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Science Diplomacy News Alert
Forum for Indian Science Diplomacy
www.fisd.in

1-15 MAY 2023

ISSUE 109

RIS Science Diplomacy News Alert is your fortnightly update on Indian and global developments in scientific research, technological advancements, and G-20, global challenges, science diplomacy, policy and governance. The archives of this news alert are available at <https://fisd.in/en/alerts-archives>. Please email your valuable feedback and comments to science.diplomacy@ris.org.in.

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SCIENCE & TECHNOLOGY

GLOBAL

[Photonic Device Offers Speed and Accuracy for Artificial Intelligence](#)

Researchers at the University of Pennsylvania have created a photonic device that provides programmable on-chip information processing without lithography, offering the speed of photonics augmented by superior accuracy and flexibility for AI applications. This device consists of spatially distributed optical gain and loss. Lasers cast light directly on a semiconductor wafer, without the need for defined lithographic pathways. The chip offers improved accuracy and ultimate reconfigurability given the elimination of all kinds of constraints from predefined features. Without lithography, these chips become adaptable data-processing powerhouses. Because patterns are not pre-defined and etched in, the device is intrinsically free of defects. Perhaps more impressively, the lack of lithography renders the microchip impressively reprogrammable, able to tailor its laser-cast patterns for optimal performance, be the task simple (few inputs, small datasets) or complex (many inputs, large datasets).

[Wearable Ultrasound Patch Provides Non-invasive Deep Tissue Monitoring](#)

A team from the University of California San Diego has developed a stretchable ultrasonic array capable of serial, non-invasive, three-dimensional imaging of tissues as deep as four centimetres below the surface of human skin, at a spatial resolution of 0.5 millimetres. This new method provides a non-invasive, longer-term alternative to current methods, with improved penetration depth. The elastography monitoring system can provide serial, non-invasive and three-dimensional mapping of mechanical properties for deep tissues. This has several key applications such as monitoring liver damage, myocardial ischemia etc. The technology enables continuous monitoring of health status anytime, anywhere. The device consists of a 16 by 16 array. Each element is composed of a 1-3 composite element and a backing layer made from a silver-epoxy composite designed to absorb excessive vibration, broadening the bandwidth and improving axial resolution. The array conforms to human skin and acoustically couples with it, allowing for accurate elastographic imaging validated with magnetic resonance elastography. In testing, the device was

used to map three-dimensional distributions of the Young's modulus of tissues ex vivo, to detect microstructural damage in the muscles of volunteers prior to the onset of soreness and monitor the dynamic recovery process of muscle injuries during physiotherapy. This technology is being commercialised.

[Novel Dual Gene-editing Approach for Eliminating HIV Infection](#)

New research from the Lewis Katz School of Medicine at Temple University and the University of Nebraska Medical Center (UNMC) shows gene-editing therapy aimed at two targets -- HIV-1, the virus that causes AIDS, and CCR5, the co-receptor that helps the virus get into cells -- can effectively eliminate HIV infection, new research shows. The study combines a dual gene-editing strategy with antiretroviral drugs to cure animals of HIV-1. It began work on next-generation CRISPR technology for HIV excision, developing a new, dual system aimed at permanently eliminating HIV from the animal model. They developed a simple and more practical procedure for the inactivation of CCR5 that includes an IV inoculation of the CRISPR gene editing molecule. The new dual CRISPR gene-editing strategy holds exceptional promise for treating HIV in humans. It is a simple and relatively inexpensive approach.

[Deep Neural Network Provides Robust Realtime Detection of Disease Biomarkers](#)

Researchers at University of California - Santa Cruz have developed a deep neural network that improves the accuracy of their unique devices for detecting pathogen biomarkers. They used machine learning to enhance their systems by improving its ability to accurately classify biomarkers. To enable classifying particle signals with 99.8 percent accuracy in real time, on a system that is relatively cheap and portable for point-of-care applications. The researchers trained the neural network with known training signals, teaching it to recognize potential variations it could see, so that it can recognize patterns and identify new signals with very high accuracy. This improved system will work for any other biomarkers. Although they are currently focused on medical applications, the system could potentially be adapted for the detection of any type of signal. To push the technology further, researchers plan to add even more dynamic signal processing capabilities to their devices. This will simplify the system and combine the processing techniques needed to detect signals at both low and high concentrations of molecules. The team is also working to bring discrete parts of the setup into the integrated design of the optofluidic chip.

