If you can't see this message, view it in your browser.

SCIENCE DIPLOMACY NEWS ALERT | 1-15 NOVEMBER 2022| ISSUE 97 www.fisd.in

NEWS ALERT

Forum for Indian Science Diplomacy

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

CONTENTS

RESOURCES AND EVENTS

SCIENCE POLICY AND DIPLOMACY

GLOBAL

Cleaner Mining of Valuable Rare Earth Elements

A Chinese group has developed an approach called electrokinetic mining that relies on electric currents to free Rare Earth Elements (REEs), sharply reducing the need for polluting chemicals. Heavy REEs—those with high atomic numbers, including dysprosium, yttrium, and terbium are usually extracted by pumping large quantities of ammonium sulfate or a similar solution into the ground. The leachate pulls REEs from the clay and percolates down to bedrock, where it is collected for processing. The research team used electrodes on the top and bottom of a volume of soil to induce an electric field, speeding the movement of the leaching agent and the ions it extracts, a technique that is already used in soil remediation and has been proposed for copper and gold mining. In a bench-top experiment, later scaled up to 20 kilograms of material, and finally moved to a field test on a 14-ton mass of clay, the method extracted a higher percentage of the REEs more quickly than conventional leaching and needed less ammonium sulfate. It also left the soil cleaner and reduced contaminating elements in the leachate, which could simplify processing. The team calculates that the process could cut mining costs by about two-thirds. Larger scale tests are planned.

Nanotechnology Makes Cancer Immunotherapy More Effective

The University of Texas scientists have developed a nanotechnology platform that can change the way the immune system sees solid tumor cells, making them more receptive to immunotherapy. This adaptable immune conversion approach has the potential for broad application across many cancer types, according to preclinical findings. This platform artificially attaches an activation molecule to the surface of tumor cells, triggering an immune response in both in-vivo and in-vitro models. The signaling lymphocytic activation molecule family member 7 (SLAMF7) receptor is critical in activating the body's immune cells against cancer cells but is not found in solid tumor cells. To promote the expression of SLAMF7 on solid tumor cells, the researchers developed their bispecific tumor-transforming nanoconjugate (BiTN) platform. These nanosystems are designed with one molecule to bind to the surface of targeted tumor cells and a second molecule to activate an immune response. The researchers used BiTN with SLAMF7 and a HER2-recognizing antibody to target HER2-positive breast cancer cells. In

laboratory models, the nanoconjugate successfully attached SLAMF7 to the breast cancer cells, resulting in phagocytosis, or ingestion, by immune cells. The approach also sensitized the breast cancer cells to treatment with an anti-CD47 antibody, which blocks the “don’t eat me” signal from tumor cells to further increase responses in solid tumors. This platform has broad potential applications for several different solid tumor types.

Handheld Diagnostic All-in-One Lab Kit

UCLA researchers have developed a handheld, all-in-one lab kit that could significantly increase the speed and volume of disease testing, while reducing the costs and usage of scarce supplies. Using a circuit board that controls a set of movable, 1-millimeter-sized magnetic discs known as "ferrobots" to transport samples through the diagnostic workflow of a nucleic acid amplification test (NAAT), the researchers' ultra-sensitive lab kit was able to detect the presence of genetic material from SARS-CoV-2. The steps to separate, sort, mix and amplify testing samples are all automated and performed at a miniaturized level inside the kit. This platform's compact design and automated handling of samples enable easy implementations of pooled testing of dozens of patient samples at the same time, and all with the same materials it currently takes to test just one patient. The system requires much lower amounts of reagent chemicals than those needed for testing the samples individually. Up to 16 samples were combined and tested at once in the team's study. If the pooled test showed a positive result, subsequent tests would automatically take place within the same platform until the actual positive samples were identified. This entire process took between 30 to 60 minutes, depending on whether there were positive samples. Due to technology's assay miniaturization and pooled-testing capabilities, the chemical reagent costs could be reduced by 10 to 300 times. The platform also offers precision and robust automation. A patent application has been filed.

