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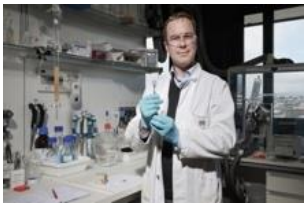
Science-Switzerland, December 2022 – January 2023

News on Swiss science, technology, education and innovation

Table of Contents

Solar-Powered Artificial Leaf Produces Hydrogen Out of Thin Air

(EPFL, January 05, 2023)



A team EPFL scientists have developed a solar-powered artificial leaf capable of harvesting water from the air and converting it into hydrogen. The device is based on novel gas diffusion electrodes, which are transparent, porous and conductive, allowing them to absorb sunlight for the conversion process. The team took inspiration from plants' ability to convert sunlight into chemical energy using carbon dioxide from the air. They developed a 3-dimensional mesh of felted glass fibers coated with a light harvesting semiconductor material. When exposed to sunlight under humid conditions, hydrogen gas is produced. The researchers are now optimizing the system for practical applications. This technology could be used as an alternative source of renewable energy in industry and beyond.
/web/2023/00-230105-7c

Deflecting Lightning with a Laser Lightning Rod

(University of Geneva, January 16, 2023)

Scientists from UNIGE, École Polytechnique, EPFL, hes-so and TRUMPF have developed a revolutionary new technology for lightning protection: the Laser Lightning Rod (LLR). It was tested on Mt Säntis in Switzerland and was able to deflect lightning over several dozen meters even in poor weather. Traditional lightning rods only protect a limited area around them, but the LLR works by generating channels of ionized air which guide lightning along its beam towards a metal rod. This allows for an unlimited extension of its height and can even pierce through clouds. The test on Mt Säntis showed that the lightning discharge followed the laser beam for up to 60 m. The LLR could be a game-changer for large facilities such as wind farms or airports which require effective lightning protection.
/web/2023/00-230116-33

Autonomously Collecting Environmental DNA With Drones

(WSL, January 18, 2023)

Researchers from ETH Zurich and WSL, together with company SPYGEN, have developed a drone that can autonomously collect samples from tree branches. Equipped with adhesive strips, the drone can measure the flexibility of the branch and adjust its flight maneuver accordingly. In tests on seven tree species, 21 distinct groups of organisms were found. The team are now preparing for a competition in Singapore and testing their device at the Zoo of Zurich's Masoala Rainforest. If successful, this project could greatly improve biodiversity research by allowing scientists to access previously inaccessible habitats and catalog species more accurately.
/web/2023/00-230118-c6

1. Policy

12th Consumer Barometer of Renewable Energy

(University of St. Gallen, December 01, 2022)

A new study from the University of St.Gallen (HSG) has revealed that Swiss citizens are increasingly considering renewable energy sources such as solar photovoltaics and heat pumps, due to the Russian war against Ukraine and energy crisis. 87% of so-called “Early Electrifiers”, a population segment that adopted these technologies rapidly, reported that most people in their social circles have a positive attitude towards these clean energy technologies. The majority of Swiss citizens also support policy measures taken by the Swiss parliament to improve conditions for hydro, wind, and solar power. These findings are important for understanding how consumers respond to global events and what kind of incentives or regulations would result in higher adoption rates for clean energy technologies.
/web/2022/01-221201-65

Barriers to Evidence Use for Sustainability

(eawag, December 02, 2022)

A project consortium made up of Eawag, ETH Zurich, the University of Bern, the Swiss Tropical and Public Health Institute, and the Research Institute of Organic Agriculture examined the use of scientific knowledge in policy and practice to promote sustainable plant protection, and the barriers to evidence use in sustainability. They identified three different actor models - truth-seeking, sense-making, and benefit-maximizing - and the obstacles each model faces as well as how each uses scientific evidence to further their goals. The study proposes a package of measures to overcome these obstacles, such as increased transparency and interdisciplinary cooperation, transdisciplinary research, and the public accessibility of data collected from public funds. Its ultimate goal is to initiate a general discussion on the barriers to evidence-based policy and practice.
/web/2022/01-221202-0a

Women's Suffrage: Better Level of Education, Fewer Weddings

(University of Basel, December 13, 2022)

A recent study by researchers at the University of Basel has retrospectively evaluated the effect of women's suffrage on their employment, education and family models, comparing women of the same age living in different cantons, who thus attained the right to vote at different times. It found that women who experienced suffrage at an earlier age were more likely to pursue gainful employment outside the home, attain higher levels of education, marry at a later age and even divorce more frequently. Men living in cantons with women's suffrage were also found to develop a more open attitude towards federal-level women's right to vote. However, no significant changes were found in terms of the share of seats held by the Social Democratic Party or in family policy issues such as child allowance.
/web/2022/01-221213-89

Federal Council Defines Measures for Sustainable Financial Center and against Greenwashing

(admin.ch, December 16, 2022)

The Swiss Federal Council has recently taken measures to ensure the sustainability of its financial center and prevent greenwashing. It outlined fifteen measures, including increasing transparency and encouraging investments that have a positive environmental impact. The Federal Council also specified that financial products or services should only be advertised as sustainable if they are compatible with at least one sustainability goal. A working group has been set up to examine how to implement this position efficiently. These measures demonstrate the commitment of the Swiss Federal Council to making Switzerland a leader in sustainable finance, which will help it remain one of the world’s leading locations for sustainable finance.
/web/2022/01-221216-2f

Federal Council Defines Measures for a Sustainable Financial Center

(Federal Council, December 19, 2022)

The Federal Council of Switzerland has released a report outlining measures to strengthen the Swiss Financial Center's leadership in sustainable finance. These fifteen measures, to be implemented between 2022 and 2025, will ensure the Swiss financial sector is compliant with the UN Sustainable Development Goals. They include improving transparency with new disclosure rules for climate compatibility, encouraging investments with positive social and environmental impact, and supporting global carbon pricing initiatives. Financial institutions are also urged to state on their websites the extent to which their dialogue with companies they invest in is compatible with sustainability goals. The report positions Switzerland as an early adopter of sustainable finance, showing its commitment to sustainable investments.
/web/2022/01-221219-2f