[Air Pollution May Increase Risk of Dementia](#)

University of California - San Diego's researchers elaborate on how exposure to the last of those new factors -- ambient air pollution, such as car exhaust and power plant emissions -- is associated with a measurably greater risk of developing dementia over time. They examined baseline cognitive assessments of approximately 1,100 men with average baseline age of 56, with 12 years of follow up. They looked at measures of exposure to particulate matter (PM2.5) in the air and nitrogen dioxide (NO2), and assessments of episodic memory, executive function, verbal fluency, brain processing speed and APOE genotype. The researchers found that participants with higher levels of exposure to PM2.5 and NO2 in their 40s and 50s displayed worse cognitive functioning in verbal fluency from age 56 to 68. And persons with the APOE-4 allele appeared even more sensitive.

[Novel Stem Cell Adhesive Using Mussels](#)

A team of researchers at Pohang University of Science & Technology (POSTECH) develop stem cell adhesive for arthritis treatment using mussel adhesion protein and hyaluronic acid. The researchers developed a novel bio-adhesive material in the form of a viscous immiscible liquid phase by combining adhesion protein derived from mussels with high-molecular-weight hyaluronic acid. The material can securely encapsulate stem cells and facilitate their firm attachment to the transplantation site. In addition, the team demonstrated that stem cells encapsulated within the liquid bio-adhesive were retained in situ when transplanted into defective cartilage in a rabbit model evaluation. The prolonged retention of transplanted stem cells within damaged cartilage facilitated cartilage regeneration and enhanced the therapeutic effects of stem cell transplantation. An additional benefit of the adhesive liquid developed by the team includes a natural adhesive that does not require any additional physical or chemical processes. The material technology for mussel adhesion protein has been transferred and a clinical study of the stem cell adhesive named CartiFix, is expected to begin soon.

Catalyst Transforms Carbon Dioxide into Sustainable Byproduct

Northwestern University researchers have created acetic acid out of carbon monoxide derived from captured carbon dioxide. The innovation uses a novel catalyst and achieved record-breaking selectivity toward desired product - Acetic acid, found in vinegar. The new method takes place via a two-step process: first, captured gaseous CO₂ is passed through an electrolyzer, where it reacts with water and electrons to form carbon monoxide (CO). Gaseous CO is then passed through a second electrolyzer, where another catalyst transforms it into various molecules containing two or more carbon atoms. The team's analysis showed that using a much lower proportion of copper (approximately 1 per cent) would favour the production of just acetic acid. It also showed that elevating the pressure to 10 atmospheres would enable the team to achieve record-breaking efficiency. The team reports a faradic efficiency of 91 per cent, meaning that 91 out of every 100 electrons pumped into the electrolyzers end up in the desired product -- in this case, acetic acid. The new catalyst also appears to be relatively stable.

Improved Efficiency and Stability of Perovskite Solar Cells

A team from City University of Hong Kong (CityU) made a breakthrough by developing an innovative multifunctional and non-volatile additive which can improve the efficiency and stability of perovskite solar cells by modulating perovskite film growth. They found that by adding a multifunctional molecule (4-guanidinobenzoic acid hydrochloride, (GBAC)) to the perovskite precursor, a hydrogen-bond-bridged intermediate phase is formed and modulates the crystallization to achieve high-quality perovskite films with large perovskite crystal grains and coherent grain growth from the bottom to the surface of the film. This molecule can also serve as an effective defect passivation linker (a method to reduce the defect density of perovskite film) in the annealed perovskite film due to its non-volatility, resulting in significantly reduced non-radiative recombination loss and improved film quality. Their experiments showed that the defect density of perovskite films can be significantly reduced after introducing GBAC. The power conversion efficiency of inverted (p-i-n) perovskite solar cells based on the modified perovskites was boosted to 24.8 per cent (24.5 per cent certified by the Japan Electrical Safety & Environment Technology Laboratories), which is among the highest values reported in the literature. Also, the overall energy loss of the device was reduced to 0.36eV, representing one of the lowest energy losses among the PVSC devices with high power conversion efficiency. Additionally, the unencapsulated devices exhibit improved thermal stability beyond 1,000 hours under continuous heating at $65 \pm 5^\circ\text{C}$ in a

nitrogen-filled glovebox while maintaining 98 per cent of the original efficiency. The team demonstrated the general applicability of this strategy for different perovskite compositions and large-area devices. For example, a larger area device (1 cm²) in the experiment delivered a high PCE of 22.7 per cent with this strategy, indicating excellent potential for fabricating scalable, highly efficient PVSCs. The team aims to further extend the molecular structures and optimize the device structure and fabricate large-area devices.

