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

16-31 DECEMBER 2023

ISSUE 124

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

[China's Super-small Inhalable Vaccine Shows Promise](#)

A team, led by researchers at the Chinese Academy of Sciences (CAS) has developed a new powdered, inhalable vaccine that could provide better protection against respiratory viral infections than traditional injectable vaccines. The aerosol-based vaccine produces microscopic spheres that measure just 2.8 microns across, and was found to produce a long, sustained immune response when tested on mice, hamsters and monkeys, with a single-dose. The researchers packaged COVID-19 virus antigens measuring 20 nanometres across into porous microcapsules that measured only 10 microns in diameter. When freeze dried, the microcapsules shrunk into solid spheres that measured about 2.8 microns across. The dry, powdered vaccine can reach the alveoli directly and be effectively deposited in the lungs. Once the COVID-19 antigens were packaged into the microcapsules they were tested in mice and monkeys, as well as hamsters. With just a single dose, delivered through a dry powder inhaler, the team found that the vaccine “conferred efficient protection” against COVID-19 in all the animals by producing large amounts of IgA and IgG antibodies. The scientists also used fluorescent tags to track the vaccine microcapsules while examining the animal lungs under microscopes. The fluorescence signals were still present in the lungs of mice 42 days after immunisation, compared to just five days for the control vaccine group. Since it is non-invasive and does not require immediate cold storage, the delivery platform is relatively inexpensive to store, which could aid in deliveries to remote areas. At room temperature, the team found that the dry powder remained stable for more than a month.

['Coscientist,' an AI-based System for Chemical Reactions](#)

A team from the US has developed an artificial intelligence-driven system "Coscientist" was able to autonomously learn about certain advanced chemical reactions and design a successful laboratory procedure to make them. This is the first time that a non-organic intelligence planned,

designed and executed a complex reaction that was invented by humans. Coscientist's software uses large language models like Chat GPT4. The software modules enabled Coscientist to search public information about chemical compounds, find and read technical manuals on how to control robotic lab equipment, write computer code to carry out experiments, and analyze the resulting data to determine what worked and what didn't. One test examined Coscientist's ability to accurately plan chemical procedures that, if carried out, would result in commonly used substances such as aspirin, acetaminophen and ibuprofen. Coscientist's final exam was to put its assembled modules and training together to fulfill the team's command to perform Suzuki and Sonogashira reactions. In less than four minutes, Coscientist had designed an accurate procedure for producing the required reactions using chemicals provided by the team. Coscientist also corrected errors in its code. AI-assisted systems like Coscientist could bridge the gap between the unexplored vastness of nature and the fact that trained scientists are in short supply.

Ethylene Exposure Transforms Seedlings into Super Plants

Researchers from Tennessee University have found that treating seeds with ethylene gas increases both their growth and stress tolerance. This discovery, involving enhanced photosynthesis and carbohydrate production in plants, offers a potential breakthrough in improving crop yields and resilience against environmental stressors. The team found that when seeds are germinating in darkness, as they usually are underground, adding ethylene can increase both their growth and stress tolerance. The team exposed the seeds to ethylene gas for several days to see what effect this might have. Several days after placing the seedlings under light, they found that the plants briefly gassed with ethylene were much larger. They had larger leaves as well as longer and more complex root systems than plants that had not been exposed to ethylene. These plants continued growing at a faster rate throughout their whole lifetime. They tested the effects of short-term ethylene treatment on germinating tomato, cucumber, wheat and arugula seeds – and found that all grew bigger. They also found that the brief ethylene treatment also increased tolerance to various stresses such as salt stress, high temperature and low oxygen conditions. The mechanisms that allow for these ethylene-exposed plants to grow larger and tolerate more stress are under further study.

