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Science-Switzerland, August – September 2024

News on Swiss science, technology, education and innovation

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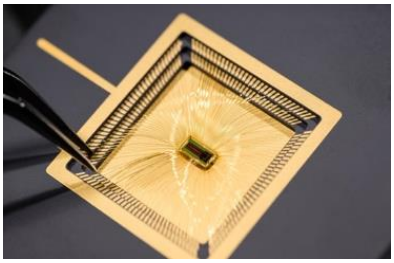
Inauguration of the Alps Supercomputer

(ETH Zurich, September 17, 2024)

On September 14th, the Swiss National Supercomputing Centre (CSCS) in Lugano unveiled their latest technological marvel, the 'Alps' supercomputer. Now ranked among the fastest computers globally, 'Alps' represents a monumental achievement resulting from the collaborative efforts of the scientific community, the public sector, and industry. ETH Zurich and the Paul Scherrer Institut are among the institutions ready to harness the extraordinary capabilities of this new infrastructure. Developed to address extreme data and computing needs, the Alps supercomputer boasts a cloud-native architecture and versatile software-defined clusters (vClusters) tailored to the specific requirements of user communities while maintaining confidentiality. This state-of-the-art infrastructure will empower scientists across Switzerland to leverage artificial intelligence, translating complex scientific inquiries into computable solutions, thus driving significant advances in research with direct societal benefits.
/web/2024/00-240917-bf

An Entire Brain-machine Interface on a Chip

(EPFL, August 27, 2024)



EPFL researchers, led by Dr. Mahsa Shoaran, have made groundbreaking progress by developing a miniaturized brain-machine interface (MiBMI). This innovative system identifies distinctive neural codes (DNCs) for each letter, enabling the microchip to process approximately a hundred bytes of data instead of thousands when patients imagine writing letters by hand. The EPFL team, collaborating with other teams at EPFL's Neuro-X and IEM Institutes, including the labs of Prof. Dr. Grégoire Courtine, Prof. Dr. Silvestro Micera, Prof. Dr. Stephanie Lacour, and Prof. Dr. David Atienza, executed this advanced research. The resulting system is not only fast, accurate, and low-power, but also versatile, paving the way for more adaptable BMIs tailored to diverse neurological disorders. Importantly, the MiBMI's shorter training times facilitate easier user adoption. This breakthrough heralds significant advancements in brain-machine interfaces, with potentials extending far beyond handwriting recognition.
/web/2024/05-240827-02

Antidepressant Shows Promise for Treating Brain Tumors

(ETH Zurich, September 23, 2024)

Researchers from ETH Zurich and University Hospital Zurich, led by Dr. Sohyon Lee, have identified the antidepressant vortioxetine as a potential treatment for glioblastoma, a severe type of brain tumor. Collaborating with neurologists Dr. Michael Weller and Dr. Tobias Weiss, the team made this groundbreaking discovery using advanced screening technology. The researchers employed pharmacoscopy, a screening platform developed at ETH Zurich, to test hundreds of active substances on live human glioblastoma cells. They discovered that neural and cancer cell signaling plays a critical role in the efficacy of neuroactive drugs. Tests on glioblastoma-afflicted mice showed that vortioxetine, especially in combination with standard treatments, had significant effectiveness. Now, the team is preparing for clinical trials to assess the drug's impact on glioblastoma patients and explore personalized treatment options using pharmacoscopy. This could mark the first major improvement in glioblastoma treatment in decades.
/web/2024/03-240923-aa

1. Policy

AI Tools to Combat Corporate Greenwashing

(University of Zurich, August 23, 2024)

Prof. Dr. Markus Leippold at the University of Zurich and his team have developed cutting-edge AI-based tools designed to differentiate between genuine climate pledges and vague, misleading intentions in sustainability reports. Their pioneering tool, ChatClimate, leverages AI to provide accurate, science-based answers on global warming, drawing on information from IPCC reports. The researchers plan to make their tools open-source, enabling public access and fostering transparency. The initiative underscores the necessity for reliable data on corporate emissions and their environmental impact, harnessing AI, large language models, and blockchain technologies to enhance sustainability practices.
/web/2024/05-240823-8d

2. Education

Students Seem to Prefer Teacher Feedback over AI Feedback

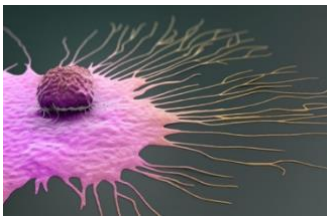
(EPFL, September 18, 2024)

Conducted by Assistant Professor Tanja Käser and her team at EPFL, a pioneering study delves into the perceptions of student feedback with a focus on AI integration in higher education. The research, titled “AI or Human? Evaluating Student Feedback Perceptions in Higher Education,” reveals a clear preference among students for feedback from human teachers over AI-generated feedback. The study involved a large and diverse student population and highlighted the social-emotional factors influencing the acceptance of AI in educational feedback. Despite advancements in Generative AI, the findings stress the continued importance of the human element in educational systems. Conducted in the Machine Learning for Education Laboratory (ML4ED), this research provides crucial insights into the complexities of integrating AI into educational feedback systems and sets the stage for future research.
/web/2024/02-240918-39

3. Life Science

Enhancing Breast Cancer Diagnosis and Treatment

(EPFL, August 06, 2024)



EPFL Professor Cathrin Brisken, MD PhD and her team have made a significant breakthrough with the development of a computational tool called EMBER. This innovative tool integrates transcriptomic data from multiple databases to predict molecular subtypes and therapy responses for breast cancer on an individual sample basis. Conducted under the EU transdisciplinary PhD training network CANCERPREV, EMBER combines over 11,000 breast cancer transcriptomes to enhance prediction accuracy. This research is crucial as it addresses the challenges in diagnosing and treating breast cancer, offering a more personalized and precise approach to treatment.
/web/2024/03-240806-d6

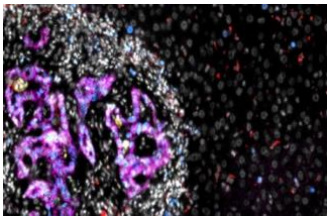
Autoantibodies Cause Lifelong Risk of Viral Infections

(University of Zurich, August 16, 2024)

Researchers at the University of Zurich, led by Associate Professor Dr. Ben Hale, have made a groundbreaking discovery in understanding the lifelong risk of viral infections. Their study uncovered the presence of autoantibodies against type 1 interferons, crucial proteins that act as early messengers in the immune response, in approximately two percent of individuals. By analyzing blood samples stored over several decades and using well-curated clinical data, the team found that these autoantibodies typically appear between the ages of 60 to 65. This revelation highlights a significant vulnerability in the aging population, who may be more susceptible to severe viral infections due to compromised type 1 interferon systems.
/web/2024/00-240816-04

Preventing Cancer Cells from Colonizing the Liver

(ETH Zurich, August 07, 2024)



Exciting new research conducted at ETH Zurich has achieved a ground-breaking discovery. Led by Professor Adam E. Moore, the team identified liver-derived constraints to metastasis that could inhibit the crucial interaction between plexin and semaphorin, thus preventing cancer cells from colonizing the liver and forming new tumors. The study was conducted through innovative in vivo interaction screening, allowing the researchers to scrutinize the relationships among cells within the cancer ecosystem. By identifying vulnerabilities in tumor metastases during the early stages of development, this research provides critical insights into the key period when metastases take root.
/web/2024/03-240807-17

Paleolithic Diets are not Without Risks

(University of Geneva, August 07, 2024)

Prof. Dr. Pierre Maechler from the University of Geneva is is leading new research examining the potential risks associated with "Paleolithic" diets. His work emphasizes the necessity of being well-informed before adopting high-protein diets. The research team assessed the activity of the GDH enzyme using blood tests to prevent metabolic overload in individuals with a deficient GDH enzyme. This discovery holds significant consequences for those following high-protein diets, particularly individuals with neurological conditions. The study brings to light the potential hazards of trending dietary practices and underscores the importance of making informed dietary choices. Further research is essential to expand our understanding of these risks.
/web/2024/03-240807-16

How Epigenetics Influence Memory Formation

(EPFL, August 07, 2024)

Scientists at EPFL, led by neuroscientist Associate Professor Johannes Gräff, have uncovered a pivotal role of chromatin flexibility in memory formation. Their groundbreaking study reveals how the packaged DNA inside cells influences which neurons are activated for specific memories. Using a virus to deliver epigenetic enzymes, the team could artificially induce chromatin openness, enhancing learning in mice. Conversely, inducing chromatin closure impaired learning abilities. This transformative research shifts focus from synaptic plasticity to nuclear DNA processes, offering new insights into memory and learning mechanisms.
/web/2024/03-240807-85