Zinc Biofortification of Microgreens

Penn State research team demonstrated that zinc biofortification through seed nutri-priming achieves needed levels of zinc in the young pea and sunflower plants. The researchers reported that zinc sulphate, was the most effective zinc source. Seeds soaked in a 200 parts per million solution of zinc sulphate resulted in higher zinc accumulation in both peas (126 per cent) and sunflower microgreens (230 per cent). Researchers examined the effect of different zinc sources and soaking concentrations on microgreen-yield components such as mineral content; phytochemical constituents such as total chlorophyll, carotenoids, flavonoids, anthocyanin and total phenolic compounds; antioxidant activity; and antinutrient factors such as phytic acid. Seed soaking in zinc sulphate and zinc oxide solutions at higher concentrations reduced phytic acid in both pea and sunflower microgreens.

Microbes for Green Biomanufacturing

A research team led by UC Berkeley has engineered bacteria to produce new-to-nature carbon products that could provide a powerful route to sustainable biochemicals. It uses bacteria to combine natural enzymatic reactions with a new-to-nature reaction called the "carbene transfer reaction." This work could also one day help reduce industrial emissions because it offers sustainable alternatives to chemical manufacturing processes that typically rely on fossil fuels. The researchers replaced expensive chemical reactants with natural products that can be produced by an engineered strain of the bacteria *Streptomyces*. The researchers observed the engineered bacterium as it metabolized and converted sugars into the carbene precursor and the alkene substrate. The bacterium also expressed an evolved P450 enzyme that used those chemicals to produce cyclopropanes, high-energy molecules that could potentially be used in the sustainable production of novel bioactive compounds and advanced biofuels.

INDIA

Enhanced Performance in Quantum Materials

JNCASR, Bengaluru, scientists worked on TlBiSe₂- a renowned topological insulator, for investigation. They have confirmed that TlBiSe₂ demonstrates meta-valent bonding, and showed a thermoelectric figure of merit zT of around 0.8, which is the highest reported to date amongst n-type thallium chalcogenides. Their work provides fundamental insights on how novel chemical bonding can be used to optimize thermoelectric performance in quantum material and how, by rational chemical designing, intriguing emergent properties can be realized in quantum materials.

New Low-cost Star Sensor Developed

A new low-cost star sensor developed by astronomers from off-the-shelf components was recently launched by ISRO on board PSLV C-55. In its first-ever space test, the sensor, which is mounted on the PSLV Orbital Experimental Module (POEM), is performing well, and the initial data has

now validated its design as well as its function. The StarBerrySense payload developed by the Indian Institute of Astrophysics (IIA), is designed to quickly calculate where the satellite is pointing is being tested in space for the very first time. The sensor withstood the harsh conditions in space and is functioning as expected. This payload is built around the well-known minicomputer RaspberryPi, and the electronics and software were designed in-house. The payload is cost-effective, simple to build, and can be deployed on a wide variety of satellites.

[National Technology Day Celebrated](#)

Prime Minister Narendra Modi addressed an event on the National Technology Day, which marks the 25th anniversary of the Pokhran tests, saying that his government has used technology as a source of empowerment and to ensure social justice. On the occasion of the National Technology Day, the Prime Minister laid the foundation stone for the Laser Interferometer Gravitational Wave Observatory - India (LIGO-India) and dedicated to the nation a facility to produce permanent magnets from rare earth minerals. He also laid the foundation stone for the Homi Bhabha Cancer Hospital and Research Centre, Jatni, Odisha; and the Platinum Jubilee Block of Tata Memorial Hospital, Mumbai. PM Modi also dedicated to the nation a Fission Molybdenum-99 production facility in Mumbai; National Hadron Beam Therapy Facility, Navi Mumbai; Radiological Research Unit, Navi Mumbai; Homi Bhabha Cancer Hospital and Research Centre, Visakhapatnam; and the Women and Children Cancer Hospital Building, Navi Mumbai. He said that India considers technology as a tool for the nation's progress, not a means to assert its dominance. He said India must take the lead in revolutionary technologies such as artificial intelligence tools which have emerged as the new game changers, with limitless possibilities in the health sector, drone technology, and the therapeutics sector.

