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SCIENCE & TECHNOLOGY

GLOBAL

[New cooling mechanism for refrigeration](#)

Approximately one-fifth of the world's electric energy is dedicated to refrigeration. Existing refrigeration systems, relying on vapour compression, have hit their thermodynamic limits and they emit greenhouse gases. Researchers from Luxembourg have developed a technology using the electrocaloric effect which involves applying an electric field to ceramic capacitors, inducing temperature changes, and creating a cooling effect. The device involves an assembly of multilayer capacitors stacked within an electrically connected fluid-filled pipe. This assembly, called a regenerator, could eventually replace the conventional compressor and the environmentally harmful fluids in current refrigerators, providing a more energy-efficient and sustainable cooling solution. The potential applications of this technology extend beyond refrigeration, including air conditioning. The team is currently actively exploring practical applications of the technology, with the objective to offer a viable and sustainable alternative to current refrigeration solutions.

[Simple method to boost anti-mosquito pesticides](#)

Researchers at The University of Texas at El Paso have discovered that adding liquid soap to certain pesticides can boost their potency by more than ten-fold. Neonicotinoids, a special class of insecticide, are a promising alternative to target populations showing resistance to existing insecticides. But they do not kill some mosquito species unless their potency is boosted.

The team tested three low-cost, linseed-oil-based soaps that are prevalent in sub-Saharan Africa and added them to four different neonicotinoids, acetamiprid, clothianidin, imidacloprid and thiamethoxam. In all cases, the insecticides drastically enhanced potency, and increased mortality from 30 percent to 100 percent compared to when the insecticides were used on their own. This opens the way to using new formulations to control mosquitos.

[System for low cost high-resolution fabrication](#)

Researchers from Leibniz University Hannover have developed a low-cost and user-friendly fabrication technique, called UV-LED-based microscope projection photolithography (MPP), for rapid high-resolution manufacturing of optical elements within seconds. This approach transfers structure patterns on a photomask to a photoresist-coated substrate under UV illumination. The MPP system is based on standard optical and optomechanical elements. It uses an extremely low-cost UV-LED with a wavelength of 365 nm is used as the light source. The MPP system can fabricate high-resolution optical elements with feature sizes down to 85 nm. MPP could be used to fabricate microfluidic devices, biosensors, and other optical devices. This fabrication approach developed by the researchers is a significant advancement in the field of lithography for the rapid and high-resolution structuring of optical elements. It is particularly well-suited for applications where rapid prototyping and low-cost fabrication are important.

[New catalyst degrades plastic pollution easily](#)

Northwestern University researchers have developed a new catalyst that quickly, cleanly and completely breaks down Nylon-6 in a matter of minutes -- without generating harmful byproducts. The process does not require toxic solvents, expensive materials or extreme conditions, making it practical for everyday applications. From clothing to carpet to seat belts, Nylon-6 is found in a variety of materials that most people use every day. The researchers found a novel catalyst which uses yttrium (an inexpensive Earth-abundant metal) and lanthanide ions. When the team heated Nylon-6 samples to melting temperatures and applied the catalyst without a solvent, the plastic fell apart -- reverting to its original building blocks without leaving byproducts behind. In experiments, the team was able to recover 99% of plastics' original monomers. In principle, those monomers then could be upcycled into higher-value products, which are currently in high demand for their strength and durability. In addition to recovering a high yield of monomers, the catalyst is highly selective -- acting only on the Nylon-6 polymers without disrupting surrounding materials. This means industry could apply the catalyst to large volumes of unsorted waste and selectively target Nylon-6. Recycling these monomers also avoids the need to produce more plastics from scratch. A patent has been filed for the new process.

INDIA

27 manufacturers of IT Hardware approved under PLI Scheme – 2.0

Under the Government's PLI Scheme – 2.0 for IT hardware on 17th May 2023 which covers laptops, tablets, all-in-one PCs, Servers and Ultra Small Form Factor devices, the applications of 27 IT hardware manufacturers have been approved. IT hardware of well-known brands such as Acer, Asus, Dell, HP, Lenovo, etc will be manufactured in India. The expected outcomes of this approval, over the tenure of the scheme are as follows- (1) Employment: total of about 200,000 (2) Value of IT hardware production 42 billion US dollars (3) Investment by companies 360 million US dollars. 23 out of 27 approved applicants are ready to start manufacturing.