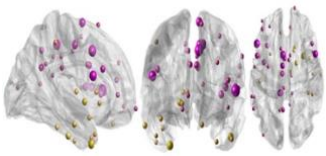
Long-Term Genome Study Reveals Pathogen Resistance Mechanisms

(University of Basel, August 09, 2024)

A research team led by Professor Dieter Ebert at the University of Basel has made a groundbreaking discovery in pathogen resistance. By analyzing three species of water fleas from diverse global populations, the study sheds light on the significant role genetic diversity plays in protecting against infectious diseases. The researchers focused on the long-term balancing selection in planktonic crustaceans. They found that the same gene variants have been used repeatedly over possibly 70 million years, continually aiding in disease resistance despite drastic environmental changes. This research, published in Nature Communications, underscores the importance of long-term competition in maintaining genetic diversity and has profound implications for understanding pathogen resistance and evolution.
/web/2024/03-240809-a9

An Over- or Under-synchronized Brain May Predict Psychosis

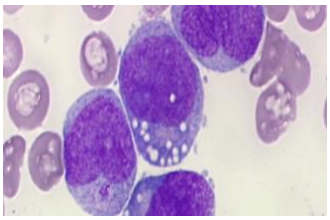
(University of Geneva, August 09, 2024)



Researchers at the University of Geneva, led by Professor Stephan Eliez from the Department of Psychiatry, have made a significant breakthrough in the potential prediction of psychosis. Their study explores the use of brain structure and function to assess the developmental trajectory of individuals, aiming to identify those at risk of developing psychiatric illnesses. Funded by the Swiss National Science Foundation, this groundbreaking research combined observations of both the brain's structure and its functional synchronization. This methodological innovation could pave the way for early identification and intervention for those susceptible to psychosis, offering new insights into the mechanisms underpinning psychiatric disorders.
/web/2024/03-240809-d1

Fighting Leukemia by Targeting its Stem Cells

(University of Geneva, August 13, 2024)



Researchers from the University of Geneva, led by Associate Professor Jérôme Tamburini and Clément Larrue, have made a significant breakthrough in leukemia treatment. Their research uncovers the intricate mechanism of ferritinophagy and its connection with mitophagy, crucial for regulating leukemia stem cells. Conducted at the University of Geneva and supported by the Swiss Cancer League, the study reveals new insights into leukemia mechanisms, potentially paving the way for new treatment options. The findings, now published in Science Translational Medicine, could transform our understanding and approach to leukemia.
/web/2024/03-240813-8b

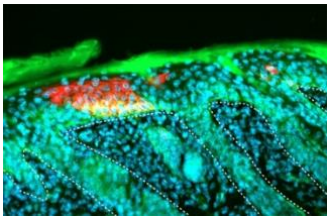
New Type of Beige Fat Cells Generates Heat without Purpose

(ETH Zurich, August 15, 2024)

Researchers from ETH Zurich, the University of Basel, the Leipzig University, and the Dana-Farber Cancer Institute in Boston, led by ETH doctoral student Anand Sharma from ETH Zurich Professor Dr. Christian Wolfrum's group, have made a landmark discovery in the study of beige fat cells. They identified a new type of these cells with what they term a "Sisyphus mechanism," involving futile cycles that consume energy and generate heat. Using single nucleus transcriptomics, the team categorized separate classes of UCP1 and futile cycle beige cells. This discovery is crucial as it provides new insights into the medical potential of beige fat cells, such as their use in transplants for individuals with metabolic diseases or the development of drugs to activate these cells.
/web/2024/03-240815-a3

Key Driver for Epithelial Cancer Development Identified

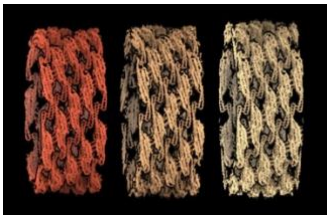
(University of Zurich, August 15, 2024)



The University of Zurich has announced a major scientific breakthrough in cancer research, led by Dr. Peter Renz and Prof. Dr. Ataman Sendoel at the Institute for Regenerative Medicine. Their groundbreaking research identified a distinct signaling pathway, TNF-alpha, which drives the transformation of epithelial cells into aggressive tumor cells. Using in vivo single-cell CRISPR, the researchers uncovered unique TNF-alpha programs involved in clonal expansion and tumorigenesis. This discovery is crucial as it could pave the way for new strategies in the early detection and treatment of various cancers, including those affecting the skin, esophagus, bladder, and colon.
/web/2024/03-240815-1c

How Cells Respond to Physical Stress

(University of Geneva, August 16, 2024)



Researchers from the University of Geneva, lead by Prof. Dr. Robbie Loewith, with collaborations from the University of Fribourg, have unveiled the intricate mechanisms by which yeast cells sense and respond to mechanical stress on their membranes. Using high-resolution cryo-electron microscopy, the team observed the interaction and reaction of lipids and proteins within the plasma membrane, revealing stabilized lipid domains that trigger specific cellular responses, advancing our understanding of cell survival and integrity. This groundbreaking study employed baker's yeast as a model organism due to its resemblance to higher organisms in cellular processes.
/web/2024/03-240816-c1

Influenza Viruses Can Use Two Ways to Infect Cells

(University of Zurich, August 16, 2024)

An international research team led by Associate Professor Dr. Silke Stertz from the Institute of Medical Virology at the University of Zurich has found that certain human and avian influenza viruses can utilize a second entry pathway to infect cells, beyond the known pathways on the cells' surface. Through meticulous research using lab-grown cell lines and human airway cultures, the team uncovered that the hemagglutinin protein on the influenza virus surface also binds to MHC class II protein complexes on immune and respiratory cells. This pivotal finding reveals how influenza viruses can adapt to use alternative entry pathways, potentially affecting their ability to infect different species and jump between animals and humans.
/web/2024/03-240816-83

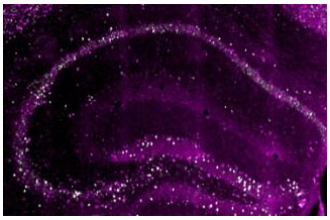
Separating the Physical and Psychosocial Causes of Pain

(ETH Zurich, August 23, 2024)

Researchers at ETH Zurich and Balgrist University Hospital, led by Dr. Stanisa Raspopovic and first author Noemi Gozzi, have achieved a groundbreaking advancement in pain assessment. They have developed a novel method that utilizes machine learning to separate the physical and psychosocial components of pain, introducing new indices for each component. This research involved measuring body signals, collecting self-disclosures, and employing computerized evaluations in conjunction with machine learning analysis of EEG and skin conductivity data. This innovative approach is crucial because it allows physicians to better assess individual patients' pain profiles and provide more personalized treatment plans.
/web/2024/03-240823-60

The Brain Creates Three Copies for a Single Memory

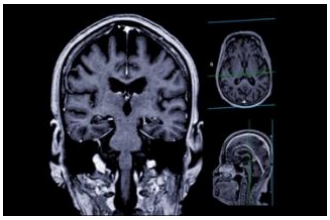
(University of Basel, August 23, 2024)



Professor Flavio Donato and his team from the University of Basel's Biozentrum have made a groundbreaking discovery in understanding how memories are stored in the brain. Their research reveals that memories exist in multiple parallel copies, each preserved for varying durations and modified over time. Using mouse models, the team discovered that a single event is stored in at least three different neuronal ensembles within the hippocampus. Early-born neurons create long-persisting memory copies, while late-born neurons generate more malleable versions, which can be modified and rewritten shortly after acquisition.
/web/2024/03-240823-13

Breakthrough in Understanding Genetic Basis of Neurodevelopmental Disorders

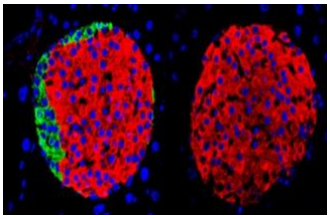
(University of Zurich, August 23, 2024)



Researchers at the University of Zurich, led by Dr. Paranchai Boonsawat and Prof. Dr. Anita Rauch from the Institute of Medical Genetics, have made a significant scientific breakthrough in deciphering the genetic causes of neurodevelopmental disorders that result in abnormal brain sizes. Their global collaborative effort identified faulty versions of the ZNRF3 gene as a key factor in these conditions. Through detailed lab experiments, the team discovered that the ZNRF3 gene is essential for balancing biochemical signals, particularly within the Wnt signaling pathway, which is crucial for brain cell production.
/web/2024/03-240823-62

Transforming Diabetes Treatment through Cellular Plasticity

(University of Geneva, September 09, 2024)



