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Science-Switzerland, April – May 2024

News on Swiss science, technology, education and innovation

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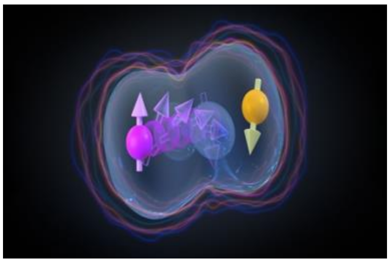
First Two-qubit Gate Achieved in a Silicon Transistor

(University of Basel, May 08, 2024)



Dr. Andreas Kuhlmann and his team at the University of Basel and NCCR SPIN: Spin Qubits in Silicon have achieved the first controllable interaction between two hole spin qubits within the configuration of a conventional silicon transistor. This research remarkably took place within the structure of electronic devices known as "FinFETs," which are at the heart of current smartphone technology and produced in widespread industrial processes. The successful demonstration of controllable qubit interaction opens up vast potential for integrating millions of qubits on a single chip, without the requirement of any extraneous components like micromagnets. The development is instrumental in developing practical, large-scale quantum computers, particularly since reliable, rapid storage, and processing of information are key to the functionality of qubits within these systems.
/web/2024/00-240508-41

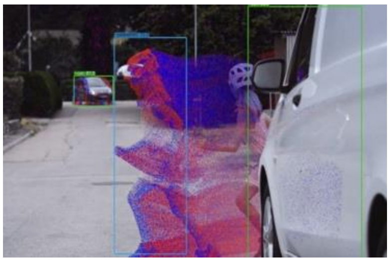
Revolutionary non-invasive Device Enhances Mobility of Tetraplegic Patients

(RTS Info, May 21, 2024)

EPFL based startup ONWARD Medical has made a significant advancement in restoring partial limb control in individuals with tetraplegia. Conducted on around 40 patients globally, their research, led by Dr. G. Courtine, has shown promising outcomes, with nearly three-quarters of the participants experiencing notable improvements in their quality of life. The therapy focuses on using electrodes to decode and enhance limb control. The system is non-invasive as it places a device on the skin rather than implanting electrodes surgically. ONWARD Medical is now awaiting safety approval and could start commercializing its device in 2025.
/web/2024/00-240521-14

Bio-inspired Cameras and AI Revolutionize Autonomous Driving

(University of Zurich, May 30, 2024)



Researchers at the University of Zurich, led by Prof. Dr. Davide Scaramuzza and Daniel Gehrig, have achieved a significant breakthrough in the field of computer vision and artificial intelligence. Their pioneering work combines a novel bio-inspired camera known as event cameras with AI, enabling 100 times faster detection of pedestrians and obstacles compared to current automotive cameras. This innovation leverages the unique capabilities of event cameras, which mimic human vision by recording data every time they detect fast movements. By doing so, they eliminate blind spots between frames, allowing for quicker obstacle detection. The researchers combined the strengths of the event camera with a color camera and trained an AI algorithm to process this data. This breakthrough is crucial for enhancing the safety of automotive systems and self-driving cars without requiring substantial increases in data and computational power.
/web/2024/05-240530-67

2. Education

Sharp Rise in the Number of PhD Students at Swiss Universities

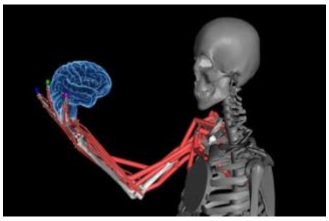
(SRF, May 10, 2024)

Over the past 20 years, the number of PhD students in Switzerland has increased by a whopping 72%, with universities awarding over 4600 doctoral degrees in 2022 alone. Among them, a rising percentage of these individuals are women and international students. Women now constitute nearly 49% of PhD students, a significant growth of 21% since the early 1990s. This rise reflects the consistent efforts made by Swiss universities to encourage women's participation in academia, inevitably leading to a higher number of women earning doctorates and remaining in the academic world. However, universities recognize the importance of further improving support systems, such as childcare facilities and promoting a better work-life balance for students, to maintain this gender-balance momentum.
/web/2024/02-240510-bb

3. Life Science

How the Brain Senses Body Position and Movement

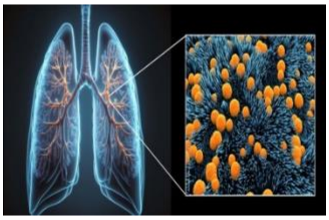
(EPFL, April 08, 2024)



EPFL researchers Dr. Alessandro Marin Vargas, Axel Bisi, and Alberto Chiappa have made a significant advancement in predicting how the nervous system senses body position and movement. The research used muscle spindle signals in the upper limb to train thousands of neural network models on computational tasks related to the proprioceptive pathway. Crucially, models focused on predicting limb position and velocity proved most effective, offering key insights into the computational principles behind sensory processing. This study pioneers new territory in neuroscience, highlighting the potential use of task-driven modeling and paving the way for advancements in neuroprosthetics.
/web/2024/03-240408-0f

Unveiling the Persistence of Infections in Cystic Fibrosis

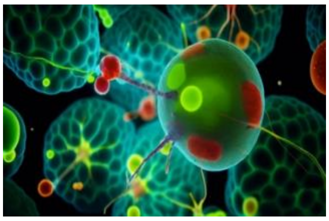
(University of Geneva, April 10, 2024)



A team at the University of Geneva, including Prof. Dr. marc chanson and Dr. Mehdi Badaoui, have made a significant breakthrough in comprehending cystic fibrosis and the stubbornness of infections despite therapy. They determined that disruption in signaling pathways in diseased cells serves as hotspots for harmful docking stations. This discovery was made following an investigation into the way diseased cells react to inappropriate signals. The revelation holds considerable significance, harboring the potential to contribute to the development of a pharmaceutical compound that could restore balance in patients with cystic fibrosis. This not only enhances the efficacy of current therapies but also mitigates their side effects.
/web/2024/03-240410-08

A New Tool for Tracing the Family Trees of Cells

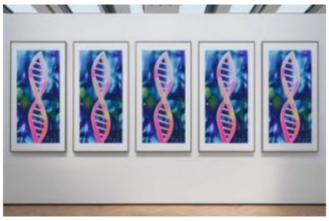
(EPFL, April 12, 2024)



Researchers at EPFL, under the leadership of Dr. Almut Eisele and Prof. Dr. David Suter, in collaboration with the Karolinska Institutet, have developed an inventive computational tool named Gene Expression Memory-based Lineage Inference (GEMLI). This tool discerns the lineage relationships between cells, eliminating the need for specialized lineage-tracing techniques. The research harnessed single-cell RNA sequencing data and takes snapshots of individual cell gene expressions. The tool enables the understanding of intricate processes within organism development from a single egg into a complex entity, and how disruptions can prompt diseases like cancer.
/web/2024/03-240412-67

Protecting Art and Passwords with Biochemistry

(ETH Zurich, April 15, 2024)



A team from ETH Zürich, headed by Prof. Dr. Robert Grass, and doctoral student Anne Lüscher, have developed a new method for counterfeit-proof certification. This system holds the potential to authenticate priceless artworks, keep track of raw materials, and verify industrial products. Their breakthrough lies in the use of polymerase chain reaction (PCR) and DNA sequencing in a one-way encoding function. It hinges on a pool of 100 million distinct DNA molecules, each comprising two randomly sequenced nucleotide segments. With these, they have developed a biochemical one-way function that encodes information in a way that cannot be decoded by algorithms, not even by one that runs on a quantum computer. This means top-notch security measures for a host of industries and certified authenticity for precious objects.
/web/2024/03-240415-c6

Video of the Formation of Human Cell Structure Created

(University of Geneva, April 16, 2024)

Dr. Marine Laporte and her team at the University of Geneva have achieved a notable first in cell imaging. Using expansion microscopy, the researchers have successfully reconstructed a video of the various stages in the formation of human centriole substructures. Examining over a thousand centrioles at different growth stages, the team has been able to document the assembly of the human centriole like never before. This finding deepens our understanding of centriole formation, and may lead to significant implications across various scientific fields.
/web/2024/03-240416-d9

Tropical Forests Cannot Recover Naturally Without Fruit Eating Birds

(ETH Zurich, April 16, 2024)

A study conducted spearheaded by Prof. Dr. Thomas W. Crowther, and his team at ETH Zürich, sheds light on the vital role of wild birds, particularly fruit-eating birds, in the regeneration of tropical forests. Their research illuminates a new, quantitative understanding of how these birds contribute to forest restoration, emphasizing their role in seed dispersal. The research emphasizes the role of birds in seed dispersal and how their movement in fragmented landscapes can reduce the potential of carbon recovery by up to 38%. Crucially, maintaining a minimum of 40% forest cover and a distance of less than 133 meters between forested areas ensures efficient bird movement and ecological recovery. Moreover, the diversity of bird species, and the different impacts they have in seed dispersal, is critical for the services provided by the ecosystem.
/web/2024/03-240416-5d

Corn Reduces Arsenic Toxicity in the Soil

(University of Bern, April 18, 2024)

A study led by researchers Dr. Veronica Caggìa, Prof. Dr. Matthias Erb, and Prof. Dr. Adrien Mestrot from the University of Bern has made an exciting breakthrough in the field of environmental science. They discovered that benzoxazinoids, a specialized metabolite produced by corn plants, can significantly reduce arsenic uptake in both the plant and surrounding soil. Investigations involved growing both normal and mutant corn plants (which don't produce benzoxazinoids) in arsenic-contained soil. Results revealed that benzoxazinoid-producing corn effectively combated arsenic toxicity as compared to their mutant counterparts. Furthermore, these metabolites were seen to transform a particularly harmful form of arsenic, hinting at possible applications for environmental remediation.
/web/2024/03-240418-8b

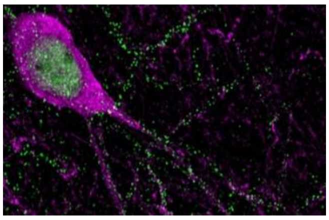
Biofortified Rice to Combat Deficiencies