Chinese Scientists Invent the Most Powerful Detonation Engine for Hypersonic Flight

Scientists from the Beijing Power Machinery Institute, China claim they have developed an unprecedented power solution for aerospace planes. The “revolutionary” air-breathing engine could, in theory, lift an aircraft from a runway to more than 30km into the stratosphere and continuously accelerate it to 16 times the speed of sound. The engine operates in two distinct modes: below Mach 7 speed, it functions as a continuous rotating detonation engine. Air from the outside mixes with fuel and is ignited, creating a shock wave that propagates in an annular, or ring-shaped, chamber. The shock wave ignites more fuel during rotation, providing a powerful and continuous thrust for the aircraft. Above Mach 7, the shock wave stops rotating and focuses on a circular platform at the engine's rear, maintaining thrust through a nearly straight-line oblique detonation format. The fuel auto-detonates as it reaches the rear platform because of the very high speed of incoming air. Throughout its operation, the engine relies on detonation as its primary driving force. According to some estimates, the explosion of combustible gases can convert nearly 80 per cent of chemical energy into kinetic energy. The current propulsion systems for China's hypersonic vehicles consist mainly of rockets and scramjet engines. The world's first sustainable detonation engine was developed by Soviet scientists during the Cold War but remained confined to laboratories because of challenges reliably controlling the shock wave. In recent years China and

the United States have engaged in fierce competition in this field. Nasa and contractors such as GE recently conducted ground tests on prototype engines. This year, China achieved the world's first flight of a rotating detonation engine on a drone platform.

New Class of Antibiotics Candidate Found

MIT researchers have discovered a class of compounds that can kill a drug-resistant bacterium that causes more than 10,000 deaths in the United States every year. They used a type of artificial intelligence known as deep learning. The researchers showed that these compounds could kill methicillin-resistant *Staphylococcus aureus* (MRSA) grown in a lab dish and in two mouse models of MRSA infection. The compounds also show very low toxicity against human cells, making them particularly good drug candidates. Researchers were also able to figure out what kinds of information the deep-learning model was using to make its antibiotic potency predictions. This knowledge could help researchers to design additional drugs that might work even better than the ones identified by the model.

Novel Nanotube Foam Material Shows Promise in Preventing Brain Injuries

The University of Wisconsin–Madison engineers have developed the new material—a vertically aligned carbon nanotube foam which can dissipate an enormous amount of rotational kinetic energy from an impact. And as a helmet lining material, it could mitigate, or even prevent, traumatic brain injuries by weakening rotational kinetic energy before it reaches the brain. The new material is 30 times better at absorbing shear strain than the foam currently used. The material shows great promise for enabling new helmets that are drastically better at preventing concussions. The researchers recently demonstrated that their vertically aligned nanotubes foams exhibited outstanding thermal conductivity and diffusivity, which would enable a helmet liner made of the material to keep the wearer's head cool in hot environments. Beyond helmet liners, the material could also be used in electronic packaging and electronic systems to both protect against shocks and keep electronics cool.

Successful Test Paves Way for Magnetic Production at CERN

Tests at CERN have confirmed the utility of the newly designed quadrupole magnets. The new magnets are made from a more challenging material: niobium–tin (Nb₃Sn). The brittleness of Nb₃Sn and the fact that its coils are very rigid, assembling Nb₃Sn magnets requires close attention. The CERN Technology department is developing a series of ten magnets (eight, plus two spare), each 7.2 meters in length. The successful test at CERN, which ran from August to October, achieved the target current of 16.53 kA at both 1.9 K and 4.5 K. The target current corresponds to the 7 TeV LHC operation, plus a 300 A margin. Although operation is planned at 1.9 K, the ability to reach target current at 4.5 K confirms design robustness and a comfortable operation margin for the HL-LHC and beyond. This is the third full-length magnet to be tested as part of a recovery plan decided on after performance limitations were observed on the first two prototypes. The other magnets showed no signs of degradation when tested, but were always limited to below target current when operated at 4.5 K. The team at CERN paused production to investigate this limitation. By improving the design of the outer shell, reducing peak stress on the magnet during coil assembly and changing the parameters of the coil manufacturing process, they eliminated the limitations and the third magnet has outshone its predecessors.

WHO Designates COVID Variant JN.1 as ‘Variant of Interest’

The UN health agency cautioned that with the onset of winter in the Northern Hemisphere, the new variant “could increase” the burden of respiratory infections in many countries, noting other diseases such as RSV, influenza and childhood pneumonia that are already on the rise. The classification of JN.1 as a separate variant of interest (VOI) is down to “its rapidly increasing spread” around the globe. JN.1 has been found in many countries, including India, China, the United Kingdom, and the United States. Previously JN.1 was classified and tracked as part of its parent BA.2.86 lineage, which itself is a descendant of the Omicron or B.1.1.529 variant of SARS-CoV-2, the virus causing COVID-19 disease. In comparison with its parent lineage BA.2.86, JN.1 has an additional mutation (the L455S mutation) in the spike protein. WHO said that based on the currently available data, “the additional global public health risk posed by JN.1 is currently evaluated as low.” WHO also highlighted that current vaccines continue to protect against severe disease and death from JN.1 and other circulating variants of SARS-CoV-2.

