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Science-Switzerland, June – July 2023

News on Swiss science, technology, education and innovation

Table of Contents

Einstein And Euler Put to The Test at The Edge of The Universe

(University of Geneva, June 26, 2023)

A team of researchers from the University of Geneva led by Camille Bonvin has developed a method for testing Einstein's and Euler's theories against both the accelerating expansion of the Universe and dark matter. The method uses a never-before-used measure, time distortion, to test the validity of their equations. Depending on the measured time distortion and its relation to time, space, and galaxy speed at the edge of the universe, either of Einstein's and Euler's theories could be invalidated in future measurements. This technique will be integrated into several missions such as EUCLID, DESI and SKA. The team has already tested its model on synthetic catalogs of galaxies and are currently working on identifying obstacles and minimizing systematic features that could hamper its application.
/web/2023/08-230626-54

ETH Zurich and EPFL Launch Green Energy Coalition

(EPFL, June 09, 2023)

ETH Zurich and EPFL presidents, Joel Mesot and Martin Vetterli, have announced the launch of the "Coalition for Green Energy and Storage", a collaboration between 20 partners from politics, science and industry to create a climate-neutral and flexible energy system for Switzerland. Partners include Alpiq, AMAG, BKW Energie, SBB / CFF, Carvolution AG, Cemsuisse, Emil Frey Gruppe, Edelweiss, FIR Group AG, Gaznat, Genève aéroport, GE Vernova, Gruyère Hydrogen Power SA, Implenia, MAN Energy Systems, Migros Industry, Romande Energie, Rolex, Swissmem, SWISS International Air Lines, VBSA, Viteos SA and Verband der Schweizerischen Gasindustrie / Association Suisse de l'Industrie Gazière. The coalition will support research and development of innovative storage and transport solutions for renewable energy carriers.
/web/2023/12-230609-1a

Early Predictor of Cognitive Decline in Parkinson's Disease

(EPFL, July 06, 2023)

EPFL scientists, led by Olaf Blanke and Fosco Bernasconi, have discovered that patients recently diagnosed with Parkinson's disease who experience early hallucinations are at greater risk of faster cognitive decline. The team conducted a series of neuropsychological interviews to assess the cognitive status of 75 patients between the ages of 60 and 70 who were diagnosed with Parkinson's disease. The scientists found that in patients with Parkinson's disease, the cognitive decline of frontal executive function was more rapid in the following 5 years for those with early hallucinations. The team is now looking for early signs like minor hallucinations to promote early intervention for slowing down progression of cognitive and psychiatric symptoms of the disease. Early detection means early treatment which can help modify the course of the disease and improve cognitive function.
/web/2023/03-230706-5f

1. Education

An Immersive Tactile Book for Blind Children

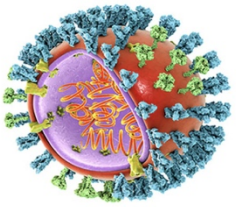
(University of Geneva, June 06, 2023)

A team from the University of Geneva has designed a book of tactile illustrations to which sounds have been associated for visually impaired children. This innovative tool makes it easier for children with or without visual impairment to identify objects. The book consists of four pages, each containing an action for children to perform with their hands, accompanied by audio instructions and sound effects. Tests revealed that the combination of gestures and sounds enabled these children, regardless of their visual abilities or visual experience, to recognize the objects depicted more easily and more quickly. Following these promising results, the project team and the publishing house «Les Doigts Qui Rêvent» are working on a new prototype featuring conductive fabrics and foams combined with electronic circuits.
/web/2023/02-230606-95

2. Life Science

How The Flu Virus Hacks Our Cells

(University of Geneva, June 01, 2023)



Researchers at the University of Geneva have recently identified a cell surface protein, transferrin receptor 1, that the influenza A virus hijacks to penetrate cells and start its infection cycle. This protein originally serves in the iron transport mechanism. By blocking this receptor with a chemical molecule, the researchers were able to significantly reduce the virus' ability to invade cells. Mirco Schmolke, Associate Professor and Béryl Mazel-Sanchez, first author, led the research team that made this discovery. While this product cannot be used to treat humans in its current form, the knowledge could help in developing strategies for treating influenza in humans and animals.
/web/2023/03-230601-f4

New Class of Antibiotics to Fight Resistant Bacteria

(University of Bern, June 01, 2023)

Researchers at the University of Zurich and the pharmaceutical company Spexis AG, led by chemist Oliver Zerbe, have developed a new class of antibiotics that are highly effective against Gram-negative bacteria, which are classified as extremely dangerous by the WHO. The new antibiotics are based on a naturally occurring peptide called thanatin, which was chemically modified to enhance its effectiveness. The new antibiotics have been tested in mice with bacterial infections and proved to be very effective, especially for treating lung infections. They are also highly effective against carbapenem-resistant enterobacteria, where most other antibiotics fail. Furthermore, they are not toxic or harmful to the kidneys and remain stable in the blood over a longer period. Further preclinical studies are needed before tests in humans can begin.
/web/2023/03-230601-04

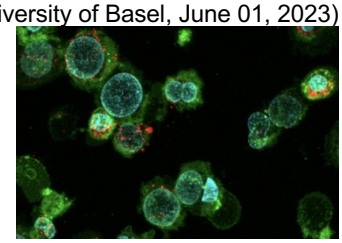
Machine Learning to Accelerate Discovery of Antimalarial Properties In Plants

(University of Fribourg, June 01, 2023)