Researchers Discover New Antiviral Compounds from Korean Native Plants

A team of Korean researchers have found new antiviral compounds derived from two Korean native plants - Codonopsis lanceolata and Aster koraiensis. The research team found that two saponins (astersaponin I and lansemaside A) found within these two plants are capable of inhibiting SARS-CoV-2 infection by blocking membrane fusion, thereby effectively blocking all the way that the virus can infect its host. In lab tests, both saponins were found to have an IC50value (half maximal inhibitory concentration) of 2 μM, indicating that they were highly effective at stopping the coronavirus from entering the cell. The inhibitory effect was identical for all SARS-CoV-2 variants, such as the Omicron. Natural saponins contained in these plants are major constituents in many foods and herbal medicines that are readily accessible in everyday life. When ingested, it can be delivered at high concentrations to the epithelial cells of the upper respiratory tract, which means it can be effective in an asymptomatic or early stage of COVID-19 infection. While their effects have been confirmed only in-vitro now, clinical trials may be possible in the future if positive results are obtained in animal tests.

CRISPR for Personalized Cancer Treatment

US researchers have used CRISPR gene editing to alter immune cells so that they recognize mutated proteins specific to a person’s tumours. Those cells can then be safely set loose in the body to find and destroy their target. It is the first attempt to combine gene editing to create personalized treatments, and engineering immune cells called T cells to better target tumours. The approach was tested in 16 people with solid tumours, including in the breast and colon. The

team sequenced DNA from blood samples and tumour biopsies and used algorithms to predict which of the mutations were likely to be capable of provoking a response from T cells, a type of white blood cell that kills mutated cells. The proteins called T-cell receptors can recognize the tumour mutations. Blood samples were taken from each participant and CRISPR genome editing was used to insert the receptors into their T cells. Each participant then had to take medication to reduce the number of immune cells they produced, and the engineered cells were infused. Each of the 16 participants received engineered T cells with up to three different targets. One month after treatment, five of the participants experienced stable disease, meaning that their tumours had not grown. Only two people experienced side effects. Further development of this therapy could improve results.

Easier Way to Remove Medical Devices

By taking advantage of a phenomenon that leads to fractures in metal, MIT researchers have designed medical devices that could be used inside the body as stents, staples, or drug depots, then safely broken down on demand when they're no longer needed. The researchers showed that biomedical devices made from aluminum can be disintegrated by exposing them to a liquid metal known as eutectic gallium-indium (EGaIn). In practice, this might work by painting the liquid onto staples used to hold skin together, for example, or by administering EGaIn microparticles to patients. Triggering the disintegration of such devices this way could eliminate the need for surgical or endoscopic procedures to remove them. The MIT team showed that after they painted gallium-indium onto aluminum devices, the metals would disintegrate within minutes. The researchers also created nanoparticles and microparticles of gallium-indium and showed that these particles, suspended in fluid, could also break down aluminum structures.

New Heat Treatment May Enable Energy-Efficient 3D Printing of Blades for Gas Turbines or Jet Engines

A new MIT-developed heat treatment transforms the microscopic structure of 3D-printed metals, making the materials stronger and more resilient in extreme thermal environments. The technique could make it possible to 3D print high-performance blades and vanes for power-generating gas turbines and jet engines, which would enable new designs with improved fuel consumption and energy efficiency. The team is also exploring ways to speed up the draw rate, as well as test a heat-treated structure's resistance to creep. They envision that the heat treatment could enable the practical application of 3D-printing to produce industrial-grade turbine blades, with more complex shapes and patterns. The new blade and vane geometries will enable more energy-efficient land-based gas turbines, as well as, eventually, aeroengines. This could from a baseline perspective lead to lower carbon dioxide emissions, just through improved efficiency of these devices.

COVID-19

COVID-19 (WORLD)

Powerful New Drug Could Block COVID-19

Scientists at Scripps Research Institute have created a new drug NMT5, that coats SARS-CoV-2 with chemicals that may temporarily modify the human ACE2 receptor and thus block its entry into human cells. However, when the virus is not present, ACE2 may operate normally. The

drug latches on to the virus and then adds a "nitro group" like nitroglycerin to ACE2 whenever the drug-coated virus approaches the receptor. NMT5 has two critical properties: it could detect and attach to a pore on the surface of SARS-CoV-2, and it could chemically modify human ACE2 using a nitroglycerin fragment. The team tested NMT5 in isolated cells as well as animals and showed how NMT5 attaches tightly to SARS-CoV-2 viral particles as the viruses move through the body. Then, they showed that when the virus gets near ACE2 to infect a cell, NMT5 adds a "nitro group" to the receptor, modifying its structure temporarily for about 12 hours, so that the SARS-CoV-2 virus can no longer bind to it to cause infection. In cell culture tests with the Omicron variant of SARS-CoV-2, the drug prevented 95 per cent of viral binding. In hamsters with COVID-19, NMT5 decreased virus levels by 100-fold, eliminated blood vessel damage in the animals' lungs, and ameliorated inflammation. The drug also showed effectiveness against nearly a dozen other variants of COVID-19, including alpha, beta, gamma, and delta strains. Since NMT5 is only using the virus as a carrier, the researchers think the drug is likely to be effective against many other variants of SARS-CoV-2. The team is now making a version of the drug to evaluate for human use, while carrying out additional safety and effectiveness trials in animals.

