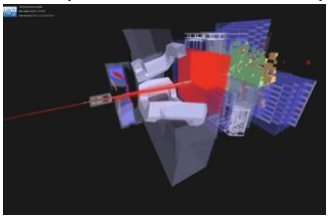
Tossing Coins to Understand Spheres

(EPFL, February 14, 2023)

EPFL mathematicians led by Professor Nicolas Monod, together with their colleagues at Purdue University, have used the Bernoulli process, a coin-tossing model, to solve a 30-year-old question about spheres and 4-dimensional spaces. The results of their study, which have been published in the mathematics journal Inventiones, shed new light on the "Euler Class", a tool used to understand complex spaces by dividing them into simpler pieces. The study shows that there is no limit to the size of the Euler class for spheres in four dimensions. The researchers turned to the Bernoulli process when classical approaches failed to solve the problem, and by combining it with the study of spheres and the Euler class, they were able to solve the old question about 4-dimensional spaces.
/web/2023/08-230214-d1

Unique Real-Time Data Analysis Begins at LHCb

(CERN, March 01, 2023)



The LHCb collaboration at the Large Hadron Collider has introduced a new real-time analysis technique that allows for faster and more precise data filtering and analysis. Previously at LHCb, data collection was handled in two steps: the detector recorded data, a fraction of which was stored on disks and magnetic tapes. This information was then analyzed, and adjustments to the detectors performed, in a time- and resource-intensive process. The new process automatically adjusts subdetectors as the data is read in real-time, compresses raw detector data more efficiently, and selects interesting events to make the best use of computing resources. With this revolutionary improvement, around 10 gigabytes of data are permanently recorded each second and made available for physics analysts.
/web/2023/08-230301-73

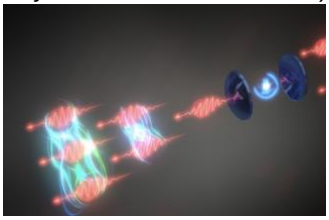
First Detection Of Neutrinos Made At A Particle Collider

(University of Bern, March 20, 2023)

Physicists from the University of Bern, Switzerland, have for the first time detected subatomic particles called neutrinos created by a particle collider, specifically at CERN's Large Hadron Collider (LHC). Neutrinos are among the most abundant particles in the universe and are key to understanding why there is more matter than antimatter. Neutrinos have been known for decades, but the majority studied have been low-energy. This new discovery, using the FASER particle detector, promises to deepen our understanding of the fundamental laws of nature, including how particles acquire mass. The FASER experiment is led by Akitaka Ariga in the Laboratory for High Energy Physics, directed by Michele Weber.
/web/2023/08-230320-54

Scientists Open Door To Manipulating ‘Quantum Light’

(University of Basel, March 21, 2023)



Scientists from the University of Basel have made a breakthrough in the manipulation of light particles, or photons, demonstrating for the first time that a few photons can be controlled and made to interact with each other. The international team of researchers created a cavity in a semiconductor that held the photons and an artificial atom, which bound the photons together and created a new entangled state. This could lead to advances in medical imaging and quantum computing, enabling more sensitive measurements with higher resolution. The research group was led by Dr. Natasha Tomm and Prof. Dr. Richard Warburton of the University of Basel.
/web/2023/08-230321-be

9. Architecture / Design

Rethinking the City-River Balance

(EPFL, February 16, 2023)

A research team of EPFL architects are rethinking the place of riversides in our cities, focusing on the banks of the Rhone river in four locations: Sion and Geneva in Switzerland, and Avignon and Givors in France. They built a decision-support tool that implements 18 different criteria to help urbanists evaluate planning proposals. River banks around cities were historically prized for their utility, especially during the industrial ages. Nowadays, with industries shifting away from waterways, it has left our cities with many brownfield sites that are primed for redevelopment that must be conducted with consideration for multiple influencing factors. The research team aimed to integrate indicators for different scales into their decision-making tool, such as canton-scale sustainability strategies, city-scale transportation networks, and neighborhood-scale use for heating or cooling buildings.
/web/2023/09-230216-35

10. Economy, Social Sciences & Humanities

Self-Regulation Training in Children Improves Chances

(University of Zurich, February 08, 2023)

The ability to self-regulate as children has long been known to be an indicator of greater success and wellbeing as an adult. Researchers from the University of Zurich and the University of Mainz, led by Ernst Fehr, have now conducted a study on school-age children to see if they could train that ability in them, and to what degree it impacted their learning. 500 primary school students, aged 6 to 7, were trained in how to set goals for themselves and achieve them. The study found that one year later, those students could read significantly better than control groups who had not been given any training, and that three years later, they were 15% more likely to go to high school. These tremendous improvements suggest that self-regulation training would have a significant impact if implemented as an integral part of curriculums.
/web/2023/10-230208-d3

How Persistent Will Inflation Be?