[Printed Conduit for Non-invasive Nerve Repair](#)

Researchers at the Indian Institute of Science (IISc) in Bengaluru have developed a smart gel-based sheet using three-dimensional (3D) printing technology that can self-roll into a tube during surgery to form a nerve conduit. The team engineered a bilayered gel sheet by 3D printing in pre-defined patterns from two gels. The gel formulations were selected to swell differently. When the dried gel sheet was immersed in water, it rapidly swelled and curled into a tube. The folding behaviour and final shape of the gel could be programmed to generate tubes of desired dimensions, which could be predicted by computational modelling. The gel sheets were then coated with thin nanometre-scale fibres to enable the body's cells to adhere to the gel sheet. Tests were done on repairing and regenerating a 2 mm gap in the sciatic nerve of rats. The shape-morphing sheets were placed under the defect region of the nerve and stimulated to wrap the defect site to form a conduit around the nerve without suturing. The nerve ends could grow through the implanted conduit. There was a remarkable improvement in nerve regeneration measured up to 45 days in the rats when the 4D printed nerve conduits were used. This technology could pave the way for a new generation of medical devices that surgeons can deploy during surgery to heal nerves and many other tissues in coming years. They can offer benefits such as reduced complexity of surgeries, deployment by minimally-invasive procedures, and faster healing.

[Organic Molecules that Emit Near-infrared Light](#)

Researchers at the Indian Institute of Science Education and Research (IISER) Bhopal have created a new family of organic molecules that emit light in the near-infrared (NIR) range, opening possibilities for OLEDs for various applications. They have achieved a nitro group containing

polycyclic aromatic molecules that exhibit fluorescence (light emission) in the near-IR wavelengths. The innovation lay in fine-tuning the structure of the nitro-group-containing molecules such that they emit near-IR light. In addition, the synthesised molecules show strong electron affinity values, excellent stability, and structural rigidity. Apart from their use in OLED applications, the strong electron affinity, NIR emissive nature, high stability, and redox robustness of these molecules make them excellent candidates for catalysts. The potential applications for near-IR-emitting OLEDs include biomedical sensors, short-range communication, night vision, and security.

Biocompatible Drug Delivery System Shows Potential

Scientists from Institute of Nano Science and Technology (INST), Mohali, explored the potential of the anti-inflammatory FDA-approved drug 9-aminoacridine (9AA) and the natural compound caffeic acid (CA), generally found in coffee or wine (reported to possess significant anti-arthritis potential) conjugated to nano micelles, for the treatment of rheumatoid arthritis (RA). The newly synthesised biocompatible therapeutic nano-micelle drug delivery system combined with anti-inflammatory drugs has shown improved potential to cure rheumatoid arthritis at the lab level. It can help ameliorate the pain associated with the disease as well as cure the disease by restoring cartilage integrity which provides flexibility to the bone. They developed a therapeutic nano-micelle loaded with an anti-inflammatory drug (9AA). The nano micelle itself has potential to provide therapeutic effect, but when combined with anti-inflammatory drugs, it showed enhanced potential to cure rheumatoid arthritis experimentally by inhibiting joint damage and cartilage degradation. The new strategy inhibits joint damage and cartilage degradation and showed short-term (21 days) disease eradication and long-term (45 days) protection from the reappearance of the disease. This drug delivery system is simple, cost-effective, safe, and has significant translational potential. The nano-formulation so far tested on rats and published in ACS Nano may bring long-term relief for numerous RA patients in the future by suppressing the disease severity of Rheumatoid arthritis.

G-20 AND GLOBAL CHALLENGES

India and China Advocate Multiple Energy Pathways in G20.