Researchers at the Royal Botanic Gardens, Kew (UK), the Swiss Institute of Bioinformatics, and the University of Fribourg have developed a machine learning approach to accelerate the discovery of antimalarial properties in plants. Led by Adam Richard-Bollans, Kew Research Fellow, and SIB Group Leader Daniele Silvestro, the team studied three flowering plant families – Apocynaceae, Loganiaceae and Rubiaceae – together comprising 21,100 species. The machine learning models were trained on plant trait data to predict the anti-Plasmodium activity of plants. The results showed that 7,677 species in the three families warrant further investigation and that at least 1,300 active anti-Plasmodium species may have been missed using conventional approaches. This highlights the vast unexplored potential of plants to produce novel medicines.
/web/2023/03-230601-8d

New Production Process for Therapeutic Nanovesicles

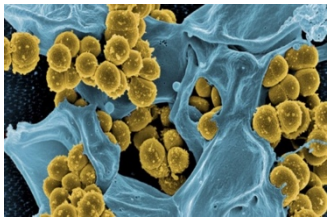
(University of Basel, June 01, 2023)



A team of researchers from the University of Basel has developed a highly efficient method for the preparation of therapeutic nanovesicles. This new approach provides up to 100 times more particles per cell and hour than conventional methods, fulfilling a key prerequisite for industrial production. Their technique consists in cultivating cancer cells, then inducing cell death, which causes them to create large vesicles. These are then pressed through a filter membrane to reduce their size, creating nano plasma membrane vesicles (nPMV) which exhibit properties similar to those of exosomes, the most commonly used extracellular vesicles. Claudio Alter, first author, and Professor Jörg Huwyler, who led the study, hope these will eventually lead to medical applications.
/web/2023/03-230601-e2

Rapid Test for Sepsis

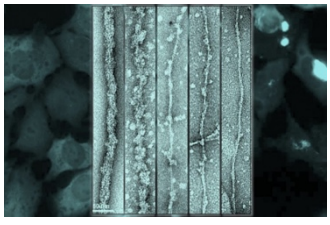
(Empa, June 01, 2023)



Empa researchers, among which Qun Ren and Fei Pan, have developed a new diagnostic procedure to detect life-threatening blood poisoning caused by staphylococcus bacteria. The procedure, which uses magnetic nanoparticles to detect and identify the bacterial pathogens, can be completed within three hours, compared to the several days it takes for a classic cultivation of bacterial cultures. This method is versatile and can be adapted to other bacteria, such as Pseudomonas aeruginosa, which is often resistant to antibiotics and can cause severe infections. This new procedure could help reduce the one million deaths caused by antibiotic resistance each year. With further validation of patient samples, the researchers hope that their sepsis test will become a crucial tool in saving lives.
/web/2023/03-230601-bd

How A Highly Unstable Protein May Lead to Neurodegeneration

(EPFL, June 05, 2023)

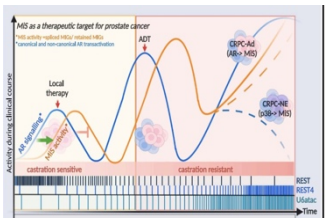


EPFL scientists have discovered a new mechanism that explains how the protein aggregates found in the brain of patients with Lou Gehrig's disease and other neurological diseases become pathogenic. The surfaces of these TDP-43 aggregates must first be cleaved by enzymes to reveal its hidden sticky surfaces, which attract normal TDP-43 proteins, inducing the formation of more aggregates. This finding suggests that inhibiting the enzymes responsible for cleaving the TDP-43 filament could be a viable therapeutic strategy to slow

down the formation and spread of these pathological protein aggregates, thus slowing down the progression of neurodegenerative diseases. The research was led by Dr. Senthil Kumar and Prof. Hilal Lashuel at EPFL.
/web/2023/03-230605-40

Minor Spliceosome Play Role in Cancer Cells

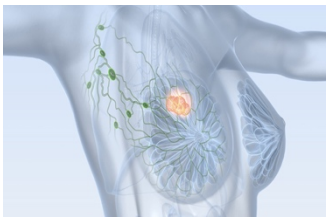
(University of Bern, June 05, 2023)



Researchers from the University of Bern, Inselspital, University Hospital Bern, and the University of Connecticut have made a significant breakthrough in cancer research. Led by Mark Rubin and Rahul Kanadia, they found out that a specific molecular machine, the minor spliceosome, is activated by cancer cells through a specific component, which stimulates uncontrolled cell growth. The team showed that inhibiting this component led to greater reduction in growth than current standard therapies without affecting normal cells. This discovery could be a game changer in developing more effective targeted combination therapies for cancers such as prostate cancer.
/web/2023/03-230605-05

Mechanisms Behind Aggressive Cancer Metastases Uncovered

(University of Basel, June 06, 2023)



Researchers at the University of Basel and University Hospital of Basel have discovered a process that helps breast cancer cells implant themselves in certain places in the body. The research team, including Professor Mohamed Bentires-Alj, and lead authors Joana Pinto Couto, Milica Vulin and Charly Jehanno, found that overproduction of an enzyme called NNMT is the key. This causes the cancer cells to also produce more collagen than normal, which helps them survive and adapt in new tissues. When the researchers removed NNMT from aggressive breast cancer cells, hardly any metastases developed. They also found that overproduction of NNMT is characteristic of a whole range of aggressive cancers. The researchers are now testing whether existing NNMT inhibitors can stop metastases in mouse models and potentially human patients.
/web/2023/03-230606-35

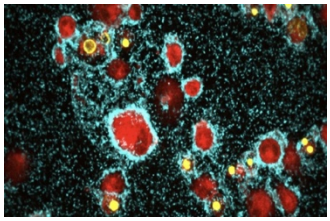
Our Visual Perception Is More Rational Than We Think

(ETH Zurich, June 13, 2023)