2. Education

University of Bern Joins European University Alliance ENLIGHT

(University of Bern, December 05, 2022)

The University of Bern recently joined ENLIGHT, a European University alliance of comprehensive, research-intensive universities. The alliance consists of nine universities from different countries, with the University of Bern being the first associated partner from Switzerland. The alliance seeks to create seamless mobility and knowledge creation between its members, and address societal challenges such as climate change and equity. The University of Bern is an ideal member for ENLIGHT due to its research focus and comprehensive range of courses. Swiss universities have been able to join European University alliances since 2022 and the State Secretariat for Education, Research and Innovation (SERI) supports such participation via Movetia, the Swiss agency for exchanges and mobility. Other Swiss universities have also joined various alliances.
/web/2022/02-221205-d5

Powering Vocational Education and Training with Technology

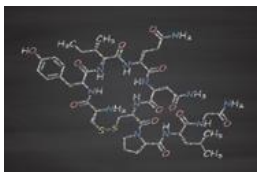
(EPFL, December 12, 2022)

EPFL and its partners have developed a series of digital technologies to revolutionize vocational training. Their online platform Realto and virtual reality tools allow students to simulate tasks that would be impossible in the real world. The team has also created interactive simulations, such as ChemLab, HeatingSim and PharmaSim, and WritingTutor, a customizable chatbot, to analyze argument quality. Their research has been used to inform federal vocational education policy and is shaping the future of vocational education. They are dedicated to developing more innovative tools that can be deployed in Swiss schools, and encouraging more VET teachers to embrace the potential of digital learning environments.
/web/2022/02-221212-c2

3. Life Science

New Sensor Developed to Detect Ocytocin in the Brain

(University of Lausanne, January 11, 2023)



A research team from the University of Lausanne and the University of Beijing has developed a new method to measure oxytocin levels in the brain. The study, published in Nature Biotechnology, uses a fluorescent sensor developed through biological engineering. Oxytocin plays an important role in regulating many physiological processes and instinctive behaviors. The sensor can measure both artificially evoked and endogenously produced oxytocin, and is able to measure oxytocin levels in real time. This could lead to new treatments for

psychiatric disorders, as it could help to better understand the role of oxytocin in the brain and how it can be used to treat mental health issues.
/web/2023/03-230111-40

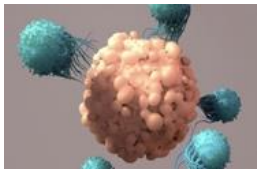
Bioinspired Nanosensors for Cancer Detection

(University of Fribourg, January 12, 2023)

The University of Fribourg has developed bioinspired nanosensors for rapid, sensitive and specific detection of cancer-derived biomarkers. These nanosensors could potentially open the way to a new generation of blood-based tests for early cancer detection and monitoring. The teams of Professor Curzio Rüegg (medicine) and of Professor Guillermo Acuna (physics) use a technique called DNA origami. A first project engineered book-shaped biosensors which can detect small RNAs (miRNA) specific for breast cancer in ten minutes with a low limit of detection. Another project utilises a nanoarray platform to detect up to four different miRNAs with single-base specificity. These results could lead to multiplexing and the ability to detect mutated DNA or mRNA, allowing for rapid, safe, simple and low-cost clinically applicable tests for cancer detection and monitoring.
/web/2023/03-230112-5a

Drug Combo Breaks Down Cancer Resistance to Immunotherapy

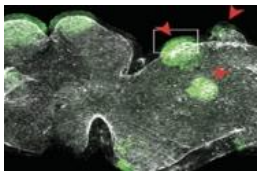
(EPFL, January 16, 2023)



In a breakthrough study, scientists from EPFL's Swiss Institute for Experimental Cancer Research, the Ludwig Institute for Cancer Research, the Lausanne University Hospital (CHUV), the Swiss Institute for Bioinformatics, and Roche have found a way to break down the resistance to immunotherapy of mice with neuroendocrine pancreatic cancer. The researchers, led by Douglas Hanahan's group at EPFL, combined a newly developed immunocytokine called PD1-IL2v with an immune checkpoint inhibitor anti-PD-L1, resulting in increased survival rates in tumor-bearing mice and producing a more sustained therapeutic effect than just the bispecific immunocytokine by itself. The combination improved therapeutic efficacy by reprogramming immunosuppressive tumor-associated macrophages and tumor vasculature to render the cancer easier to "detect" by immune cells.
/web/2023/03-230116-d9

How to Turn a Tentacle Into a Foot

(University of Geneva, January 17, 2023)



Scientists from the University of Geneva and the Friedrich Miescher Institute for Biomedical Research in Basel succeeded in modifying the structure and function of tentacle cells in Hydra. Led by Brigitte Galliot, Matthias Christian Vogg, and Charisios Tsiairis, they identified a key regulator of cell identity maintenance: the transcription factor Zic4. By reducing Zic4 expression by half, the researchers turned Hydra tentacle cells into food cells, forming functional feet on the animal's head. This process is called transdifferentiation. The researchers also discovered that transdifferentiated cells returned to the cell cycle, re-initiating the DNA synthesis process without going as far as mitotic division. These results provide new keys to understanding transdifferentiation. They could pave the way for new therapies to regenerate certain deficient cell types in humans.
/web/2023/03-230117-f1

EPFL Startup Develops System for Producing Blood Platelets On Demand

(EPFL, January 29, 2023)

EPFL startup HemostOD has developed a system to produce blood platelets on demand. Platelets are essential for blood clotting and are stored for only 4-7 days, making it difficult for hospitals to meet demand. The system uses anonymized stem cells to create universal platelets that can be administered to any patient. HemostOD is collaborating with Lausanne University Hospital, the University of Lausanne and the University of Geneva on an Innosuisse-funded project to demonstrate large-scale feasibility and test in clinical trials. The company recently completed a CHF 650,000 seed funding round and hopes to launch the system in 2027.
/web/2023/03-230129-d7