India, backed by China, is trying to build a consensus within the G20 group to let countries choose a roadmap to cut carbon emissions instead of setting a deadline to end the use of fossil fuels. India, the current G20 president, is keen on introducing the phrase 'multiple energy pathways' in a communique to be released at the G20 summit in September and has been supported by countries including China and South Africa. At a meeting of the G20 Energy Transitions Working Group (ETWG) in the western state of Gujarat, India opposed a deadline proposed by rich nations to end the use of coal. In the smaller G7 group, UK and Canada pushed for agreement on a 2030 coal phase-out date but were successfully opposed by Japan, the USA and the EU. China supported India, saying it cannot put a timeline on ending fossil fuel dependence and would want to put all its available resources to optimum use. The two countries are the top two consumers of coal in the world. China has set a net zero target of 2060 while India aims for 2070. It was the first time India used the phrase 'multiple pathways' in global climate negotiations against repeated demands by Western nations to end coal usage. The phrase is in conformity with the 2015 Paris Agreement on combating climate change that favours "common but differentiated responsibilities, under different national circumstances". A dominant view was seen emerging on every country to have individual pathways to achieve their national commitments and endowments.

IN BRIEF

[Czech Republic Signs Artemis Accords](#)

During a ceremony held at NASA Headquarters in Washington, D.C. on May 3, the Czech Foreign Minister signed the Artemis Accords making it the 24th country to sign on to the international agreement that lays out principles for responsible exploration and development of the moon and space. The Czech Republic has participated in the development of equipment for NASA's planned moon-orbiting Lunar Gateway space station and the European Large Logistics Lander that will be able to transport tons of cargo to and from the moon. In addition, in April 2023, the European Space Agency (ESA) funded studies at several Czech research institutions that aim to assess the feasibility of building a nuclear rocket for deep-space exploration. Some nations, including Russia and China, have argued that the framework is tilted in favour of the United States. Others, such as Germany, France and India, have likewise abstained from the accords out of a belief that resources in space should be off-limits for economic use by any one nation.

[Breakthrough in Synthetic Spider Silk Fabrication](#)

Washington University Researchers have made a breakthrough in synthetic spider silk production, potentially enabling more sustainable clothing manufacturing. By using engineered mussel foot proteins to create bi-terminal Mfp fused silks (btMSilks), they achieved an eightfold increase in yield and improved strength and toughness, paving the way for an eco-friendly alternative to traditional textiles. The researchers created new spider silk fusion proteins, called bi-terminal Mfp fused silks (btMSilks). Microbial production of btMSilks has eightfold higher yield than recombinant silk proteins, and the btMSilk fibres have substantially improved strength and toughness while being lightweight. By placing mussel foot protein fragments at the ends of synthetic silk protein sequences, the team created a less repetitive, lightweight material at least twice as strong as recombinant spider silk. The yields of material increased to 8 grams of fibre material from 1 liter of bacterial culture. The team will expand the tunable properties of their synthetic silk fibres to meet the exact needs of each specialized market. Because this synthetic silk is made from cheap feedstock using engineered bacteria, it presents a renewable and biodegradable replacement for petroleum-derived fibre materials like nylon and polyester.

[Materials for Cheap and Efficient CO2 Capture](#)

A team of researchers from Saudi Arabia and China have developed a promising method for carbon capture and storage. Using a salt—guanidinium sulphate, they have created lattice-like structures called clathrates that trap the CO₂ molecules and result in an energy efficient way to contain the greenhouse gas. The clathrate is stable and non-corrosive at ambient temperature and pressure, a highly desirable feature compared with other solutions that are commonly used in carbon capture. The salt-based, clathrate structure utilizes low energy, physisorption processes while capturing CO₂ without water or nitrogen interference. The discovery introduces a new way of storing and transporting carbon dioxide as a solid. The salt clathrate allows CO₂ to be carried as a solid powder, with high volume per weight capacity, making this method energy efficient, with tremendous potential applications and improvements in CO₂ capture in terms of stability, recyclability, sorption capacity and selectivity, and lowering regeneration energy penalty and cost.