INDIA

WHO Prequalifies Malaria Vaccine Made in India

The World Health Organisation (WHO) has added the R21/Matrix-M malaria vaccine to its list of “prequalified vaccines.” The global health body had in October, recommended the use of the vaccine for prevention of malaria in children following the advice of its Strategic Advisory Group of Experts (SAGE) on Immunisation and the Malaria Policy Advisory Group. The prequalification is a prerequisite for vaccine procurement by UNICEF and funding support for deployment by Gavi, the Vaccine Alliance. This malaria vaccine has been developed by Oxford University and is manufactured by Serum Institute of India. The R21/Matrix-M vaccine is the second vaccine against malaria to be approved, after the RTS,S vaccine which was approved in 2011. WHO said the addition of the second vaccine is expected to meet the demand and provide sufficient vaccine supply “to benefit all children living in areas where malaria is a public health risk.” It also said both vaccines are shown to be safe and effective in preventing malaria in children and, when implemented broadly, are expected to have high public health impact.

PM Modi used the AI Tool Bhashini while Delivering his Speech

Prime Minister Narendra Modi reportedly used the pioneering real-time Artificial Intelligence based translation tool, Bhashini, during his speech at Kashi Tamil Sangamam in Varanasi. The speech translation was done through Bhashini for those people among the audience who only understood Tamil. Bhashini is an AI-powered language translation system that enables people to speak in their own native language while talking to speakers of other Indian languages. In 2022 the Government of India unveiled Bhashini. This native AI-based language translation platform can transcend language barriers by translating in real-time and enabling people from various languages to interact with each other over digital platforms. The platform aims to facilitate convenient internet and digital services accessibility in Indian languages, incorporating voice-based access and fostering content generation in these languages. This online platform also has a separate section called ‘Bhasha Daan’, which allows the public to contribute to multiple crowdsourcing initiatives and is accessible through respective Android and iOS apps.

New Pathway to Attain Soft Tunable 3D Photonic Crystals

The research team from the Centre for Nano and Soft Matter Sciences, Bengaluru, has shown an elegant pathway to achieve complete photonic bandgap in BPs. The new pathway to attain soft

tunable 3D photonic crystal can control light in all directions by introducing nanoparticles of appropriate shape and size in the blue phase liquid crystal can pave the way for sophisticated photonic devices. The methodology involves ingenious ways of incorporating high refractive index nanoparticles of appropriate shape and size in the blue phase liquid crystal. The spherical-shaped, Selenium nanoparticles with a high refractive index that get confined inside the defect cores of the BP effectively increased the refractive index contrast. This led to PBG width getting enhanced, a clear indication that the BP is driven towards a complete PBG system.

IISc Identifies Coronavirus Protein that Stops Immune Response

Study by the Indian Institute of Science has shown that the viral protein 'ORF6' in coronavirus provides a replication advantage to the virus and triggers the COVID-19 infection. The protein is capable of shutting down immune responses. The scientists explored the ability of different SARS-CoV-2 proteins to antagonise the host's innate immune system, and found that the ORF6 protein mitigated type-I interferon induction and downstream IFN signalling. The researchers have discovered that the ORF6 directly interacts with the host viral sensor (RIG-I) responsible for identifying viral RNA during infection. ORF also shows promise in disrupting the expression of antiviral genes downstream of RIG-I. This interference mirrored a dual action - disabling the ignition (RIG-I) and applying brakes to halt antiviral gene expression.