(University of Geneva, April 19, 2024)

From the University of Geneva, lead scientist Professor Teresa Fitzpatrick and her team have made a breakthrough in food nutrition. Their research resulted in the increase of vitamin B1 content in the endosperm of rice, a significant leap compared to earlier attempts where advancements were limited to the leaves and bran. By generating crops that express a tailored gene, they were able to increase vitamin B1 directly within the ready-to-eat portion of rice grains. This advancement lends promise to real field conditions. Regulatory steps relating to biofortification via genetic engineering are needed before commercial cultivation can take place.
/web/2024/03-240419-5a

How the Brain Fine-tunes its Sensitivity

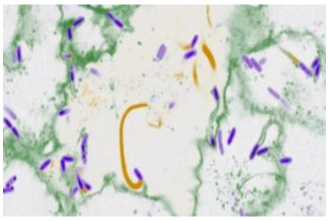
(University of Basel, April 23, 2024)



Researchers at the University of Basel, led by Prof. Dr. Peter Scheiffele, have uncovered a molecular mechanism helping the brain maintain a stable balance. Their breakthrough focuses on understanding how neuronal networks mediate the equilibrium between neural excitation and inhibition. The research, primarily conducted on mouse models and spearheaded by first author Dr. Zeynep Okur, reveals a feedback mechanism where highly excited neurons emit a protein, BMP2, signaling inhibitory neurons. This process strengthens new synapses, reducing network activity and finessing the sensitivity of neuronal circuits in the brain. This discovery provides influential implications for the treatment of epilepsy and several neurodevelopmental disorders, with the potential of triggering interventions in the BMP2 signaling pathway to regulate brain sensitivity.
/web/2024/03-240423-0b

Pathogen Uses Bacterial Nanomachine to Spread Undetected

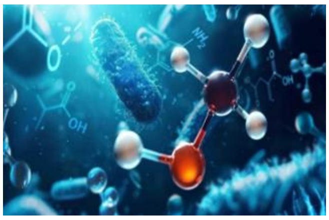
(University of Basel, April 23, 2024)



A team from the University of Basel, led by Prof. Dr. Marek Basler, has made an inspiring discovery on how the pathogen Burkholderia thailandensis remains undetected by our immune system. Their research centered on the type VI secretion system (T6SS), a bacterial nanomachine, key to the pathogen's stealthy spread. The scientists found that the pathogen uses T6SS to move undetected, efficiently spreading by inducing cell fusion and migrating from cell to cell. This research has significant implications for understanding Barbholderia's defense evasion strategies and its dissemination process, and it opens a new horizon to dig deeper into pathogens' survival tactics.
/web/2024/03-240423-bd

Engineering Bacteria to Produce Climate-Neutral Chemicals

(ETH Zurich, April 24, 2024)



A pioneering breakthrough in the sustainable production of industrial chemicals has been made by Prof. Dr. Julia V. and her team at the Eth Zürich - Institute Of Microbiology. The research demonstrates the capacity of a bacterium that feeds on methanol to synthesize various chemicals without emitting CO2. Vorholt and her team equipped bacteria that feed on methanol with additional genes to produce the desired chemical compounds. This biotechnological breakthrough could lead to decreased reliance on fossil fuels in industrial chemical production, dramatically reducing its ecological footprint.
/web/2024/03-240424-b0

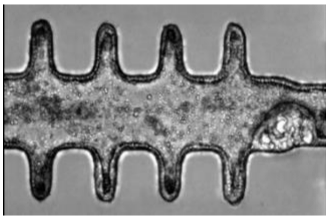
How Gut Microbiome Influences the Sleep Cycle of Newborns

(University of Fribourg, April 26, 2024)

Researchers Dr. Petra Zimmermann and Prof. Dr. Salome Kurth from the University of Fribourg, ETH Zürich, and Children's Hospital Lucerne, are exploring an innovative connection between symbiotics, the intestinal microbiota, and their potential impact on the sleep cycle and neurobehavioral development in children, both prematurely born and full-term. By administering symbiotics to a cohort of 380 children and comparing it with a placebo group, the Napbiome study aims to investigate the changing dynamics of microbiota in early development stages. Parents will be integral to the research by assisting via questionnaires and sample collections, followed by clinical evaluations of children at pivotal age markers.
/web/2024/03-240426-13

Mini colons Revolutionize Colorectal Cancer Research

(EPFL, April 26, 2024)



A major breakthrough in cancer research has been accomplished by scientists from EPFL, in collaboration with Roche's Institute of Human Biology. Led by Prof. Dr. Matthias Lutolf, and first authors Dr. Luis Francisco Lorenzo Martín and Tania Hübscher, the team created lab-grown miniature colon tissue that mirrors the complexity of colorectal tumors, providing a more accurate representation of how tumors form outside the human body. Employing a combination of microfabrication and tissue engineering techniques, these mini-colons mimic the physical structure and cellular diversity of actual colon tissue in both health and disease states. Moreover, they can be induced to develop tumors, using optogenetics, providing invaluable insight into cancer initiation and progression.
/web/2024/03-240426-8a

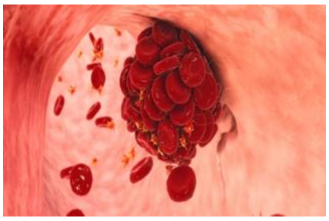
Curiosity Promotes Biodiversity

(University of Basel, April 26, 2024)

A scientific breakthrough led by Prof. Dr. Walter Salzburger from the University of Basel, working with Dr. Carolin Sommer-Trembo and Dr. Milan Malinsky from the University of Bern, has revealed a pivotal genetic variant influencing the exploratory behavior of cichlid fish in Lake Tanganyika. The researchers pinpointed the genetic trait near the gene cacng5b, which shows activity in the brain. Recording the behaviors of 57 cichlid species in experimental ponds on Lake Tanganyika's Southern shore, the study extends our understanding of how genetic personality traits can influence biodiversity. The research also showcases the use of artificial intelligence in predicting animal behavior based on genetic information.
/web/2024/03-240426-ba

Immense Potential in Africa for Genome Editing

(University of Fribourg, May 01, 2024)



A study led by an international team of scientists including Assistant Professor Thomas Auer of the University of Fribourg, highlights the untapped potential of genome editing in Africa. The lack of funding, infrastructure, and skilled workforce, along with regulatory uncertainties, restricts scientists from fully utilizing technologies such as the molecular scissors CRISPR-Cas9. Despite these challenges, Kenyan and Ethiopian scientists successfully engineered a sorghum variant resistant to the destructive plant parasite Striga. Greater inter-country collaboration, public-private partnerships, tax incentives, and investments in education and infrastructure can create productive avenues for broadening the use of genome editing.
/web/2024/03-240501-00

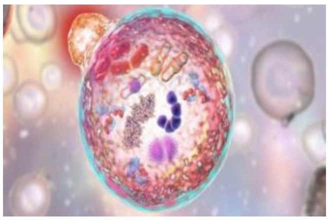
Breakthrough in the Biological Process of Muscle Regeneration

(University of Fribourg, May 02, 2024)

A study by Prof. Dr. Ania Jazwinska and first author Hendrik Oudhoff at the University of Fribourg has shed light on muscle regeneration using zebrafish as a model organism. Their research has identified a crucial signal, known as TOR (target of rapamycin), which is necessary to kickstart muscle regeneration. The importance of this study lies in the unparalleled insights it provides into human muscle regeneration potential, offering promising horizons for biomedical applications. Crucially, it also sheds light on fundamental differences in regenerative capabilities between humans and zebrafish.
/web/2024/03-240502-63

Advancing the Understanding of Cellular Processes for Disease Treatment

(University of Fribourg, May 10, 2024)



Researchers Alexandre Leytens, Michael Stumpe, and Jörn Dengjel from the Department of Biology at the University of Fribourg have made a significant breakthrough in cellular biology. Their innovative method accelerates and fine-tunes the evaluation of autophagy, a fundamental cellular process, paving the way for new insights into complex diseases like cancer, Alzheimer's, and diabetes. The breakthrough technique employs advanced mass spectrometry, monitoring the activities of 40 proteins involved in autophagy, and has the amplified potential to improve understanding of various diseases. This heightened precision and speed in evaluating cellular cleaning processes can guide developments for targeted medications and enhanced disease treatments.
/web/2024/03-240510-07

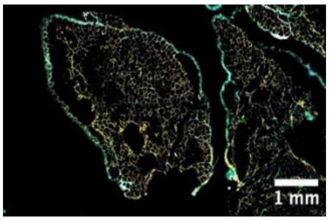
Portable DNA Analysis Device Lets Scientists Identify Plants out in the Field

(EPFL, May 15, 2024)

Researchers at EPFL, led by Nicolas Adam and involving Charlotte Alers and Ghali Jaidi, have created a portable DNA analysis device through their multidisciplinary project named GenoRobotics. This innovative technology promises swift and cost-effective identification of plant species directly in the field. This advancement is crucial for biodiversity preservation as it enables quick and reliable species identification and data collection, particularly in remote areas like Madagascar, where they are planning an expedition. Significantly, the project is conducted as open-source, facilitating broader impact and contributions to biodiversity preservation efforts worldwide.
/web/2024/03-240515-a0

New Cells Could Be Key to Treating Obesity

(EPFL, May 16, 2024)



Researchers led by Prof. Dr. Bart Deplancke at EPFL have made significant strides in obesity research. They uncovered a population of cells in the omentum, a large fatty-tissue hanging from the stomach, that inhibit the production of body fat, presenting a promising new pathway for obesity treatment. The team found certain cells in the human omentum that release a protein called IGFBP2, that helps stop the creation of fat cells. This discovery, funded by Fondation Leenaards, PHRT - Personalized Health and Related Technologies, and the Swiss National Science Foundation SNSF, could revolutionize obesity treatment by offering targeted therapies to modulate the behavior of specific fat deposits.
/web/2024/03-240516-86

