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SCIENCE & TECHNOLOGY

GLOBAL

[Scientists Warn of Many Dangerous Climate Feedback Loops](#)

A new report written by an international team of researchers, including scientists from Oregon State University (OSU), warns of many risky climate feedback loops and the need for action in both research and policy. They described 41 climate feedback loops that have major implications for climate change. Climate feedback loops are processes that can either amplify or diminish the effects of our greenhouse gas emissions. In total, the researchers identified 27 amplifying feedbacks, 7 dampening feedbacks, and 7 uncertain feedbacks. Some particularly troubling feedback loops include the permafrost feedback wherein rising temperatures lead to permafrost thawing, which results in more carbon dioxide and methane emissions, amplifying warming. The researchers recommend that on climate research, a rapid transition toward integrated Earth system science is needed. On climate policy, more ambitious plans for emissions drawdown should be pursued.

[Carotenoid-based Degradable Polymer](#)

Researchers at the University of Toronto have incorporated a compound derived from beta-carotene, or β -carotene — an organic, red-orange pigment abundant in plant-based foods such as carrot, tomato, potato, watermelon, and many more — into a polymer that is fully degradable. They combined the carotenoid derived from beta-carotene, a 10-carbon dialdehyde, and p-phenylenediamines, a group of compounds used in degradable polymers, to make three different poly(azomethine)s. When dried, the resulting materials ranged in color from black to bright red. The bright red version — created with p-phenylenediamine containing two hexyl side chains completely broke down into its original components in acidic solutions, which could potentially be recovered. However, when both acid and artificial sunlight were used, this process sped up. After an extended period, the sample broke down even further into smaller di-aldehydes and other compounds. This work opens up the use of carotenoid monomers for producing biobased, degradable, and conjugated polymers.

[New Approach to Create Lead-free Capping Layer for Perovskite Cell](#)

Research led by scientists at Nanyang Technological University, Singapore (NTU Singapore) announced the findings of using non-toxic metals with a new approach to fabricate the capping layer of perovskite solar cells, making the cells more environmentally friendly while maintaining high conversion efficiency. They have found that a zinc-based compound PEA₂ZnX₄ synthesized using a new approach called the full precursor (FP) method can create a lead-free capping layer for the perovskite cell. The scientists also say that the new method contributes to efforts to make the perovskite layer more environmentally friendly, stable, and

efficient since it does not require extracting lead ions from the perovskite layer to make the traditional lead-based capping layer, which unlocks new opportunities for applying other materials to reform both the perovskite and capping layers hence optimizes the overall cell performance.

[Copper Catalyst Converts CO2 into Liquid Fluids](#)

Researchers have made real-time movies of copper nanoparticles as they evolve to convert carbon dioxide and water into renewable fuels and chemicals. Their new insights could help advance the next generation of solar fuels. The work was made possible by combining a new imaging technique called *operando* 4D electrochemical liquid-cell STEM (scanning transmission electron microscopy) with a soft X-ray probe to investigate the same sample environment: copper nanoparticles in liquid. At the heart of the new technique is an electrochemical "liquid cell" sample holder with remarkable versatility. A thousand times thinner than a human hair, the device is compatible with both STEM and X-ray instruments. The electrochemical liquid cell's ultrathin design allows reliable imaging of delicate samples while protecting them from electron beam damage. A special electrode enabled the team to conduct X-ray experiments with the electrochemical liquid cell. Combining the two allows researchers to comprehensively characterize electrochemical reactions in real time and at the nanoscale. The copper nanograins could potentially boost the energy efficiency and productivity of some catalysts designed for artificial photosynthesis, a field of research that aims to produce solar fuels from sunlight, water, and CO₂.

[Electronic Metadevices Break Barriers to Ultra-fast Communications](#)

EPFL researchers have come up with a new approach to electronics that involves engineering metastructures at the sub-wavelength scale. It could launch the next generation of ultra-fast devices for exchanging massive amounts of data, with applications in 6G communications and beyond. They rearranged the device notably by etching patterned contacts called metastructures at sub-wavelength distances onto a semiconductor made of gallium nitride and indium gallium nitride. These metastructures allow the electrical fields inside the device to be controlled, yielding extraordinary properties that do not occur in nature. The device can operate at electromagnetic frequencies in the terahertz range (between 0.3-30 THz) -- significantly faster than the gigahertz waves used in today's electronics. They can therefore carry much greater quantities of information for a given signal or period, giving them great potential for applications in 6G communications and beyond. The electronic metadevices developed in the POWERlab could form the basis for integrated terahertz electronics by producing compact, high-frequency chips that can already be used with smartphones, for example. This new technology could change the future of ultra-high-speed communications, as it is compatible with existing processes in semiconductor manufacturing.