Eutelsat OneWeb to provide satellite broadband in India

The Indian National Space Promotion and Authorization Centre (IN-SPACe) has approved Eutelsat OneWeb to provide commercial satellite broadband services. OneWeb India is the first company authorized for enabling an India-focused Low Earth Orbit (LEO) satellite constellation. OneWeb India is to provide internet services to rural unconnected areas on a 24-hour basis. The validity of the authorization is five years. Eutelsat OneWeb already has 648 satellites orbiting Earth and is expected to provide about 21 Gbps throughput over India. Eutelsat OneWeb can launch commercial connectivity services as soon as spectrum allocation is granted by the Indian government. OneWeb India already has approvals to provide satellite broadband, as well as to establish and operate gateways in Gujarat and Tamil Nadu. Bharti Enterprises owns over 20 percent of OneWeb which is also a founding member of the Indian Space Association (ISpA), and has collaborated with ISRO to launch 36 satellites into orbit.

Strategic contract to build LEO satellites in India

Tata Advanced Systems Limited and Satellogic announced their collaboration for establishing and developing local space technology capabilities in India. The project will commence with comprehensive training, knowledge transfer, and local assembly of optical sub-meter resolution Earth Observation satellites, the first of which is planned to be launched as TSAT-1A. The focus will be on manufacturing satellites and developing imagery in India for national defense and

commercial applications, toward which TASL is commissioning a satellite AIT plant at its Vemagal facility in Karnataka. TASL will also work with local SMEs for payloads and other technologies to bolster India content. TASL and Satellogic will collaborate on the development of a new satellite design and work together to integrate multiple payloads on a single satellite that will generate a diverse range of data over India.

E-Auction of Critical and Strategic Minerals Blocks

The first tranche e-auction of Critical & Strategic Minerals was launched by Union Minister of Parliamentary Affairs, Coal and Mines, Shri Pralhad Joshi here on 29th November, 2023. A total of 20 critical mineral blocks will be auctioned in the first tranche, out of which 16 mineral blocks are put up for grant of Composite Licence and four mineral blocks for grant of Mining Lease. Details of the mines, auction terms, timelines etc. can be accessed on [MSTC auction platform](#). The Government is committed to bring more blocks of critical mineral blocks to auction in a phased manner.

G-20 AND GLOBAL CHALLENGES

Virtual G20 Leaders' Summit held

A Virtual G20 Summit, chaired by Prime Minister Modi witnessed participation by all 21 members of the G20, including the AU, the nine Guest Countries, and 11 International Organizations. Discussions focused on progress on the agenda of the New Delhi Summit. Leaders expressed condemnation of terrorism, deep concern over the loss of civilian lives, called for extending timely and adequate humanitarian assistance, not allowing the conflict to spread, and to find a long-term solution for the Palestine issue. On G20 Finance Track discussions focused on the five main agenda points – MDB reforms, Digital Public Infrastructure, the roadmap for Crypto Assets, Climate Finance, and Financing of Cities of Tomorrow. India as a member of the G20 Troika, will be playing a constructive role during the Brazilian Presidency in moving forward on many issues. Brazil's theme for the G20 is 'Build a Fair World and a Sustainable Future'. And under that, most of the New Delhi Leaders' Declaration, can be implemented..

Digital Public Infrastructure Repository and Fund for Global South

Prime Minister Shri Narendra Modi announced the launch of two India-led initiatives: the Global Digital Public Infrastructure Repository and a Social Impact Fund aimed at promoting the development of Social Impact Fund to advance Digital Public Infrastructure (DPI) in the Global South during the Virtual G20 Leaders' Summit on 22nd November 2023. This follows the decisions at the G20 New Delhi Leaders' Declaration (NDLD). The GDPIR is a comprehensive resource hub, pooling essential lessons and expertise from G20 members and guest nations. Its primary aim is to bridge the knowledge gap in the choices and methodologies required for the design, construction, deployment, and governance of DPIs. The GDPIR showcases the information in a standardized format from countries and organizations that have developed DPIs at scale, incorporating elements such as maturity scales, source codes (where available), and governance frameworks. Currently, the GDPIR features 54 DPIs from 16 countries, and it can be accessed at <https://www.dpi.global>. Prime Minister Narendra Modi also announced the creation of a Social Impact Fund (SIF), to which India has pledged an initial commitment of 25 million USD. The SIF is envisioned as a government led, multistakeholder initiative to fast-track DPI implementation in the global south. This fund will offer financial support to provide upstream

technical and non-technical assistance to countries in developing DPI systems. The SIF offers a platform for all relevant stakeholders, including other governments, international organizations, and philanthropic entities, to contribute to this fund and help accelerate the achievement of the Sustainable Development Goals (SDGs) in Low- and Middle-Income Countries (LMICs) through DPIs.