A groundbreaking study conducted by a team led by Professor Pedro Herrera from the University of Geneva, has unveiled a remarkable ability of pancreatic cells to change function, specifically in insulin production. This research, featuring Dr. Marta Perez Frances, discovered that non-beta cells can start producing insulin if beta cells die prematurely, overturning long-held beliefs about the regenerative capacity of differentiated adult cells. Using mice models in which non-beta pancreatic cells were selectively eliminated, the team observed how these cells could adapt to regulate blood sugar levels, even in the absence of beta cells. This discovery highlights the potential for developing new diabetes therapies by pharmacologically triggering cellular plasticity.
/web/2024/03-240909-38

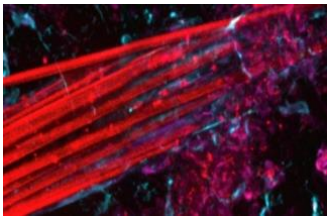
An Unparalleled Map of the Brain-Spinal Cord Connection

(EPFL, September 10, 2024)

A groundbreaking study published in Imaging Neuroscience by researchers from EPFL's Neuro X Institute, the University of Geneva, and McGill University's The Neuro (Montreal Neurological Institute-Hospital) has developed a new tool to map the functional connectivity between the brain and spinal cord in humans. Led by Dimitri Van De Ville from the Medical Image Processing Laboratory, this research offers a more detailed view of how these two critical components of the central nervous system (CNS) interact. By overcoming the technical challenges of imaging both the brain and spinal cord simultaneously — which traditionally require separate scans — the team used functional magnetic resonance imaging (fMRI) and diffusion MRI to collect their data.
/web/2024/03-240910-44

Revolutionary Ultra-Flexible Brain Probes Precisely Record Brain Activity

(ETH Zurich, September 12, 2024)



Researchers at ETH Zurich, led by Prof. Dr. Mehmet Fatih Yanik, have achieved a groundbreaking development in neuroscience. They created tentacle-like electrodes made of gold and polymers, capable of recording individual brain-cell activity over extended periods without causing tissue damage. Their extensive research, which involved tracking and analyzing nerve-cell activity in rats' brains for several months, led to the discovery of large-scale, synchronous interaction of brain cells crucial for processing complex information and memory formation. This innovation holds significant implications for understanding brain functions and their impairments in neurological and psychiatric disorders.
/web/2024/03-240912-c6

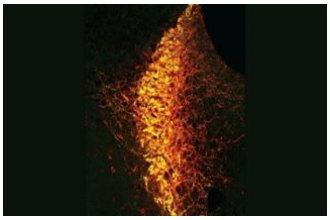
Colorful Traits in Primates Ease Tensions Between Groups

(University of Zurich, September 13, 2024)

Researchers at the University of Zurich, led by Prof. Dr. Stefan Lupold, in collaboration with Dr. Cyril Grueter from the The University of Western Australia, have made a groundbreaking discovery. They have unveiled a curious link between dimorphic traits in primates and their intergroup interactions, suggesting these traits might help ease tensions between groups by allowing quick assessment of rivals from afar. By analyzing the role of between-group signaling in the evolution of primate ornamentation, this study challenges the conventional belief that vibrant colors and elaborate body ornaments are solely for within-group competition for mates. This research offers new perspectives on the evolution of primate ornamentation and the complexities of animal communication.
/web/2024/03-240913-e2

Uncovering the Neuronal Basis of Attention

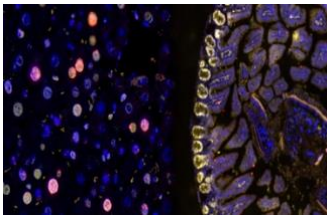
(University of Geneva, September 18, 2024)



In groundbreaking research at the University of Geneva, Assistant Professor Valerio Zerbi from the Department of Psychiatry and Department of Basic Neurosciences has revealed that our state of attention is controlled by a small number of neurons in the brain. This discovery was recently published in Nature Neuroscience and showcases the potential to advance our understanding of attention mechanisms. By employing cutting-edge techniques to monitor brain activity in real time, the team enabled individuals to regulate their attention using visual feedback. Such findings could have widespread implications, from treating attention disorders to optimizing cognitive performance in everyday life.
/web/2024/03-240918-05

Why Some Organs Age Faster than Others

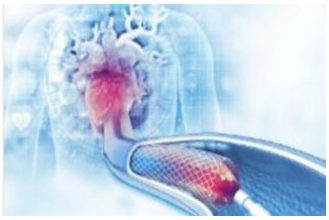
(University of Geneva, September 19, 2024)



A pioneering team from the University of Geneva, in collaboration with the University Hospital of Bern, and the University of Bern, led by Professor Thanos Halazonetis, has made a significant discovery about DNA damage and aging. Their research reveals that non-coding DNA accumulates more damage in slowly proliferating tissues, such as the liver, which leads to more rapid aging. The team conducted their research by studying liver cells, which rarely proliferate, and analyzed the correlation between the liver's rapid aging and the lower frequency of DNA replication in its cells. This finding is crucial as it opens new pathways for understanding cellular aging and possibly slowing it down.
/web/2024/03-240919-cc

Stents with Degradable Polymer Coating Offer No Advantage

(University of Bern, September 20, 2024)



A study led by Prof. Dr. Lorenz Räber from Bern University Hospital, and the University of Bern, in collaboration with six Japanese hospitals, investigated the efficacy of stents with degradable polymer coating compared to conventional stents. The research found no long-term advantage of degradable polymer-coated stents over traditional stents, with both types proving equally effective after three years. The study utilized patient data from stent implantations following heart attacks, highlighting the critical necessity of long-term drug therapy, particularly the rigorous use of cholesterol-lowering medication, to mitigate risks post-implantation. This research stresses the significance of consistent aftercare and diligent cholesterol level monitoring, providing valuable insights for optimizing treatment in heart attack survivors and improving long-term patient outcomes.
/web/2024/03-240920-82

Complex Genetic Programs at the Root of our Movements

(University of Geneva, September 24, 2024)

Researchers at the University of Geneva, led by Prof. Dr. Denis Jabaudon, have achieved a groundbreaking understanding of the complex genetic programs that underlie our movements. Their study focused on corticospinal neurons, which are crucial for fine motor skills and are highly vulnerable to conditions like spinal cord injury and amyotrophic lateral sclerosis (ALS). Using an innovative approach, the team successfully forced these neurons to retract, revealing new pathways for reprogramming neural cells. This breakthrough offers valuable insights into the genetic foundations of movement and holds promise for developing treatments for neurodegenerative diseases. The research, supported by compelling experimental evidence, marks a significant advance in the field of neuroscience and redefines potential therapeutic strategies.
/web/2024/03-240924-00

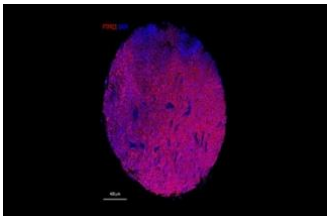
How Heartbeat and Breathing Influence Visual Perception

(University of Fribourg, September 25, 2024)

Researchers from the University of Fribourg, led by Professor Juliane Britz, funded by the Swiss National Science Foundation, have made a groundbreaking discovery. Their study reveals that interoceptive signals, such as heartbeat and breathing, significantly influence visual perception and the neuronal markers of consciousness. The research involved having volunteers observe patterns on a screen and respond to questions about their perception. The team measured electrical activity in the participants' brains and hearts using electrodes and also tracked their breathing. Remarkably, the neuronal markers of consciousness appeared around 150 milliseconds earlier when images were displayed during a relaxed heart state compared to a contracting heart state. This finding underscores the importance of bodily signals in neuroscience, challenging the notion that the brain operates independently of the body.
/web/2024/03-240925-f4

Programming Cells to Target Brain Tumors

(University of Geneva, September 27, 2024)



Researchers from the University of Geneva and the Geneva University Hospitals (HUG), led by Assistant Prof. Dr. Denis Migliorini, have made a groundbreaking advancement in the fight against glioblastoma. The team developed CAR-T cells capable of selectively targeting malignant gliomas while preserving healthy tissue, offering a potential new treatment pathway for the most aggressive and common primary brain tumor. By identifying a specific marker on the surface of glioblastoma cells, the team generated immune cells equipped with an antibody to target and destroy these tumour cells. The treatment was tested in mouse models, demonstrating controlled tumor growth and prolonged survival without signs of toxicity.
/web/2024/03-240927-fe

Early Detection of Asthma Signs in Infants

(University of Basel, September 27, 2024)

Researchers from the University of Basel, the University of Applied Sciences and Arts Northwestern Switzerland, the Inselspital Bern, and various European partner institutions, led by Prof. Dr. Urs Frey, have identified early signs of asthma in infants. Published in The Lancet Digital Health, this groundbreaking study suggests that signs of developing asthma can be detectable within the first year of life. The research utilized digital health data from around 780 healthy infants, born across Europe, to examine interactions between known risk factors and the emergence of symptoms like coughing or wheezing. By analyzing lung adaptations in the first year, researchers distinguished children who developed asthma between ages two and six from those who did not by school age.
/web/2024/03-240927-c5