Key Mechanism that Allows Tuberculosis to Persist in Humans Discovered

Researchers at the Indian Institute of Science (IISc) have uncovered an important mechanism that allows the tuberculosis (TB) bacterium to persist in the human host for decades. The team, including researchers from the National Centre for Biological Sciences (NCBS) and Institute For Stem Cell Science and Regenerative Medicine (InStem), Bengaluru, found that a single gene involved in the production of iron-sulphur clusters could be crucial for the persistence of the TB bacterium. TB is caused by Mycobacterium tuberculosis (Mtb), which can be present in the human body for decades without any symptoms. The team grew Mtb in liquid cultures containing special supplements needed for its growth in a state-of-the-art Bio Safety Level-3 facility at the Center for Infectious Disease Research (CIDR), IISc. Several proteins in Mtb depend on iron-sulphur clusters for functioning. These clusters consist of iron and sulphur atoms organised in various configurations like chains or cuboids. The iron atoms in the cluster can pass on electrons from one site of a protein complex to another in cellular reactions such as respiration and carbon metabolism. The researchers generated a mutant version of Mtb that lacked the IscS gene and then sought to find out how the IscS gene contributes to disease progression. They also noted that bacteria lacking the IscS gene were more likely to be killed by certain antibiotics.

Aditya-L1 Sun Mission to Conduct Critical Insertion into Halo Orbit

Aditya-L1, India's first mission to study the Sun, is set to conduct a complex manoeuvre that will insert it into the halo orbit around Lagrange Point 1 (L1) - considered to be the most significant of the Lagrangian points for observation of the Sun. The insertion into L1, a point of gravitation equilibrium between the Earth and the Sun, is a critical phase of the mission that requires precise navigation and control. According to scientists, the meticulous process involves ensuring that the spacecraft maintains its trajectory to successfully enter the halo orbit. Aditya L1 will enter the L1 point on January 6. Once Aditya-L1 is placed in the specific spot, it will remain there for the next five years, gathering data which is important not only for India but for the entire world as well.

India's maiden sun mission was launched on September 2 from the second launch pad of the Satish Dhawan Space Centre (SDSC) in Sriharikota.

Effective Low-cost Remedy for Appetite Loss in Chemo Patients Found

A trial conducted at JIPMER offers an effective low-cost remedy to lower food intake by patients undergoing chemotherapy. The trial found that an antipsychotic drug can combat severe appetite loss in patients undergoing chemotherapy. They found success with Olanzapine, primarily an antipsychotic drug, costing a mere ₹2 per day. The research has garnered international recognition and prompted alterations in the recommendations set forth by the American Society of Clinical Oncology for managing anorexia in chemotherapy recipients. The recent trial's focus on low-dose daily olanzapine, demonstrated promising outcomes, proving to be a simple, inexpensive, and well-tolerated intervention significantly improving appetite and promoting weight gain in newly diagnosed patients undergoing chemotherapy. The results revealed a significant disparity, with 60 per cent (35 out of 58 patients) in the olanzapine group achieving over 5 per cent weight gain, while only 9 per cent (5 out of 54 patients) in the placebo group experienced similar results. Additionally, the proportion of patients suffering from weight loss at the study's conclusion was lower among those treated with olanzapine (14 per cent vs 59 per cent).

India's First Winter Arctic Mission Launched

India's maiden winter mission to the Arctic launched on 18 December, will boost the country's research around global climate, sea levels and biodiversity. Union minister of Earth Sciences flagged off the winter science expedition to the Arctic region, aiming to maintain a year-long presence at the Himadri research station in Svalbard, Norway. The Norwegian government will be providing logistical and other support to the visiting Indian team.

New Stereoscopic Visualisation Could Help Surgical Planning

A joint collaboration between the Department of Radiology SCTIMST; the Department of Anatomy, Govt Medical College, Thiruvananthapuram and the International Institute of Information Technology (IIIT), Hyderabad has led to the development of a new stereoscopic visualisation tool which could give doctors better insight into the intricacies of the heart and the structures around it. The new visualisation method utilises 3D graphic models created from MRI images of volunteers and using stereoscopic projection (the technology used in 3D movie theatres), these three dimensional figures can be projected onto a big screen for classroom teaching or a larger audience. 3D visualisation makes the complex anatomy of a congenital heart anomaly easier to understand. Another advantage is that these images provide a more cohesive and clear picture to the cardiologist, cardiac anaesthetist, the cardiac surgeon and a cardiac radiologist, and surgical planning is easier. The software, which is being used as an interface to convert the DICOM images (DICOM is the international standard in radiology to transmit, store, retrieve, process and display medical imaging information) to the 3D format, was also developed. The software is affordable, platform-independent and customisable. It can seamlessly operate on any machine and can be tailored to the specific requirement of users. All it requires is a pair of overhead projectors, a computer, a screen for projecting 3D images and 3D glasses to view the images.