SARS-CoV-2 Virus Protein Damages the Heart

Researchers at the University of Maryland have identified how a specific protein in SARS-CoV-2, the virus responsible for COVID-19, damages heart tissue. They then used a drug to reverse the toxic effects of that protein on the heart. The team identified the most toxic SARS-CoV-2 proteins in studies using fruit flies and human cells. They found a promising drug selinexor that reduced the toxicity of one of these proteins, but not the other one, known as Nsp6 which turned out to be the most toxic SARS-CoV-2 protein in the fly heart. The Nsp6 protein hijacked the fruit fly's cells in its heart to turn on the glycolysis process, which enables cells to burn the sugar glucose for energy. The Nsp6 protein adds to the damage by disrupting the cell's powerhouse, called the mitochondria, which produces energy from sugar metabolism. The team then blocked sugar metabolism in fruit flies and mouse heart cells using the drug 2-deoxy-D-glucose (2DG). They found that the drug reduced the heart and mitochondria damage caused by the Nsp6 viral protein. 2DG is inexpensive and is used regularly in laboratory research. Although 2DG has not been approved by the U.S. Food and Drug Administration to treat disease, the drug is currently in clinical trials for treatment of COVID-19 in India.

COVID-19 Shown to Trigger Inflammation in the Brain

Research led by the University of Queensland (UQ) in Australia has found that COVID-19 activates the same inflammatory response in the brain as Parkinson's disease. The discovery not only identified a potential future risk for neurodegenerative conditions in people who have had COVID-19, but also suggested a possible treatment. They studied the effect in the laboratory of the virus on the brain's immune cells, 'microglia' which are the key cells involved in the progression of brain diseases like Parkinson's and Alzheimer's. They found the cells effectively activated the same pathway that Parkinson's and Alzheimer's proteins can activate in disease, the inflammasomes. Triggering the inflammasome pathway sparked a 'fire' in the brain, which began a chronic and sustained process of killing off neurons without any outward symptoms for many years. This may explain why some people who've had COVID-19 are more vulnerable to developing neurological symptoms like Parkinson's disease. The researchers found the spike protein of the virus was enough to start the process and was further exacerbated when there were

already proteins in the brain linked to Parkinson's. Persons pre-disposed to Parkinson's, Alzheimer's and other dementias that have been linked to inflammasomes could be susceptible to Covid triggering. The researchers administered a class of UQ-developed inhibitory drugs that are currently in clinical trials with Parkinson's patients. They found it successfully blocked the inflammatory pathway activated by COVID-19, essentially putting out the fire. The drug reduced inflammation in both COVID-19-infected mice and the microglia cells from humans, suggesting a possible treatment approach to prevent neurodegeneration in the future.

COVID-19 (INDIA)

India's Covid Vaccination Drive Praised

The US government's Covid-19 response coordinator Dr Ashish Jha has hailed India's "phenomenal" Covid-19 vaccination drive and called it a "stunning achievement". Dr Jha also praised the Narendra Modi-led government for doing an "excellent job" by inoculating people of the country against the coronavirus infection in a very phased and controlled manner. Speaking at the Hindustan Times Leadership Summit, he said India had turned its situation around after the awful Delta wave, with a massive ramp-up of vaccine production and a phenomenal vaccination campaign. He said it was one of the most impressive in the world. On January 16, 2021, India opened its vaccination drive in a phased manner where healthcare workers and older individuals were prioritized first. There were challenges vaccine hesitancy, vaccine supply, misinformation and rumours, and registration and appointments at Co-Win platform. However, all these were overcome with time. Being a country of 1390 million people, India surprised the world with its efficiency in delivering vaccines to the remotest parts of the country.