Antibodies Against Multiple Coronavirus Variants

(Universita della Svizzera Italiana, January 30, 2023)

Two PhD students from the Institute for Research in Biomedicine (IRB) in Switzerland, affiliated with USI, have discovered that some portions of the coronavirus spike remain unchanged through different strains, which they have termed “coldspots”. By analyzing samples from COVID-19 convalescent individuals, they found antibodies specific to these coldspots that blocked virus infection in laboratory experiments and protected from disease in preclinical models. The study, published in Science Immunology, suggests that it may be possible to develop countermeasures that are broadly effective against present and also future coronaviruses. This is an important step forward in the fight against the virus.
/web/2023/03-230130-7e

4. Nano / Micro Technology / Material Science

New Materials for the Computer of the Future

(PSI, December 09, 2022)

Researchers from the Paul Scherrer Institute (PSI) and the University of Minnesota are exploring a new technology that could revolutionize microelectronics. Their research focuses on transition metal oxides (TMOs), which have exotic properties and multifunctional phenomena. In a recent Communication Physics article, the Milan Radovic research group at PSI showcased remarkable progress in understanding the surface state electronic properties of barium tin oxide (BaSnO3). Combining optical transparency and high electrical conductivity, BaSnO3 could enable the development of optically capable microchips. This is a major advancement for microchip technology compared to current silicon-based models and could lead to transistors that can be switched with light.
/web/2022/04-221209-fb

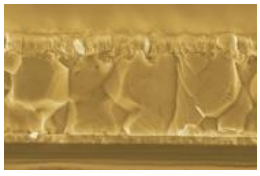
Gold-Based Passive Heating for Eyewear

(ETH Zurich, December 12, 2022)

Researchers from ETH Zurich have developed a gold nanolayer-based transparent coating that can convert sunlight into heat, providing a low-cost, energy-efficient solution for preventing fogging on glasses, car windshields, windows, and mirrors. Minuscule clusters of gold are set between two layers of protective titanium oxide and applied onto the glass surface. This thin, pliable coating is highly selective, absorbing only infrared radiation while being effectively transparent to visible light. The team is investigating potential applications of this coating, aiming to optimize its effectiveness. Its versatility, coupled with its low cost, make it a promising solution to antifogging and energy-efficient heated surfaces.
/web/2022/04-221212-bf

New Process Boosts Efficiency of Bifacial CIGS Thin Film Solar Cell

(Empa, December 14, 2022)



Empa researchers have developed a new low-temperature production process for bifacial thin film solar cells, resulting in record efficiencies of 19.8% for front and 10.9% for rear illumination. This is a huge breakthrough, as previous production methods capped at respectively 9.0% and 7.1% efficiency. The cells are composed of thin layers of copper indium gallium diselenide and a transparent electrical contact, allowing them to absorb light from both sides. This process drastically improved energy conversion efficiency, with potential to yield efficiencies beyond 33% in the future. The technology has the potential to reach 70% of the photovoltaics market share by 2030, according to the International Technology Roadmap of Photovoltaics.
/web/2022/04-221214-21

Plant-Based Insulation Material Doubles as CO2 Sink

(Empa, January 27, 2023)

Researchers at Empa are developing a novel type of insulation material from plant-based raw materials or waste products that can permanently bind the CO2 it contains. This "biochar" serves as insulation in construction, and then when the building is deconstructed, it can later be used in agriculture to increase soil fertility. The idea has been supported financially by various funding institutions, such as the Minerva Foundation, ETH Board and SFOE. If successful, this could save a half million tons of CO2 equivalents annually and correspond to over one percent of Switzerland's total greenhouse gas emissions. The project is still in development but has great potential for reducing the ecological footprint of buildings.
/web/2023/04-230127-a7

Neuro-Chip to Manage Brain Disorders

(EPFL, January 30, 2023)

A revolutionary new neural chip has been developed by two EPFL research teams to manage brain disorders, especially Parkinson's and epilepsy. Named NeuralTree, the device has a 256-channel high-resolution sensing array and an energy-efficient machine learning processor. It works by extracting neural biomarkers – patterns of electrical signals associated with certain neurological disorders – from brain waves, classifying them and activating a neurostimulator to block symptoms. Its efficient design and data processing capabilities make it better than current systems. The creators are looking into further enhancements to make the chip more intelligent, such as self-updating algorithms, which could revolutionize care for those with neurological disorders.
/web/2023/04-230130-bd

5. Information & Communications Technology

AI Enables More Effective Humanitarian Action

(EPFL, December 12, 2022)

Researchers from EPFL, ETH Zurich, the ICRC and Bin Khalifa University have developed AI-based tool Pomelo, which can generate population density estimates with unprecedented precision. This program uses public data from remote sensing systems, such as building counts, average building sizes, proximity to roads, road maps, and night lighting. It has been tested in several African countries, producing granular results over surface areas as small as one hectare with great accuracy. Pomelo has the potential to revolutionize the way humanitarian workers approach crisis or conflict zones, as accurate population data is essential for efficient distribution of resources. The AI-based tool can enable more effective and efficient aid, and a user-friendly version is planned for release by April 2023.
/web/2022/05-221212-c9

UrbanTwin: Seeing Double for Sustainability

(EPFL, December 19, 2022)

Scientists from five institutions have come together to develop a digital "Urban Twin" of the city of Aigle, using neural networks. Led by EPFL, the project also involves researchers from ETHZ, WSL, EMPA and EAWAG. The goal is to create a holistic tool to support decision-makers in achieving environmental goals such as the Energy Strategy 2050 and “sponge cities”. Neural networks will be used to model urban infrastructure such as energy, water systems, buildings, and mobility networks, and simulate its evolution under various climate scenarios. This open technology can be applied to other Swiss urban areas. UrbanTwin is an exciting opportunity for Swiss scientists to collaborate on cutting-edge research with potential for improved decision-making capabilities in regards to environmental sustainability.
/web/2022/05-221219-f5