G-20 AND GLOBAL CHALLENGES

T20: Digital Transformation and Financing for Sustainable Development

The first conference of the T20 engagement group during the Brazilian presidency of the G20 discussed social justice and digital leadership in Brasilia. Promoted by the Institute for Applied Economic Research (Ipea) and the Observer Research Foundation (ORF America), the "Brasilia Conference on Social Justice: Preparing the Scenario for the Brazilian G20 Presidency" took place on December 14 and 15. The highlight was the debate on digital transformation and financing as drivers of sustainable development. The event also reinforced the importance of social and climate justice on the global agenda. The seminar also presented the experiences of Brazil and India as guides for inclusive digitalization in the countries of the Global South. Both countries have advanced in the field of technology, developing solutions such as digital identification and payments and public services platforms. The leadership of these countries, both in the G20 and globally, can boost progress towards the Sustainable Development Goals (SDGs).

Sherpas Support Proposals and Priorities Presented by the Brazilian Presidency

The first G20 Sherpa and Finance Tracks' meeting (11-15 December), discussed the priorities of the Brazilian presidency for the G20. Member countries and invited guest countries (Angola, Egypt, the United Arab Emirates, Spain, Nigeria, Norway, Portugal and Singapore) expressed support for the priorities - the fight against hunger, poverty and inequality; sustainable development and climate change and global governance reform. More than 100 meetings of the working groups and task forces that make up the G20 are planned during the Brazilian Presidency, including face-to-face and virtual, of the two tracks (Sherpa and Finance), at the technical and ministerial level, in host cities of the five regions of Brazil. Some initiatives include (1) The Task Force for a Global Alliance Against Hunger and Poverty proposed by Brasil's G20 presidency, and will focus on establishing a Global Alliance to raise resources and knowledge for implementation of public policies and social technologies that are proven to be effective in reducing hunger and poverty around the world. (2) The Task Force for the Global Mobilization Against Climate Change will promote a high-level dialogue among governments, financial institutions, and international organizations to enhance global macroeconomic and financial alignment to implement the goals of the United Nations Framework Convention on Climate Change and the Paris Agreement. The highlight will be the summit to be held in Rio de Janeiro, 18-19 November 2024.

IN BRIEF

Electronic Soil that Enhances Crop Growth

Researchers from Linköping University have developed an electrically conductive "soil" for soilless cultivation, known as hydroponics. Barley seedlings grow on average 50 per cent more when their root system is stimulated electrically through this new cultivation substrate. The team has developed an electrically conductive cultivation substrate, tailored to hydroponic cultivation, that they call eSoil. The researchers have shown that barley seedlings grown in the conductive "soil" grew up to 50 per cent more in 15 days when their roots were stimulated electrically. Hydroponic cultivation enables plants to grow without soil, needing only water, nutrients and something their roots can attach to—a substrate. It is a closed system that enables water recirculation so that each seedling gets exactly the nutrients it needs. Therefore, very little water is required and all nutrients remain in the system, which is not possible in traditional cultivation. Hydroponics also enables vertical cultivation in large towers to maximize space efficiency. Crops already being cultivated in this manner include lettuce, herbs and some vegetables. Grains are not typically grown in hydroponics apart from their use as fodder. In this study the researchers show

that barley seedlings can be cultivated using hydroponics and that they have a better growth rate thanks to electrical stimulation. The electronic cultivation substrate eSoil is made of cellulose, the most abundant biopolymer, mixed with a conductive polymer called PEDOT. This is the first time it has been used for plant cultivation and for creating an interface for plants in this manner. The researchers' "soil" has very low energy consumption and no high voltage danger. It could open the pathway for new research areas to develop further hydroponic cultivation.

New Catalyst Could Provide Liquid Hydrogen Fuel of the Future

Researchers at Lund University in Sweden have developed an innovative car fuel system that operates in a circular manner, minimizing greenhouse gas emissions. This system utilizes a unique liquid that, when combined with a solid catalyst, transforms into hydrogen fuel for the car. After usage, the spent liquid is removed from the vehicle's tank and recharged with hydrogen, making it ready for reuse. This process forms a closed-loop system that significantly reduces environmental impact. The concept is known as LOHC (liquid organic hydrogen carriers). The system is intended to work using a liquid that is "charged" with hydrogen. The liquid is pumped through a solid catalyst which extracts the hydrogen. This can be used in a fuel cell – which converts chemical fuel to electricity – while the "spent" liquid carries on to another tank. The only emission is water. The spent liquid can then be emptied at a filling station before refueling with new, charged liquid. This would probably mean large-scale production of the substance, comparable to today's oil refineries. The team converted more than 99 percent of the hydrogen gas that was present in the liquid. The liquids used are isopropanol (which is a common ingredient in screenwash) and 4-methylpiperidine. Some challenges remain. One is that the lifespan of the catalyst is rather limited. Another is that iridium, which the catalyst is based on, is a precious metal.