Swiss scientists led by ETH Professor Rafael Polania and University of Zurich Professor Todd Hare recently showed that our visual perception depends more strongly on the utility of information than previously thought. Cognitive biases can begin at the retina, and their experiments demonstrated that people perceive the same things differently when their context changes. An artificial intelligence agent that had to solve the same tasks as human study participants helped confirm these findings. The results of the study may also shed new light on the discussion of biases in humans and AI agents, as they are an unconscious part of vision and kick in long before we can think about what we see.
/web/2023/03-230613-ea

Cholera Bacteria Form Aggressive Biofilm to Kill Immune Cells

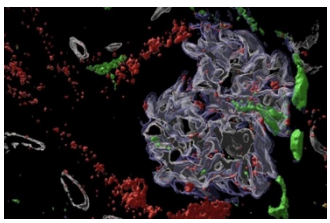
(University of Basel, June 16, 2023)



A research team led by Professor Knut Drescher at the Biozentrum, University of Basel, has discovered a novel type of bacterial community on immune cells. This aggressive biofilm, formed by the cholera-causing pathogen Vibrio cholerae, is lethal for the cells and provides new insights into the infection strategies of pathogens. First author Dr. Lucia Vidakovic and her team found that the bacteria intertwine their feeler-like appendages to form a meshwork rather than a typical slimy matrix. The hemolysin toxin was identified as the culprit for killing the immune cells. Using a human intestinal organoid model, they demonstrated that Vibrio cholerae is able to form lethal biofilms on macrophages after colonizing and disrupting the human intestinal barrier. The findings of this study could help in developing new approaches to fight bacterial pathogens.
/web/2023/03-230616-2a

Mapping The Anatomical Localization of Atypical Chemokine Receptors

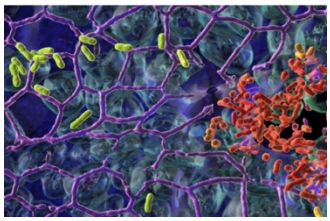
(Universita della Svizzera Italiana, June 16, 2023)



A new study conducted by the group of Marcus Thelen of the IRB at the Università della Svizzera Italiana has mapped the anatomical localization of three atypical chemokine receptors (ACKRs) in different organs. This comprehensive map provides a solid steppingstone for future functional explorations of ACKRs based on their anatomical localization. To generate this map, the team used genetically engineered mice expressing fluorescent proteins in place of ACKR3, ACKR4 and a novel ACKR, GPR182 (ACKR5), and fluorescently-labeled chimeric chemokines. The results revealed unique and shared distribution patterns, predominantly in lymph and blood vessels. This knowledge will now allow researchers to study the function and collaboration of ACKRs in different organs.
/web/2023/03-230616-a3

Researchers Uncover Dual Strategy of Dangerous Nosocomial Pathogen

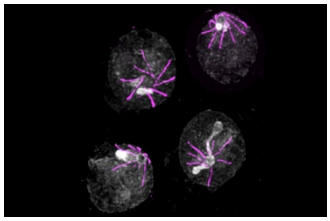
(University of Basel, June 20, 2023)



Researchers from the University of Basel, led by Professor Urs Jenal, have uncovered why one of the most dangerous nosocomial pathogens, Pseudomonas aeruginosa, is so difficult to combat. The team discovered that the bacteria follow a dual strategy - some bacteria colonize the tissue surface while others spread in the body. This division of labor is regulated by different levels of the bacterial signaling molecule c-di-GMP. The study provides important insights into the infection process and opens up new ways to treat infections. Dr. Christina Manner was the first author of the study and Professor Jenal was project leader.
/web/2023/03-230620-85

Disorient The Malaria Parasite to Prevent It from Causing Harm

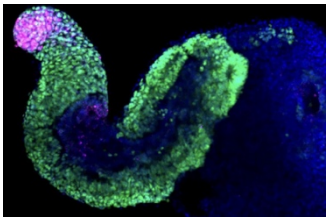
(University of Geneva, June 21, 2023)



University of Geneva researchers Mathieu Brochet, Ronja Kühnel, and Emma Ganga recently discovered a new type of sensor in the malaria parasite Plasmodium that allows it to detect its environment and adapt accordingly. This sensor is composed of five proteins and is also present in other apicomplexan parasites such as Toxoplasma, which causes toxoplasmosis. Without this sensor, Plasmodium cannot continue its development cycle or leave red blood cells after infecting them. The research team believes that their findings may open up possibilities for scrambling the signals perceived by the parasite in order to disorientate it and prevent its replication and transmission.
/web/2023/03-230621-9f

Embryoids Shed Light on A Complex Genetic Mechanism

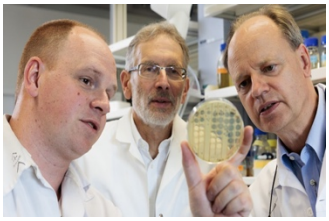
(EPFL, June 22, 2023)



Researchers at EPFL and the University of Geneva have made a breakthrough in understanding the early development of mouse embryos. Led by Prof. Denis Duboule, who heads the Laboratory of Developmental Genomics at EPFL, the team carried out their research on pseudo-embryos grown in the laboratory from stem cells. This new cell model allowed them to observe how Hox architect genes are activated according to a precise schedule by an internal clock. This research presents results that could not be achieved with animal models alone and is a major milestone in advancing our understanding of embryogenesis. This new model is faster and easier to use than animal models, and it is also less expensive.
/web/2023/03-230622-ae

Antibiotic Resistance: A Patient Saved by Bacteriophages

(University of Geneva, June 27, 2023)



A team of researchers from the University of Geneva and the Geneva University Hospitals have successfully used bacteriophages to treat a patient suffering from an antibiotic-resistant chronic bacterial lung infection. This is the first time that bacteriophages have been used to treat such an infection. The multidisciplinary team, led by Alexandre Luscher, Thilo Köhler and Christian van Delden, was able to select a specific phage for the patient's bacteria and administer it in combination with antibiotics. The treatment was successful in enabling the patient to leave hospital, regain their independence and return to work. This case highlights the potential of phage therapy as a strategy for combating antibiotic resistance, but further research is needed into selecting phages specific to each patient, establishing treatment protocols and avoiding phage-resistant strains.
/web/2023/03-230627-f9