[Electroconductive Hydrogel for Biomedical Applications](#)

A research team from the University of Hong Kong (HKU) has recently developed a new type of electroconductive hydrogel with outstanding mechanical strength and manufacturability, creating opportunities for the engineering of various bioelectronic devices. The new hydrogels developed use a 3D nanofiber network as a template to guide the assembly of conducting polymers (such as polypyrrole). The high connectivity of the nanofibers provided both structural robustness and an effective pathway for electron conduction. The material developed contains 80% water by weight, while at the same time showing a high electrical conductivity of ~80 S/cm and a mechanical strength of ~9.4 MPa. These conductive hydrogels are easy to fabricate, and can be made into arrays of electrodes, interconnects, and biosensors, enabling functional systems such as wearable health monitors or cardiac tissue engineering platforms. It opens opportunities for many advanced medical tools down the road, such as neural prosthetics, cardiac patches, electronic skin, etc.

[Improved mRNA Vaccines Using AI](#)

A research team from US, China, and Singapore have used a classical concept in computational linguistics to design a new algorithm, LinearDesign, which optimized the structural stability and codon usage of messenger ribonucleic acid (mRNA) sequences. They were able to substantially improve mRNA half-life and protein expression and dramatically increase antibody titer by up to 128-fold in vivo. This new mRNA design had no chemical modification but showed high stability, translation efficiency, and immunogenicity. Another advantage is its low manufacturing cost. Furthermore, the mRNA molecule tended to move faster by electrophoresis. In the case of varicella-zoster virus (VZV) vaccines, LinearDesign also showed substantial improvements. This algorithm could be adapted to modify nucleotides. In the future, it could help optimize other parameters relevant to mRNA design. More importantly, it is a general method for molecule design that could help design all kinds of therapeutic proteins, including monoclonal antibodies and anti-cancer drugs.

[Novel Spider Silk Materials for Cell-specific Effects](#)

Researchers at the University of Bayreuth have developed materials made of spider silk that can be specifically modified or processed in such a way that living cells of a certain type adhere to them, grow and proliferate. The cell-specific effects of spider silk materials can be produced by functionally modifying silk proteins through the incorporation of peptides that interact with cells (cell-adhesive peptides) which are present in the extracellular matrix (ECM) of natural tissues. The researchers grafted some cell-adhesive peptides into several variants of a silk protein derived from a spider silk of the garden cross spider. Some of these altered silk proteins were found to be generally cell-adhesive, while others generally exhibited cell-repellent behaviour. In some cases, cell-specific interactions were observed in addition. The peptide KGD specifically promotes the attachment and growth of myoblasts which can develop into muscle fibres. This work opens up a novel pathway leading to cell-specific applications of materials made from spider silk—for scaffolds to promote natural regenerative processes, coating of implants, or even in the 3D printing of hydrogels with encapsulated cells that can be further processed into functional materials.

RESOURCES & EVENTS

[Germany Promises €2bn to Global Green Climate Fund](#)

German Chancellor Olaf Scholz has promised to give €2 billion (\$2.2 billion) to the United Nations' Green Climate Fund. The Fund, set up in 2010, has spent around \$12bn so far funding

climate projects but has recently warned of cutbacks because of a lack of resources. The pledge is a third more than Germany's previous contribution to the fund. Once confirmed, the money will support climate investment during the 2024-2027 period. Scholz's pledge at the Petersberg Climate Dialogue in Berlin could encourage other wealthy nations at the fund's regular pledging conference in the German city of Bonn in October. Austria, the only other major nation to make a pledge so far, increased its contribution by 25 percent to €0.16 billion (\$0.18 billion). Germany is historically one of the fund's biggest donors alongside the UK, France and Japan, who have yet to make their latest pledges. US President Biden recently promised \$1 billion to the fund. But this is only a partial fulfillment of the outstanding \$2 billion which President Barack Obama promised before Donald Trump later reneged on.

Council of Europe and Right to Healthy Environment

Iceland is leading discussions about recognising the right to a healthy environment across the 46 nations of the Council of Europe. Prime minister Katrín Jakobsdóttir said that there is a "pressing need for an autonomous right to a clean, healthy and sustainable environment" to help address climate change and other environmental crises and pledged to send "a strong message on future challenges" at a forthcoming summit in May. Recognition of the right to a healthy environment could open up the potential for environmental lawsuits at both national and regional levels. A healthy and sustainable environment is increasingly being seen as a fundamental human right around the world. Last summer, the UN General Assembly passed a landmark resolution recognising it as a universal right. The Council of Europe endorsed a set of guidelines on human rights and the environment in 2022. A technical body has been tasked with exploring the need and feasibility of a legal tool to protect the right, and is due to report on its findings in September. There are concerns about how such a right would be implemented, such as the question of what type or scale of ecosystem harm would allow someone to bring a claim.