AI Model Predicts Genome Editing Efficiency

(University of Zurich, September 27, 2024)

Researchers at the University of Zurich, led by PhD student Kim Fabiano Marquart in Prof. Dr. Gerald Schwank's lab at the Institute of Pharmacology and Toxicology, have achieved a significant advancement in genome editing. Collaborating with Prof. Dr. Michael Krauthammer's team, they developed an innovative AI model capable of predicting the efficiency of genetic editing at any given target site. This groundbreaking work involved testing a new, compact gene-editing protein (TnpB) at 10,211 different target sites to identify the DNA sequence features influencing editing efficiency. The TnpB protein is notably smaller than the widely known CRISPR-Cas systems, making it easier to transport into cells, a significant leap forward in gene editing.
/web/2024/03-240927-d6

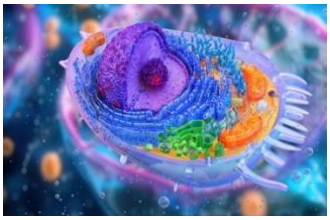
Unexpected Immune Response May Hold Key to Long-Term Cancer Remission

(EPFL, September 27, 2024)

In a groundbreaking study led by Associate Professor Li Tang from the EPFL School of Engineering, and in collaboration with Yale University, University of Pennsylvania, and Cleveland Clinic, researchers have uncovered a surprising connection between the type 2 immune response and long-term cancer remission. Previously associated with parasitic infections and thought to hinder cancer immunity, this response is now shown to positively correlate with sustained remission. This research is pivotal as it challenges existing cancer treatment paradigms and offers valuable insights into enhancing CAR-T therapy for lasting cancer remission.
/web/2024/03-240927-4b

Breakthrough in Understanding Gene Silencing in Cells

(EPFL, September 30, 2024)

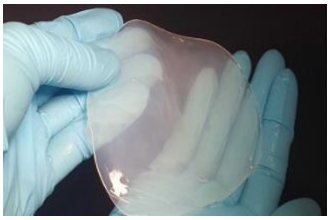


Scientists at EPFL, led by researchers Dr. Martina Begnis and Prof. Dr. Didier Trono, have made a groundbreaking discovery in gene regulation. They identified the protein ZNF274's crucial role in maintaining certain gene clusters inactive within the cell nucleolus, advancing our understanding of genetic control mechanisms. The research, conducted using a variety of sophisticated techniques, revealed how ZNF274 anchors gene clusters to the nucleolus, effectively keeping them silent. Published in Science Advances, this work underscores the importance of the nucleolus in regulating gene activity and the spatial organization of DNA within the nucleus.
/web/2024/03-240930-ba

4. Nano / Micro Technology / Material Science

Turning Bacteria into Cellulose-producing Mini-factories

(ETH Zurich, August 09, 2024)



Researchers at ETH Zurich, led by Professor André Studart with doctoral student Julie Laurent, have developed an innovative approach to modify bacteria using UV light to significantly enhance cellulose production. Their groundbreaking work has yielded 40,000 variants of the cellulose-producing bacterium Komagataeibacter sucrofermentans, with four variants achieving up to seventy percent more cellulose production than the original strain. The approach involved irradiating bacterial cells with UV-C light to induce mutations, leading to an overproduction of cellulose. The team found that all four high-performing variants shared the same mutation in a gene coding for a protein-degrading enzyme, likely disrupting regulation of cellulose production. This breakthrough is crucial as it can pave the way for increased production of non-protein materials through bacterial modification. The researchers have already applied for a patent for their methodology and mutated bacterial variants, marking a significant milestone in the field of biotechnology.
/web/2024/04-240809-23

Computer Chips have the Potential to Become even Smaller

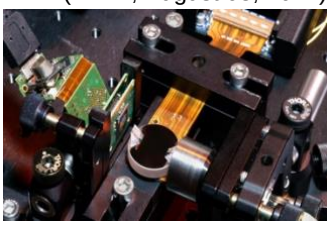
(Paul Scherrer Institute, August 28, 2024)

The Paul Scherrer Institut (PSI) has made a pioneering breakthrough in semiconductor production using photolithography with extreme ultraviolet (EUV) light. This research, led by Dr. Dimitris Kazazis from the Laboratory for X-ray Nanoscience and Technologies at PSI, opens new horizons for the semiconductor industry. The innovative approach extends traditional EUV lithography by exposing the sample blueprint for the microchip to alter the chemical properties of the photoresist. Subsequent treatments form the desired wiring patterns. This advancement enables the production of much smaller computer chips, as the shorter wavelength light allows for finer structure printing. The PSI team will continue their research with a new EUV tool at the SLS by the end of 2025 and the SLS 2.0 upgrade, promising greatly enhanced performance and capabilities.
/web/2024/04-240828-d5

5. Information & Communications Technology

Breakthrough in Optical Neural Networks

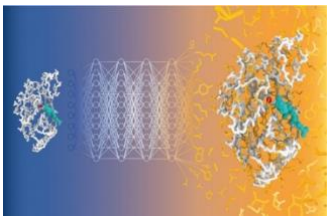
(EPFL, August 08, 2024)



Engineers at EPFL, led by Dr. Demetri psaltis, alongside first author Leo Jih-Liang Hsieh and co-author Ilker Oguz, have made a significant breakthrough in optic-based AI systems. They developed an innovative programmable framework that effectively overcomes computational bottlenecks, offering a new frontier in optical neural networks. Their approach involves encoding image pixels on the surface of a low-power laser beam, leading to nonlinear multiplication of the pixels. This enables accurate, scalable computations using scattered light, drastically reducing the energy required compared to electronic systems.
/web/2024/05-240808-5d

Revolutionary AI Approach to Protein Design

(EPFL, August 08, 2024)



Researchers at EPFL, led by Professor Matteo Dal Peraro, have made a groundbreaking advancement in protein engineering. They developed a novel AI-driven model capable of predicting protein sequences from backbone scaffolds, incorporating complex molecular environments. This breakthrough paves the way for significant advancements in medicine and biotechnology. The team's innovative AI model predicts protein sequences while considering the complex molecular environment, facilitating the de novo design of proteins. This approach promises to revolutionize targeted treatments for diseases and the creation of specialized enzymes for industrial applications.
/web/2024/05-240808-e6

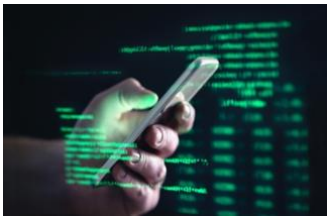
Advancing Imaging Technology with AI

(EPFL, August 20, 2024)

Prof. Dr. Sabine Süsstrunk, head of EPFL's Images and Visual Representation Laboratory, discusses breakthrough research on the synergy between artificial intelligence and imaging technology. AI and imaging can drive a virtuous cycle resulting in superior sensors, enhanced analytical capabilities, and groundbreaking improvements in spatial and temporal resolution. The article empathizes the importance of transparency and ethics in the application of AI to imaging, underscoring the potential threats to the credibility of scientific publications. By focusing on reproducibility and ethical considerations, researchers aim to ensure the reliability of results, which is critical for scientific progress.
/web/2024/05-240820-c0

Finding Security Flaws in Android ahead of Malicious Hackers

(EPFL, August 20, 2024)



A research team at EPFL, led by Associate Professor Mathias Payer, comprising Dr. Marcel Busch and PhD students Philipp Mao and Christian Lindenmeier, has achieved a significant breakthrough in mobile security. They uncovered 31 critical security flaws in the Android system, pinpointing vulnerabilities in its most privileged components, and developed methods to mitigate some of these key threats. Using the open nature of the Android platform, the team conducted their research by developing automated tools that enhance testing and broaden mitigations.
/web/2024/05-240820-59

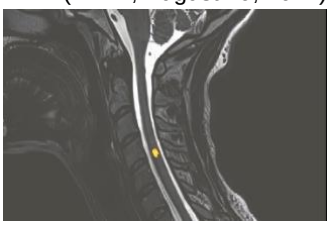
Operating from 9,300km Away

(ETH Zurich, August 27, 2024)