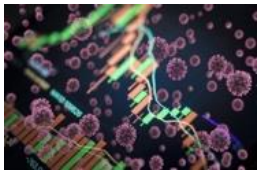
Integrated Photonic Circuits Could Close 'Terahertz Gap'

(EPFL, January 13, 2023)

Cristina Benea-Chelmus of EPFL's School of Engineering, along with colleagues at ETH Zurich and Harvard University, have developed a new thin-film circuit that produces finely tailorable terahertz-frequency waves when connected to a laser beam. This breakthrough opens up potential applications in optics and telecommunications. The chip, made of lithium niobate and etched at the nanometer scale, is extremely thin and can be integrated into existing electronic and optical systems. It allows for precise control over terahertz radiation. The device uses standard optical signals from lasers, making it compatible with existing telecommunications technology. It could also be used for spectroscopy and imaging as it is non-ionizing and much lower energy than other types of waves currently used for such purposes, as well as for quantum applications.
/web/2023/05-230113-bf

Detecting Higher-Order Phenomena in Real-World Data

(EPFL, January 18, 2023)



Researchers from EPFL, University of Geneva, Central European University and CENTAI Institute have developed a novel approach to network analysis that allows them to reveal and interpret interactions among multiple variables in time series data. This higher-order approach was applied to brain activity, stock price fluctuations and 20th-century epidemics datasets, detecting major features that could not be detected by standard pairwise statistics. For example, in the brain activity dataset the method was able to detect oscillations between chaotic and synchronized neural interactions. In the economic example, it was better able to distinguish between periods of financial stability and crisis. The complexity of the mathematical modeling grows exponentially with each added variable, so today's computing power is limited to five variables at most.
/web/2023/05-230118-63

Harnessing CERN's Machine Learning to Improve Self-Driving Cars

(CERN, January 25, 2023)

CERN and Swedish software company Zenseact have recently completed a three-year joint research project which could help autonomous driving cars make faster decisions. The collaboration aimed to use CERN's expertise in machine learning to make deep-learning techniques faster and more accurate for 'computer vision', which helps cars analyse and respond to their external environment. The same techniques can also be used to improve algorithmic efficiency in a wide range of domains including energy efficiency gains in data centres or cell screening for medical applications. This innovative research is an important step forward for autonomous driving technology, as it will allow self-driving cars to make better decisions quickly and safely – thus helping avoid accidents in the future.
/web/2023/05-230125-d5

6. Energy / Environment

New Method to Adaptively Adjust Emissions Reductions Path

(University of Bern, December 01, 2022)

A team from the University of Bern has developed a new method, the AERA (adaptive emissions reduction approach), for determining the necessary reduction in greenhouse gas emissions to meet the Paris climate agreement's 2°C goal. AERA uses observation data, such as global surface temperatures and CO2 emissions statistics, to determine an optimal emissions reduction path that is independent of model-based projections. The algorithm correlates emissions with rising temperatures and adjusts the emission path. The research suggests that in order to achieve the 2°C goal, global CO2 emissions would have to fall by 7% between 2020 and 2025, and for 1.5°C, a 27% reduction would be needed. The team hopes this new calculation method will be incorporated into international climate policy to effectively implement the Paris Agreement.
/web/2022/06-221201-3a

Security of Supply and Climate Neutrality by 2050

(Empa, December 13, 2022)

The Energy Future 2050 project, conducted by the Association of Swiss Electricity Companies VSE and Empa, has developed a unique database that simulates Switzerland's overall energy system up to the year 2050. It shows that achieving the energy and climate targets will require a massive acceleration in the expansion of renewable energies, a massive increase in energy efficiency, and focused conversion and expansion of the grids, as well as energy exchange with our European neighbors. Security of supply, grid expansion and reconstruction, and the addition of storage facilities are also needed. Without these efforts, it will be impossible to reach the energy and climate targets by 2050. VSE emphasizes the need to declare security of supply a national interest and to remove all hurdles in order to achieve the targets.
/web/2022/06-221213-77

Over 80% of Glaciers Worldwide Could Disappear by 2100

(WSL, January 09, 2023)

A new study published in Science has revealed that two out of three glaciers worldwide could disappear by 2100, depending on the success of efforts to curb the climate crisis. The research team used an unprecedented amount of data to create their model, accounting for different types of glaciers. Even in a best-case, low-emissions scenario, over 25 percent of glacial mass will be gone and nearly 50 percent of glaciers by number are projected to disappear. The team noted that it would take between 30 and 100 years for emissions to be reflected in glacier mass loss rates. Smaller glacial regions like Central Europe and Western Canada and the US will be disproportionately affected by temperatures rising more than 2° C.
/web/2023/06-230109-b3

Ozone Layer on Track to Recover Within Four Decades

(admin.ch, January 11, 2023)

The UN-backed Scientific Assessment Panel to the Montreal Protocol on Ozone Depleting Substances quadrennial assessment report confirms the phase out of nearly 99% of banned ozone-depleting substances. If current policies remain in place, the ozone layer is expected to recover to 1980 values by around 2066 over the Antarctic, 2045 over the Arctic and 2040 for the rest of the world. The panel also examined the potential effects of stratospheric aerosol injection (SAI) on ozone. The Montreal Protocol has been a true champion for the environment, showing us what can and must be done to transition away from fossil fuels and reduce greenhouse gases.
/web/2023/06-230111-56

Robust and Flexible Reactor for Synthetic Methane

(Empa, January 17, 2023)

Researchers from Empa have developed a new reactor concept for the production of synthetic methane, a carbon-neutral energy carrier. The process of sorption-enhanced methanation involves adsorbing the water produced during the reaction on a porous catalyst support, leading to pure methane as a product. This new concept is more flexible and stable than previous processes and has potential for energy savings due to its lower pressure requirements and lack of hydrogen separation and recirculation. If implemented, this could be a major step forward in achieving a successful energy transition with fewer CO2 emissions, as renewable energy can be made transportable and storable in the long term.
/web/2023/06-230117-c7