[New Drug to Reverse Key Symptoms of Schizophrenia in Mice](#)

A team from Nagoya University in Japan used the drug fasudil to reverse two common symptoms associated with schizophrenia: reduced density of pyramidal neurons and cognitive dysfunction associated with methamphetamine treatment. They used fasudil to inhibit ROCK in model mice with mutations in their ARHGAP10 gene to see if this improved symptoms. They found that treatment restored the density of pyramidal neurons in the medial prefrontal cortex, a part of the brain associated with attention and long-term memory. As a result, mice with

methamphetamine-induced cognitive impairment treated with the drug also performed better on visual discrimination tests. Targeting Rho-kinase signaling may provide new therapeutic approaches for the treatment of schizophrenia patients, including those with ARHGAP10 gene mutations.

3D-Printed Heart Replicas

Massachusetts Institute of Technology engineers have developed a procedure to 3D print a soft and flexible replica of a patient's heart. These models could help doctors tailor treatments, such as aortic valves, to an individual patient. They can then control the replica's action to mimic that patient's blood-pumping ability. The procedure involves first converting medical images of a patient's heart into a three-dimensional computer model, which the researchers can then 3D print using a polymer-based ink. The result is a soft, flexible shell in the exact shape of the patient's own heart. The team can also use this approach to print a patient's aorta -- the major artery that carries blood out of the heart to the rest of the body. To mimic the heart's pumping action, the team has fabricated sleeves similar to blood pressure cuffs that wrap around a printed heart and aorta. The underside of each sleeve resembles precisely patterned bubble wrap. When the sleeve is connected to a pneumatic system, researchers can tune the outflowing air to rhythmically inflate the sleeve's bubbles and contract the heart, mimicking its pumping action. The researchers can also inflate a separate sleeve surrounding a printed aorta to constrict the vessel. This constriction, they say, can be tuned to mimic aortic stenosis -- a condition in which the aortic valve narrows, causing the heart to work harder to force blood through the body.

INDIA

Telemedicine Services to more than 100 million Patients

India's national telemedicine platform – eSanjeevani-has provided teleconsultation services to 100 million beneficiaries. 100.11 million patients were served at 115,234 Health & Wellness Centres (as spokes) through 15,731 hubs and 1,152 online OPDs populated with 229,057 medical specialists and super-specialists trained in telemedicine. eSanjeevani has been augmented further to support over 1 million consultations in a day, so far, the platform has peaked to serve 5,10,702 patients in a day. “eSanjeevani - the National Telemedicine Service of India is the world's largest telemedicine implementation in primary healthcare, especially for people in rural areas. Over 57% of the beneficiaries of eSanjeevani are women and around 12% beneficiaries are senior citizens. The cloud-based eSanjeevani platform was introduced in two modes: (1) eSanjeevaniAB-HWC (a provider-to-provider telemedicine platform): connects patients through health workers and medical officers in Health & Wellness Centres to the doctors and specialists in hubs established in secondary/tertiary level health facilities or medical colleges. (2) eSanjeevaniOPD (a patient to provider telemedicine platform): it empowers citizens to access outpatient services in the confines of their homes through smartphones of laptops etc. The telemedicine platform that has brought a large populace (doctors as well as patients) into the digital health ecosystem by providing free of cost consultations. The initiative has enabled digitalisation of health information, which can aid policymakers to come up with effective and timely health policies. eSanjeevani played a key role during the Covid 19 pandemic in providing medical care at homes. eSanjeevani is also part of the Ayushman Bharat Digital Mission that aims to develop the backbone necessary to support the integrated digital health infrastructure of the country.

Unique Coatings Developed to Prevent Post-surgical Infections

Researchers from ARCI, Hyderabad have developed a nanocomposite coating (named as ATL) by combining water repellence and biocidal property, which exhibits both hydrophobic and biocidal behaviour. The developed coating not only inhibits biofilm formation by restricting bacterial and water adhesion but also kills attached bacteria. ATL was deposited on different surgical sutures made of silk, nylon, and polyglactin 910 (vicryl) in addition to surgical instrument grade stainless steel 420 coupons and tested for biofilm inhibition against American Type Culture Collection (ATCC) and clinical isolate strains of proven biofilm-forming bacteria such as *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Staphylococcus aureus* and *Escherichia coli*. The ATL-coated vicryl sutures exhibited higher percentage biofilm inhibition when compared to commercially available triclosan-coated antibacterial sutures. Cytotoxicity of the formulation was evaluated on coated surface, and it was found that ATL coatings are non-cytotoxic. The coatings developed in the present study can be used as a non-cytotoxic alternative to the commercially available antibacterial coatings, especially for healthcare applications on surgical sutures/surgical instruments to prevent the rise of multidrug-resistant bacteria. A patent has been filed for this technology.