Researchers from ETH Zurich and The Chinese University of Hong Kong, led by Dr. Alexandre Mesot Medarde at the Multi-Scale Robotics Lab, ETH Zurich, and headed by Professor Brad Nelson, have achieved a remarkable medical advancement: they successfully controlled an endoscope over a distance of 9,300 kilometers, with Mesot controlling the endoscope from Zurich using a PlayStation controller, while the procedure occurred in Hong Kong. This innovation relies on a magnetic navigation system developed at ETH Zurich, paired with a fast, secure internet connection to the operating theatre. The research's importance lies in its potential to improve surgical care in remote areas, especially where local expertise is lacking. The procedure involved manipulating a 4-millimeter-thick probe within the stomach of a live pig, with the responsive delay between Zurich and Hong Kong being just 300 milliseconds.
/web/2024/05-240827-8e

Medical Imaging Aims to Bring the Invisible to Light

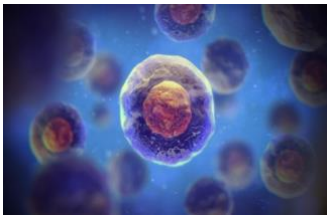
(EPFL, August 29, 2024)



EPFL research groups under the leadership of Prof. Dr. Dimitri Van De Ville at the Medical Image Processing Lab, have made remarkable strides in medical imaging technology. Their breakthrough allows for higher resolution images, capable of detecting even the smallest anomalies in the human body, and is a testament to the progress in the field of artificial intelligence. These advancements were achieved through significant improvements in imaging sensors, devices, and data processing techniques, many of which were developed at EPFL. Notably, ultrasound imaging has advanced to enable potential real-time calculations. Such technological progress also brings important ethical considerations, as the capability to non-invasively detect bone fractures, tumors, and observe internal organs revolutionizes medical diagnosis and treatment.
/web/2024/05-240829-fc

AI Tool Maps Out Cell Metabolism with Precision

(EPFL, September 09, 2024)



Scientists at EPFL, led by researchers Ljubisa Miskovic and Vassily Hatzimanikatis, have developed an innovative AI tool called RENAISSANCE. This groundbreaking tool creates detailed kinetic models of cellular metabolism, enhancing our understanding of how cells function. RENAISSANCE combines various types of cellular data to accurately portray metabolic states, simplifying kinetic model creation. The research team successfully generated models that matched experimentally observed metabolic behaviors, providing a comprehensive map of molecular interactions within a cell. This advancement is crucial for understanding metabolic changes induced by diseases and paves the way for new treatments and biotechnologies. Funded by the Swiss National Science Foundation, the European Union's Horizon 2020 research program, the Swedish Research Council, and EPFL, this tool's efficiency and ease of use will enable broader utilization in academia and industry, fostering impactful collaborations.
/web/2024/05-240909-53

Large Language Models Feel the Direction of Time

(EPFL, September 17, 2024)

A fascinating study led by Associate Professor Clément Hongler at EPFL and Jérémie Wenger of Goldsmiths, University of London has unveiled a remarkable "Arrow of Time" effect in large language models like GPT-4. The research demonstrates that these models excel at predicting the next word in a sentence over the previous word, highlighting a directional sensitivity in how they process text. By examining this phenomenon, the researchers have provided new insights into the structure of natural language and its computational representation. This breakthrough has significant implications for designing more powerful LLMs and offers a novel perspective on the passage of time as an emergent phenomenon in physics. The findings are crucial for enhancing our understanding of the capabilities and limitations of LLMs and hold promising potential for advanced AI applications.
/web/2024/05-240917-f7

6. Energy / Environment

Disruption of Vegetation and Long-term Climate Impact

(ETH Zurich, August 09, 2024)

Earth and environmental scientists at ETH Zurich, led by Professor Taras Gerya, along with collaborators from the University of Arizona, University of Leeds, IPBS-Toulouse, and WSL, have made a groundbreaking discovery. Their study reveals that warming-induced disruption of vegetation can lead to the failure of climate-regulating mechanisms for millions of years. Using a sophisticated model that incorporates vegetation and its role in the geological climate system, the researchers explored how Earth responds to massive carbon releases from volcanic activity under various scenarios. This research is crucial as it sheds light on the long-term climate effects caused by disturbed natural ecosystems, emphasizing the role of plants in climate regulation. It also highlights the lasting ecological imbalances triggered by past volcanic events, which disrupted carbon-climate regulation systems for extended periods.
/web/2024/06-240809-e6

Breakthrough in Understanding Local Adaptation Strategies of Alpine Flowers

(EPFL, August 09, 2024)

Researchers from EPFL's Geospatial Molecular Epidemiology Group, in collaboration with several Swiss institutions, have achieved a significant scientific breakthrough. Led by student Dr. Annie Guillaume and senior scientist Dr. Stéphane Joost, the study was able to detect natural selection signatures at a finer spatial resolution than previously possible, crucial for understanding species survival strategies. Using a multiscale approach and computer modeling, the study focused on the Alpine rock-cress and revealed local adaptation strategies tied to small-scale habitat variations. They found a significant association between a gene involved in the plant's defense mechanism and surface roughness, evident only at a 2-meter spatial resolution. This underscores the need for multiscale analyses in conservation genetics. These insights are vital for informing effective biodiversity conservation measures, emphasizing the importance of local adaptation strategies even within genetically similar species.
/web/2024/06-240809-1b

New Research Shows How Trees Cope with Extreme Heat

(EPFL, August 14, 2024)

EPFL and WSL have made significant strides in understanding how forest trees react to extreme heat. Led by Dr. Alice Gauthey, the research team discovered intriguing variations in tree canopy temperatures throughout the day and over the summer, providing essential insights into how trees cope with rising temperatures. Utilizing drones equipped with infrared thermal imaging cameras, the researchers measured the temperature of the uppermost leaf layer in forests across Switzerland, France, and Spain. They also measured photosynthesis rates and water loss in the leaves on branches in the treetops.
/web/2024/06-240814-aa

The Arctic Bears Witness to Climate Change

(EPFL, August 23, 2024)

Scientists from EPFL, led by Dr. Julia Schmale, have embarked on two ground-breaking Arctic expeditions to study the effects of climate change. The first, part of the GreenFjord international expedition and financed by the Swiss Polar Institute, focused on mapping greenhouse gases dissolved in water from century-old glaciers in Greenland fjords, uncovering their potential role in global warming. Utilizing advanced instruments, the team analyzed the spatial variability of these gases. The second expedition, part of the Tara Polar Station project, aims to gather central Arctic data over the next 20 years.
/web/2024/06-240823-77

Iron as an Inexpensive Storage Medium for Hydrogen

(ETH Zurich, August 31, 2024)

Researchers at ETH Zurich and Empa, led by Professor Wendelin Stark, have achieved a significant advancement in energy storage and hydrogen production. Leveraging the steam-iron process, a technology dating back to the 19th century, the team has developed a method to store hydrogen for extended periods with minimal energy losses. Using surplus solar power, water is split to produce hydrogen, which is then introduced into a stainless steel reactor filled with natural iron ore at 400 degrees Celsius. The hydrogen extracts oxygen from the iron ore, yielding elemental iron and water. This stored energy can be converted into electricity or heat using a gas turbine or fuel cell when needed. This innovation supports Switzerland's aim for a fossil-free energy supply based on renewable sources by 2050 and represents a vital step towards achieving seasonal energy storage.
/web/2024/06-240831-6b

Smart Grid Solutions to Meet Rising Demands

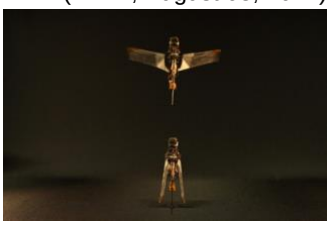
(EPFL, September 13, 2024)

Researchers from EPFL, led by Professor Mario Paolone, have developed a new method for managing the power grid's load factor. This critical research, in collaboration with Lausanne power utility, aims to reduce investment and operational costs for the community. Amid rising temperatures, air conditioning usage in Switzerland has put significant strain on the power grid. The research team calculated the grid's load factor based on power flow and utilized locational marginal pricing to optimize market benefits and enhance grid performance. By testing these solutions under real-world conditions, they explored how solar energy and demand management, alongside energy storage systems, can handle the fluctuating supply and demand. This innovation is crucial for ensuring an efficient, cost-effective, and sustainable energy future.
/web/2024/06-240913-fd

7. Engineering / Robotics / Space

Revolutionary Beetle-Inspired Microrobot

(EPFL, August 08, 2024)



Researchers at EPFL, led by Vu Hoang Phan, have developed a groundbreaking 18-gram microrobot that emulates the flight mechanism of a rhinoceros beetle. This breakthrough involves passive wing deployment and retraction, translated into a flapping microrobot capable of stable flight. The team conducted their research by anchoring the back head of a rhinoceros beetle and using high-speed cameras to capture its wing motion. The robot's motor activates the flapping and passive deployment of its 20 cm wide wings, enabling take-off and stable flight. This pioneering work is crucial for creating robots suitable for cluttered and confined spaces, showcasing significant advancements in the field of bioinspired robotics.
/web/2024/07-240808-a2