Tracing the Flow of Water with DNA

(University of Basel, January 20, 2023)

Dr. Oliver S. Schilling studied the hydrological cycle of Mount Fuji, Japan. His research combined environmental DNA analysis with the evaluation of other natural tracers to study the flow of groundwater beneath the mountain and its relationship to the pristine springs aboveground. His team found evidence of deep groundwater sources and systematic deep circulation of the water within the mountain. These findings are crucial for understanding complex groundwater systems and for implementing sustainable water management policies. They could help shield regions from seasonal water shortages.
/web/2023/06-230120-f9

Boosting Efficiency of Renewable Energy Storage with High-Temperature Electrolysis

(Ostschweizer Fachhochschule, January 23, 2023)

Scientists from the OST - Ostschweizer Fachhochschule and the EPFL in Sion have collaborated to increase the efficiency of renewable energy storage in synthetic fuels from 50% to nearly 70%. Lead by Luca Schmidlin from IET Institut für Energietechnik, the team has developed a high temperature electrolysis process that uses excess heat from the methane synthesis process to generate steam for electrolysis. This increases the overall efficiency of converting renewable electricity into methane gas, a key component of synthetic fuels. The results of this research could have a significant impact on the economic feasibility of renewable energy storage, helping to make it more widely available.
/web/2023/06-230123-9a

7. Engineering / Robotics / Space

ALICE Estimates How Transparent the Milky Way Is to Antimatter

(CERN, December 12, 2022)

The international ALICE collaboration from CERN recently determined that light atomic antimatter nuclei can traverse the Milky Way without being absorbed. This would help experiments such as those onboard the International Space Station and the upcoming GAPS balloon mission in their search for these nuclei, potentially emitted from dark matter. The ALICE team measured the rate at which antinuclei are absorbed by normal matter and then ran simulations to determine how well these particules can traverse the Milky Way. The simulations suggested a transparency of 50% for dark matter emitted nuclei and up to 90% for cosmic-ray collisions. Searching for light antimatter nuclei from outer space could be the key to understanding dark matter, and ALICE's findings open up a new window into cosmic phenomena.
/web/2022/07-221212-15

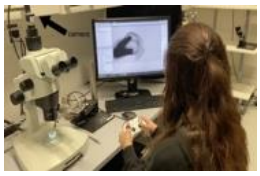
Ornithopter: Winged Robot That Can Land Like a Bird

(EPFL, December 21, 2022)

Scientists from EPFL have developed a new robotic ornithopter that can autonomously land on a tree branch. The robot, developed by postdoctoral fellow Raphael Zufferey, weighs 700 grams and is equipped with an on-board computer, navigation system, and finely calibrated leg-claw appendage. This allows it to detect, slow down for, and firmly grasp the perch without expending any energy. The breakthrough marks a major step forward for flapping-wing robots, which can now do more than just free flight. In the future, this technology could be used for collecting biological samples or measurements from trees or even land safely on artificial structures. It also could be used to provide an efficient way for ornithopters to recharge their batteries using solar energy and carry out long-range missions.
/web/2022/07-221221-0a

Robotic Microsurgeon Reveals How Embryos Grow

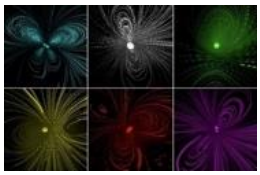
(EPFL, January 10, 2023)



At EPFL, researchers have developed a robotic microsurgery platform that can perform high-precision dissections to advance our understanding of embryonic development. Led by Andy Oates and Selman Sakar, the platform is compact, high-resolution, and dexterous. Ece Özelçi, the iPhD candidate on the project, trained in both robotics and developmental biology. Using the platform, Özelçi was able to target precise regions of zebrafish embryos and remove their elongating tails for explanting. This revealed unexpected behavior of the embryo's notochord. The researchers hope that this work will lead to advances in tissue engineering as robot-assisted microsurgery increases throughput, precision, and repeatability while democratizing complex procedures.
/web/2023/07-230110-ff

Precision Arm for Miniature Robots

(ETH Zurich, January 16, 2023)



ETH Zurich scientists have developed a new device that combines conventional robotics and microfluidics. Led by Professor Daniel Ahmed, the team has created an ultrasonically actuated glass needle that can be attached to a robotic arm. This allows them to pump and mix minuscule amounts of liquid and trap particles. The device comprises a thin, pointed glass needle and a piezoelectric transducer that causes the needle to oscillate. The device allows them to mix tiny droplets of highly viscous liquids, pump fluids through a mini-channel system, and trap fine particles present in the fluid. The team believes their device could be used for a variety of tasks in microrobotic and microfluidic applications, such as laboratory analysis, sorting tiny objects, introducing DNA into individual cells, and additive manufacturing and 3D printing.
/web/2023/07-230116-06

James Webb Space Telescope Identifies Origins of Icy Building Blocks of Life

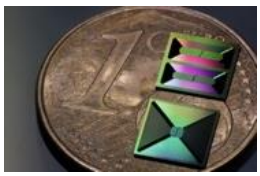
(University of Bern, January 25, 2023)

An international research team, including the Center for Space and Habitability at the University of Bern and the National Centre of Competence in Research PlanetS, has discovered the deepest and coldest ice ever detected in an interstellar molecular cloud. Using the James Webb Space Telescope, they were able to identify a wealth of ices, including simple ices such as water, carbon dioxide, carbon monoxide, and methane as well as more complex organic ices like methanol. They also found that the amount of elements crucial to life (carbon, hydrogen, oxygen, nitrogen and sulphur) in the ices was less than expected. This suggests that these elements could be trapped in other forms such as rocky dust particles. The discovery provides astronomers with new insights into the icy components that could form planets and eventually lead to life.
/web/2023/07-230125-0f