How the Evolution of Tooth Enamel Tissue Unfolded

(University of Zurich, July 02, 2023)

A team of researchers from the University of Zurich's Center for Dental Medicine, led by Professor Thimios Mitsiadis, have discovered that the Notch pathway is a key gene network responsible for changes in tooth shape and enamel composition during evolution. Using genetically modified mouse models, they found that mutations in this signaling pathway can lead to defective structures in tooth enamel. The team hypothesize that the evolution of teeth depends on Notch signaling for the generation of new dental cell types from already existing primitive dental cell types. These findings could be used to predict how Notch-associated mutations in humans could affect their teeth morphology and enamel formation. The correlation between Notch molecules and specialized cell types may also represent a general mechanism underlying mammalian evolution.
/web/2023/03-230702-9c

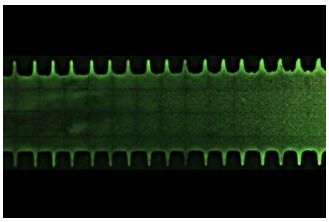
Fighting Tumors Down to The Last Cancer Cell

(PSI, July 03, 2023)

A new drug developed by researchers at the Paul Scherrer Institute (PSI) could increase survival rates for metastatic prostate cancer patients. The drug, being tested in the PROGNOSTICS project, uses a radioactive isotope called terbium-161. This isotope emits a wide range of energies to precisely target and destroy tumor cells in metastatic prostate cancer patients. The project is led by Roger Schibli of PSI, Damian Wild of the University Hospital Basel, and Nicola Aceto of ETH Zurich and will receive 2 million Swiss francs in funding. Preclinical studies have shown promise and clinical trials are set to begin in 2024. If successful, more extensive trials are planned.
/web/2023/03-230703-b8

Flowing Fluids Shape the Social Life of Gut Microbes

(EPFL, July 06, 2023)



A new study by researchers at EPFL, in collaboration with ETH Zurich, has revealed a previously overlooked factor that could be influencing our gut health: the physical forces of flowing fluids. The team studied two common gut bacteria, Bacteroides thetaiotaomicron and Bacteroides fragilis, to understand how fluid flow affects their interactions and nutrient sharing. Led by Alex Persat and Tom Battin, the team found that fluid flow influences how these bacteria interact with one another, forming biofilms attached to the inner surface of the intestine. Furthermore, they discovered that too strong a flow can limit the growth of B. fragilis biofilms. This research highlights the importance of considering physical forces in addition to chemistry when understanding gut bacteria communities and could lead to novel approaches for promoting a healthy microbiome.
/web/2023/03-230706-4b

3. Nano / Micro Technology / Material Science

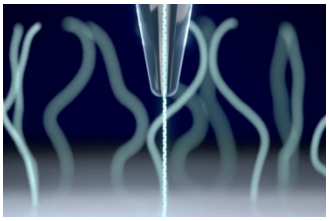
Surgical Patch Detects Leaks After Abdominal Surgery

(ETH Zurich, June 15, 2023)

ETH Zurich and Empa researchers have developed a new surgical patch that can seal wounds in the abdomen after surgery, but also detect potential leaks. Inge Herrmann, Alexandre Anthis, Benjamin Suter, and Andrea Schlegel have been working together to bring this patch into the clinic. The patch is made of polymers that form a hydrogel which can absorb fluid and cross-link with the intestinal tissue to seal the wound. It also contains sensors that detect changes in pH or enzymes from digestive juices, which can then be detected by ultrasound or computer tomography. The team is now founding a start-up, Veltist, to bring this technology to market, helping to reduce complications after abdominal surgery.
/web/2023/04-230615-ad

Researchers Control Individual Molecules for Precision Sensing

(EPFL, June 19, 2023)

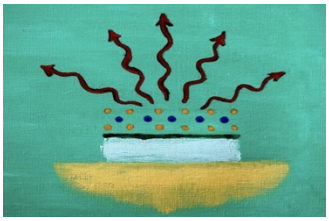


EPFL researchers Aleksandra Radenovic, Georg Fantner and Samuel Leitão have achieved near-perfect control over the manipulation of individual molecules with their new technique, scanning ion conductance spectroscopy (SICS). By combining nanopore technology with the precision of scanning ion conductance microscopy (SICM), the team has been able to lock onto specific molecules and locations and control how fast they move. This increased

detection capability could significantly improve diagnostic and sequencing applications, such as DNA sequencing and proteomics. The team's work was recently published in Nature Nanotechnology.
/web/2023/04-230619-1a

An Unexpected Antenna for Nanoscale Light Sources

(ETH Zurich, July 03, 2023)

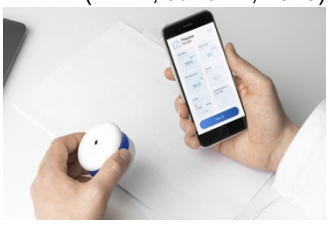


ETH Zurich researchers, led by Prof. Lukas Novotny and colleagues from EMPA in Dübendorf and ICFO in Barcelona, have made a breakthrough for modern data transfers. These rely on light sources, which are technologically challenging. The team has found a new mechanism to create tiny but efficient light sources based on the tunnel effect. Using quantum mechanics and a surprising placement of semiconductors on top of graphene electrodes, outside the tunnel junction, they created an antenna prototype almost by accident. This could lead to faster switching and modulation of light, which is essential for modern data transfer. The research was recently published in Nature Materials. With further improvements, these nanoscale light sources could be used for various applications in the future.
/web/2023/04-230703-e4