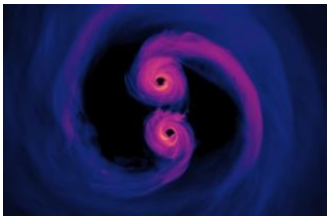
Unraveling the Formation of Organic Macromolecules in Space

(University of Bern, August 12, 2024)

Dr. Niels Ligterink from Delft University of Technology, formerly at the Physics Institute of the University of Bern, has led a groundbreaking study published in Nature Astronomy. This research provides valuable insights into the formation of organic macromolecules, crucial components thought to play a role in the building blocks of planets. Utilizing an observation-based model, Dr. Ligterink and his team have elucidated the processes by which these large molecules form, offering a clearer understanding of their presence in chondrites. This is a significant stride in the field of space exploration and organic chemistry.
/web/2024/07-240812-08

Using Small Black Holes To Detect Big Black Holes

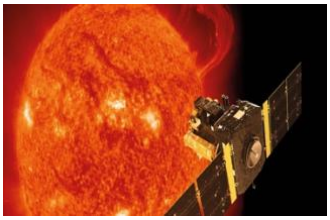
(University of Zurich, August 16, 2024)



An international team of astrophysicists, including researchers from the University of Zurich and the Max Planck Institute for Astrophysics, has proposed a groundbreaking method to detect pairs of the largest black holes in the universe. Led by Prof. Dr. Lucio Mayer from the University of Zurich, the study leverages gravitational waves generated by binaries of small stellar black holes to identify supermassive black hole pairs at galactic centers. The researchers harnessed a deci-Hz gravitational-wave detector to study these waves emitted by small stellar black hole binaries. This innovative approach is crucial as it provides a novel method to detect otherwise inaccessible massive black hole pairs, significantly advancing our understanding of supermassive black holes' origins. Such discoveries could illuminate much about the formation and evolution of galaxies.
/web/2024/07-240816-5f

The Age of the Sun Depends on when We Look at It

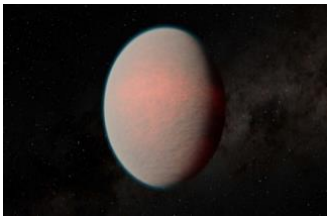
(University of Geneva, August 21, 2024)



Conducted at the University of Geneva, led by researcher Dr. Jérôme Bétrisey, a groundbreaking study delves into the oscillations of stars to uncover their mysteries. The team's innovative work sheds light on how the age and characteristics of stars, including our Sun, can depend on observational timing. By meticulously studying stellar oscillations, the research achieved a precise understanding of internal star structures, covering aspects like size, age, chemical composition, and stellar life cycle stages. Focused on reducing discrepancies between observational data and theoretical models. Not only does this advance the field of asteroseismology, but it also holds significance for deciphering the properties of planets around these stars and retracing the Milky Way's history.
/web/2024/07-240821-e3

Planets May Contain More Water than Previously Thought

(ETH Zurich, August 21, 2024)



Researchers from ETH Zurich and Princeton University, led by Dr. Caroline Dorn, have made a groundbreaking discovery that suggests exoplanets hold significantly more water than we previously believed. This research provides new insights into the composition and potential habitability of exoplanets. By leveraging model calculations based on fundamental laws of physics, the team investigated the distribution of water between silicates and the iron core in the magma oceans of exoplanets. Their findings indicate that a substantial amount of iron is initially found in the hot magma as droplets, with water sequestered in this molten soup combined with these iron droplets.
/web/2024/07-240821-47

Sweating Dummies Provide Insights into Enhancing Workplace Comfort

(EMPA, August 23, 2024)

Led by Dr. Agnes Psikuta from Empa, in collaboration with partner institutes at EPFL and the Polish Silesian University of Technology, this research reveals groundbreaking insights into maintaining comfortable temperatures in workplaces and operating theaters using smart dummies. The project employs advanced sensor technology and mathematical modeling with two manikins, HVAC and ANDI, to quantify heat radiation and heat balance. These intelligent dummies optimize energy requirements in buildings while improving thermal comfort. This innovation is crucial as it promises more sustainable and energy-efficient building designs.
/web/2024/07-240823-6b

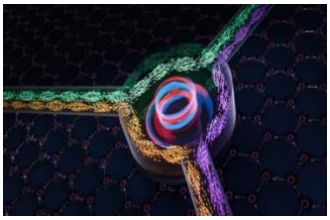
Greater Precision in Exoplanet Characterization

(University of Zurich, August 31, 2024)

Led by Prof. Dr. Sascha P. Quanz of ETH Zurich, the LIFE (Large Interferometer For Exoplanets) space mission aspires to greatly enhance our ability to characterize exoplanets. By positioning multiple satellites in space to create an enormous telescope, LIFE will measure light in the medium infrared range, providing unprecedented insights into the surface and atmosphere of distant planets. Astrophysicist Ravit Helled from the University of Zurich guides this research toward identifying Earth-like exoplanets and assessing their habitability. The potential to discover exoplanets with conditions suitable for life is groundbreaking, addressing a fundamental question in the search for alien life and our understanding of Earth's uniqueness.
/web/2024/07-240831-d2

One-way Street for Sound Waves

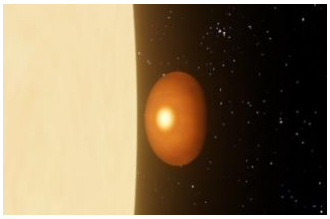
(ETH Zurich, September 10, 2024)



In a groundbreaking study led by Prof. Dr. Nicolas Noiray, researchers from ETH Zurich and EPFL have developed an innovative method to prevent sound waves from traveling backwards without influencing their forward propagation. The team, including lead author Dr. Tiemo Pedergnana, achieved this by using a spinning wave whistle combined with three acoustic waveguides arranged in a triangular shape along the edge of the circulator. This novel approach ensures unidirectional travel of sound waves, opening up possibilities for its application to electromagnetic waves in radar technology and other technical fields where one-way wave travel is essential.
/web/2024/07-240910-a6

Iron Winds on an Ultra-hot Exoplanet

(University of Geneva, September 11, 2024)



Researchers at the University of Geneva, in collaboration with the National Centre of Competence in Research PlanetS, have made a groundbreaking discovery in exoplanetary science. Their study has detected iron winds on the ultra-hot exoplanet WASP-76 b, offering crucial insights into the climates of distant worlds. Utilizing the advanced ESPRESSO spectrograph, the team measured the velocity and chemical composition of these iron winds with unprecedented precision. This remarkable level of detail allows for a deeper exploration of dynamic atmospheric processes on exoplanets, particularly those gas giants exposed to extreme radiation from their host stars.
/web/2024/07-240911-24

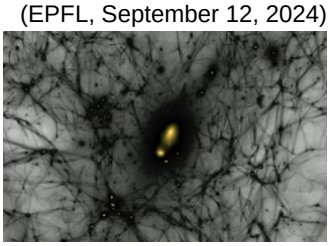
Surgical Robots that Hear, Feel and Act

(University of Zurich, September 12, 2024)

The FAROS project, funded by the European Union's Horizon 2020 research and innovation program, was spearheaded by Assistant Professor Philipp Fürnstahl at the University of Zurich. This groundbreaking initiative was a collaborative effort involving the Computer Science group at Balgrist University Hospital, Sorbonne University (France), King's College London (UK), KU Leuven (Belgium), and a French industry partner. The project achieved a scientific breakthrough by developing surgical robots capable of hearing, feeling, and acting in clinical settings. This significant advancement was made through a multidisciplinary collaboration, merging expertise from robotics, sensory technology, and computer-assisted surgery.
/web/2024/07-240912-0c

AI Helps Distinguish Dark Matter from Cosmic Noise

(EPFL, September 12, 2024)



Under the leadership of Dr. David Harvey, an AI-powered tool has marked a pivotal moment in our understanding of dark matter. An EPFL team developed a Convolutional Neural Network (CNN) to analyze images of galaxy clusters, distinguishing between the effects of dark matter self-interactions and AGN feedback, a monumental leap in dark matter studies. Utilizing the BAHAMAS-SIDM project, which models galaxy clusters under various scenarios, the CNN was trained to identify distinct signals from dark matter interactions and AGN feedback with unprecedented precision. This collaborative effort involved researchers from SLAC, Stanford, and the Dark Energy Survey, all aiming to unravel the mysteries of dark matter — a critical but elusive component of our universe.
/web/2024/07-240912-82

Artificial Muscles Propel a Robotic Leg to Walk and Jump

(ETH Zurich, September 17, 2024)