India-made Drug Could Treat Heart Damage Caused by Covid Protein

A drug developed by the Defence Research and Development Organisation (DRDO) may reverse the heart damage caused by a protein in the SARS-CoV-2 virus. This was found in a study conducted on fruit flies and mice. Researchers from the University of Maryland identified how a specific protein in SARS-CoV-2, the virus responsible for COVID-19, damages heart tissue. They then used the drug, 2-deoxy-D-glucose (2DG), to reverse the toxic effects of that protein on the heart. Developed by Dr Reddy's Laboratories in collaboration with DRDO, 2DG is an oral drug. The drug reduced the heart and mitochondria damage caused by the Covid generated viral protein Nsp6.

Covid Vaccine Makers to Dump 350 million Doses

The Serum Institute said around 100 million doses are set to be dumped and Bharat Biotech will junk 250 million doses. Both companies have stopped production of COVID-19 vaccines. Production of Covovax however will continue as per requirement. Bharat Biotech has more than 200 million doses of Covaxin in bulk form and around 50 million doses in vials ready to use. Due to lack of product demand, production stoppage of Covaxin was initiated several months ago, earlier this year. Covaxin doses in vials are set to expire during early 2023. India has administered 2.19 billion doses, including precaution or booster doses. However, poor uptake has blighted the roll-out of booster doses. The disastrous initial phases of the covid pandemic have led to more than 44.6 million cases and 530,509 deaths in the last two years.

INDIA–SCIENCE & TECHNOLOGY

New Generation Superabrasive Tools

A research team at IIT Madras has developed new-generation multi-point/single-layer superabrasive tools for advanced grinding applications. They used advanced chemical bonding technology with an application-specific novel formulation of filler material and controlled spacing of grits on the tools by an indigenously developed semi-automatic grit-printing device. The novel formulation offers an excellent blend of strength, wear resistance, and wetting characteristics. The grit-planting setup allows a manufacturer to print grit in a customised pattern to suit the requirement of an application. The recommended coating enhances the durability of the bond, thus adding life to the developed tools. The joint strength and wear-resistant characteristics of the bonds of these tools are superior to those of their commercial counterparts. The technology can produce new-generation tools with versatile geometries.

ISRO Cryogenic Engine Tested Successfully

ISRO carried out a hot test of its upgraded CE-20 cryogenic engine on 9 November to achieve a thrust of 21.8 tonnes, an increase from 19 tonnes. This enables India's heaviest launcher LVM3 to lift heavier payloads. The higher thrust is obtained by increasing the quantity of fuel being stored in the tanks and by increasing the rate of flow of fuel to the engine. The major modification carried out on this test was the introduction of a Thrust Control Valve (TCV) for thrust control. In addition to this 3D-printed liquid oxygen and liquid hydrogen turbine and exhaust casings were used for the first time.

Technique for Efficient Fabrication of Low-cost LCD Devices

A team of scientists from the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru conceptualized and implemented a novel way of employing 2D materials to overcome the drawbacks of current methods. Using h-BN nanoflakes as the specific material, the group employed a procedure called solution-processed deposition technique and found it to be effective in getting the LC alignment over a much larger area. They also found the resultant crystals to be quite robust with no evidence of decay in LC orientation over several months. It was noted that the method demonstrating a non-conventional and contact-free route for getting unidirectional alignment of LC, is also much simpler, scalable, flexible for adaptation, and cost-effective.

Gene Editing in Temperature Sensitive Organisms, Plants and Crops

Inorder to advance CRISPR-Cas9 platform into the forefront of biomedical and analytical biotechnology, scientists of Raman Research Institute (RRI), have explored temperature-dependent binding and release of cleaved products by the Cas9 enzyme. The team demonstrated that the Cas9 enzymes strongly bind to the target at very low temperatures and remains bound to the cleaved DNA products even after the enzyme has done its job. Subsequently, the bound products were released in a controlled fashion using high temperature or chemical denaturants (that make proteins and DNA lose their 3-dimensional structure and become non-functional). The research expands possible application of the Cas9-based genetic toolbox to a previously unexplored temperature range that would be compatible with long-term storage of biological samples. Their observations on high efficiency of Cas9 binding to target at very low temperatures also provide opportunities to edit genomes of the less explored organisms called

cryophiles with an optimal growth temperature of 15°C. The results on Cas9-DNA binding and release mechanics will provide valuable insights for developing temperature-dependent applications of the CRISPR-Cas9 technology. It also builds a quantitative understanding of the product release mechanism of this enzyme system.