4. Information & Communications Technology

DeepBreath: Using Deep Learning to Identify Respiratory Disease

(EPFL, June 12, 2023)



EPFL and University Hospital Geneva have developed an AI algorithm, DeepBreath, that will power a new intelligent stethoscope, Pneumoscope, with the potential to improve the management of respiratory disease in low-resource and remote settings. The algorithm was trained on recordings from almost 600 pediatric outpatients across five countries and validated for its accuracy. It is able to distinguish between three common types of respiratory disease: pneumonia, bronchiolitis, and asthma. The algorithm is also robust to variations in background noise, soundscape, epidemiology, and local protocols for diagnosis. A team of students from EPFL completed their master theses on the project as part of the development of DeepBreath, led by Dr. Mary-Anne Hartley and Professor Alain Gervaix. Pneumoscope is set to revolutionize diagnosis and management of respiratory diseases in low-resource settings.
/web/2023/05-230612-81

Lasers Enable Internet Backbone Via Satellite

(ETH Zurich, June 22, 2023)

ETH Zurich scientists Yannik Horst and Jürg Leuthold, along with their European partners, have achieved a breakthrough in optical data communications. Through a successful test between the Jungfraujoch and Bern in Switzerland, they demonstrated the capacity to transmit several tens of terabits per second through air turbulence. This technology could soon replace expensive deep-sea cables as the internet backbone, making internet access more cost-effective and faster. The project was made possible by the expertise of Thales Alenia Space, ONERA, and Leuthold's ETH Zurich research group. Their new 4D binary phase-shift keying modulation format enabled high data rates even under challenging conditions. This is a major step forward for global internet access.
/web/2023/05-230622-4b

5. Energy / Environment

How Much Microplastics Is There in Swiss Rivers And Lakes?

(Empa, June 15, 2023)

Empa researchers David Mennekes and Bernd Nowack have developed a model to calculate the concentration of microplastics in Swiss lakes and rivers. The model focuses on the seven most common polymers, such as polyethylene, polypropylene, and PVC. According to the new model, around half of the microplastics that enter Swiss waters remain in the country, with around a third settling in lakes and the remainder in rivers. The Rhine near Basel contains the highest concentration of microplastics due to its proximity to major cities. The model can also be applied to other countries and areas, allowing for behavioral changes or government measures to be estimated.
/web/2023/06-230615-a1

Climate Change Releases Carbon Stocks Deep Underground

(University of Zurich, June 15, 2023)

Researchers from the University of Zurich's Department of Geography, led by Professor Michael W. Schmidt, have found that global warming is causing significant loss of the organic compounds that help plants store carbon in their leaves and roots. This majorly undermines plans to use soils and forests as natural carbon sinks. The study, conducted in the Sierra Nevada National Forest, showed that the compound lignin was reduced by 17%, while waxy compounds called cutin and suberin were down 30%. These are all organic compounds that help plants store carbon in their leaves and roots. Pyrogenic carbon was also present in significantly reduced amounts. These findings have major implications for tackling global warming, as they suggest that relying on soils and forests as natural carbon sinks may not be enough to stop emissions at the source.
/web/2023/06-230615-a0

2°C Warming Target Still Achievable

(EPFL, June 21, 2023)

Researchers from EPFL's Laboratory of Environmental and Urban Economics have found that if the 120 countries that signed the Glasgow Climate Pact keep to their pledges, global temperatures could be held to just below 2°C by 2100. Scientists Marc Vielle and Sigit Perdana, climate change modeling specialists at EPFL, carried out the research with colleagues from other universities. The team used a series of models incorporating socioeconomic, regional and technology-related factors to analyze the climate policies of several countries. They also assessed the feasibility of each scenario, looking at various factors and regional differences. Their findings have just been published in the journal Nature Climate Change. The study shows that the world is still on track to beat the 2°C target under the most ambitious scenario but more effort is needed to keep global warming below 1.5°C.
/web/2023/06-230621-67

Global Warming Accelerates CO2 Emissions From Soil Microbes

(ETH Zurich, June 22, 2023)

A team of researchers from ETH Zürich, WSL, Eawag, and the University of Lausanne, led by Peter Molnar and Alon Nissan, have published a study revealing a projected surge in CO2 emissions from soil microbes by up to 40 percent by 2100. The novel mathematical model developed by Alon Nissan simplifies the estimation process by utilizing only two crucial environmental factors: soil moisture and soil temperature. The research shows that microbial CO2 emissions in polar regions will increase twice as much as in other geographical zones due to declining soil moisture rather than a rise in temperature. This highlights the importance of understanding carbon dynamics within soils to better inform climate change mitigation strategies.
/web/2023/06-230622-bc

How An Ocean-Fertilizing Bacterium Forms Aggregates

(ETH Zurich, June 23, 2023)

ETH Zurich researchers Roman Stocker, Ulrike Pfreundt, and Jonasz Slomka have made a breakthrough in understanding the behavior of the marine microorganism Trichodesmium. For the first time, they have uncovered how individuals form and reshape organized aggregates without central control. The team discovered that individual filaments glide against each other, a movement that they can reverse at varying speed and enables them to stay together and control their shape. By simply reacting to neighboring filaments, aggregates organize themselves without central control. This simple yet effective behavior is key to Trichodesmium's fundamental ecological role and its importance in carbon storage in the ocean.
/web/2023/06-230623-fd

4000 Scenarios for A Climate Turnaround

(PSI, July 03, 2023)