Cop28 Head Backs Fossil Fuel Emissions Phase-out.

The head of the Cop28 climate talks has called for "phasing out fossil fuel emissions", raising debate over the role of carbon capture and storage (CCS) technology in the fight against climate change. In a speech setting out his agenda for the talks in Dubai in December, the United Arab Emirates (UAE) climate envoy Sultan Al-Jaber, at a meeting of climate ministers in Berlin said that in a pragmatic, just and well-managed energy transition, we must be focused on phasing out fossil fuel emissions while phasing and scaling up viable, affordable zero-carbon alternatives. The addition of the word "emissions" is likely to be seen as a loophole for continuing to use fossil fuels if their emissions are kept out of the atmosphere with CCS. Critics say that CCS will play a key role in some sectors that are hard to clean up, but it is still an expensive option, while renewables and energy efficiency are the most affordable and readily available mitigation technologies. According to the IPCC's scientists, stopping a tonne of carbon dioxide with CCUS costs between \$50 and \$200. Replacing fossil fuels with renewables usually saves money.

US Plans Extra Measures for AI Safety

The White House announced a few extra measures to help ensure the safety of artificial intelligence (AI), but again stopped short of proposing new laws or international collaboration. The steps announced on 4 May include developing new US government policies for when and how federal agencies use AI, an extra \$140 million for the National Science Foundation to study AI applications, and an agreement by several US tech companies to let hackers at an upcoming

computing conference run open safety tests on their AI systems. Of the measures announced, the most significant is a plan for a public consultation on draft guidelines for how the federal government uses or buys AI itself. The extra NSF funding, meanwhile, is to create new centres to help develop AI applications in climate, education, energy, public health and other domains. In another initiative, Google, OpenAI, Microsoft, and other tech companies are “to participate in a public evaluation of AI systems” at DEFCON 31, a hacker convention in Las Vegas this August. There, the companies’ AI models will “be evaluated thoroughly by thousands of community partners and AI experts.

New EU Patent Rules and Industry Standards Proposed

Industrial R&D organisation in Europe have criticised new patent rules rolled out by the European Commission, calling for further consultations on proposals aimed at harmonising parts of European patent legislation that currently vary across member states. The proposals cover patents relating to industry standards, such as 5G mobile standards that many companies need access to; the compulsory licensing of patents in crisis situations; and supplementary protection certificates through which pharma companies can extend the patent life of drugs. Taken together with the unitary patent system that 17 EU countries are to introduce next month, the new rules will reduce the cost of patenting from an average of €36,000 to €5,000. Critics say the changes mean that the management of patents would be turned over to an agency with no previous experience with patents or standards. Patents are granted for technologies that are essential in making a product compliant with standards and regulations, such as 5G, Wi-Fi and Bluetooth. Holders of such patents get a monopoly on a technology but are obliged to licence them on fair, reasonable, and non-discriminatory (FRAND) terms. The Commission says the current system is not transparent enough and is prone to cause lengthy disputes and litigation. With the new proposal, EU policymakers say the new rules will fix these issues. The Commission’s proposal will be considered by the European Parliament and member states who have the opportunity to review and propose amendments to the text.

SCIENCE POLICY AND DIPLOMACY

Benchtop DNA Printers and Biosecurity Concerns

Biologists who have been obtaining DNA sequences online from companies will soon have a more convenient option: benchtop machines that can print all the DNA they need. But this technology brings with it new risks of bioterrorism. A [recent report](#) urges companies and governments to revamp existing screening to prevent someone with malign motives from making a toxin or pathogen. The current screening system, which is voluntary, could be upended by benchtop DNA synthesis, says the report. Synthetic DNA sequences are available online from roughly 100 companies, which print the DNA and ship it to their customers. Benchtop DNA printers that can make DNA on demand may soon be available. This has long raised concerns that malign actors could synthesize the DNA to make a powerful toxin or even a pathogen capable of triggering another global pandemic. In 2010, the U.S. government released voluntary guidelines for DNA synthesis companies, recommending that they vet customers and screen ordered sequences against known dangers. Members of an industry group called the International Gene Synthesis Consortium, which carry out the majority of DNA synthesis worldwide, agreed to abide by the standards. But such guidelines are not yet mandatory. The report notes that in a few years, the length of stretches of DNA that can be synthesized with machines will likely increase to as many as 7000 base pairs,

the size of the smallest viruses. The report recommends that benchtop synthesis devicemakers screen their customers and all requests for DNA sequences prior to synthesis.