8. Physics / Chemistry / Math

Photonics Chip Allows Light Amplification

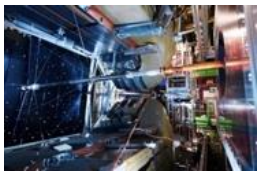
(EPFL, December 01, 2022)



Scientists from EPFL, led by Prof. Kippenberg and Dr Riemensberger, have developed a breakthrough photonic chip-based continuous-travelling-wave parametric amplifier. Their research focused on the development of a traveling-wave amplifier based on a photonic integrated circuit operating in the continuous regime. It used an ultralow-loss silicon nitride photonic integrated circuit more than two meters long to build the first traveling-wave amplifier on a photonic chip. This new chip, 3x5 mm2 in size, operates in the continuous regime and provides 7 dB net gain on-chip and 2 dB net gain fiber-to-fiber in the telecommunication bands. This breakthrough is important as it enables the amplification of optical signals contained in optical fibers and can be used in optical communication and laser-based technologies such as LiDAR.
/web/2022/08-221201-3e

LHCb Brings Leptons Into Line

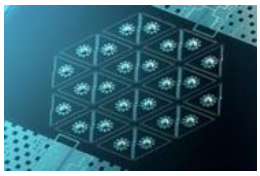
(CERN, December 22, 2022)



The LHCb collaboration has announced new particle decay measurements which provide the highest-precision test yet of lepton flavor universality; a key property of the Standard Model. The analysis is in excellent agreement with the prediction and indicates that there is no evidence of new particles or forces. This result supersedes previous findings of anomalies, that had led to cautious excitement among physicists that a more fundamental theory might be discovered at the LHC. The upgraded LHCb, now collecting data for Run 3, will allow for even higher-precision tests of rare decays, exploring anomalies in lepton flavor universality, differences between matter and antimatter, and new hadrons. These tests may help uncover exciting new physics that could provide insight into the Standard Model's flavor structure.
/web/2022/08-221222-3f

Optomechanics Simulates Graphene Lattices

(EPFL, December 26, 2022)



A team of scientists from EPFL's Laboratory of Photonics and Quantum Measurements have created the first superconducting circuit optomechanical graphene lattice. Led by Prof. Tobias Kippenberg and first author Amir Youssefi, the breakthrough overcomes the challenges of scaling quantum optomechanical systems. Cavity optomechanics can allow precise control of mesoscopic objects, and theoretical studies have predicted that richer physics and novel dynamics can be accessed in optomechanical lattices. The team's measurements closely match the theoretical predictions, providing a route towards novel hybrid quantum systems when combined with superconducting qubits. This could lead to new insights into quantum mechanics and topological phenomena.
/web/2022/08-221226-53

Polymer Fluorescent Inks with Security and Solar Power Applications

(ETH Zurich, January 04, 2023)

Researchers from ETH Zurich and RMIT University have developed a new approach for producing fluorescent inks. Using artificial intelligence algorithms, the team has achieved a range of colors, including red, which was previously difficult to produce. The inks have potential applications for banknotes, certificates, data encryption and OLED displays. The color-changing property can be used for security features; an initially red ink that turns blue after prolonged UV illumination has been demonstrated. Led by Yinyin Bao, the research team hopes their work will lead to more efficient production methods of fluorescent dyes with useful applications across industries.
/web/2023/08-230104-12

Ultrafast Control of Spins in a Microscope

(EPFL, January 30, 2023)

EPFL researchers led by Prof. Carbone, Dr. Tengdin, Dr. Sapozhnik and PhD student B. Truc have made a breakthrough in the field of spintronics. By using sequences of laser pulses within a femtosecond time frame, they were able to control and visualize the rotation of electron spins in Cu2OSeO3, a selenium-copper mineral, at the fastest speed ever achieved. They also imaged these spin changes using transmission electron microscopy. This breakthrough has huge implications for the fundamental aspects of spintronics as it offers a new protocol for controlling magnetic textures at ultrafast timescales. It could be used to create low-consumption ultrafast devices such as new types of memories, logic gates and high-precision sensors. This could lead to faster and more efficient information storage devices with improved accuracy and precision.
/web/2023/08-230130-99

9. Architecture / Design

Chip Lets Scientists Study Biocement Formation in Real-Time

(EPFL, December 05, 2022)

A team of EPFL and University of Lausanne scientists, led by Ariadni Elmaloglou and Dimitrios Terzis, used a chip the size of a credit card to study the properties of biocement formation. The chip, with a flow channel as thin as a human hair, was used to observe the formation of minerals in various sand mixtures. The researchers injected variations of biocements into one end of the channel and, with the help of time-lapse microscopy, observed the solution's behavior over several hours. This technology enables them to examine which mixtures can lead to superior mechanical properties across the length of the flow path. Potential applications of biocement include crack repair, carbon storage, and soil remediation, as it can be produced cheaply and at ambient temperature.
/web/2022/09-221205-68

Chalets Provide Insight Into Our Relationship With Mountains

(EPFL, December 07, 2022)

Dr. Patrick Giromini's book, "Transformations silencieuses: Etude architecturale du bâti alpin" explores the societal construct established in the 18th century that has largely shaped our relationship with mountains and chalets. His research draws attention to the importance of respecting local norms when renovating disused structures, while advocating against the glorifying and museum-ifying of Alpine villages. Giromini's insights are invaluable for understanding the relationship between humans and mountains, and for developing sustainable approaches to mountain habitat construction. He encourages us to think critically about current trends and be conscious of the economic and philosophical implications of our development practices.
/web/2022/09-221207-c4

"Google Earth on Steroids" Boosts Urban Development

(EPFL, December 13, 2022)

Uzufly, an EPFL spin-off company, has developed an innovative urban planning tool that combines aerial imaging with 3D models of digital twins. Using drones, thousands of aerial photographs are captured and turned into 3D models that can incorporate data such as land plots, zoning areas, and even underground infrastructure or solar power generation capacity. This technology is useful for city officials to evaluate the compatibility of new buildings with existing neighborhoods, as well as for research in archeology and architecture. Uzufly's pioneering approach is revolutionizing the way we plan our cities, and the company has partnered with several EPFL labs to conduct joint R&D projects. This is an invaluable tool for urban planners and city officials to ensure that expansionary projects are compatible with existing neighborhoods.
/web/2022/09-221213-cb