Researchers from the Paul Scherrer Institute, Columbia University, University College Cork, and other institutions have developed an extensive computer simulation to analyze different ways of mitigating climate change. It is the first such study to take uncertainties into account. The team calculated 4,000 scenarios for 15 regions of the world, taking into account possible developments in ten-year steps up to 2100. The study combines climate models with economic models and 1200 technologies for supplying and using energy, as well as reducing greenhouse gas emissions. It considers 18 uncertainty factors such as population growth, economic growth, climate sensitivity and resource potential. The results provide a sound basis for customized analyses at the national level to enable the transition to a zero-carbon economy.
/web/2023/06-230703-e9

Consequences of Pesticide Use in the Tropics

(Eawag, July 05, 2023)

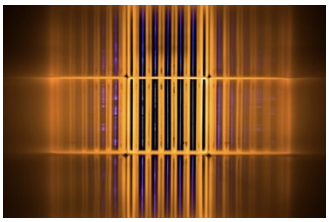
The interdisciplinary project "Pestrop", led by Eawag and the Swiss Tropical and Public Health Institute, is working to uncover the consequences of pesticide use on human health and the environment in tropical countries. The team has investigated which pesticides were used in two test regions in Costa Rica and Uganda from 2017 to 2020, as well as their presence in streams and drinking water production. Evidence of long-term negative effects of pesticide use on farmers' health was found, along with deficits in environmental data, inadequate advice to farmers, and outdated statutory requirements on pesticide use. Surprisingly, insecticides such

as chlorpyrifos were found even though they are rarely sprayed on fields - suggesting that they may be entering the environment through farmyard manure. The project is being jointly led by Dr. Samuel Fuhrimann from Swiss TPH and Dr. Thomas Bucheli from Eawag.
/web/2023/06-230705-a5

6. Engineering / Robotics / Space

Actively Reducing Noise by Ionizing Air

(EPFL, June 01, 2023)



Scientists from EPFL have built a plasma-based “reverse loudspeaker” that cancels out noise by interacting with sound vibrations in the air. Their concept, named “plasmacoustic metalayer”, consists in a thin layer of ionized air that can instantaneously respond to external commands via an electric field. The thinness of the plasma layer makes it much more efficient than membrane-based active noise cancellers, especially at high frequencies. The research team, led by postdoc Stanislav Sergeev and senior scientist Hervé Lissek, have experimentally demonstrated perfect sound absorption, with 100% of incoming sound canceled out. Its compactness and versatility make it ideal for a variety of applications, which is why EPFL has partnered with Sonexos SA, a Swiss-based audio technology company, to bring this technology to reality.
/web/2023/07-230601-36

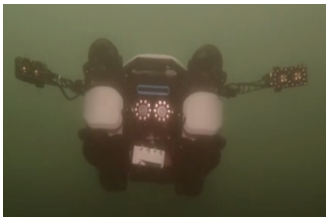
Ambulatory, Long-Term Monitoring of Electric Brain Activity

(CSEM, June 01, 2023)

CSEM and the Inselspital, University Hospital Bern have teamed up to develop a solution that enables reliable, long-term, and continuous monitoring of brain activity for epilepsy and sleep disorders. The ULTEEM solution consists of two sensors that can be clipped onto any metallic glasses frame for day-time use, and a headband with CSEM’s proprietary dry electrodes for night-time use. The device is lightweight and comfortable to wear, while providing accurate readings of electric brain activity. An upgraded version of the ULTEEM night solution is currently being tested in an extended clinical study, with plans to integrate it into a secure cloud ecosystem. This collaboration brings crucial value to clinicians in pathologies such as epilepsy and sleep disorders.
/web/2023/07-230601-bf

Diving Robot for Dangerous Operations

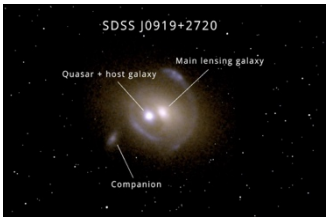
(ETH Zurich, June 04, 2023)



The ETH spin-off Tethys has developed an underwater robot that can be used in situations that are too dangerous for human divers. Founded by Pioneer Fellows Jonas Wüst and Pragash Sivananthaguru, the robot is equipped with acoustic sensors and cameras, allowing it to autonomously search large areas underwater and quickly localize objects or people. Once the robot has located its target, an operator takes over the navigation and guides the robot diver to the target. The Tethys robot can carry up to 40 kg back to the surface, enabling emergency services to focus on other important tasks. This innovative technology has already been used by several local authorities for underwater search and rescue operations.
/web/2023/07-230604-18

Weigh A Quasar's Galaxy with Precision

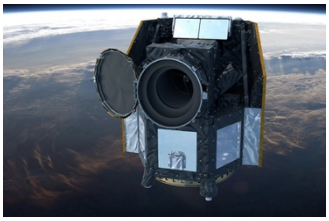
(EPFL, June 13, 2023)



EPFL scientists Frédéric Courbin, Martin Millon, and Aymeric Galan have conducted the most accurate measure of the mass of galaxies hosting quasars. Using the phenomenon of strong gravitational lensing, the team was able to determine the mass of one such galaxy. The team identified a quasar acting as a gravitational lens in the Sloan Digital Sky Survey database and observed it with the Hubble Space Telescope. A wavelet-based lens modeling technique developed by Galan was used to disentangle the masses of various objects in order to obtain an accurate result. The findings provide insight into how galaxies form and evolve throughout cosmic time. With the ESA-NASA mission Euclid's launch this summer, scientists expect to detect hundreds more gravitational lensing quasars, further advancing our understanding of the universe.
/web/2023/07-230613-93

Four New Exoplanets Discovered

(University of Geneva, June 15, 2023)