Bacteria Can be Engineered for Rare-earth Processing

Researchers from Cornell University have genetically engineered the bacterium *Vibrio natriegens* to enhance its ability to biosorbent or extract rare earth elements. The scientists modified the bacterium's genome using a plasmid called MP6, introducing errors into the genome and screening for mutants with improved biosorption of rare earth elements. The engineered strain of *Vibrio natriegens* was capable of biosorbing 210 per cent more dysprosium compared to the wild-type and produced selectivity improvements of up to 50 per cent between the lightest (lanthanum) and heaviest (lutetium) REE. Given the ease of finding significant biosorption mutants, these results highlight just how many genes likely contribute to biosorption as well as the power of random mutagenesis in identifying genes of interest and optimizing a biological system for a task.

Breakthrough in organic semiconductor synthesis

A team of researchers led by UNIST South Korea has achieved a significant breakthrough in the field of organic semiconductors. Their successful synthesis and characterization of a novel molecule called "BNBN anthracene" has opened up new possibilities for the development of advanced electronic devices. The team's research focused on enhancing the chemical diversity of these semiconductors by replacing carbon-carbon (C-C) bonds with isoelectronic boron-nitrogen (B-N) bonds. This substitution allows for precise modulation of the electronic properties without significant structural changes. The

researchers successfully synthesized the BBNB anthracene derivative, which contains a continuous BBNB unit formed by converting the BOBN unit at the zigzag edge. In addition to its unique properties, the BBNB anthracene derivative demonstrated promising potential for application in organic electronics. When used as the blue host in an organic light-emitting diode (OLED), the BOBN anthracene exhibited a remarkably low driving voltage of 3.1V, along with higher efficiency in terms of current utilization, energy efficiency, and light emission. The research holds great potential for applications in organic semiconductors.

RESOURCES & EVENTS

[CERN Council Decides to Conclude Cooperation with Russia and Belarus in 2024](#)

CERN Council has decided to end the Organization's cooperation with the Russian Federation and the Republic of Belarus at the expiry in 2024 of the International Cooperation Agreements (ICAs) with the two countries. The cooperation will come to an end on 27 June 2024 for the Republic of Belarus and on 30 November 2024 for the Russian Federation. All relations between CERN and Russian and Belarusian institutions will cease as of these dates. Relations continue with scientists of Russian or Belarusian nationality otherwise affiliated with CERN. The Council decisions have been taken in light of the ongoing military invasion of Ukraine by the Russian Federation with the involvement of the Republic of Belarus.

[UK: Supreme Court Rules that AI Cannot be Recognized as an Inventor](#)

On December 20, 2023, the UK Supreme Court ruled that artificial intelligence (AI) systems cannot be legally recognized as inventors in patent applications, as decided in the case of *Thaler v Comptroller-General of Patents, Designs and TradeMarks* [2023 UKSC 49]. The judgment follows an appeal from lower courts by Dr. Stephen Thaler, who had filed patent applications and credited an AI system named DABUS as the inventor. Dr. Thaler argued that his ownership of DABUS entitled him to apply for patents. The Court unanimously dismissed the appeal by Dr. Thaler and held that the definition of an inventor under the Patents Act 1977 is restricted to natural persons, thereby excluding AI systems like DABUS from this designation. Following the judgment, Dr. Thaler's patent applications, where he claimed DABUS as the inventor, were deemed to be withdrawn after the expiration of the specified 16-month period under Rule 10(3) of the Patent Rules 2007. The Court underscored that an inventor must be a person, and patent rights cannot be assigned based on the ownership of an AI system.