ISRO to Launch First Private Rocket 'Vikram-S'

India's first private rocket 'Vikram-S' is set to be launched on 15 November. The rocket has been developed by Skyroot Aerospace; a Hyderabad based Aerospace company. With the launch of Vikram-S', India will make its debut in the manufacturing of private entities in the Aerospace sector. According to the report, Skyroot Aeronautics' first mission, a test flight of the Vikram-S launch vehicle into space, will be called '*Prarambh'* and it will take off on 15 November.

Organic Semiconductor-based Acidity Tester

Scientists at the Indian Institute of Science Education and Research (IISER-TVM) Thiruvananthapuram have developed an organic semiconductor-based device that can be used to design disposable, flexible pH meters to test the full-scale acidity and alkalinity of substances. It requires only a drop of the fluid whose pH needs to be measured accurately in a few milliseconds without the need of calibration. The pH sensor uses an organic thin film as the sensing layer made of a semiconducting polymer called P3HT (or poly(3-hexylthiophene-2,5-diyl)). The analyte drop is placed on the P3HT film channel between the source and drain and used as the 'gate dielectric' to measure the pH value from the change of threshold voltage and drain current modulation. The team tested their device and found that it effectively senses pH values ranging from 3 to 12 within a few milliseconds. The device needs no calibration, has a stable performance for 5 minutes and can be used as a single-use, rapid pH meter. The organic ISFET pH sensor can be used to sense the acidity of bodily fluids and may be used to fabricate wearable acidity sensors. The absence of calibrating the pH sensor means that it can be used to make hand-held, disposable pH meters that farmers can use to check the acidity of their soil for optimum harvest.

IN BRIEF

Meta AI Predicts Shape of 600 million Proteins

Researchers at Meta (formerly Facebook) have used artificial intelligence (AI) to predict the structures of some 600 million proteins from bacteria, viruses and other microbes that haven't been characterized. The team generated the predictions using a 'large language model', a type of AI that is the basis for tools that can predict text from just a few letters or words. The team used sequences of known proteins, which can be expressed by a chain of 20 different amino acids, each represented by a letter. The network then learned to 'autocomplete' proteins with a proportion of amino acids obscured. This training imbued the network with an intuitive understanding of protein sequences, which hold information about their shapes. A second step combines such insights with information about the relationships between known protein structures and sequences, to generate predicted structures from protein sequences. Meta's network, called ESMFold, isn't quite as accurate as AlphaFold, but it is about 60 times faster at predicting structures. Using a database of bulk-sequenced 'metagenomic' DNA from environmental sources including soil, seawater, the human gut, skin, and other microbial habitats the Meta team predicted the structures of more than 617 million proteins. in only2

weeks. Millions of these structures are entirely novel, and unlike anything in databases of protein structures determined experimentally or in the AlphaFold database of predictions from known organisms.

Novel Redox Flow Battery Paves Way for Low-cost Storage

Researchers at Case Western Reserve University (CWRU) have come up with a concept for a slurry iron redox flow battery. It offers the potential for very low-cost, large-scale energy storage with safe and sustainable materials. By incorporating a conducting carbon slurry into the negative electrolyte of an all-iron flow battery, the researchers have ensured that the iron plating reaction occurs in such a way that makes the decoupling of power from energy possible for their hybrid flow battery system. The slurry electrode allows for the plated metal to be directed into tanks for long-duration energy storage.The hybrid system is limited in how much energy they can store by how much metal fits into the cell.In the slurry system, one can add more electrolyte and make the tanks bigger without changing the size of the electrochemical cell, which determines the power output.The battery technology has matured to a point where commercial scale units are now being designed and tested by a company who licensed the technology. Cost estimates for energy storage calculated under the project stand at around $50/kWh.

Removing Carbon Dioxide from Power Plant Smokestacks

Researchers at the National Institute of Standards and Technology (NIST), Singapore have found that aluminum formate (ALF), one of a class of substances called metal-organic frameworks (MOFs) can separate carbon dioxide (CO2) from the other gases that commonly fly out of the smokestacks of coal-fired power plants. ALF performs well relative to other high-performing CO2 adsorbents, but it rivals designer compounds in its simplicity, overall stability, and ease of preparation. ALF is made from aluminum hydroxide and formic acid, two chemicals that are abundant and readily available on the market. It would cost less than a dollar per kilogram. ALF molecular structure resembles a three-dimensional wire cage with innumerable small holes just large enough to allow CO2 molecules to enter and get trapped, but just small enough to exclude the slightly larger nitrogen molecules that make up most of the flue gas. However, making ALF at large scales and for reducing the humidity of the flue gas before scrubbing it, and using the captured CO2 remains a challenge.