(University of St. Gallen, February 10, 2023)

A new study from the University of St.Gallen shows that inflation may persist longer than expected and may even be exacerbated in the medium term by overly tight monetary policy. The researchers also argue that the fight against inflation solely through central banks may be counterproductive in the medium term, as it makes loans more expensive, which companies need for their investments in productivity increases. The study sheds light on the persistent nature of inflation and highlights the need to adopt a comprehensive approach to addressing it, beyond just monetary policy measures. The findings suggest that in order to prevent inflation from persisting, it is important to encourage investment and maintain a healthy supply chain.
/web/2023/10-230210-e2

Innovative Economics to Reduce Child Labor

(University of Zurich, February 11, 2023)

University of Zurich economist Guilherme Lichand has conducted multiple pilot studies to innovatively reduce child labour and marriage in Côte d'Ivoire and Malawi. In Côte d'Ivoire, where many children drop out of school to work on cocoa plantations, he set up a "nudging" program wherein parents received a text message twice a week encouraging them to keep their children in school. After 18 months, the researchers observed a 50% decrease in school drop-out rates and a 30% decrease in sixth grade repeats. In Malawi, where underage marriage of girls is widespread, a survey showed

many parents opposed the custom, but felt pressured to comply to show their belonging to the community. A maize-donating program that offered alternative ways of supporting the community brought child marriage down by 30% within one and a half year.
/web/2023/10-230211-59

Circular Economy in Switzerland: Principle vs Practice

(ETH Zurich, March 02, 2023)

A recent study by political scientists from ETH Zurich and the Federal Office of the Environment (FOEN) shows that while the Swiss population supports the concept of a circular economy, their personal willingness to contribute is low. The study, led by Thomas Bernauer, found that although people are in favor of a duty to repair for retailers, a repairability label, and a mandatory percentage of recycled material in packaging, they are less likely to buy used products and share consumer goods. The researchers suggest that financial incentives and information campaigns could help to strengthen the demand for used goods and make sharing more appealing.
/web/2023/10-230302-1a

First Seismic Risk Model in Switzerland

(ETH Zurich, March 07, 2023)

Switzerland has released its first seismic risk model, which aims to predict and estimate the cost of the potential damage that earthquakes could cause to buildings and people in Switzerland. The new model was created by the Swiss Seismological Service (SED) at ETH Zurich, the Federal Office for the Environment, and the Federal Office for Civil Protection. It combines information about earthquake risk, building vulnerability, and affected persons and assets to help government agencies make informed decisions in the areas of earthquake preparedness and incident management. The risk model is available to the public and shows that cities on the Swiss Plateau, including Basel, Geneva, Zurich, Lucerne, and Bern, are at highest risk of damage.
/web/2023/10-230307-71

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

Ten Swiss Sciencepreneurs to Explore Singapore

(startupticker.ch, February 07, 2023)

The Academic-Industry Training Program for South-East Asia, executed by ETH Zurich and VentureLab, will bring ten selected Swiss startups to Singapore. The program will allow them to explore South-East Asian markets. The selected startups are: Ariya Bio (gene editing 9 therapeutic strategy for hemoglobinopathy), breathe (emergency use critical care ventilator for low-resource settings), Drone Imagery (drone detection of black-beetle infestations in forests), Irmos Technologies (AI-based buildings and bridge maintenance tools), Maven Health (AI-driven health risk prediction), MY-SENSATION (nerve stimulation to improve mobility and reduce pain), NanoDecoder (nanopore technology for molecular sequencing in food-quality checks), Neuropat (early diagnosis of Parkinson's disease), Sallea (cell-growth scaffolds for meat cultivation), SmartVNS (rehabilitative brain stimulation).
/web/2023/11-230207-a1

New Tool to Support Low-Tech and Sustainable Projects

(startupticker.ch, February 10, 2023)

The Foundation for Technological Innovation (FIT) has announced the launch of FIT Impact, a program aimed at young entrepreneurship projects with an impact. In collaboration with the universities in the canton of Vaud, the program will award grants ranging from 10,000 to 20,000 CHF to low-tech and sustainable projects with a strong social and environmental impact. FIT aims to take into account the strong dynamics and evolution of the Vaud innovation ecosystem. In addition to the FIT Tech and FIT Digital programs, FIT Impact is a new type of support tailored to low-tech social innovation projects. FIT Impact will work in tandem with UNIL and CHUV, EPFL, EHL, HEIG-VD, and the Institut La Source, complementing the support programs provided by the schools.
/web/2023/11-230210-db

EPFL Startups in 2022

(EPFL, February 11, 2023)