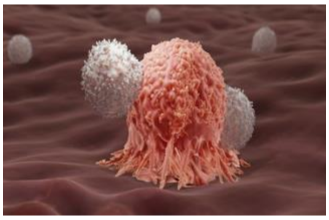
Time Matters in Cancer Immunotherapy

(University of Geneva, May 17, 2024)

Researchers from the University of Geneva and Ludwig Maximilian University of Munich, led by Prof. Dr. Christoph Scheiermann, have made a breakthrough in understanding the timing of immune responses in cancer. Their findings highlight that the effectiveness of biopsies and immunotherapies varies depending on the time of day, which could significantly influence patient diagnosis and treatment outcomes. The study emphasizes the importance of the circadian rhythm in immune cell activity, impacting how and when treatments should be administered. The research involved injecting mice with melanoma cells and analyzing tumors at different times of the day.
/web/2024/03-240517-87

How Immune Cells Recognize Abnormal Cells

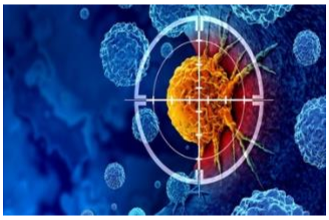
(University of Basel, May 22, 2024)



Researchers from the University of Basel and University Hospital Basel, led by Prof. Dr. Gennaro De Libero, have made a groundbreaking discovery in immunology. First author Dr. Alessandro Vacchini and the team have uncovered how immune cells known as MR1T cells can recognize and attack cancer cells by identifying chemically modified DNA and RNA building blocks on the surface of tumor cells. These molecules result from changes in specific metabolic pathways, allowing MR1T cells to distinguish cancer cells from healthy cells. This breakthrough opens the door to potential novel immunotherapies against various cancer types.
/web/2024/03-240522-eb

Gentler Cell Therapies for Blood Cancer

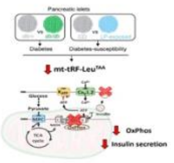
(University of Basel, May 23, 2024)



Researchers from the University of Basel, led by Prof. Dr. Lukas Jeker, along with first authors Simon Garaudé and Dr. Romina Matter-Marone, have achieved a groundbreaking advancement in blood cancer treatment. The team has developed a targeted modification of donor stem cells, known as "shielding," which protects these cells from cancer treatment while enabling the targeted removal of leukemia cells. This innovative approach was realized by identifying and modifying a surface molecule called CD45, present on all blood cells including leukemia cells, but absent on other body cells. The interdisciplinary research, involving bioinformatics experts, biochemists, genetic engineering experts, and clinicians, could introduce new treatment options for patients unable to undergo traditional chemotherapy.
/web/2024/03-240523-91

Discovery of Mitochondrial RNA Fragment Impacting Diabetes

(University of Lausanne, May 24, 2024)



In a collaborative study between the University of Lausanne, the University of Pisa, and the University of Strasbourg, researchers have uncovered a small RNA fragment, which plays a crucial role in mitochondrial metabolism and insulin secretion. First author Dr. Cecile Jacovetti from the University of Lausanne spearheaded this significant research effort. The team used specially designed molecules to reduce the levels of a specific RNA fragment in pancreatic cells and insulin-producing cells. By examining changes in gene activity and protein levels, they discovered the effects of lowering this RNA fragment.
/web/2024/03-240524-c7

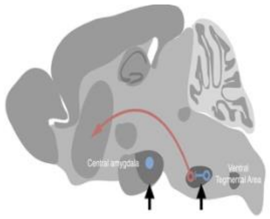
New Approach to Combat Epstein-Barr Virus

(University of Basel, May 24, 2024)

A team of researchers from the University of Basel and the University Hospital Basel, led by Prof. Dr. Christoph Hess, have made a breakthrough in targeting the Epstein-Barr virus (EBV). They discovered that inhibiting a specific metabolic pathway in infected cells can diminish latent EBV infection, reducing the risk of EBV-related diseases, including various cancers. The research focused on patients who developed EBV-triggered blood cancer following an organ transplantation. The team found that EBV upregulates the enzyme IDO1 in these patients, leading to increased energy production and the rapid proliferation of reprogrammed B cells.
/web/2024/03-240524-23

Understanding Opioid Addiction

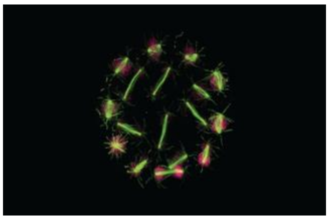
(University of Geneva, May 24, 2024)



Scientists from the University of Geneva have made strides in understanding fentanyl addiction. The team, spearheaded by Prof. Dr. Christian Lüscher and Dr. Fabrice Chaudun, made a significant discovery involving fentanyl, a powerful synthetic opioid. Their research reveals that fentanyl activates two distinct cell populations in the brain via the same cell receptor but in different regions. One triggers the euphoric effect of the drug, the other the aversive state during withdrawal. This dual-action could explain why individuals not only take opioids for pleasure but also to ward off the withdrawal and why opioids may be more addictive than other substances. This new perspective could improve substitution treatments with fewer side effects.
/web/2024/03-240524-7b

How and Why Different Cell Division Strategies Evolve

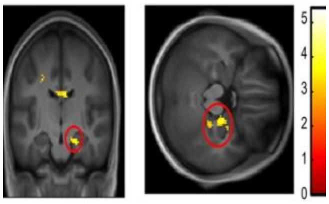
(EPFL, May 28, 2024)



A study led by Dr. Omaya Dubin's group at EPFL, in collaboration with Dr. Gautam Dey and Dr. Yannick Schwab at EMBL Heidelberg, uncovered fascinating insights into the cell division strategies of marine protists related to animals. Their research revealed that these protists use either open or closed mitosis depending on their life cycle stages, suggesting that mechanisms of cell division evolved long before animals themselves emerged. The team utilized comparative genomics, Expansion Microscopy, and Volume Electron Microscopy to delve into the mitotic processes of the marine protists. The study found a correlation between life cycle stages and mitotic strategies: species with multiple nuclei underwent closed mitosis, while uninucleate species underwent open mitosis.
/web/2024/03-240528-c8

Exercise, Memory, and the Genetic Risk Factors of Alzheimer's

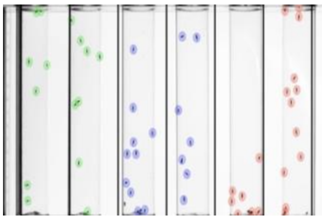
(University of Geneva, May 29, 2024)



A study from the University of Geneva, led by Dr. Kinga Igloi in collaboration with Professor Sophie Schwartz's group at the Geneva Neuroscience Center, has unveiled significant insights into the effects of physical exercise on memory. Focusing on young, healthy individuals with an increased genetic risk of developing Alzheimer's disease, this research builds on Dr. Igloi's previous findings that a 30-minute session of moderate-intensity sport can improve memory capacity. This study aims to determine whether exercise benefits extend to those with a higher genetic risk of Alzheimer's, specifically individuals carrying a variation in the APOE gene that increases their risk by three to twelve times.
/web/2024/03-240529-31

Breakthrough in Combatting Age-related Motor Decline

(EPFL, May 30, 2024)



Researchers at EPFL, under the leadership of Professor Brian McCabe's group, have made a remarkable discovery: they found that the decline in motor capabilities associated with aging can be countered in fruit flies by increasing the expression of the protein "Trio," a finding that holds potential for human treatments. The research team conducted their study on fruit flies, focusing on the impact of increased Trio protein expression on neuromuscular junctions. They discovered that flies with elevated levels of the Trio protein exhibited significantly better motor abilities at middle age compared to control flies. Higher Trio levels helped maintain synaptic structures, prevent fragmentation, and sustain high levels of neurotransmitter release during intense stimuli, akin to young flies.
/web/2024/03-240530-ee

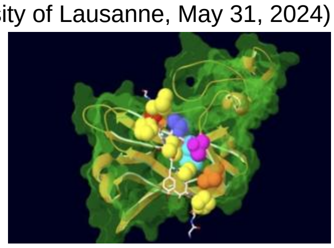
New Model Reevaluates Predictions on Species Extinction

(University of Lausanne, May 31, 2024)

Researchers from Ifremer and the University of Lausanne have developed a new model to evaluate species' susceptibility to climate change. Led by Mathieu Chevalier, Dr. Olivier Broennimann and Prof. Dr. Antoine Guisan, this innovative model provides more moderate predictions on the proportion of terrestrial and marine species threatened by extinction due to climate change compared to traditional models. The research focused on climatic aspects and incorporated new hypotheses regarding species' possible responses to climate change.
/web/2024/03-240531-99

Breakthrough in the Detection of KINSSHIP Syndrome

(University of Lausanne, May 31, 2024)



A team of scientists led by Prof. Dr. Alexandre Reymond at the University of Lausanne has achieved a major breakthrough in detecting the rare genetic disease "KINSSHIP syndrome." The study highlighted the detrimental effects of both excess and deficiency of the protein AFF3 on embryonic development. The research investigates the pathophysiological mechanisms of AFF3 and its influence on transcriptomic profiles, marking the first time these effects have been demonstrated. This is crucial because it provides key insights into the early diagnosis of a rare developmental disorder and offers promising perspectives for future research and potential treatments.
/web/2024/03-240531-09

4. Nano / Micro Technology / Material Science

Printable Aerogel Holds Potential for Medical Use

(EMPA, April 10, 2024)

A team at Empa, led by researchers Dr. Deeptanshu Sivaraman, Dr. Wim J. Malfait, and Dr. Shanyu Zhao have developed a printable bio-aerogel made entirely of cellulose. This development holds immense potential in the field of medicine. The breakthrough is based on the use of cellulose nanoparticles to produce an ink ideal for 3D printing. These bio-aerogels maintain their shape and porosity even after being rehydrated and then re-dried, simplifying storage and handling. The uniqueness lies in the eco-friendly material's potential for medical applications, including drug delivery, and as scaffolds for cell growth.
/web/2024/04-240410-64

New Process to Produce Semiconductors

(Paul Scherrer Institute, April 12, 2024)