Converting CO2 into Methanol at Scale

The world's first commercial scale CO2-to-methanol plant has started production in Anyang, China, to produce methanol from captured waste carbon dioxide and hydrogen gases. The plant's production process is based on the Emissions-to-Liquids (ETL) technology developed by Carbon Recycling International (CRI) and first demonstrated in Iceland. The new facility can capture 160,000 tonnes of carbon dioxide emissions a year, which is equivalent to taking more than 60,000 cars off the road. The captured carbon dioxide is then reacted with the recovered hydrogen in CRI's ETL reactor system with the capacity to produce 110,000 tonnes of methanol per year. CRI's reactor uses specialised catalysts to convert the carbon dioxide and hydrogen feed gases into methanol. The entire unit weighs around 84 tonnes, mounted in a dedicated steel frame and connected to a specialised gas compressor and a distillation column under 70-meters-tall. The ETL process uses carbon dioxide that is recovered from existing lime production emissions and hydrogen that is recovered from coke-oven gas. CRI's second project in China is expected to come online in the second half of 2023.

China Tests Engine for its Moon and Mars Rocket

China has completed a first hot fire test of a fully assembled powerful new engine that could power new launch vehicles and boost the country's space capabilities. The full system test of the 500-ton-thrust, dual nozzle kerosene-liquid oxygen staged combustion cycle engine took place on Nov. 5, marking a milestone for the rocket engine. The engine, sometimes referred to as the YF-130, is more than four times more powerful than the nation's current YF-100 kerosene-liquid oxygen engines, which produce 120 tons of thrust and are used in China's Long March 5, 6 and 7 rockets. The powerful new engine has been slated for use in the first stage of a Long March 9 super heavy-lift rocket that could facilitate missions to the moon and Mars. The development follows the successful testing in September of a liquid hydrogen-liquid oxygen engine for the rocket's upper stage. China has also tested a new, 80-ton engine which uses a methane and liquid oxygen propellant mix. The engine will be used for commercial space launch vehicles.

RESOURCES & EVENTS

Fossil Fuels will Peak Within Five Years

The International Energy Agency (IEA) released its 2022 World Energy Outlook, which says the global energy crisis and Russia's war have "turbo-charged" the shift away from fossil fuels. For the first time, coal, oil and gas will each peak, even if countries fail to meet their climate pledges. The report says this will be a "pivotal moment" in history. Countries are moving to electrify heat and transport more quickly than they were last year, the IEA says. It adds that "clean energy…is the big growth story of this outlook". Global energy demand growth will "almost entirely" be met by renewables. Moreover, global solar capacity will climb 18 per cent higher by 2030 than expected last year – and wind 14 per cent. Global carbon dioxide (CO2) emissions are now set to peak by 2025 at the latest, the outlook says. As a result, the world would warm by 2.5C this century, slightly less than the 2.6C the IEA expected last year. Countries have also boosted the ambition of their climate pledges. These would now limit warming to 1.7C if met in full, rather than 2.1C stated last year. However, there is still a "long way to go" to align action with the 1.5C target. See the full report here.

Meeting of the Parties to the Montreal Protocol (MOP34)

The 34th Meeting of the Parties (MOP 34) to the Montreal Protocol on Substances that Deplete the Ozone Layer was held from 31 October – 4 November 2022 in Montreal, Canada. Celebrating the 35th anniversary of one of the world's most successful environmental treaties, the meeting s adopted 24 decisions, including on (1) illegal import of certain refrigeration, air-conditioning, and heat pump products and equipment; (2) identification of gaps in the global coverage of atmospheric monitoring of controlled substances and options for enhancing such monitoring; (3) strengthening institutional processes with respect to information on HFC-23 by-product emissions; (4) strengthening Montreal Protocol institutions, including for combating illegal trade; (5) ongoing emissions of carbon tetrachloride (CTC); (6) critical-use exemptions (CUEs), stocks and quarantine and pre-shipment uses of methyl bromide; (7) enabling enhanced access and facilitating the transition to energy-efficient and low or zero-global-warming-potential (GWP) technologies. It calso adopted the terms of reference for the study on the replenishment of the Multilateral Fund (MLF) for 2024-2026. The Montreal Protocol has already avoided 0.5-1°C warming by mid-century thanks to its long-term implementation, and

the additional benefits may arise from implementation of the 2016 Kigali Amendment on hydrofluorocarbons (HFCs), which are powerful greenhouse gases.