10. Economy, Social Sciences & Humanities

Conflicting Motives Govern Sense of Fairness

(University of Zurich, December 05, 2022)

A research team from the University of Zurich led by neuroeconomists Jie Hu and Christian Ruff examined people's perception of justice in resource distribution. Using fMRT to measure brain activity, they examined the responses of participants to a variety of scenarios involving resource redistribution. They found that people have an aversion to inequality, but are reluctant to harm others or disrupt existing social hierarchies: participants in the study were willing to make someone financially worse off in order to reduce inequality, but not to the point

of making the initially advantaged person worse off than the other. The study suggests that inequality may be more accepted in unequal societies, as it is perceived as less damaging to the status quo.
/web/2022/10-221205-60

Beyond Marketing – Are Aid Organizations With Quality Seals More Trustworthy?

(University of Basel, December 06, 2022)

Dr. Alice Hengevoss and Professor Georg von Schnurbein, of the University of Basel, studied the effectiveness of self-regulatory initiatives and quality seals employed by international aid organizations. Their research showed that these initiatives increased transparency and enabled NGOs to more closely examine their strategies. It also found no evidence of these seals being mere marketing tools or outright bogus. Platforms created by associations fostered interaction between organizations, enabling them to share best practices. These self-regulation initiatives are essential, especially during Christmas when charities receive a large influx of donations. Lack of transparency can make people hesitant to donate and hinder money from reaching those who need it. By increasing transparency, donors can be assured that their money is going to the right place.
/web/2022/10-221206-3b

Environmentally Aware Employees Drive Innovation

(University of St. Gallen, December 13, 2022)

This study, conducted by an international team of researchers led by Stephanie Rüegger and Maximilian Palmié from the University of St. Gallen, investigates the relationship between an employee's private environmental orientation and their economic performance in the workplace. Through analysis of 283 hospitality industry employees, the researchers found that an environmentally friendly attitude had a positive correlation with the economic performance of their respective companies, resulting in increased innovation, commitment, and proactivity from the employees. The findings of this study, published in the Journal of Business Research, provide the first step in understanding the links between ecological or social attitudes and economically valuable employee behavior. In light of this, managers should incentivize and reward employees for having environmentally friendly attitudes to reap the maximum economic benefits.
/web/2022/10-221213-fa

Ecological Risks to be Given More Consideration in Global Financial Flows

(admin.ch, December 22, 2022)

SECO has announced a CHF 5 million funding package for the NatureFinance project, which aims to encourage financial institutions in developing countries to consider ecological opportunities and risks when making decisions. The project will focus on Peru, Colombia, South Africa and Indonesia. NatureFinance will develop instruments and methods to assess ecological risk and provide training on how to use them. This should increase cash flow to sustainable sectors and companies while also providing the basis for establishing global standards. The project is an important step towards protecting biological diversity and creating new incentives for its preservation.
/web/2022/10-221222-32

Immediate Uptick in Investment Needed to Reach Net Zero

(ETH Zurich, January 09, 2023)

A new meta-study conducted by ETH Zurich researchers Bjarne Steffen and Lena Klaaßen, published in Nature Climate Change, found that Europe must dramatically increase its investments in climate-relevant infrastructure over the next two years to reach an annual investment of 302 billion euros in order to reach its goal of net-zero greenhouse gas emissions by 2050. This includes 75 billion euros annually for solar and wind power plants, 40 to 60 per cent additional financial flows for the expansion of distribution networks and the railway, and a 70% reduction in investment required in conventional power plants. To expedite this increase in capital,

political measures should be tailored to funding in those sectors where there is the greatest need for investment. Immediate action must be taken if this target is to be achieved.
/web/2023/10-230109-e8

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

FIF Funding Boosts Geneva's Start-Ups for UN SDGs

(startupticker.ch, December 09, 2022)

Five companies in Geneva have received grants and seed loans from the Fongit Innovation Fund (FIF) ranging from CHF 50,000 to CHF 100,000. The three grant loan recipients are In-Teeth Technology, Planeto and RefFIT; the two seed loan beneficiaries are Multiwave Technologies SA and Beekee Sarl. All five were chosen for their potential to positively impact the UN Sustainable Development Goals, and their innovative approaches to global issues. In-Teeth Technology is transforming patient experience, Planeto is accelerating energy transition, RefFIT provides software for the material industry, Multiwave Technologies SA is developing medical imaging technologies, and Beekee Sarl produces preloaded educational content. Through this funding, the FIF is helping Geneva's startups and making a major impact.
/web/2022/11-221209-d4

Swiss Start-Ups: Pioneers in Sustainability

(startupticker.ch, December 09, 2022)

The Swiss startup scene is exploding, with sustainability start-ups at the forefront. In fact, no other country has more sustainability start-ups than Switzerland when considering population size. This success can be attributed to the country's strong innovation ecosystem and venture capital investment which has grown from CHF 200 million to CHF 600 million in 2019. This also saw the proportion of sustainability start-ups in all technology and science-based start-ups increase from 4% to almost 10%. Startup founders have access to leading universities and companies, which has allowed them to develop innovative projects such as meat substitute products and AI platforms for resource saving agriculture. It is inspiring to see Switzerland taking proactive steps towards establishing a more sustainable way of living through the help of innovative startups.
/web/2022/11-221209-d0

10 Swiss Startups Selected for Mobile World Congress

(VentureLab, December 12, 2022)