In a joint venture, the PSI Paul Scherrer Institut and Finnish company PiBond Ltd are collaborating to commercialize advanced EUV semiconductor lithography products. Under the guidance of Dr. Yasin Ekinci, they have made impressive strides in the development of next-generation lithographic materials, setting a new benchmark for innovation in semiconductors. Applying advanced materials for extreme ultraviolet lithography (EUV), the team was able to fabricate faster and more energy-efficient semiconductor chips. This impactful discovery, nurtured by a strategic technology licensing agreement, is poised to transform semiconductor device manufacturing by overcoming current hurdles in lithographic materials.
/web/2024/04-240412-4c

An Ink for 3D-Printing Flexible Devices without Mechanical Joints

(EPFL, April 19, 2024)

Lead researcher Prof. Dr. Esther Amstad and her team at EPFL have created an innovative ink for 3D printing flexible devices without mechanical joints, using a unique technology known as Double Network Granular Elastomers (DNGEs). Looking forward, the lab sees vast potential applications for this tech - from assisting in motion-guided rehabilitation to revolutionizing prosthetics and robot-assisted activities. Their ultimate aim is to integrate active elements into these DNGE structures, further expanding their use in a wider array of sectors.
/web/2024/04-240419-38

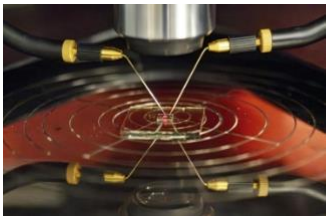
A Fluorine-free Alternative to Water-repellent Textiles

(EMPA, May 02, 2024)

A remarkable breakthrough has been achieved in textile technology by a team led by Dr. Dirk Hegemann from Empa, Dominik Pregger from Lothos, and Bernd Schäfer from bäumlin & ernst ag (beag). Their collective research goals were centered on developing eco-friendly textiles, and their success comes in the form of a unique plasma coating process that uniformly applies a water-repellent finish to textile fibers. This innovative process renders seamless distribution of hydrophobic substances throughout entwined fibers, effectively preventing any water penetration.
/web/2024/04-240502-05

Better Image Sensors with Perovskite

(EMPA, May 30, 2024)



Researchers from Empa and ETH Zürich, including Prof. Maksym Kovalenko, Ivan Shorubalko, Prof. Taekwang Jang, and Dr. Sergii Yakunin, are developing a groundbreaking image sensor using perovskite. This new sensor captures significantly more light than traditional silicon pixels and doesn't require an additional filter, as the color absorption is inherently built into the material. The team uses lead halide perovskites so that they only absorb light of specific wavelengths while remaining transparent to others. This novel approach ensures true-color photos even in challenging lighting conditions and allows pixels to be stacked to capture even more light.
/web/2024/04-240530-63

5. Information & Communications Technology

Machine Learning Enables Viability of Vertical-Axis Wind Turbines

(EPFL, April 08, 2024)

Dr. Sébastien Le Fouest and Prof. Dr. Karen Mulleners at EPFL's UNFOLD lab have made significant strides in vertical-axis wind turbine (VAWT) technology. Their research showcases a method to not only combat but use the dynamic stall phenomenon to improve wind turbine efficiency and robustness. Through machine learning and optimal blade pitch control, the team can redirect blade pitch to produce smaller, manageable vortices and push them away, thereby using dynamic stall as a means to produce power.
/web/2024/05-240408-32

Security Vulnerabilities in AMD and Intel Chips Put Cloud Services at Risk

(ETH Zurich, April 10, 2024)

Professor Shweta Shinde's team of computer scientists at ETH Zürich has made a discovery that puts to light vulnerabilities in cloud security systems. Their findings indicate that hackers could exploit these vulnerabilities to gain access to cloud systems and stored data, utilizing an overlooked process of CPUs known as the interrupt mechanism. Their research relied on two attack scenarios that used this interrupt mechanism to disrupt regular processing and unravel weaknesses in the server hardware employed by leading computer chip manufacturers like AMD and Intel.
/web/2024/05-240410-cc

AI's New Power of Persuasion: It Can Change your Mind

(EPFL, April 16, 2024)

A team at EPFL, led by Prof. Dr. Robert West, has examined the persuasive capabilities of large language models (LLMs), specifically OpenAI's GPT-4. The study aimed to compare the persuasive abilities of AI models to those of humans, and understand the role of personalization in AI's power of persuasion. The study placed 820 participants in debates against either a human or an AI chatbot, with or without personal data available to the debater. Findings revealed that GPT-4 was most persuasive when it had access to personal information. This groundbreaking research not only emphasizes the potential influence of LLMs on human behavior but also underscores the essential need for further research to understand and regulate the persuasive power of large language models.
/web/2024/05-240416-d5

Advancing Europe's AI Capabilities

(SCNAT, April 16, 2024)

A new European institute for Artificial Intelligence in science and future technologies should be created, according to a recommendation co-chaired by Andrea Emilio Rizzoli from the Dalle Molle Institute for Artificial Intelligence in Lugano. This initiative aims to provide high-performing computational power, sustainable cloud infrastructure, and AI training programs to educational and research institutions throughout Europe, in a community-driven approach. This recommendation unfolds as part of the Scientific Advice Mechanism, compiling expertise from over 100 institutions to ensure a fair and comprehensive representation of Europe's scientific landscape.
/web/2024/05-240416-7d

How Fitness Trackers Can Help People with Multiple Sclerosis

(ETH Zurich, April 18, 2024)

A study conducted by Dr. Shkurta Gashi & his team from ETH Zürich, University Hospital Zurich, and the University of Zurich, showcases the capability of fitness trackers and smartphones in reliably collecting long-term health data for Multiple Sclerosis (MS) patients. The data collected from 55 MS volunteers and 24 control subjects over two weeks using fitness tracking armbands enabled specialists to make better decisions and propose potentially effective treatments sooner than before. This study marks a significant step forward in leveraging technology to improve MS patients' quality of life.
/web/2024/05-240418-dc

AI Designs New Drugs Based on Protein Structures

(ETH Zurich, April 25, 2024)

A new development in drug discovery has been made by ETH Zürich, with Prof. Dr. Gisbert Schneider and Dr. Kenneth Atz. They have successfully used artificial intelligence to design new pharmaceutical ingredients based on protein structures, an achievement set to revolutionize the field. The AI algorithm they have developed can generate blueprints for promising drug molecules, manipulating the activity of a protein with a known three-dimensional shape. Additionally, it guarantees that these molecules can be chemically synthesized. The team has conducted successful tests with industry partners, including Roche, and their software is now globally accessible to researchers, marking a significant stride in efficient drug design and the potential for more effective pharmaceutical treatments.
/web/2024/05-240425-75

Rescuing Music with X-rays

(Paul Scherrer Institute, May 02, 2024)

Dr. Sebastian Gliga and his team at PSI Paul Scherrer Institut, are recovering and digitizing high-value historic audio tapes non-destructively using X-ray. Their innovative approach does not rely solely on the magnetic field, but meticulously considers the individual particles generating the field. Compared to the traditional method of inducing voltage, this X-ray technique makes it possible to convert almost every single magnetization state into a high-quality audio signal. This significant development, funded by the Swiss National Science Foundation SNSF, Innosuisse, the UBS Culture Foundation, and the PSI Founder Fellowship, contributes to our understanding of magnetic structures, and has potential implications for advances in technology and materials science.
/web/2024/05-240502-df

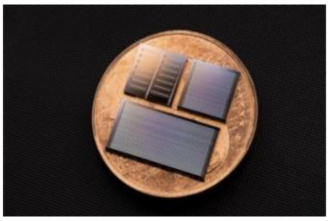
Modular Software for Scientific Image Reconstruction

(EPFL, May 07, 2024)

A team at EPFL's Laboratory of Audiovisual Communications, including lead researchers Sepand Kashani, Dr. Matthieu Simeoni, and Dr. Joan Rué, have developed a new Python framework named Pyxu, which facilitates and accelerates scientific image reconstruction. The development process of Pyxu involved adapting powerful, specialized algorithms from various scientific fields, with the goal of presenting these tools in a unified, accessible platform. What's crucially unique about Pyxu is that it restores lost light information, improves resolution and contrast, and reconstructs images from often partial or low-quality data from telescopes, microscopes, and tomographs.
/web/2024/05-240507-17

Development of Low-cost Photonic Integrated Circuits

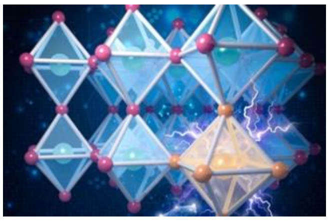
(EPFL, May 16, 2024)



Researchers at EPFL, led by Prof. Dr. Tobias Jan Kippenberg, have achieved a groundbreaking development in photonic technologies. They created scalable photonic integrated circuits (PICs) using lithium tantalate, marking a significant advancement in optical technologies with the potential for widespread commercial applications. The team fabricated high-efficiency lithium tantalate PICs with an impressively low optical loss rate of just 5.6 dB/m at the telecom wavelength. This was accomplished using a combination of deep ultraviolet photolithography and dry-etching techniques. This advancement is crucial as it enables scalable, cost-effective manufacturing of advanced electro-optical PICs, poised to revolutionize optical communications and computing systems.
/web/2024/05-240516-a6

Machine Learning Accelerates Discovery of Solar-cell Perovskites

(EPFL, May 21, 2024)



Researchers at EPFL, led by Haiyuan Wang and Alfredo Pasquarello, have leveraged machine learning to identify 14 new materials for solar cells, setting the stage for more efficient and cost-effective solar technology. The team developed an advanced dataset of band-gap values for perovskite materials through hybrid functionals, which accurately account for the material's electronic polarization properties. This approach significantly improved the accuracy of band-gap predictions over standard methods. Supported by the Swiss National Science Foundation and the National Natural Science Foundation of China, this research holds the potential to lower solar technology costs and speed up its adoption globally.
/web/2024/05-240521-e5

An AI Leap into Chemical Synthesis

(EPFL, May 22, 2024)