Research Collaboration to Tackle Grand Societal Challenges

Leaders from the MIT School of Architecture and Planning, the MIT Morningside Academy for Design (MAD) and the Hasso Plattner Institute (HPI) announced the Hasso Plattner Institute-MIT Research Program on Designing for Sustainability. This research collaboration, funded by the Hasso Plattner Foundation, is an eight-year program to drive joint scientific research at both institutes in sustainable design, innovation, and digital technologies, as well as in translating research results into practice. Through this engagement, MIT and HPI aim to tackle global challenges as expressed in the United Nations Sustainable Development Goals (SDGs). The program will connect faculty and students from both institutions, with the intention of having the most significant possible societal impact. Program participants will conduct research in basic and applied design thinking and innovation. Funded researchers study the complex interaction between members of multidisciplinary teams challenged to deliver breakthrough product, service, and business-model sustainable design innovations. Applied design thinking research will focus primarily on topics from among the 17 SDGs, including health, education, energy, and climate action. Innovation research is targeted on the creation of high-impact products and startups (product and venture design) that translate research into practice.

Indo-German Week of Young Researchers Inaugurated

The Indo-German Week of the Young Researchers 2022 was inaugurated on 7 November 2022 to bring young researchers from the two countries together and share their research interests and build long-term research partnerships. During the programme, an initiative jointly organised by the SERB, India, and German Research Foundation (DFG), thirty promising young researchers from India and Germany will discuss and interact closely on various contemporary matters in chemical sciences. The interaction will be the first of its kind among the researchers of two countries in the post-pandemic world. Each participant would deliver a research lecture and get an opportunity to interact closely with other participants. The main goal of the conclave is to foster collaboration among early and mid-career researchers and scientists who will be setting the agenda of scientific cooperation soon. The conclave is led by Prof Vinod K Singh from IIT Kanpur and Prof Burkhard König from University of Regensburg, Germany.

Indian Biological Data Center (IBDC) at Faridabad

Union Minister of State (Independent Charge) Ministry of Science and Technology, Dr Jitendra Singh dedicated to the nation India's first national repository for life science data- 'Indian Biological Data Center' (IBDC) at Faridabad, Haryana. IBDC is mandated to archive all life science data generated from publicly funded research in India. It has a data storage capacity of about 4 petabytes and houses the 'Brahm' High Performance Computing (HPC) facility. The computational infrastructure at IBDC is also made available for researchers interested in performing computational-intensive analysis. IBDC has started nucleotide data submission services via two data portals viz. the 'Indian Nucleotide Data Archive (INDA)' and 'Indian Nucleotide Data Archive - Controlled Access (INDA-CA)' and has accumulated over 200 billion bases from 2,08,055 submissions from more than 50 research labs across India. It also hosts an online 'Dashboard' for the genomic surveillance data generated by the INSACOG labs. The dashboard provides customized data submission, access, data analysis services, and real-

time SARS-CoV-2 variant monitoring across India. Data submission and access portals for other data types are under development and would be launched shortly. IBDC is committed to the spirit of data sharing as per FAIR (Findable, Accessible, Interoperable, and Reusable) principles.

SCIENCE POLICY AND DIPLOMACY

Rich Nations Deflect GCF Climate Finance Burden to Private Sector

Wealthy nations are pushing for the United Nations Green Climate Fund (GCF) to seek donations from big businesses and the super-rich, as government donations prove increasingly unreliable and insufficient. The UK and US have together failed to hand over more than $2bn of promised money to the fund, which has responded by putting three projects on hold. At the fund's October board meeting, the US led wealthy countries in pressuring the fund's staff to target private sector donations, despite the secretariat expressing doubts about this strategy. The Green Climate Fund was set up in 2010. Based in South Korea, it receives voluntary donations from rich nations and distributes this money to projects which help low- and middle-income countries cut emissions or adapt to climate change. In 2014, then US president Barack Obama promised the fund $3bn but only handed over $1bn before the end of his term. His successor Donald Trump did not give any money to the GCF and, so far, neither has Joe Biden. These failures have led to cutbacks in mitigation [carbon-cutting] projects. At the latest board meeting, the fund announced it would postpone three projects because the UK government had failed to deliver $288m due in September. Facing cutbacks, the fund's secretariat put together a research paper on alternative sources of funding for the 2024-2027 period. They looked at whether to seek donations from big businesses, rich people, governments through the International Monetary Fund's special drawing rights and from optional levies on purchases like airline tickets. However, the paper's authors found there would be "significant challenges" to accepting private sector donations. The GCF will be seeking contributions from governments next year ahead of the 2024-2027 spending period.