Hope for Intractable Epilepsy in Children

Scientists from JNCASR in collaboration with scientists at Seattle Children's Research Institute, Seattle, USA, focused on mutations of PI3K-AKT-MTOR pathway and identified acute mechanisms that are MTOR-independent, with the help of preclinical drug assays. The team found that acute inhibition of PI3K or AKT, but not MTOR activity, suppresses the intrinsic hyperactivity of the mutant neurons. These acute mechanisms are distinct from those causing neuronal hyperactivity in other AKT/MTOR epileptic models and define parameters to facilitate the development of new molecularly rational therapeutic interventions for different types of intractable epilepsy. This research has highlighted the relevance of repurposing of cancer drugs to treat neurodevelopmental disorders. This preclinical study provides a foundation to build novel targeted therapeutics towards betterment of livelihood of numerous children suffering from rare brain disorders, including intractable epilepsy.

Mobile Health Intervention Can Help Prevent Secondary Stroke

A research paper published by the Indian Council of Medical Research (ICMR) has found that mobile health intervention can lead to an improved lifestyle and prevent secondary stroke. The trial was conducted as part of the Secondary Prevention by Structured Semi-Interactive Stroke Prevention Package in India (Sprint-India) which was a multicenter, randomized-controlled trial of a semi-interactive mobile health intervention among stroke patients across 31 stroke centres in India. The trial's intervention was a package composed of SMS text messages, health education videos and stroke prevention workbook for patients. The messages focused on controlling blood sugar, blood pressure, cholesterol, improving physical activity, eating a healthy diet and not to miss taking medicines to prevent stroke. The SPRINT study is the first trial in India (and perhaps globally) to try to assess the role of an mHealth intervention in secondary prevention of stroke at such a large scale. It provides hope in improving lifestyle and medical complications leveraging technology in a resource-constrained setup. In phase 2 which started in September 2022, 4 more stroke trials, which are very relevant to the country, have been initiated by ICMR.

Medicinal Plant 'Borthekera' have Cardio-protective Potential

Garcinia pedunculata, a medicinal plant commonly called 'Borthekera' in the Assamese language, traditionally forbidden for raw consumption, has been found to protect from heart diseases. Administration of the dried pulp of the ripe fruit of the medicinal plant reduced cardiac hypertrophy indicators and oxidative stress and heart inflammation brought on by ISO. The sun-dried slices of the ripe fruit are used for culinary and medicinal purposes and are known to have therapeutic properties like anti-inflammatory, anthelmintic, antibacterial, antifungal, antidiabetic, hypolipidemic, nephroprotective, and even neuroprotective activity. With scientific interventions seeking proof of these claims, multiple studies have reported that *G. pedunculata* is a rich source of antioxidants. Scientists of Institute of Advanced Study in Science and Technology (IASST) explored this medicinal plant's potential to prevent heart diseases in mice. A double dosage of bioactive chloroform fraction (GC) of the herb was tested in rats. Cardiac hypertrophy, cardiac troponin I, tissue lipid peroxidation, and serum inflammatory markers were all significantly elevated in the disease group, which were maintained at near-normal levels in the GC pretreated groups. The endogenous antioxidants were also revamped in the GC-treated groups. Moreover, the chemical characterization of the chloroform fraction revealed the presence of active phytochemicals like hydroxycitric acid, hydroxycitric acid lactone, and parvifoliquinone along with compounds like GB-1a, Garcinone A, 9-Hydroxycalabaxanthone, Chlorogenic acid, and Garcinol as well. The therapeutic effects reported in this study are likely due to the presence of all these compounds. All these results strongly infer the good cardioprotective potential of *G. pedunculata* fruit abundantly available in Northeast India.