Scientists from EPFL, led by Dr. Philippe Schwaller, have introduced a large language model-based AI system named ChemCrow, which could revolutionize drug discovery. The system leverages 18 advanced tools to streamline complex chemical processes, thus transforming chemical research for both experts and novices. The development of ChemCrow hallows for unprecedented efficiency in navigating and performing chemical research tasks, and could broaden access to complex chemical knowledge and processes, lowering barriers for non-experts and enhancing the toolkit available to seasoned chemists. Such advancements could accelerate R&D in pharmaceuticals, materials science, and beyond.
/web/2024/05-240522-97

6. Energy / Environment

Nanodevices Can Produce Energy from Evaporating Water

(EPFL, April 10, 2024)

EPFL researchers Prof. Dr. Giulia Tagliabue and Tarique Awar have made a fascinating advancement in energy production using nanodevices, changing how we think about the use of tap and seawater. By mastering the technique of nanosphere colloidal lithography, the researchers were able to create a hexagonal network of silicon nanopillars, which allowed the generation of current and voltages simply through the evaporation of fluid samples. The significance of this innovative approach hold enormous potential in waste-heat recovery, renewable energy generation, and the powering of sensors, thus revolutionizing the use of water evaporation for energy.
/web/2024/06-240410-84

Tiny Plastic Particles Are Found Everywhere

(University of Basel, April 11, 2024)

Researchers at the University of Basel and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, led by Clara Leistenschneider, have discovered high concentrations of microplastics in the Southern Weddell Sea off Antarctica. The pollution levels are even higher than previously assumed. The team studied particles measuring between 11 and 500 micrometers in size, and collected them by pumping water into tanks, filtering, and analyzing it through infrared spectroscopy. This vital research highlights the surprising degree of microplastic pollution present in the Antarctic Ocean and underscores the urgent need for understanding its potential impact on both the environment and food chains. The team now plans to examine water samples from lower depths to further demonstrate the need for enhanced environmental conservation efforts.
/web/2024/06-240411-b7

A Greener Future: New Easily Biodegradable Plastics

(University of Fribourg, April 26, 2024)

Spearheaded by lead researcher Prof. Dr. Christoph Weder, teams from the Adolphe Merkle Institute, Technische Universität Darmstadt, the University of Strathclyde, and the University of Fribourg have made an important environmental breakthrough: They have developed a new type of polymer that degrades more easily than its conventional counterparts, thanks to the use of a compound named cyclobutene. Incorporating this compound into polymers, the research allows for on-demand degradation into smaller molecules under mechanical forces and an alkaline solution, without premature degradation during usage. This significant advancement could help in mitigating the environmental harm of plastic pollution - a pressing concern, considering we produce around 430 million tons of plastic annually.
/web/2024/06-240426-0a

Switzerland Inaugurates its Largest Green Hydrogen Power Plant

(Swissinfo.ch, April 30, 2024)

Following a year of construction, Switzerland's largest green hydrogen production facility was inaugurated in Domat/Ems, in canton Graubünden. Managed by Axpo Group and its local partner Rhiienergie AG, the 2.5-megawatt facility can produce 350 tons of green hydrogen every year, replacing the annual use of 1.5 million liters of diesel. Hydrogen is produced by the electrolysis of water, powered by green electricity from the nearby Reichenau hydropower plant. The produced hydrogen is then densified for delivery to filling stations and industrial customers. Continuing its commitment to green energy, the Axpo Group aims to promote this market both in Switzerland and across Europe.
/web/2024/06-240430-2a

How the Plant World Shapes the Climate Cycle

(ETH Zurich, May 01, 2024)

A recent breakthrough by lead researcher Dr. Julian Rogger, a biogeodynamics expert at the Institute of Geophysics at ETH Zürich, in collaboration with the University of Leeds, offers transformative insight into the relationship between plant life and the climate cycle, stretching back to 390 million years. Their research entailed the creation of a comprehensive computer model, including factors like the shifting of continents, climate changes, and vegetation responses — all based on geological data comprised of sediment chemical analysis and fossil studies. The findings underscore the significance of stable periods, which allow vegetation to thrive and subsequently stabilize Earth's climate over extensive timeframes.
/web/2024/06-240501-32

How to Clean Up New Delhi's Smoggy Air

(Paul Scherrer Institute, May 01, 2024)

An international study, helmed by atmospheric scientists Dr. Andre Prevot and Dr. El Haddad Imad from the PSI Paul Scherrer Institut and involving researchers from India, China, Germany, Denmark, France, and Spain, has made a groundbreaking discovery. The study unveils, for the first time, the portions of air particulates over northern India that pose the most significant health risks. Through a four-year investigation in New Delhi, one of the cities with the highest air particulate concentrations, the team identified the quantities, origins, and oxidative potentials of these particulates. Oxidative potential is crucial in understanding the harmful impact a chemical compound can have on living beings and human health.
/web/2024/06-240501-53

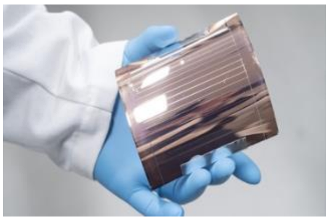
How Rising Treelines can Affect Alpine Lakes

(EPFL, May 09, 2024)

Scientists from EPFL, led by researcher Dr. Hannes Peter, in collaboration with various European universities, uncovered the effects of rising treelines on high-altitude and high-latitude lakes. The study presents the first-ever detailed mapping of the Alpine treeline progression and its implications at a molecular level. Field experiments in Northern Finland and Austria, along with lab tests, were conducted to study the response of lake bacteria to organic carbon from diverse soil types. The findings suggest that as treelines rise, the dissolved organic matter in these lakes changes and affects how the bacteria process the organic carbon, leading to increased CO_2 emissions.
/web/2024/06-240509-ab

Making Perovskite Solar Cells Ready for the Real World

(EMPA, May 10, 2024)



The SuPerTandem project, involving 15 leading European research institutions and companies with lead researcher Dr. Fan Fu from Empa, is breaking new ground in the development of perovskite tandem solar cells. The revolutionary project seeks to develop flexible perovskite tandem modules exceeding a 30% efficiency level, produced through scalable and cost-effective processes. Perovskite tandem solar cells are the result of layering two perovskite compositions with varied band gaps on top of each other, allowing for theoretically higher efficiency. Beyond cutting the costs of solar power, the importance of perovskite tandem solar cells lies in the potential of cheaper, higher efficiency solar energy possessing lower CO2 footprints compared to prevailing silicon solar cells, coupled with the team's efforts to scale rooftop application.
/web/2024/06-240510-24

Swiss Streams Under Threat

(Eawag, May 10, 2024)

A recent study led by Christiane Ilg, Eawag, and the University of Zurich, sheds light on the ecological state of small Swiss streams. The research revealed that human activities severely impact many of these streams, with nearly a quarter being affected by modifications to the stream bed structure or being diverted underground. The study, which involved sampling 99 streams across various regions in Switzerland, also highlighted serious pollution issues. Streams located in areas with substantial agricultural activity were found to be laden with pesticides. This eye-opening research underscores the urgent need for measures to protect, preserve and restore these vital habitats that maintain our biodiversity.
/web/2024/06-240510-96

Mosaic Grassland Landscapes are the Most Beneficial

(ETH Zurich, May 15, 2024)

Led by Valentin Klaus at ETH Zürich, a study has analyzed the impact of various farming practices on ecosystem services in Switzerland. The researchers meticulously examined 90 permanent grassland areas across more than 30 farms in the canton of Solothurn, assessing three specific practices: fertilization, usage type (meadow or pasture), and farming systems (conventional IP-SUISSE or organic). The comprehensive analysis of soil and plant communities categorized ecosystem services into provisioning, regulating, and cultural groups, revealing that extensive grassland farming not only boosts biodiversity but also serves multiple societally relevant ecosystem services.
/web/2024/06-240515-6b

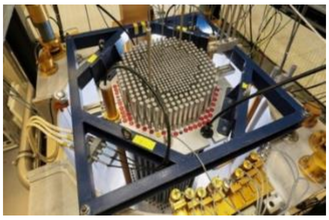
Using Solar Energy to Generate Heat at High Temperatures

(ETH Zurich, May 16, 2024)

A team of researchers at ETH Zürich, led by Dr. Emiliano Casati and guided by Professor Prof. Dr. Aldo Steinfeld, has made a significant advancement in solar energy technology. They developed a new thermal trap using a quartz rod coupled with a ceramic absorber, which efficiently converts sunlight into heat. Lab experiments showed this innovative thermal trap can achieve temperatures up to 1050 degrees Celsius, a remarkable improvement over the previous maximum of 170 degrees Celsius. This research is pivotal as it enhances solar absorption efficiency, potentially supporting high-temperature solar plants.
/web/2024/06-240516-c4

Innovative Gamma-ray Method Enhances Nuclear Reactor Safety

(Paul Scherrer Institute, May 23, 2024)



Scientists at EPFL, led by Prof. Dr. Andreas Pautz from the Paul Scherrer Institut, have developed a groundbreaking method for non-invasive and remote monitoring of nuclear reactors. By strategically positioning two bismuth germanate scintillators outside EPFL's research reactor, they were able to monitor gamma radiation emitted during operation. This novel approach allows researchers to gather crucial information about the reactor's state, including changes in criticality and fuel composition, without interfering with its operations. The method also incorporates statistical analysis of the variability in gamma ray detection over time. This research is pivotal in enhancing nuclear safety and treaty compliance, offering a more adaptable and sensitive solution, especially for new nuclear technologies like small modular reactors in remote locations.
/web/2024/06-240523-67

Unlocking the Fuel Cell Potential of Building Energy Systems

(EMPA, May 24, 2024)