Ten Swiss startups have been chosen to represent the country's innovation at the Mobile World Congress in Barcelona next year. The 10 Venture Leaders Mobile 2023, chosen by an expert jury, will attend the 4YFN startup conference and be given a booth to network with investors, industry leaders and potential clients. The startups selected, Almer Technologies AG, Fusion Lab Technologies Sàrl (biped.ai), Futurae Technologies AG, MinWave Technologies SA, MPower Ventures AG , NEXTLENS Switzerland AG, Resilio SA, Sleepiz AG, Swiss Vault AG and xFarm Technologies SA, provide innovative solutions in areas such as cybersecurity, digital health and mobile components. This is an incredible opportunity for them to expand their international presence.
/web/2022/11-221212-d1

Sustainable Startups Receive Venture Kick Funding

(Venture Kick, December 28, 2022)

Three Swiss startups have been awarded CHF 40,000 from Venture Kick to develop innovative solutions for a more sustainable future. Gaia Technologies has developed an upcycling method to recover bio-compounds from agricultural sidestreams and transform them into clean-label ingredients. Impossible Materials has created a cellulose white pigment to replace titanium dioxide as a safe and sustainable alternative in health-sensitive sectors. SolidWatts is developing high-power industrial-grade radio frequency and microwave heating based on Solid-State Amplifier (SSA) technology for various industries, helping integrators transition away from fossil fuels while saving more than

100 Megatonnes of CO2 per year. These startups are leading the way in developing solutions that can help accelerate the transition towards a greener tomorrow.
/web/2022/11-221228-b9

26 New ETH Spin-Offs Founded in 2022, Raising 1.2 Billion Swiss Francs

(ETH Zurich, January 10, 2023)

ETH Zurich is home to a thriving spin-off ecosystem, with 26 new spin-offs launched in 2022 alone. These businesses span a wide variety of industries, from IT and communications technology to healthcare and sustainability. The total funding raised by ETH spin-offs in 2022 was an impressive 1.2 billion Swiss francs. Three ETH spinoff companies also reached unicorn status this year, celebrating a market value above 1 billion USD before going public. These three companies are Scandit, which enables fast scanning even under difficult conditions, Southpole, which helps companies lower their carbon footprint, and Climeworks, dedicated to carbon capture. At the heart of ETH's spin-off success is a commitment to encouraging students to pursue their ideas and bring them to market.
/web/2023/11-230110-53

12. General Interest

55 Million Euros to Develop the Public Transport of the Future

(University of Geneva, December 22, 2022)

The University of Geneva (UNIGE) is part of a new European consortium, ULTIMO, which is developing an autonomous public transport service in three pilot cities, including Geneva. The project, with a budget of 55 million euros, will deploy fifteen driverless electric minibuses in Geneva from 2025. The consortium brings together twenty-three partners from eight European countries, including eight Swiss partners. The project is led by Deutsche Bahn AG and could revolutionize mobility in Europe by providing door-to-door, on-demand 24-hour transport, reducing costs, and avoiding queuing and congestion.
/web/2022/12-221222-d5

Remembering a Pioneer of High-Temperature Superconductivity

(UZH, January 17, 2023)

K. Alex Müller, Nobel Prize laureate and physicist, passed away in Zurich at the age of 95. He was best known for his revolutionary discovery of the first high-temperature superconductor in 1986 with J. Georg Bednorz, which earned them the Nobel Prize in Physics in 1987. Born in Basel in 1927, Müller studied earned his doctorate from ETH Zürich in 1958. He then joined IBM as a Fellow in 1963 and was appointed privatdozent at UZH in 1962 and adjunct professor in 1970. In 1987, he was appointed full professor of solid-state physics. Müller's discovery of high-temperature superconductors has had a lasting impact on the field of solid-state physics and enabled many practical applications. He will be remembered for his pioneering work and commitment to science.
/web/2023/12-230117-11

13. Calls for Grants/Awards

CHF3.1 Million in Funding for New Research Projects at PSI

(PSI, December 21, 2022)

Zurab Guguchia and Kirsten Schnorr have both been awarded SNSF Starting Grants to pursue research projects in solid-state physics and physical chemistry. Their grants will be used to investigate quantum mechanical properties of multi-layer solids, and ultrafast X-ray-induced chemistry of solvated nanoparticles and molecules respectively. Two other scientists were also awarded grants: Max Zoller's project will use theoretical particle physics to develop new methods and automated tools for high-precision predictions at the Large Hadron Collider. Tomáš Bzdušek's project will explore new types of topological matter. Thanks to the SNSF initiative, these talented researchers at the Paul Scherrer Institute and University of Zurich can carry out innovative projects.
/web/2022/13-221221-65

2023 Watt d'Or Award Winners

(admin.ch, January 13, 2023)

The Swiss Federal Office of Energy has announced the winners of the 2023 Watt d'Or awards, recognizing excellence in the energy field. The jury selected four projects from a pool of 39 applicants, each representing a different category: energy technologies, renewable energies, energy-efficient mobility and buildings and spatial development. The winning projects are Lugaggia Innovation Community, Limmattaler Regiowerk Limeco, 3S Swiss Solar Solutions AG, EVTEC AG and Solskin. Additionally, Refugees go Solar was awarded a special jury award for bridging the gap between refugees and the Swiss solar industry. The Watt d'Or is an important platform to showcase and promote excellence in energy technology. It is not endowed with any prize money but instead serves to recognize innovative products and services in the energy sector.

Upcoming Science and Technology Related Events

Annual European Life Sciences CEO Forum
March 1-2, 2023
https://is.gd/OZ7o3d
Life Sciences, Partnering, Investments
Zurich

World IA Day
March 3-4, 2023
https://is.gd/a3unUD
Information Architecture, User Experience
Zurich

IFZ FinTech Conference 2023
March 8, 2023
https://is.gd/H0BlJ1
Financial Innovation
Rotkreuz

Voxxed Days
March 16, 2023
https://is.gd/z3UQO5
Technology, Innovation, Networking
Zurich

21th Swiss Photovoltaic Conference
March 20-21, 2023
https://is.gd/YhYkBq
Energy, Sustainability, Solar
Bern

START Summit
March 23-24, 2023
https://is.gd/eG8Miv
Startups, Investors, Networking
St-Gallen

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