EPFL startups had a successful fundraising year in 2022, despite the global economic instability. 28 early-stage funds were awarded to EPFL startups, and a total of CHF 73 million were raised. Five EPFL startups (Anokion, Distalmotion, MindMaze, Nanolive, and Opna Immuno-Oncology) raised over CHF 20 million each, and 28 startups attracted seed funding of between CHF 1 million and CHF 5 million. The increase in seed funding was accompanied by a jump in investment in the CHF 5–20 million range, totaling CHF 121 million in 2022, up from CHF 21 million in 2021. This growth in investment reflects the high potential of EPFL startups and the opportunities investors see in their technology. In 2018, EPFL introduced a program allowing students to create startups as part of their Master's projects, which six of the 21 startups created in 2022 went through.
/web/2023/11-230211-13

Scale Up Vaud Welcomes 13 High-Growth Companies

(startupticker.ch, March 08, 2023)

he Scale Up Vaud program has announced the addition of 13 high-tech companies to its community of scale-ups in Switzerland: Aequivalent, Bloom Biorenewables, ClearSpace, CREAL, CYSEC, Daphne Technology, Inpher, Insoligh, SamanTree Medica, Swibeco, Talent.com, Sensile Technologies, and Smeetz. With a total of 50 firms now part of the program, they have raised over CHF 525 million in capital in 2022 and created nearly 3,500 jobs in Switzerland and 4,900 jobs abroad since their founding. The program, introduced in 2016 by Innovaud, provides support to high-growth tech companies to help them develop and create high-caliber jobs in the region. A record number of IPOs and acquisitions have taken place since 2021, demonstrating Switzerland's favorable environment for innovation and business development.
/web/2023/11-230308-51

Smart Ring to Monitor Health

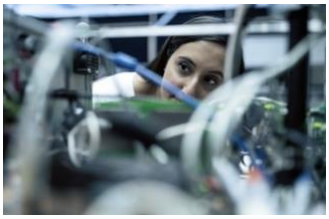
(EPFL, March 17, 2023)

Senbiosys, an EPFL spin-off, has developed a new smart ring called Iris that incorporates all the health-monitoring features currently available in smartwatches. The ring contains six photoplethysmogram (PPG) sensors, which measure vital signs like heart rate, blood oxygen levels, breathing rate, blood pressure, and more. Senbiosys's PPG sensors measure just four cubic millimeters, which is four times smaller than the ones found in competing devices on the market. The ring has been designed to provide a personalized way of tracking different health indicators, while being no more intrusive than a piece of jewelry. The ring has raised five times more than the initial target of 100,000 francs in a recent crowdfunding campaign, and the proceeds will be used to take Iris from the prototype stage to large-scale production.
/web/2023/11-230317-25

13. Calls for Grants/Awards

SNSF Approves Consolidator Grants for 30 Swiss Projects

(SNSF, February 08, 2023)



54 million Swiss francs in total will be distributed to selected projects. This transitional measure aims to consolidate the scientific independence of researchers and help them carry out their work in Switzerland, currently non-associated with Horizon Europe. Out of 182 applications, 30 projects were selected, which will be awarded approximately 54 million francs in total over an average period of 5 years. 14 of the 30 projects selected are led by women, who had a higher success rate in applying for the grant. 12 projects will be funded in mathematics, natural sciences and engineering, 8 in biology and medicine, and 10 in humanities and social sciences.
/web/2023/13-230208-88

Andrea Rinaldo Wins "Nobel Prize in Water"

(EPFL, March 21, 2023)

EPFL Professor Andrea Rinaldo has been named the winner of the 2023 Stockholm Water Prize, the most prestigious water research award in the world. Rinaldo, an expert in hydrology, has spent his career studying recurring mechanisms in hydrological and ecological processes in drainage basins. His unique approach looks not only at surface phenomena but also at the underlying soil composition in areas where water streams converge. Through his work, Rinaldo has developed mathematical models for predicting the propagation of invasive species and pathogens, which has enabled public health officials to take necessary preventive measures before diseases afflict too many people. Rinaldo will receive the award from King Carl XVI Gustaf in Stockholm in August.
/web/2023/13-230321-c1

Upcoming Science and Technology Related Events

Swiss IT Forum 2023
April 19, 2023
https://is.gd/eCUN7M
Software, Digital, IT
Zurich

Swiss BioTech Day 2023
April 24-25, 2023
https://is.gd/iYU8Ju
Biotechnology, Life Sciences
Basel

Women's Health Innovation Summit Europe
April 26-27, 2023
https://is.gd/NkPJsf
FemTech, Healthcare, Innovation
Basel

SHIFT Switzerland
May 11, 2023
https://is.gd/QdrhIO
Circularity, Sustainability, Leadership
Bern

Hack Summit
May 11-12, 2023
https://is.gd/J92dmH
Climate, Energy, Carbon
Lausanne

Startup Days 2023
May 25, 2023
https://is.gd/BV8vDo
Startups, Investors, Networking
Bern

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