Researchers from Empa and the Hälg Group, supported by the Swiss Federal Office of Energy SFOE, are investigating how fuel cells in buildings can buffer peak loads for the electricity grid during the coldest days. Spearheaded by Philipp Heer from Empa and Kevin H. W. from Hälg Group, the "H2districts" project aims to tackle the challenge of increased electricity demand, particularly due to the widespread use of electrically powered heat pumps. Starting in October 2023 and set to complete in September 2025, this two-year project proposes the use of hydrogen in stationary fuel cells as a solution to mitigate peak load operations and reduce CO2 emissions. The real application of the concept at Empa will serve as the data basis for further development. The interdisciplinary collaboration includes expertise in building automation, logistics, renewable hydrogen supply, and the development and operation of fuel cells, marking significant strides toward optimizing energy efficiency and addressing energy challenges in the building sector.
/web/2024/06-240524-ea

Advancing Solar Efficiency with Tandem Cells

(EPFL, May 27, 2024)

At EPFL, new advancements are being made in the field of solar energy under the leadership of Michael Ballif. The research team, including engineers from both Ballif's lab and CSEM in Neuchâtel, has developed innovative "tandem" cells, that feature a perovskite layer on a silicon base. These revolutionary solar cells have set a new world record by surpassing the 30% power conversion efficiency threshold. This innovative technology promises substantial improvements in photovoltaic cell yields and more efficient solar energy production. Solar-energy startups in and around Neuchâtel are leveraging this cutting-edge research to innovate photovoltaic integration into building architecture, using customizable colored panels and tiles. Additionally, the research highlights the necessity for expanding manufacturing capacities to enhance market resilience and efficiently manage potential overproduction.
/web/2024/06-240527-ee

7. Engineering / Robotics / Space

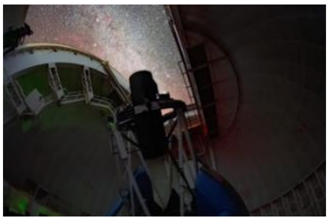
Hopping into the Future of Space Exploration

(ETH Zurich, April 12, 2024)

The Space Hopper project at ETH Zürich exhibits the ingenuity and dedication of Bachelor and Masters's degree students of ETH Zürich, who are coming up with new ideas for asteroid exploration. Their scientific breakthrough: the development of a robot adept in low-gravity environments, that harnesses a hopping-like locomotion method. Tried and tested on a European Space Agency parabolic flight to simulate zero gravity, this advancement could reshape future exploration of smaller celestial bodies, such as asteroids and moons — entities that may potentially hold valuable mineral resources.
/web/2024/07-240412-f1

Researchers Unveil the Largest 3D Map of the Universe Ever Made

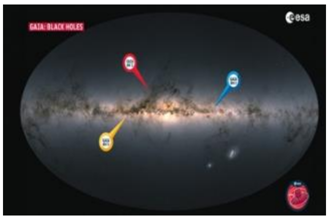
(EPFL, April 12, 2024)



A team of researchers from multiple universities, including EPFL and the Lawrence Berkeley National Laboratory (Berkeley Lab), under the direction of DESI Director and Berkeley Lab scientist Dr. Michael Levi, have successfully created the most extensive 3D map of the universe. Their work marks a groundbreaking advancement in measuring the expansion history of our universe at seven different slices of cosmic time, with an impressive precision of 1 to 3%. The research was conducted using the Dark Energy Spectroscopic Instrument (DESI) which collected data from over a million galaxies a month.
/web/2024/07-240412-08

Massive Black Hole Discovered in Our Galaxy

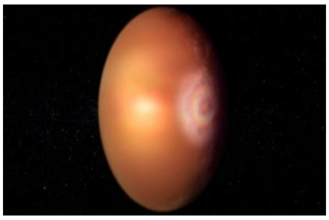
(University of Geneva, April 17, 2024)



Researchers at the University of Geneva and the Gaia Collaboration group, including lead experts Dr. Laurent Eyer, Prof. Dr. Tsevi Mazeh, and Dr. Berry Holl, have made a noteworthy discovery in our Galaxy. Their rigorous research has led to the detection of a large dormant black hole, named Gaia BH3, with a mass of 33 times that of the sun. The methodical analysis of data centered on non-single stars exhibiting extreme motions allowed the research team to ensure authenticity and to avoid false detections. This discovery is critical not just in black hole study, but also provides insights into the evolution of massive stars and the formation of high-mass black holes within our galaxy.
/web/2024/07-240417-2a

CHEOPS Detects a Rainbow on an Exoplanet

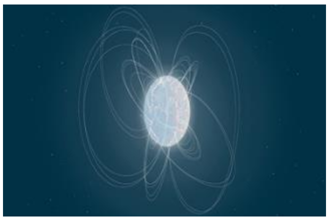
(University of Geneva, April 24, 2024)



A team of researchers from the University of Geneva and the Instituto de Astrofísica e Ciências do Espaço in Portugal have detected a "rainbow" exoplanet WASP-76b, making it the first recorded occurrence beyond our solar system. Led by Prof. Dr. Olivier Demangeon, the study suggests a surprising hypothesis to explain the additional luminous flux on the eastern side of the planet: it could be due to a localized and anisotropic reflection akin to a rainbow, which occurs when the light is reflected by clouds comprised of perfectly uniform droplets. Speculated to be composed of iron, these droplets broaden our knowledge about planetary atmospheres beyond our solar system.
/web/2024/07-240424-62

Rare Gamma-ray Burst Detected in Nearby Galaxy

(University of Geneva, April 25, 2024)



Scientists from the University of Geneva and the National Institute for Astrophysics in Milan (INAF - Istituto Nazionale di Astrofisica), led by Dr. Sandro Mereghetti detected a gamma-ray burst from a nearby galaxy named "M82", an event typically observed in far-off parts of the sky. Using the Integral Burst Alert System (IBAS) and data from the European Space Agency - ESA's XMM-Newton space telescope, the researchers were able to study this rare occurrence in greater detail. This essential discovery advances our understanding of gamma-ray bursts and their origins, broadening the horizons of astrophysics and our comprehension of the universe.
/web/2024/07-240425-d2

Understanding How Animals Change How They Walk Using Robots

(EPFL, May 01, 2024)

The BioRobotics Laboratory at EPFL, led by Prof. Dr. Auke J. Ijspeert, has made great strides in understanding the way animals dynamically change how they walk. The breakthrough research brought insightful revelations on how these transitions occur, with lead researcher Milad Shafiee, and co-author Dr. Guillaume Bellegarda. The research deployed was centered around deep reinforcement learning (DRL) to facilitate a quadruped robot to navigate diverse terrains. The study was primarily driven by the hypothesis of viability or fall avoidance. This study is fundamental as it not only manifests new insights into animal locomotion but also implies potential advancements in robotic modeling for biological research, aiming to reduce dependency on animal models, hence addressing ethical concerns.
/web/2024/07-240501-61

Bioinspired Sampling Device Makes Blood Tests Less Invasive

(ETH Zurich, May 07, 2024)

A research team from ETH Zürich, led by Prof. Dr. Jean-Christophe Leroux and featuring first-author doctoral student David Klein Cerrejon, made a substantial breakthrough by developing a cost-effective, minimally invasive blood sampling device. Mirroring the functionality of leeches, this invention has hopeful prospects in improving healthcare, particularly in regions burdened with malaria. The device's conceptualization stems from their comprehensive study of leeches' ability to create a suction effect for efficiently extracting blood. After successful testing on pigs, the team is currently optimizing the material composition for safe human usage, with financial support hailed from Fondation Botnar through the Basel Research Centre for Child Health.
/web/2024/07-240507-1c

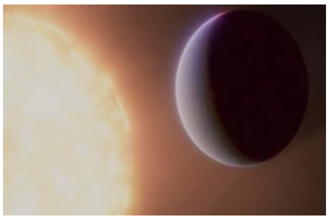
Bio-inspired Robotics' New Frontier

(EPFL, May 10, 2024)

A recent research project has been conducted by the Bioinspired Robotics Lab (BioRob) at EPFL, under the helm of lead researcher Prof. Dr. Auke J. Ijspeert, in partnership with the BBC. They have refined robotics design through rigorous field tests in uncontrolled African environments, leading to the development of an enhanced version of their platform, the resilient, versatile, and water-resistant Krock-2. The research is transformative for bio-informed robotics, positioning these as critical tools for applications such as disaster response and search-and-rescue. A new direction spurred from this work is the development of sensor-equipped tactile skin capable of detecting environmental interaction forces.
/web/2024/07-240510-1a

Hints of a Possible Atmosphere Around a Rocky Exoplanet

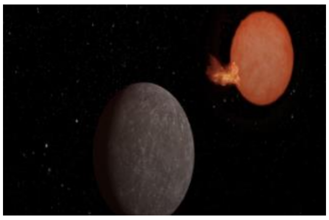
(University of Bern, May 10, 2024)



A team from the University of Bern's Department of Space Research and Planetary Sciences, under the direction of Prof. Dr. Brice-Olivier Demory, has made a remarkable discovery of potential atmospheric hints around a rocky exoplanet, namely 55 Cancri e, as part of the James Webb Space Telescope program. The research involved interpreting thermal emission spectra captured by JWST's NIRCam in November 2022. These readings pointed towards a relatively low temperature of about 1500 degrees Celsius on the exoplanet, indicating the possible presence of a volatile-rich atmosphere. This holds significant implications, providing novel insights into the atmospheric composition and thermal processes of rocky exoplanets.
/web/2024/07-240510-a7

Earth-sized Exoplanet Found Around Red Dwarf Star

(University of Geneva, May 16, 2024)



An international team of astronomers, including members from the Technology & Innovation Platform of NCCR PlanetS, University of Geneva, and University of Bern, has unveiled an extraordinary find: an Earth-sized exoplanet (SPECULOOS-3 b) orbiting an ultra-cool Red Dwarf star. This is only the second time such a discovery has been made. Red dwarfs, which account for 70% of the stars in our galaxy, offer unique opportunities for studying planetary systems and the potential for life beyond Earth. The discovery emphasizes the importance of such stars in the search for life. SPECULOOS-3 b, located about 55 light years away, is nearly identical in size to Earth but drastically different in environment. It orbits its star in just 17 hours, likely experiencing perpetual daylight on one side and constant darkness on the other due to tidal locking. Despite these harsh conditions, this planet remains a prime candidate for atmospheric studies, particularly with the James Webb Space Telescope. As noted by Emeline Bolmont, assistant professor at UNIGE and co-author of the study, if SPECULOOS-3 b retains an atmosphere, this finding could have significant implications for the habitability of other planets in red dwarf systems, such as those in the TRAPPIST-1 system.
/web/2024/07-240516-6a