ISRO Successfully Conducts Key Rocket Engine Test for Chandrayaan-3

The flight acceptance hot test of the CE-20 cryogenic engine that will power the cryogenic upper stage of the launch vehicle for the Chandrayaan-3 mission was successfully conducted, according to the Indian Space Research Organisation. The hot test was carried out for 25 seconds at the High Altitude Test Facility of the ISRO Propulsion Complex at Mahendragiri in Tamil Nadu on February 24. All the propulsion parameters during the test were found satisfactory and closely matched with predictions. The cryogenic engine will be further integrated with the propellant tanks, stage structures and associated fluid lines to realise the fully-integrated flight cryogenic stage. Earlier this year, the Chandrayaan-3 lander successfully underwent EMI/EMC test to ensure the functionality of the satellite subsystems in the space environment. Chandrayaan-3 interplanetary mission has three major modules: the propulsion module, the lander module, and the rover. ISRO plans to launch the mission in June by Launch Vehicle Mark 3 (LVM3).

G-20 AND GLOBAL CHALLENGES

Preparations for Science-20 Meetings

Union Minister of State (Independent Charge) Science & Technology Dr Jitendra Singh reviewed the preparations for Science-20 meetings and Research Innovation Initiated Gathering (RIIG) and side events. The Science-20 Summit meeting will be held in Coimbatore from 21st to 22nd July, 2023 with the theme of "Disruptive Science for Innovative and Sustainable Growth". The Sub-themes (side event topics) are- 1. Non-conventional energy for a greener future, Bangaram Island, Lakshadweep (27-28 February 2023); 2. Connecting Science to Society, Agartala (3-4 April 2023); and 3. Culture and Holistic Health: Cure and Prevention of

Disease, Indore (16-17 June 2023). The Research Innovation Initiated Gathering (RIIG) will focus on “Research and Innovation for Equitable Society”. The Sub-theme/ topics for RIIG gathering will be 1. Materials for Sustainable Energy (led by CSIR), Ranchi (21-22 March 2023); 2. Scientific Challenges and Opportunities towards Achieving a Sustainable Blue Economy (led by MoES), Dibrugarh & Itanagar (24-25 March 2023); 3. Bio-resource/ Biodiversity and Bio-economy (led by DBT), Shimla (19-20 April 2023); and 4. Eco-Innovations for Energy Transition (led by SERB), Diu (18-19 May 2023) and the RIIG Summit and Research Minister meeting, Mumbai (4-6 July 2023).

Dharamshala to Host G20 S&T Department Meeting in April

The G20 science and technology department meeting is proposed to be held at Dharamshala in Kangra district on April 19-20 in which about seventy delegates from across the world will participate. In Dharamshala a meeting of the Science and Engineering Research Board and the G20 Working Group on Research and Innovation is proposed to be held in Dharamshala.

IN BRIEF

More Durability in Next-generation Solar Cells

Researchers led by University of Toledo have solved the problem of durability of perovskite solar cells, taking the technology one step closer to powering solar panels in the consumer market. The team discovered the ingredient that enhances adhesion and mechanical toughness. They experimentally demonstrated that perovskite solar cells treated with 1,3-bis(diphenylphosphino)propane (DPPP), a diphosphine Lewis base molecule, retained a high-power conversion efficiency and exhibited superior durability after continuous operation under simulated sun illumination for more than 3,500 hours, or more than 145 days. They used what is called one sun illumination, which is equivalent to outdoor sunlight. DPPP is also a commercialized product with low cost and easy accessibility, which make it suitable for the commercialization of perovskite solar cells.

Technology to be a Major Focus of India-Germany Ties

A joint innovation and technology vision was released during Chancellor Olaf Scholz’s two-day visit to India. The joint Vision, which includes a focus on deepening ties between industry and spurring cooperation on development of advanced technologies like Artificial Intelligence and 6G, is the most comprehensive economic document signed between the two major economies till date. India and Germany share a long history of cooperation in science and technology, research, and innovation, under the framework of the Inter-Governmental Agreement on ‘Cooperation in Scientific Research and Technological Development’ signed in May 1974. The jointly funded Indo-German Science and Technology Centre (IGSTC) has supported projects in areas such as Advanced Manufacturing, Embedded System and ICT, Sustainable Energy/Environment, Biotechnology/Bioeconomy, Bio-Medical Technology/Water and Wastewater Technology, and Smart Cities/e-Mobility.

RESOURCES & EVENTS

India France Cooperation in Clean Energy

An Indo-French Workshop on Clean and Sustainable Energy Technologies (INFINITE) was held in New Delhi to discuss greater cooperation with France in the field of clean energy including green transitioning to EVs and hydrogen energy. In Carbon Capture and Storage, India has a total geological CO₂ storage capacity of 400-600 Gt at various underground sites. The objective of the workshop is to bring together experts, researchers, policymakers, and industry leaders from both countries to exchange knowledge, ideas, and best practices on the development and deployment of clean and sustainable energy technologies. The workshop will feature a range of presentations and discussions on various topics related to Solar Energy, Hydrogen Energy, Carbon Capture Utilization & Storage, Electrochemical Energy Storage, and Clean Fuels. The INFINITE workshop provides a platform for experts and stakeholders from both countries to exchange knowledge, identify areas of collaboration, and explore new avenues for cooperation in the field of clean and sustainable energy technologies.