Researchers from ETH Zurich and the Max Planck ETH Center for Learning Systems (CLS), led by Assistant Professor Robert Katzschmann at the Soft Robotics Laboratory, ETH Zurich and Dr. Christoph Keplinger at the Max Planck Institute for Intelligent Systems, have made a groundbreaking advancement in robotics. Thomas Buchner and Toshihiko Fukushima, the lead researchers and co-first authors, have developed a revolutionary electrohydraulic musculoskeletal robotic leg designed for agile, adaptive, and energy-efficient movement. Aside from showcasing a significant leap in robot mobility, this breakthrough holds immense promise for applications in prosthetics, rehabilitation, and search and rescue operations.
/web/2024/07-240917-83

New Manufacturing Process for High-performance Lithium-metal Batteries

(EMPA, September 19, 2024)

The Horizon 2020 SOLiDIFY consortium, featuring 14 European partners including Empa, has developed a high-performance lithium-metal solid-state battery. A major scientific breakthrough has been achieved with a unique "liquid-to-solid" processed electrolyte. Manufactured at the EnergyVille battery lab in Belgium, the prototype battery boasts an impressive energy density of 1070 Wh/L, surpassing current lithium-ion batteries. The innovative polymerized ionic liquid-based solid nanocomposite material used for the electrolyte allows a thin separator and thick cathode, creating a compact cell stack.
/web/2024/07-240919-c4

Discovery of Hidden Exoplanets Between the Neptunian Desert and Savanna

(University of Geneva, September 20, 2024)

An international team, including members from the University of Geneva, The Technology & Innovation Platform of NCCR PlanetS, and the Centro de Astrobiología, has identified a newly discovered feature in the distribution of exoplanets, termed the "Neptunian Ridge." The research, led by Ph.D. student Amadeo Castro-González from the Center for Astrobiology in Madrid, with contributions from Dr. Vincent Bourrier, Assistant Professor at the University of Geneva, marks a significant breakthrough in understanding the complex dynamics of the Neptunian Desert and Savanna regions. Analyzing data from NASA's Kepler mission with the high-resolution spectrograph ESPRESSO on the Very Large Telescope of ESO, the team conducted a comprehensive census of the orientations of orbits within close-in Neptunes.
/web/2024/07-240920-0e

AI Helps Detect and Monitor Infrastructure Defects

(EPFL, September 26, 2024)

Researchers from EPFL led by Dr. Florent Forest, have achieved a significant breakthrough in civil engineering. They developed a novel method leveraging explainable artificial intelligence to detect and monitor defects in large-scale infrastructure. By training an algorithm to differentiate images with and without cracks in concrete walls, the research effectively quantifies crack severity over time. Conducted by analyzing hundreds of image samples, the system identifies critical pixels, enhancing the efficiency and cost-effectiveness of infrastructure inspection, particularly in railway safety. Field tests on railway sections between Zermatt and Brig, and Brig and Disentis, demonstrated the method's robustness.
/web/2024/07-240926-8f

8. Physics / Chemistry / Math

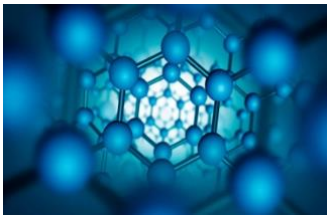
Breakthrough in Neutrino Interaction Rates Measurement

(University of Bern, August 12, 2024)

The University of Bern's Laboratory for High Energy Physics announced a scientific breakthrough in measuring neutrino interaction rates at unprecedented energies. Led by Prof. Dr. Akitaka Ariga and Prof. Dr. Michele Weber, the research utilized the Large Hadron Collider at CERN to advance our understanding of fundamental particles. The new measurements are essential for shedding light on fundamental laws of nature, such as the matter-antimatter imbalance in the universe. Understanding neutrinos can answer critical questions about the universe's nature and its early phases.
/web/2024/08-240812-af

AI Enhances Chemical Analysis at the Nanoscale

(EPFL, August 14, 2024)



Scientists at EPFL, led by Dr. Hui Chen, with Dr. Duncan Alexander and Prof. Dr. Cécile Hébert, have achieved a significant breakthrough in nanoscale chemical analysis. The team developed an innovative machine learning method called PSNMF or "non-negative matrix factorization-based pan-sharpening"; this method enhances the clarity and accuracy of energy-dispersive X-ray spectroscopy (EDX) data, enabling easier identification and quantification of chemical elements in nano-materials. Utilizing the characteristic of "Poisson noise," the PSNMF method combines data from nearby pixels to improve signal-to-noise ratios and overlapping signals. This advancement not only enhances the ability to study and use nano-materials across various fields but also holds great promise for applications in advanced electronics, medical devices, and more.
/web/2024/08-240814-4f

First Neutrino Observations with Prototype of the Ultimate Neutrino Observatory DUNE

(University of Bern, August 15, 2024)

Prof. Dr. Michele Weber from the University of Bern's Laboratory for High Energy Physics has led a study that marks the first observation of neutrinos using the "ND-LAr" detector prototype at the world's ultimate neutrino observatory, DUNE. This significant milestone is part of ongoing efforts to better understand these fundamental particles, which played a crucial role in the early universe. The research involved testing the ND-LAr prototype at the University of Bern, with plans for the neutrino beam to resume at Fermilab in fall 2024. The data from these initial detections will pave the way for numerous doctoral theses and scientific publications, forming the foundation for the commissioning of ND-LAr in 2030. The University of Bern's participation in DUNE is funded by several Swiss and European institutions, marking the first collaboration between a Swiss university and Fermilab.
/web/2024/08-240815-ef

New Value for the Half-life of Samarium-146

(Paul Scherrer Institute, August 28, 2024)

A groundbreaking study led by Schumann Dorothea from the Paul Scherrer Institute, in collaboration with the University of Zurich and the The Australian National University, has achieved the most precise measurement of the half-life of samarium-146 to date. This scientific breakthrough is set to make considerable waves in the field of nuclear science. The team meticulously conducted the research, ensuring full traceability and comprehensive documentation of all steps involved. This effort was particularly crucial because a 2012 study reported a surprisingly low value for the half-life of samarium-146, requiring a more accurate measurement.
/web/2024/08-240828-44

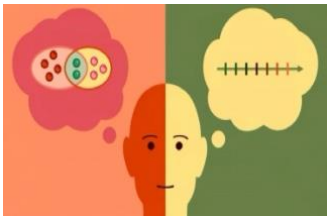
Advancing Chemical Plastics Recycling

(ETH Zurich, August 31, 2024)

Scientists at ETH Zurich, led by Dr. Antonio José Martín Fernández. have achieved a significant breakthrough in chemical plastics recycling. They have successfully developed a method to break down polyethylene and polypropylene into molecules that can be repurposed as fuels or lubricants. The researchers discovered that the key to this process involves stirring the molten plastic thoroughly in a tank to ensure proper mixing of the catalyst powder and hydrogen. This advancement in catalyst technology sets a new benchmark for global research in targeted and effective recycling methods. The importance of this breakthrough lies in its potential to enable the worldwide scientific community to develop sustainable cycles for plastic waste, reducing environmental burden and promoting sustainability.
/web/2024/08-240831-9d

How Problem-Solving Methods Affect Memory in Math

(University of Geneva, August 31, 2024)



A study led by Professor Emmanuel Sander from the University of Geneva, in collaboration with Cergy Paris University and University of Bourgogne, revealed how different arithmetic problem-solving methods can alter memory and even create false memories. This breakthrough highlights the intricate relationship between solving methods and memory retention in the context of mathematical problem-solving. The researchers analyzed memorization processes to indirectly access mental representations and identify difficulties faced by students. Their findings demonstrate that solving arithmetic problems can indeed generate false memories influenced by the nature of the problems.
/web/2024/08-240831-11

Revolutionary Pharmaceutical Research with DNA-Encoded Chemical Libraries

(ETH Zurich, September 09, 2024)

Researchers at ETH Zurich, led by Dr. Jörg Scheuermann, have achieved a significant breakthrough in pharmaceutical research. They've developed an innovative technology for creating and exploring vast collections of molecules using DNA-encoded chemical libraries (DEL) with magnetic particles. This cutting-edge technology enables the production of larger molecules composed of five or more building blocks and includes a self-purification mechanism. It holds considerable promise for discovering new active pharmaceutical ingredients and could substantially benefit fundamental biological research.
/web/2024/08-240909-a1

New Method in the Fight Against Forever Chemicals

(ETH Zurich, September 19, 2024)