An international team of European astronomers have successfully identified the existence of four new exoplanets with the help of the CHEOPS space telescope. Led by researchers Dr. Solène Ulmer-Moll and Dr. Hugh Osborn from the University of Bern and the University of Geneva, respectively, and members of the National Centre of Competence in Research (NCCR) PlanetS, they used a unique synergy between CHEOPS and NASA's TESS satellite to detect two Neptune-sized planets called TOI 5678 b and HIP 9618 c, with periods of 48 days and 52.5 days respectively. Two other members from the team also identified two similar planets in other systems using this technique. The four planets are ideal targets for further study by NASA's James Webb Space Telescope which may help solve their composition mystery for potential habitability.
/web/2023/07-230615-d7

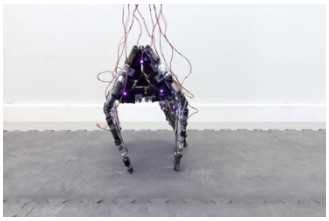
Researchers Unveil First Chat-GPT-Designed Robot

(EPFL, June 19, 2023)

Researchers at EPFL have demonstrated the potential of artificial intelligence tools to collaborate with humans on robot design by using Chat-GPT-3 to develop a robotic gripper for harvesting tomatoes. Led by Josie Hughes, head of the Computational Robot Design & Fabrication Lab in the School of Engineering, and including EPFL PhD student Francesco Stella and Cosimo Della Santina of TU Delft, the team used an 'ideation' discussion to define specifications for their robot before refining its code and troubleshooting its functioning. The study provides a framework for humans and AI tools to design robots collaboratively, while also raising ethical questions around bias, plagiarism, and intellectual property.
/web/2023/07-230619-58

Mori3: A Polygon Shapeshifting Robot for Space Travel

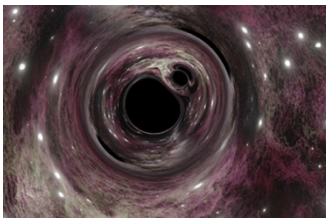
(EPFL, June 25, 2023)



Jamie Paik and her team of researchers at EPFL's School of Engineering have created an origami-like robot named Mori3 that can change shape, move around, interact with objects and people, and even transform into almost any 3D object. The team pushed the boundaries of various aspects of robotics to make Mori3 a reality. The individual modules of the robot are triangular in shape and easily join together to create polygons of different sizes and configurations. Mori3 robots can move around, handle and transport objects, and interact with users. The researchers hope that Mori3 robots will be used in spacecraft, for communication purposes and external repairs, due to their versatility in such a tight-space environment.
/web/2023/07-230625-54

Unveiling The Origins of Merging Black Holes In Galaxies Like Our Own

(University of Geneva, July 01, 2023)



A team of scientists from the University of Geneva, Northwestern University, and the University of Florida have used advanced simulation tools to uncover the origins of merging black holes in galaxies like our own. Led by Simone Bavera, a post-doctoral researcher at UNIGE's Department of Astronomy, and Anastasios Fragkos, assistant professor in the same department, the team used the POSYDON code to simulate binary-star populations and predict the existence of merging 30 solar mass black hole binaries in galaxies similar to the Milky Way. POSYDON is an open-source software package that leverages a pre-computed library of detailed single- and binary-star simulations to predict the evolution of isolated binary systems. The team is currently developing a new version of POSYDON that will include a larger library capable of simulating binaries in different galaxy types.
/web/2023/07-230701-c1

A Heat-Resistant Drone to Support Firefighters

(Empa, July 02, 2023)

Researchers Mirko Kovac, David Häusermann and Shanyu Zhao, from Empa and Imperial College London, have developed a heat-resistant drone called the FireDrone. This drone can analyze the source of danger at close range in the event of a building or forest fire. The FireDrone is heatproofed with an aerogel, an ultralight material consisting almost entirely of air-filled pores enclosed in a hint of polymer substance. This composite material consists of polyimide and silica and is also reinforced with glass fibers. The FireDrone survived several test flights, even through a large gas fire, and is now being further developed for use in extreme temperatures. This technology could help to optimize strategies before entering dangerous zones and reduce unnecessary risk for firefighters.
/web/2023/07-230702-84

7. Physics / Chemistry / Math

Breaking The Ice Over A 40-Year Problem of Supercooled Water

(EPFL, June 01, 2023)

Scientists at EPFL have made a breakthrough discovery that allows them to study water in the subzero temperature range known as “no man’s land.” This range has historically been impossible to access, preventing scientists from understanding the anomalous nature of water. The team, led by Professor Ulrich Lorenz, developed a method to rapidly prepare deeply supercooled water and probe it with electron diffraction before it can crystallize, with the help of a custom-built specialized time-resolved electron microscope. Their findings show that as water is cooled from room temperature to cryogenic temperatures, its structure evolves smoothly, which helps narrow down the possible explanations for the origin of its anomalies.
/web/2023/08-230601-aa

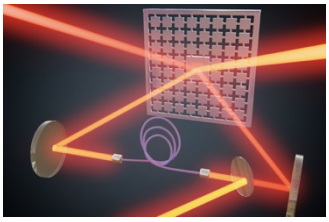
Critical Schrödinger Cat Code for More Reliable Qubits

(EPFL, June 15, 2023)

EPFL scientists Luca Gravina and Fabrizio Minganti, led by Professor Vincenzo Savona, have developed a revolutionary “critical Schrödinger cat code” qubit that can store and process information in a way that is more reliable and resistant to errors than previous qubit designs. Drawing inspiration from Erwin Schrödinger’s famous thought experiment, the critical cat code developed by the physicists combines two previously used approaches: leveraging anharmonic effects in the cavity, and relying on carefully engineered cavity losses. Their hybrid approach combines the best of both worlds, resulting in an advanced resilience to errors that could revolutionize quantum computing.
/web/2023/08-230615-8b

A New Technique for Cooling Membranes With Lasers

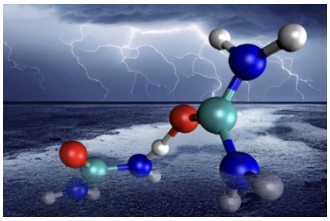
(University of Basel, June 26, 2023)