I2U2 Business Forum Convened

The inaugural I2U2 Business Forum was held on 22 February 2023 in Abu Dhabi, UAE. The Forum brought together senior private and public sector representatives from India, Israel, the United Arab Emirates, and the United States (I2U2) to discuss opportunities for cooperation between the business communities of the four countries. It was the first event of this kind to take place since the official launch of the I2U2 Group during the I2U2 Leaders' Summit in July 2022. The I2U2 partnership is focused on driving tangible economic cooperation between its members across a range of sectors, including food security, water, energy, space, transportation, health, and technology. India is setting up an I2U2 Innovation Centre in Gurugram, Haryana, India. and has joined the Agriculture Innovation Mission for Climate, which was launched by the UAE and the United States at COP26 and includes Israel as a partner among 140 other governmental and non-governmental entities. Discussions covered a possible USD 2 billion investment in a project to build a series of integrated agricultural facilities across India and the potential development of a 300-megawatt wind and solar hybrid power plant.

Biotech Conclave in Imphal

"International Bio-resource Conclave" was held from February 24-26, 2023 at Imphal, Manipur with the theme "Reimagine Ethnopharmacology: Globalisation of Traditional Medicine" organised by the Institute of Bio-resources and Sustainable Development (IBSD) The programme encouraged many entrepreneurs to promote unique bio-resources and traditional knowledge of this region. IBSD has set up Bio Incubators Nurturing Entrepreneurship for Scaling Technologies (BioNEST) incubator at IBSD, Node Meghalaya to develop women entrepreneurship in Meghalaya.

SCIENCE POLICY AND DIPLOMACY

China to Boost Funding, Global Teamwork in STI

Robust basic research is the only way to make China a global scientific and technological power, President Xi Jinping has said. He said the government would continue to pour more money into

basic research, but it was also important to diversify funding sources and encourage social investment through tax incentives and other supporting policies, including encouraging enterprises and private donors to set up science prizes and funds for more basic research initiatives. International collaboration was more important than ever when it came to using basic research to combat global challenges such as climate change, energy security, and outer space utilisation, Xi said, adding that China needed to set up platforms to make such cooperation possible. He also highlighted the need for China to launch global research funds, and make domestic science and technology projects more accessible to overseas researchers, while urging self-reliance in nurturing future talent for world-leading research. Basic science subjects should be prioritised in middle school and college to create a huge, advanced talent force to address the country's strategic needs, he said. But Xi also clarified that it was essential to both meet the country's needs as well as support free, cutting-edge science and technology exploration.

[Russia Suspends Nuclear Arms Treaty](#)

Russia will continue to observe limits on the number of nuclear warheads it can deploy under the New START treaty despite a decision to suspend participation in the agreement, Moscow said on 21 February. President Vladimir Putin announced the freeze during a speech to both houses of the Russian parliament and submitted a draft law on the suspension to the Duma, the lower house of parliament, which will consider it on Wednesday and take an immediate decision. Under the treaty, signed in 2010 and extended until 2026, Moscow and Washington committed to deploying no more than 1,550 strategic nuclear warheads and a maximum of 700 long-range missiles and bombers. In order to maintain a sufficient degree of predictability and stability in the sphere of nuclear missiles, Russia said it intends to adhere to a responsible approach and will continue to strictly observe the quantitative restrictions provided for by the New START treaty within the life cycle of the treaty. The ministry also said it would continue to notify the United States of planned test launches of inter-continental ballistic missiles (ICBMs). The United States, NATO, as well as other nuclear powers Britain and France criticised Putin's decision. In its statement, the ministry blamed the United States for Russia's decision to suspend the treaty, accusing Washington of being in non-compliance with its provisions and of trying to undermine Russia's national security. Inspections of nuclear arsenals allowed for under New START were suspended in March 2020 because of the coronavirus pandemic. Russia cancelled talks last November on the resumption of mutual inspections. Putin emphasised in Tuesday's speech that Russia was only suspending, not terminating, its participation in the treaty. Russia and the United States together hold 90% of the world's nuclear warheads.

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