India-Israel MoU for Industrial Research and Development Cooperation

A Memorandum of Understanding (MoU) on Industrial Research and Development Cooperation was signed between the Council of Scientific and Industrial Research (CSIR) India and the Directorate of Defense Research and Development (DDR&D), Israel. The MoU enables cooperation in industrial sectors including Healthcare; Aerospace & Electronics Instrumentation; Civil, Infrastructure & Engineering; Chemicals and Petrochemicals, Sustainable Energy including Energy Devices; Ecology, Environment, Earth & Ocean Sciences and Water; Mining, Minerals, Metals & Materials; Agriculture, Nutrition & Biotechnology. The collaboration will be monitored by a Joint Steering Committee led by the heads of the CSIR and DDR&D for taking forward mutually benefiting Industrial and technology cooperation. Another MoU was signed between CSIR-Indian Institute of Chemical Technology (CSIR-IICT) India, and M/s 101 Therapeutics, Israel for conducting clinical trials of a COVID-19 drug having enormous therapeutic potential.

International Partnerships for Sustainable Future

Secretary, Department of Science and Technology (DST) highlighted the importance of developing a mechanism of sharing knowledge, science, and technology between countries to create a sustainable, resilient society at a United Nations' Global STI Forum 2023 Side Event on Community Resilience Resource Centers (CRRCs) For Aiding Post Covid Socio-Economic Recovery in India. Insisting on knowledge sharing of hydrogen-based energy, new sustainable energy systems as well as ways to address food security issues, he emphasised on a holistic approach in which AIs and other new technologies can be used to develop a resilient planet by addressing new and emerging challenges like changing climate, GHGs, pandemics, and other unknown diseases. The Community Resilience Resource Centres will help implement projects focused on livelihoods with S&T interventions and suitable skills so that the communities can make choices and manage uncertainty for a sustainable future. They will facilitate bilateral and multilateral partnerships. The day-long side event deliberated on preparations for a blueprint for future cooperation between India and the world that can enable community-based technological solutions and frugal innovations for local resilience building.

Conferences of the Parties to the Basel, Rotterdam, and Stockholm Conventions

The 2023 meetings of the three Conferences of the Parties (TripleCOP, 1-12 May) addressed issues at the core of their mandates. The COPs adopted joint decisions on technical assistance and financial resources, including a new resource mobilization strategy that aims to raise the funding commensurate to the challenges that countries face. The COPs also advanced work on the illegal traffic and trade of hazardous chemicals and wastes. The Basel Convention adopted several decisions, the most significant of which was the technical guidelines on plastics wastes on how to manage these wastes in an environmentally sound manner and is timely, given the ongoing negotiations for a new treaty on plastic pollution. The Rotterdam Convention only listed one of the seven chemicals recommended by its scientific subsidiary body. In light of this longrunning inability to list chemicals, there were extensive discussions on the effectiveness of the Convention. Parties agreed to establish an intersessional process to gather information. A proposal to add a new Annex to the Convention that would list chemicals on which parties could not reach consensus failed to garner the 3/4 majority required to amend the Convention. The Stockholm Convention's

global monitoring report found that the Convention is contributing to the observed decreased concentrations of persistent organic pollutants (POPs) in people and the planet. Parties agreed to eliminate the production and use of methoxychlor, a pesticide, Dechlorane Plus, a flame retardant, and UV-328, an ultraviolet filter used in plastics. The COP adopted a compliance mechanism.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc. Contact us at science.diplomacy@ris.org.in

NOTE TO OUR READERS AND STAKEHOLDERS:

RIS Science Diplomacy Programme (fisd.in) is glad to present a new version of Science Diplomacy News Alerts, following India's assumption of the Presidency of the G20. A new section G20 and global challenges has been added. We request your cooperation to review the Alerts and improve its content. For this purpose, please complete the form at <https://forms.gle/o4d869FxaM9t3KNw7>, and submit it. Your support and cooperation is appreciated.