Researchers at the University of Basel, led by Prof. Dr. Philipp Treutlein and Prof. Dr. Patrick Potts, have successfully used laser light to cool a small membrane down to extremely cold temperatures - less than a thousandth of a degree above absolute zero. The team, which also included PhD student Maryse Ernzer and postdoc Manel Bosch Aguilera, used a coherent feedback loop in which the laser light acted both as a sensor and as a damper to dampen and cool the thermal vibrations of the membrane. This breakthrough could have applications for highly sensitive sensors, such as atomic force microscopes.
/web/2023/08-230626-5b

Why Urea May Have Been the Gateway to Life

(ETH Zurich, June 28, 2023)

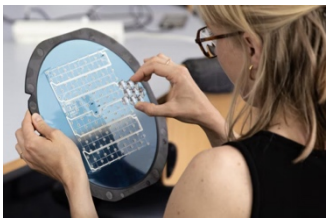


Researchers from ETH Zurich and the University of Geneva, led by Professor Hans Jakob Wörner, have developed a new method to observe chemical reactions taking place in liquids at extremely high temporal resolution. This method could help us to understand how life on Earth began. Using their new method, the researchers studied a chemical reaction involving urea that may have been key to the emergence of life on Earth. Through exposure to ionizing radiation such as cosmic rays, it's possible that concentrated urea produced malonic acid over multiple synthesis steps. In turn, this may have created the building blocks of RNA and DNA. The results are not only relevant for biochemistry but also for important industrial synthesis reactions.
/web/2023/08-230628-5b

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

Photovoltaics: Swiss Innovation Once Again Puts Europe Center Stage

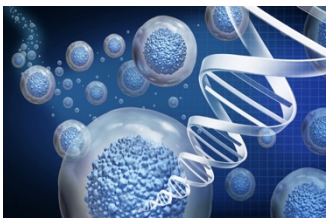
(CSEM, June 26, 2023)



The European research project HIPERION, led by experts from CSEM and the University of Neuchâtel, is revolutionizing solar energy technology. Their new flat photovoltaic panels are the most efficient ever designed, with a power conversion efficiency of over 29% under standard test conditions. HIPERION modules combine space concentration technology with conventional photovoltaic technology to achieve a concentration factor of 200 times. This innovation also successfully addresses the issue of efficiency loss on concentrator modules in cloudy weather. Their flat shape makes them highly practical and improves their compatibility with existing infrastructure. The project is currently monitoring and evaluating the module performance at pilot sites in order to gather valuable data on its competitive advantages in different regions.
/web/2023/11-230626-a5

Gentler Cell Therapy with Cimeio, Prime Medicine, and University of Basel Collaboration

(University of Basel, June 26, 2023)



Cimeio Therapeutics, a University of Basel spin-off, is working to develop gentler cell therapies for blood cancer and other serious blood diseases. Led by researchers from the University of Basel, the start-up has partnered with Prime Medicine to bring their vision closer to reality. The collaboration will use Prime Medicine's groundbreaking gene editing technology to make targeted changes to surface proteins on donated blood stem cells, allowing them to be distinguished from the patient's own cells and making it easier for them to be transplanted without burden for the patient. This could potentially pave the way for a cure for inherited blood diseases by repairing genetic defects within the stem cells in situ. Cimeio and Prime Medicine are now working together to combine their respective technologies in order to make this dream a reality.
/web/2023/11-230626-5d

EPFL Spin-Off Closes the Loop on PET Recycling

(EPFL, June 28, 2023)

EPFL spin-off DePoly is making waves in the Swiss startup scene with their innovative method of recycling polyethylene terephthalate (PET) at ambient temperature. Led by CEO Samantha Anderson, DePoly recently raised CHF 12.3 million to build a pilot plant capable of processing 500 metric tons of PET per year. This method is able to process dirty or mixed plastics that are usually incinerated, and it could have a major impact on the global PET recycling rate, which currently stands at less than 50%. Co-founders Bardiya Valizadeh and Christopher Ireland have been instrumental in refining the process and perfecting the formula for breaking down PET into terephthalic acid and ethylene glycol. With their pilot plant set to open in 2024, DePoly is hoping to make a real difference in reducing plastic waste worldwide.
/web/2023/11-230628-15

Upcoming Science and Technology Related Events

99th Congress of the Swiss Abroad
August 18-20, 2023
https://is.gd/rP255u
Finance, Banking, Investment & Insurance
St. Gallen

Conference on Organometallic Chemistry
August 24-25, 2023
https://fm23.scg.ch/
Scientific, Research & Development
Bern

ISREC-SCCL Symposium
August 21-24, 2023
https://is.gd/L4cZM2
Life Sciences, Health Care & Medical, Pharmaceutical & Biotechnology
Lausanne

ESEH Conference
August 22-26, 2023
https://is.gd/0TsvCS
Environment & Waste
Bern

International Nanoscience Student Conference
August 22-25, 2023
https://is.gd/7uXxIc
Human Resources, Education & Training
Basel

Epigenetic Inheritance Symposium
August 23-25, 2023
https://is.gd/bEJB5G
Life Sciences, Health Care & Medical, Scientific, Research & Development
Zurich

ETH Industry Day
September 6, 2023
https://is.gd/Pj68wD
Industrial Products & Engineering, Scientific, Research & Development
Zurich

Top 100 Swiss Investor Summit 2023
September 6, 2023
https://is.gd/DN2Dx1
Investment, Science & Innovation
Zurich

Top 100 Swiss Startup Award 2023
September 6, 2023
https://is.gd/EVRwQP
Startups, Science & Innovation
Online livestream

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