Launch of Satellite Mission for Study of the Clouds

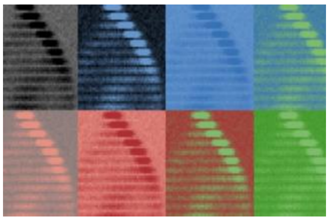
(RTS Info, May 30, 2024)

A groundbreaking satellite mission, led by researchers from the European Space Agency (ESA), in collaboration with the Japan Aerospace Exploration Agency (JAXA), seeks to better understand the role of clouds in climate evolution. Named Earth Cloud Aerosol Radiation Explorer (EarthCARE), this project focuses on the dual role of clouds in either cooling or heating the atmosphere. EarthCARE will operate 400 km above Earth, and is featured with Light Detection and Ranging (LIDAR) and radar. It will exceptionally decode the vertical structure of clouds, something no previous satellites have accomplished. This mission is hugely anticipated by the scientific community as it could assist in recalibrating climate models and evaluating Earth's radiation balance. More than 75 actors worldwide are involved in the EarthCARE mission, including Swiss companies Beyond Gravity and Thales Alenia Space.
/web/2024/07-240530-aa

8. Physics / Chemistry / Math

Exploring Topological Effects in Quantum Systems

(ETH Zurich, April 19, 2024)



Researchers at ETH Zürich, led by Prof. Dr. Tilman Esslinger and PhD student Zijie Zhu, have made an exciting scientific breakthrough by detecting topological effects in an artificial solid. This discovery significantly contributes to our understanding of quantum systems, providing a more comprehensive picture of the fundamental properties of these structures. Traditionally, studying topology and interactions in solids has posed a major challenge to physicists. The ETH Zürich team overcame this by using extremely cold fermionic potassium atoms trapped in laser-created spatially periodic lattices, enabling them to manipulate energy levels and observe unique topological outcomes.
/web/2024/08-240419-85

Energy Scientists Unravel the Mystery of Gold's Glow

(EPFL, April 22, 2024)

EPFL scientists have developed the first comprehensive model of the quantum-mechanical effects behind photoluminescence in gold. This achievement holds the potential to drive advancements in solar fuels and battery technology. Their research approach led to unprecedented insights into luminescence emanating from the thin gold films, and resolved the debate about why it occurs under certain conditions.)
/web/2024/08-240422-c2

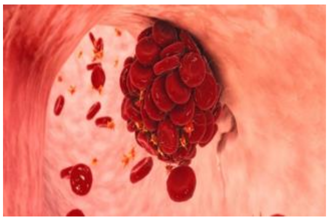
Understanding Upward Positive Lightning Flashes

(EPFL, April 30, 2024)

A breakthrough in the study of the dangerously rare upward positive lightning flashes has been achieved by scientists at EPFL. Led by Prof. Dr. Farhad Rachidi, in collaboration with the HES-SO and Uppsala University in Sweden, the team has succeeded in making the first direct measurement of X-ray radiation at the start of these elusive flashes. This feat was accomplished by recording lightning at the Säntis tower in northeastern Switzerland. The research offered insight into the origins of upward positive lightning, a potential dominant type at high altitudes and notably more damaging, and bettered our understanding of lightning formation for mitigating its associated risks.
/web/2024/08-240430-08

A New Anticoagulant with No Risk of Bleeding

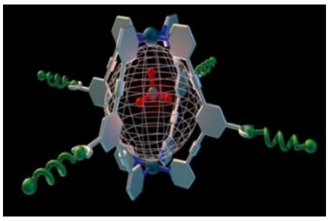
(University of Geneva, May 01, 2024)



In an innovative leap for medical science, a research collective from the University of Geneva and the University of Sydney has reinvented how we view anticoagulant treatments. Led by Prof. Dr. Nicolas Winssinger, the team has unveiled an anticoagulant with immediate "on-demand" reversible activity. This new anticoagulant has the potential to revolutionize not only surgical procedures, but its swift activation & deactivation mechanism could also be leveraged in immunotherapies. The anticoagulant operates through a duo of molecules that inhibit the activity of thrombin, a key protein in blood coagulation. The “antidote” works by disjoining these molecules, thereby neutralizing the active ingredients.
/web/2024/08-240501-55

SMARTdrugs: A New Hope for the Treatment of Aggressive Cancers

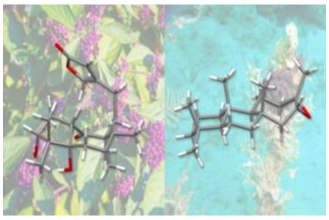
(University of Zurich, May 02, 2024)



Spearheaded by Prof. Dr. Jason Holland at the University of Zurich, among five European teams with complementary skills, a breakthrough project titled SMARTdrugs aims to develop specially engineered "supramolecular" compounds for treating aggressive lung and brain tumors. Using a mix of the concept of self-assembly used in biology and radio chemistry, these groundbreaking compounds promise a revolutionary approach to cancer therapies. The significance of this research lies in its potential to improve prognosis for aggressive cancer patients and advance cancer diagnosis and therapy.
/web/2024/08-240502-82

New Approach in the Synthesis of Complex Natural Substances

(University of Basel, May 08, 2024)



At the University of Basel, Prof. Dr. Olivier Baudoin and doctoral student Oleksandr Vyhivskyi have achieved a scientific milestone: they have synthetically produced diterpenes, a subclass of terpenes, resulting in two natural compounds, randainin D and barekoxide, using an innovative synthesis method. They pioneered a method that harnesses light energy to trigger chemical reactions, enabling the formation of intricate ring structures and insertion of allyl groups, key elements in organic compound synthesis. This breakthrough expands our capability to produce therapeutic terpenes synthetically, enabling precise molecular structure adjustments and improving their properties.
/web/2024/08-240508-c1

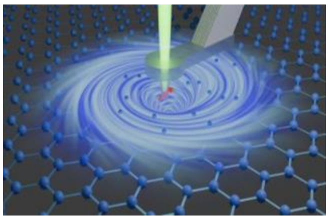
Paradigm Shift in Quantum Magnetism

(ETH Zurich, May 09, 2024)

At the cutting edge of quantum physics, a team of scientists from ETH Zürich, Harvard University, and Princeton University, have accomplished an innovative breakthrough under the guidance of lead researcher Prof. Dr. Eugene Demler. This advancement has revolutionized the understanding of magnetic quantum phenomena and was achieved through the development of a novel method known as "quantum pointillism." The pioneering technique permitted these scientists to examine intricate quantum systems composed of interacting particles, making individual atoms discernible in the lab. By employing quantum simulators and analyzing data from investigations of unique materials of a triangular crystal lattice, they painstakingly reconstructed the conditions intrinsic to a solid.
/web/2024/08-240509-fb

Detection of Electron Vortices in Graphene

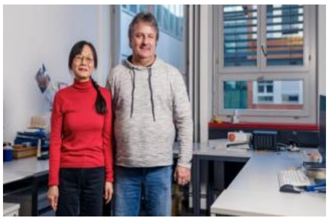
(ETH Zurich, May 14, 2024)



Pioneering research by ETH Zürich, led by Prof. Dr. Christian Degen, has resulted in the successful detection of electron vortices in graphene. This discovery offers new insights into the curious behavior of electrons in graphene by acting like a viscous liquid, which contrasts starkly with conductors such as iron or copper. The team employed a high-resolution magnetic field sensor to achieve this feat. By appending circular discs to a conductive graphene strip and utilizing a sensitive quantum magnetic field sensor embedded in a diamond needle, they measured the minuscule magnetic fields formed by the electrons in the graphene. This enabled the visualization of vortices and even observed the flow direction reversal in smaller discs.
/web/2024/08-240514-fe

Breakthrough in Enzyme Research for Green Chemistry

(Paul Scherrer Institute, May 14, 2024)



Researchers Dr. Xiao-Dan Li, Dr. Richard Kammerer, and Prof. Dr. Volodymyr Korkhov at the PSI Paul Scherrer Institut have successfully characterized the enzyme styrene oxide isomerase for the first time. Published in Nature Chemistry, this breakthrough paves the way for environmentally friendly production of valuable chemicals and drug precursors. By elucidating the enzyme's structure and function, the team has overcome previous limitations to its practical application. Using advanced techniques like cryo-electron microscopy, the researchers uncovered that the enzyme's efficiency owes to an iron-containing group, similar to the iron-containing pigment in our blood. This allows the enzyme to split the epoxide ring in styrene oxide, a key step in the Meinwald reaction, with high precision, producing only one specific product. Their findings promise significant advances for the chemical and pharmaceutical industries, offering a versatile, energy-saving tool for green chemistry.
/web/2024/08-240514-b6

AI Method Could Automate Scientific Experiments

(University of Basel, May 20, 2024)

A team led by Professor Christoph Bruder at the University of Basel, along with colleagues from Massachusetts Institute of Technology, and lead researcher Julian Arnold, have spearheaded the development of a generative method to compute phase diagrams of physical systems. Phase diagrams describe the states in which a material can exist and are challenging to calculate. The results of this study could potentially lead to automated scientific experiments in the future. Using sophisticated generative models and complex algorithms, the team can autonomously calculate phase diagrams in a fraction of the time compared to traditional methods. This technique, akin to AI systems like ChatGPT, generates numerous possible states of a system and determines their corresponding phases. This innovation is poised to revolutionize laboratory automation as well as help optimize language models, offering wide-ranging applications in multiple scientific domains.
/web/2024/08-240520-81

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

A Therapeutic Helmet Promises Advances in the Treatment of Alzheimer's

(University of Basel, April 11, 2024)