2nd Voice of the Global South Summit held.

The second Voice of Global South Summit witnessed participation by around 130 countries. PM Modi said that holding two summits of the Global South within a year, and a large number of leaders participating sends out a significant message that the Global South wants its autonomy, its voice in global governance, and is ready to take greater responsibility in global affairs.

During the summit, the Global South Centre of Excellence named “Dakshin” was launched.

This centre will focus on research related to developmental issues of developing countries. Through this initiative, practical solutions to problems in the Global South will also be looked for. Under the Aarogya Maitri initiative, India is committed to delivering essential medicines and supplies for humanitarian assistance. Recent deliveries include Palestine (7 tonnes of medicines and medical supplies), Nepal (more than 3 tonnes of medicines). India will also be happy to share its capabilities in digital health service delivery with the Global South. PM Modi said that the Global-South Science & Technology initiative, will help the Global South with capacity building and research. The climate and weather data obtained from “G20 Satellite Mission for Environment and Climate Observation” will be shared particularly with the countries of the Global South. The Global South Scholarships Programme has also been started. The Global-South Young Diplomats Forum is to be organized soon with the participation of young diplomats. PM Modi said that from 2024, an Annual International Conference will be held in India, which will focus on the development priorities of the Global South. This conference will be organized by the “Dakshin” Centre in collaboration with partner research centres and think-tanks of the Global South. Its main objective will be to identify practical solutions to the development problems of the Global South, which will strengthen our future. [Link to Chair’s summary of the 2nd Voice of the Global South Summit.](#) [Link to Media briefing.](#)

IN BRIEF

New non-invasive method for prenatal genetic testing

A team led by Massachusetts General Hospital (MGH) has developed a non-invasive genetic test that can screen the blood of pregnant individuals to survey all genes for fetal DNA sequence variants. The test was able to capture variants that were inherited from the mother as well as new variants that were not present in the mother and associated with prenatal diagnosis. Presently, invasive medical procedures such as amniocentesis involve significant cost and carry some inherent risks to the mother and fetus. The newly developed non-invasive fetal sequencing (NIFS) test could offer the capacity to discover and interpret variants across the fetal exome from DNA circulating in the mother’s blood. The team tested their NIFS approach on 51 pregnancies using a maternal blood sample without the need for a separate genetic test on the mother or father. The research team found that the method was highly sensitive for discovering single-base DNA changes and small insertions and deletions that were present in the fetal genome but not in the maternal genome. In 14 pregnancies NIFS detected all of the clinically relevant variants that were reported from invasive testing in the same individuals. The clinical implications of this research

are potentially profound, particularly for pregnancies in which a fetal anomaly is suspected from ultrasound and an invasive test is indicated.

RESOURCES & EVENTS

[Indo-Pacific Economic Framework for Prosperity \(IPEF\) Supply Chain Agreement](#)

The third Indo-Pacific Economic Framework for Prosperity (IPEF) Ministerial Meeting was held in San Francisco, California on 14 November 2023. IPEF was launched jointly by the USA and other partner countries of the Indo-Pacific region on May 23, 2022 at Tokyo. IPEF has 14 partner countries including Australia, Brunei, Fiji, India, Indonesia, Japan, Republic of Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand, Vietnam & USA. It seeks to strengthen economic engagement among partner countries with the goal of advancing growth, peace and prosperity in the region. The framework is structured around four pillars relating to Trade (Pillar I); Supply Chains (Pillar II); Clean Economy (Pillar III); and Fair Economy (Pillar IV). India had joined Pillars II to IV of IPEF while it has an observer status in Pillar-I. At this Ministerial Meeting, negotiations under the IPEF Pillar-III (Clean Economy), Pillar IV (Fair Economy) and the Agreement on the Indo-Pacific Economic Framework for Prosperity (which seeks to establish a ministerial-level council and a commission) were substantially concluded. Moreover, following the conclusion of the negotiations on the IPEF Supply Chain Agreement in May 2023, the IPEF Ministers signed the IPEF Supply Chain Agreement during the Ministerial Meeting. [The Press Statement is here](#)