Researchers at ETH Zurich, led by Professor Salvador Pané Vidal with contributions from doctoral student Andrea Veciana, have developed an innovative method to degrade the hazardous subgroup of PFAS known as PFOS. This scientific breakthrough leverages piezocatalysis, a technology never before used to break down PFOS chemicals in water. In their research, the team utilized nanoparticles and ultrasound to effectively degrade PFOS molecules, demonstrating impressive success in lab settings. This advancement is crucial as PFOS are highly toxic, extremely persistent, and contribute to significant soil and water contamination, posing severe health risks to humans and animals. While the laboratory results are promising, scaling this method for practical applications remains a challenge, highlighting the need for continued research and development.
/web/2024/08-240919-39

9. Architecture / Design

Housing Could Improve our Well-being and Reach Net-zero by 2040

(EPFL, September 17, 2024)

A study led by Dr. Sascha Nick from EPFL has explored pathways to transform Swiss housing in alignment with Switzerland's 2050 climate targets. The research, part of the SWEET SWICE program funded by the Swiss Federal Office of Energy, suggests innovative solutions for societal transition. Dr. Nick's research utilized computer modeling and systems analysis to evaluate existing Swiss buildings and resident movement patterns. The proposed housing model emphasizes shared living spaces and smaller individual living areas, potentially doubling residential capacity without new construction. The study also advocates for car-free neighborhoods with essential amenities within a short walk. This approach aims to provide high-quality housing, reduce inequality, and enhance well-being, crucial for a growing population.
/web/2024/09-240917-f9

Innovations in Sustainable Construction Technology

(ETH Zurich, September 18, 2024)

Researchers at ETH Zurich have pioneered a revolutionary robotic building method. This groundbreaking advancement introduces a fast, robot-assisted printing process for earth-based materials that remarkably does not require cement. Using a technique called "impact printing," the robot shoots material from above, gradually constructing a wall. Upon impact, the parts bond together seamlessly, eliminating the need for pauses to let the material solidify. This innovative method enables the construction of entire houses from clay or excavated earth, making it a highly sustainable and cost-effective building material. By reducing the labor-intensive and slow nature of traditional building methods, this process has the potential to transform the construction industry and make eco-friendly housing more accessible to all.
/web/2024/09-240918-36

10. Economy, Social Sciences & Humanities

An Economic Analysis of Extinction and Biodiversity Threats

(University of Basel, August 23, 2024)

Professors Rolf Weder from the University of Basel and Professor M. Scott Taylor from the University of Calgary have made significant strides in understanding the economic causes of extinction and the human threat to biodiversity. Their research delves deep into how high demand can drive not just the extinction of individual species, but potentially trigger a mass extinction event. Conducting rigorous economic analysis, the researchers identified conditions leading to extinction and proposed innovative solutions. One major recommendation is an automatic restriction or ban on international trade for entire genera or families at risk, rather than individual endangered species. Additionally, they emphasize the need to professionalize the Living Planet Index to better track and summarize data on less charismatic species. Their findings are crucial for informing effective conservation policies and safeguarding biodiversity from human-induced threats.
/web/2024/10-240823-ae

The Importance of Work Increases with Age

(ETH Zurich, September 26, 2024)

The collaborative research led by Prof. Dr. Gudela Grote from ETH Zurich and Prof. Dr. Bruno Staffelbach from the University of Lucerne, has produced insights into the sense and nonsense of work from the employees' perspective, especially amidst the rise of AI in the workplace. The research, conducted via a comprehensive survey of 2088 employees across Switzerland's German-, French- and Italian-speaking regions, took place from March to June 2024. This study is pivotal as it delves into how AI technologies influence the meaning of work for employees and examines the evolving attitudes toward work, family, and leisure over the last decade. Supported by the Swiss National Science Foundation, the Swiss HR Barometer 2024 provides crucial insights into the dynamic nature of the modern workplace.
/web/2024/10-240926-40

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

Crop Forecasting with Satellite Data and Weather Forecasts

(ETH Zurich, September 27, 2024)

At ETH Zurich, researchers Dr. Gregor Perich and Dr. Lukas Graf are pioneering new innovations in farming with Terensis, a platform that combines soil and weather data to inform farmers' crop management decisions. Using satellite data to measure the radiation reflected by plants, the researchers can precisely determine plant conditions, identifying issues like drought stress or fungal infestations. This technology aids farmers in planning long-term strategies and optimizing resource use, streamlining access to vital information. Backed by the European Space Agency Business Incubation Centre Switzerland (ESA BIC CH) and recognized with the ETH spin-off label, Terensis holds the potential to revolutionize agriculture, offering valuable insights to farmers, insurers, and policymakers.
/web/2024/11-240927-ba

12. General Interest

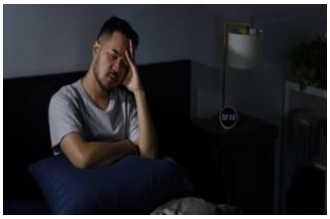
Ancient Sea Cow Attacked by Multiple Predators

(University of Zurich, September 13, 2024)

A team led by Dr. Marcelo R. Sanchez-Villagra from the University of Zurich, has made a pivotal discovery in the field of paleontology. They unearthed a partial skeleton of a sea cow from the Early to Middle Miocene Agua Clara Formation near Coro, Venezuela, providing rare insight into the complex predator-prey relationships of that era. Discovered by a local farmer, the fossils were found in an unusual location and in excellent preservation. The excavation, which required several visits due to the skeleton's size and substantial sediment, revealed clear signs of predation. This discovery offers one of the few records of multiple predators feeding on the same prey, allowing scientists to glean valuable insights into ancient marine ecosystems and predator-prey dynamics. This research marks a significant advancement in our understanding of ancient marine behavior and interactions.
/web/2024/12-240913-f7

Why We Sleep Poorly in New Places

(University of Fribourg, September 23, 2024)



Researchers from the University of Fribourg, led by PhD student Anna Wick and Prof. Dr. Björn Rasch, have made significant strides in understanding the First-Night Effect (FNE) of sleep. Their innovative studies reveal that FNE persists even when nights are non-consecutive, highlighting that both an unfamiliar environment and the situation can affect sleep quality. The research involved monitoring brain activity using mobile electroencephalograms (EEGs) and having participants complete sleep quality questionnaires each morning. It was found that spending more than one night in a new place can enhance sleep quality. Additionally, asymmetric sleep patterns were observed every night, not just during the FNE, indicating that these patterns may be more about individual traits than the surrounding environment. This study provides valuable insights into addressing poor sleep in new places, offering practical advice for travelers and individuals changing their sleeping environments.
/web/2024/12-240923-15

Genetic Study on Rapa Nui Debunks Ecocide Theory

(University of Lausanne, September 25, 2024)

In a groundbreaking study, researchers from the University of Lausanne and the University of Copenhagen, have refuted the popular theory that an "ecocide" caused the collapse of the Rapa Nui population on Easter Island. Published in Nature, the study reveals that the Rapanuis had contact and mixed with Amerindians centuries before Europeans arrived on the island. By analyzing ancient DNA, the team established genetic connections between the ancient Rapanuis and modern populations, finding the closest genetic relatives are those currently living on Easter Island. This important discovery not only provides concrete evidence to initiate discussions on repatriating the ancestors' remains but also empowers the Rapanui community to control access to their ancestors' genetic data. Additionally, the research underscores the critical need to clarify the origins of individuals whose remains are in museum archives, benefiting both scientists and the Rapanui community.
/web/2024/12-240925-f7

Upcoming Science and Technology Related Events

BaselOne 2024
October 16-17, 2024
https://is.gd/gXuh7e
IT, Web & Electronic, AI
Markethalle, Basel

WSERAA-2024
October 17-19, 2024
https://roboticssummit2024.com/
Electronics & Electrical Goods, IT, Web
Bern

3rd International Meet on Astronomy and Astrophysics
October 17-19, 2024
https://is.gd/6jNgQl
Scientific, Research & Development
Bern

Swiss Python Summit
October 17-18, 2024
https://www.python-summit.ch/
IT, Web & Electronic, AI
OST, Rapperswil

Aeronautical Meteorology Scientific Conference
October 21-25, 2024
https://is.gd/ZYSBzC
Logistics, Transportation and Packaging
World Meteorological Organization, Geneva

Global Summit on Sensors and Sensing Technology
October 21-23, 2024
https://is.gd/Hf2CHt
Electronics, Research & Development
Bern

Global Summit and Expo on Materials and Nanoscience
October 21-23, 2024
https://is.gd/EGkWvL
Nanoscience
Bern

Public Health Palliative Care International Conference
October 22-25, 2024
https://www.phpci2024.org/
Life Sciences, Health Care & Medical, Pharmaceutical & Biotechnology
Bern

The Zurich AI Conference
October 24, 2024
https://is.gd/qkxfg8
IT, Web & Electronic, AI
Zurich

Swiss Robotics Day
November 1, 2024
https://swissroboticsday.ch/
IT, Web & Electronic, AI
Congress Center, Basel

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