Bottneuro AG co-founders Bekim Osmani, PhD and Prof. Dr. Raphael Guzman, are developing an innovaitve neurostimulator named Miamind, in collaboration with the University of Basel. Built with a focus on treating degenerative diseases like Alzheimer's and Parkinson's, Miamind promises targeted brain electrostimulation at home. The breakthrough of this device lies in employing targeted brain electrostimulation to tackle degenerative conditions like Alzheimer's and Parkinson's disease. This research holds the potential to transform treatments of neurodegenerative diseases, and the device is now undergoing clinical test to confirm its effectiveness.
/web/2024/11-240411-4e

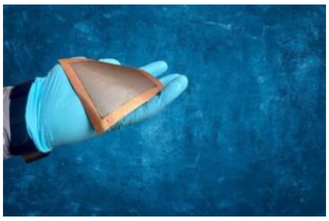
Research Has Lost None of Its Innovative Drive

(University of Basel, April 17, 2024)

A controversial study published in 2023 (Park et alii) reported a crucial decline in novel knowledge within the scientific and innovation system. Challenging this claim, researchers from the University of Basel, including Dr. Christian Rutzer and Economics Professor Rolf Weder, in partnership with Georgetown University's Professor Jeffrey Macher, have presented compelling counterevidence. The team meticulously analyzed millions of scientific publications and patents, demonstrating critical measurement errors in the original Nature study's calculations. Their findings refute the overblown claims of a sharp recession in disruptive research, emphasizing the continuous vitality of our scientific system.
/web/2024/11-240417-35

ETH Zurich Spin-offs Develop High Performance Batteries

(ETH Zurich, April 30, 2024)



ETH Zürich spin-off companies, 8inks and BTRY, are making significant strides in solid state battery technology. They are developing high-performance batteries featuring customizable, lightweight, and thin design through an innovative technique named "multilayer curtain coating," which holds the potential to revolutionize the manufacturing standard for lithium-ion batteries. This newly developed technique outperforms the traditional slot die technique that has been in use for the last three decades. Currently, under active testing in various battery formats, the technology aims to scale-up for industrial use, particularly in electric vehicles and renewable energy storage.
/web/2024/11-240430-30

QAI Ventures Invests in Swiss AI Solution Provider

(Startupticker.ch, May 13, 2024)

Phoenix Technologies, IBM, and Red Hat are teaming up to establish a major AI Innovation Centre at Switzerland Innovation Park Basel Area to fuel the growing demand for building and deploying advanced AI models on a sovereign cloud in Switzerland. QAI Ventures, a Swiss ecosystem builder, has acquired a stake in Phoenix Technologies, and together they aim to promote technological advancements and innovations originating from Switzerland, offering access to the latest in cloud technology and AI capabilities. Phoenix Systems's kvant AI solution, now set to be seamlessly integrated with IBM’s AI applications and the Swiss Sovereign Cloud, will also empower businesses to create advanced AI models securely and efficiently.
/web/2024/11-240513-1d

Offline AI Device Keeps Meetings Confidential

(Swisstech, May 31, 2024)

csky.ai, a Lausanne-based startup part of Trust Valley, has developed an AI-powered transcript recorder. Named ClearMind, this innovative device converts confidential conversations into structured, legally compliant documents using on-device, or "Edge AI" technology. The technology has been rigorously tested in a psychiatrist’s office and showcased at international events like CES in Las Vegas and Vivatech in Paris. ClearMind’s on-device AI processing is a significant breakthrough, as it diminishes reliance on cloud services, ensuring that data ownership remains with the user. The impact of this innovation is vast, potentially transforming how confidentiality and privacy are maintained in healthcare, finance, and professional services.
/web/2024/11-240531-04

12. General Interest

Experimental Project for Soil Decontamination in Lausanne

(Ticino Digital Business, May 14, 2024)

The biotechnology company TIBIO, based in Ticino, is tackling a massive challenge: dealing with the expansive dioxin pollution affecting over 4,000 plots and one million cubic meters of soil in the city of Lausanne. Among several proposed solutions for managing and treating the contaminated soil, TIBIO is exploring the promising approach of bioremediation using microorganisms. This method offers significant benefits, such as soil preservation and considerably lowers traffic and CO2 emissions as it negates the need for excavation and soil transportation. With over 15 years of experience in this sector, TIBIO will be entrusted with the development of this environmental biotechnology solution for dioxin bioremediation. This project, funded by the canton of Vaud, is currently under development in the laboratory and will place across Ticino and TIBIO's Romandy branch in Lausanne and Chavornay.
/web/2024/12-240514-1f

New Gel Breaks Down Alcohol in the Body

(ETH Zurich, May 14, 2024)

Dr. Jiaqi Su and her team at ETH Zürich have developed an innovative gel that breaks down alcohol in the body. The protein-based gel could potentially revolutionize the ways in which the adverse effects of alcohol consumption are mitigated. The gel, composed of protein fibrils immersed in an iron bath, initiates a multistage enzymatic cascade that effectively converts alcohol to acetic acid, mitigating the harmful effects of alcohol. The gel was tested on mice and was shown to decrease blood alcohol levels substantially and reduce stress on the liver. This research holds promise for an impact on public health by limiting the negative health effects of alcohol consumption.
/web/2024/12-240514-f3

Producing More Sustainable and Nutritious Chocolate

(ETH Zurich, May 22, 2024)

Researchers at ETH Zürich, led by Kim Mishra, have developed a groundbreaking type of chocolate called cocoa-fruit chocolate. This innovative chocolate is more sustainable and nutritious than conventional varieties, thanks to its unique formulation, which uses cocoa fruit jelly as a replacement for powdered sugar. The research team focused on enhancing the nutritional and sustainable aspects of chocolate by reducing the sugar content and increasing the product's nutritional value. They have created a healthier alternative to traditional chocolate, which also offers a model of how technology, nutrition, eco-compatibility, and income diversification for small farmers can synergize to improve the entire value-creation chain of the cocoa plant.
/web/2024/12-240522-ad

Advancing Sleep Research for Healthier Lives

(University of Bern, May 30, 2024)

At the University of Bern, an interdisciplinary research project called "Decoding Sleep" has reached has come to an end. Led by Chief Physician Dr. Claudio Lino Bassetti from the Department of Neurology at Inselspital, this large-scale endeavor brought together 13 research groups from the Faculties of Science, Medicine, and Human Sciences, culminating in remarkable findings on sleep-wake regulation. Through collaboration spanning medicine, psychology, psychiatry, and computer science, the project produced over 100 scientific publications and two patents. The newfound understanding of sleep-wake mechanisms paves the way for early and personalized therapies for sleep-related disorders. This milestone also marks the foundation for the Swiss Sleep House Bern, enhancing counseling services and reinforcing the University of Bern's 40-year leadership in global sleep research.
/web/2024/12-240530-c1

Enhancing the Archiving of Genetic Data

(WSL, May 31, 2024)

Led by Dr. Deborah M Leigh from WSL, an international team of researchers has achieved a significant milestone in genetic data management. They propose standardized formats for different types of genetic and genomic data, along with the mandatory inclusion of extensive metadata, enhancing data accessibility for researchers worldwide. The research emphasizes the importance of archiving genetic data in these proposed standardized formats. By ensuring comprehensive metadata and adopting these standards retroactively for older data, the research aims to enable more accessible, equitable, and innovative use of genetic data on a global scale.
/web/2024/12-240531-c0

13. Calls for Grants/Awards

Swissloop Tunneling Wins Not-a-Boring-Competition

(Greater Zurich Area, April 26, 2024)

Swissloop Tunneling, a team from ETH Zürich, has clinched the champion title for the first time in the third edition of the Not-a-Boring-Competition, organized by Elon Musk-owned The Boring Company in Texas, USA. The contest aims to advance tunnel infrastructure development, fostering innovative solutions to increase tunnel boring machine speeds while reducing construction costs, as part of Musk's high-speed transportation system concept, Hyperloop. Swissloop Tunneling had previously won the Innovation Awards in 2021 and 2023 and had managed a second-place finish overall. Their most recent project, a revamped Groundhog Beta tunnel drill, stood out with its redesigned overall system and liner mechanism for tunnel wall construction. Industrial partners and Empa have been key supporters of the team, providing workshops and testing grounds. Swissloop Tunneling now prepares to sustain its innovative streak for the following competition in 2025.
/web/2024/13-240426-d5

Upcoming Science and Technology Related Events

Using Nature's Design Principes to Create Functional Artificial Materials
June 16-21, 2024
https://is.gd/RjJt4t
Pharmaceutical & Biotechnology
Eurotel Victoria, Les Diablerets

World Biodiversity Forum
June 16-21, 2024
https://www.worldbiodiversityforum.org/en
Business & Economy
Davos

medArt Basel
June 17-21, 2024
https://www.medartbasel.ch/2023.html
Life Sciences, Health Care & Medical
University Hospital Basel

10th International Symposium on Hydraulic Structures (ISHS) 2024
June 17-19, 2024
https://ishs2024.ethz.ch/
Power, Renewable & Storage Energy
ETH Zurich

OEWG 3: Science Policy Panel on the Management of Chemicals and Waste
June 17-21, 2024
https://is.gd/CsncUe
Chemicals, Physics & Molecular Sciences
CICG Centre International de Conférences, Geneva

International Symposium on Hydraulic Structures
June 17-19, 2024
https://vaw.ethz.ch/en/ishs2024.html
Environment & Climate Conditions, Research & Development
ETH Zurich

Real Time Manufacturing Lusanne
June 19, 2024
https://real-time-manufacturing.com/
Industrial Products & Engineering
SwissTech Convention Center, Lausanne

SSH-Diagnostic Meeting
June 19-20, 2024
https://www.sgh-ssh.ch/ssh-diagnostic-meeting/
Chemicals, Physics & Molecular Sciences
Zentrum Paul Klee, Bern

Biotech Outsourcing Strategies
June 19-20, 2024
https://www.bio2bevents.com/bosbasel2024/
Pharmaceutical & Biotechnology
Congress Center, Basel

Cloud Leadership Day
June 19, 2024
https://cloudleadershipday.com/
IT, Web & Electronic
Arena Cinemas, Zurich

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