Seven Countries Join ASAT Test Ban

Seven countries have committed formally to the U.S.-led initiative to ban destructive direct-ascent, kinetic-energy anti-satellite (ASAT) weapons testing. The United States became the first nation to declare the self-imposed ban in April 2022. Canada followed in May, New Zealand in July, Japan and Germany in September, and the United Kingdom and South Korea in October. Other countries, such as France and Ireland, have expressed support for the ban, but have not made a commitment. China, India, the Soviet Union and Russia, and the United States are the only nations to have conducted such tests against satellites, which are known to create massive amounts of debris in space. The U.S. announcement preceded the inaugural session in May 2022 of the UN open-ended working group aimed at reducing space threats, which was created out of a 2021 UN resolution that promised to address military movements in space through norms, rules of the road, and principles of responsible behavior. The working group held its second session in September. The third session is planned for early 2023, and the fourth in August 2023. At the UN General Assembly in October 2022, the United States tried to make the ban fully multilateral by introducing a resolution calling on all countries to commit not to conduct ASAT tests. Belarus, China, Nicaragua, North Korea, Syria, Venezuela, and Russia opposed the resolution.

Call for Limits on Lethal Autonomous Weapons

In a joint statement on October 22, a group of 70 UN member states including the United States expressed concern about "new technological applications, such as those related to autonomy in weapons systems." The statement also emphasized "the necessity for human beings to exert appropriate control, judgment, and involvement...to ensure any use of force is in compliance with international law, particularly international humanitarian law, and that humans remain accountable for decisions on the use of force." Several major powers are developing and, in some cases, fielding various types of autonomous combat systems, including unmanned aerial vehicles, ground vehicles, surface vessels, and undersea vessels. Many of these weapons utilize artificial intelligence to improve capabilities to identify, track, and attack enemy targets. The joint statement follows more than eight years of inconclusive discussions among the 125 states-parties to the Convention on Certain Conventional Weapons (CCW) on the subject of lethal autonomous weapons systems. In CCW discussions, calls have been made for binding agreements to limit or ban these weapons systems, while the states that are building autonomy into certain weapons systems, including Russia and the United States, have resisted calls for a binding agreement and instead advocated for a less restrictive "code of conduct."

Russia Dispatches Gigantic 200-Ton Magnet to ITER in France

Russia has sent one of six giant magnets to France that will be used in the world's largest International Thermonuclear Experimental Reactor (ITER) as part of a global effort to harness nuclear fusion power. A total of 35 countries are working together on this nuclear fusion program at a facility in Provence (France), near Marseilles, hoping it could pave the way for a new source of unlimited, clean energy for the entire planet. ITER is one of the last international scientific projects in which Russia is still participating amid the ongoing Ukraine crisis. The ship carrying the Russian-made magnet, or 'the 200-ton poloidal field coil,' was dispatched from St. Petersburg on November 1. This coil will act as a magnet once an electric current flows through it. The 200-ton 9-meter-wide coil is a key element of the thermonuclear reactor. It is one of six such poloidal field coils that are expected to start and maintain thermonuclear fusion. Chinese specialists are responsible for manufacturing one coil. The remaining four larger coils will be made in France. Nuclear fusion is considered a clean, safe, and unlimited energy source. The ITER project involves building the world's largest 'tokamak' – a giant, doughnut-shaped magnetic fusion device. The Russian-made poloidal field coil was initially scheduled for shipping in May, but sanctions prevented Russian ships from docking in Europe. The ITER project was set in motion in 1985 when US President Ronald Reagan and Soviet Union leader Mikhail Gorbachev met to discuss how to cool tensions between the two superpowers through international scientific collaboration for a new source of energy for the benefit of all mankind. The ITER project developed further since then, and now includes participation from 35 partner nations, including China, India, South Korea, Japan, and the nations of the European Union.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc.

NOTE TO OUR READERS AND STAKEHOLDERS:

The Science Diplomacy Programme at RIS has been sending you the fortnightly issues of Science Diplomacy Alerts regularly. 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.