[Dialogue 2023 on Science And Technology Policy](#)

The Office of the Principal Scientific Adviser to the Government of India and the Indian Institute of Science, Bangalore, convened the first one of its kind S&T Policy summit – ‘Dialogue 2023: Expanding Science and Technology Horizon’ on November 18, 2023, in Bengaluru. In his keynote address, Prof. A K Sood shared insights on India’s technological advancement and various missions that are driving national technology competitiveness. He emphasized the connection between Science, Research, Education, and Innovation, underscoring their role in achieving Sustainable Development Goals. Sessions of the summit focused on ‘Shaping Technological Futures’, ‘Science, Technology and Society’, ‘Ethics of Disruptive Technologies’, and ‘Charting Global Technology Competitiveness: A Strategic Imperative’. A Workshop was held on the Diversity of Knowledge – People and Practices. The summit concluded with a closing plenary session on the ‘Public Perception of Science’

SCIENCE POLICY AND DIPLOMACY

[Negotiations on a new Plastics Treaty](#)

The Third Session of the Intergovernmental Negotiating Committee (INC-3) to Develop an International Legally Binding Instrument (ILBI) on Plastic Pollution: was held in Nairobi from 11-19 November 2023. It discussed a Zero Draft, developed by the INC Chair in conjunction with the INC Secretariat. However, during INC-3, the varying interpretations of UNEA resolution 5/14 came to the fore as delegates shared their views on the “full life cycle of plastic,” with some favoring measures addressing plastic production, and others favoring downstream measures to eliminate plastic waste. Others focused on how best to ensure lasting design standards for plastic

products. Agreement was reached on a mandate for the preparation of a revised Zero Draft, based on the compilations of submissions by delegations throughout the week. The revised Draft is also expected to include those elements contained in the Synthesis Report. Delegates were unable to agree on a mandate for intersessional work to be done in preparation of INC-4, to be held in April 2024. Key unresolved issues include - (a) defining the lifecycle of plastics, and if measures will begin far upstream, midstream, or downstream; (b) the type of obligations the treaty will have and (c) how trade related issues would be handled

Use of Digital Sequence Information on Genetic Resources discussed

Under the Convention on Biological Diversity (CBD), discussions took place at first meeting (Geneva, 12-18 November) of the Working Group on benefit sharing from the use of digital sequence information (DSI) on genetic resources (WGDSI-1) and the 12th meeting of the Ad Hoc Open Ended Intersessional Working Group on Article 8(j) and related provisions (WG8j-12) on Indigenous Peoples and local communities (IPLCs). Divergences remained on key issues including distinguishing between Indigenous Peoples and local communities. These disagreements spilled over into other agenda items, such as the new programme of work for WG8j and leading to many “bracketed” provisions that will have to be resolved at COP 16. Common ground was reached on the remaining issues on its agenda, such as the knowledge management component of the Kunming-Montreal Global Biodiversity Framework (GBF), the joint programme of work on the links between biological and cultural diversity, and the role of Indigenous languages in the intergenerational transmission of traditional knowledge, innovations, and practices. The WGDSI-1 deliberations covered issues such as the modalities of a multilateral mechanism on benefit-sharing from the use of DSI on genetic resources, including a global fund. The new mechanism may provide a meaningful contribution towards closing the biodiversity financing gap, and to biodiversity conservation. Divergences remained on issues such as capacity building and development, and technology transfer.

UNCCD Committee reviews desertification

The twenty-first session of the Committee for the Review of the Implementation of the Convention (CRIC 21) of the UN Convention to Combat Desertification (UNCCD) (Samarkand, 13-17 November) reviewed data on desertification from 126 countries for the first time. Discussions related to improving the procedures for communication and the quality and formats of reports, and reviewed some of the main findings and recommendations from an independent assessment that was undertaken to help strengthen implementation of the Convention through 2030 and beyond, including the interlinkages between land degradation, climate change, and biodiversity, and the need for increased synergies.

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