[New AI and High Performance Computing Research Centre at IIT Bhubaneswar](#)

The Indian Institute of Technology (IIT) Bhubaneswar has established a new AI and HPC Research Center (AHRC) to conduct interdisciplinary and collaborative research in the field of AI and High Performance Computing (HPC). The centre has started working on developing AI tools for the diagnosis of several diseases. AHRC is designed as a National Research Center with the participation of other eminent academic, industry, and government research organisations in India and abroad to find solutions to real-world problems in several areas through research, innovation and application of Artificial Intelligence and High-Performance Computing. It will provide a global

platform to the researchers from the state and across India for leading-edge research and innovation in the field of Artificial Intelligence and high performing computing. AHRC scientists are working on developing AI tools for diagnosis of several diseases and fast screening for life-threatening diseases in the rural communities in Odisha in collaboration with scientists from AIIMS (All India Institute of Medical Sciences) Bhubaneswar and State University of New York in the United States.

JIPMER Sets Up Multi-Centre Clinical Trial Unit in Oncology

The Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) in Puducherry has established a multi-centre clinical trial unit in oncology to improve the outcome of treatment for cancer patients. Funded by the Biotechnology Research Assistance and Development Council (BIRAC), under its flagship National Biopharma Mission Programme, the unit would assist Indian pharma conduct clinical trials with indigenously developed medicines.

IIG Released Decade Long Data from Antarctica Station

Scientists from the Indian Institute of Geomagnetism (IIG) have made a significant discovery to understand the seasonal variations in the density of ionosphere over Antarctica based on decade-long records from the Indian Antarctic station, Bharati. The findings are based on recordings between 2010 and 2022 at the Bharati station. The scientists have found that the total electron count (TEC) – the total number of electrons present along a path between a radio transmitter and receiver — in the ionosphere peaks in the region during equinoctial months — the time when the sun crosses the plane of the Earth’s equator, making night and day of approximately equal length all over the Earth — followed by the summer and the winter seasons. findings hold significant implications for satellite-based navigation and communication systems. Data related to the seasonal variations will help scientists understand potential disruptions caused by changes in the ionosphere, which can aid in improving the efficiency of upcoming technology. Scientists said that it was observed that though there was no sunlight incidence throughout the day in winter months (polar nights) at Bharati station, a diurnal pattern was observed with peak ionospheric density near local noon. The day-night ionospheric density variations were observed regardless of 24 hours of sunlight in summer and complete darkness in winter. The scientists attributed the peak ionisation to particle precipitation and transportation of convectional plasma from high latitudes. Also, the maximum ionospheric density in the summer months where 24 hours sunlight is present (polar days), was about twice as much as that of polar nights in the Bharati region.

SCIENCE POLICY AND DIPLOMACY

Tallinn Mechanism to Strengthen Ukraine Cybersecurity

Estonia and Canada, Denmark, France, Germany, Netherlands, Poland, Sweden, Ukraine, the United Kingdom and the United States have decided to set up a system aimed at amplifying the cyber support of donors to Ukraine in the civilian domain. The plan composed on 30 May in Tallinn by all participating states was launched on 20 December 2023 and the system was named the Tallinn Mechanism. The Mechanism will improve coordination of support from various countries. Top tech companies and NGOs of donor countries are involved in the Mechanism. The Mechanism allows sharing of information about urgent and long-term needs to Estonian companies. NATO and the EU are observers in the Tallinn Mechanism. The Mechanism has offices in Kyiv, Warsaw, and a coordination group that unites representatives of Ukraine and all donors. The Mechanism is open

to new members once relevant conditions have been agreed upon. The Tallinn Mechanism works in parallel with the IT Coalition that addresses Ukraine's cyber issues in the military domain.

COP 28 Agrees on Transitioning from Fossil fuels, Loss and Damage.

COP28 adopted a decision operationalizing the new loss and damage fund that was established the previous year in Sharm el-Sheikh, Egypt, and a number of parties announced pledges for its initial capitalization. This success was made possible by an agreement reached in the Transitional Committee that was tasked and met throughout 2023 to make a recommendation on the institutional arrangements for the fund. Negotiations were difficult, especially on the central outcomes for this conference: the first Global Stocktake (GST) under the Paris Agreement, the framework for implementing the Global Goal on Adaptation (GGA), the mitigation work programme, the work programme on just transition pathways, and matters related to Paris Agreement Article 2.1(c), on aligning finance flows with low-greenhouse gas (GHG) climate-resilient development. Consultations continued into the early hours of Wednesday, 13 December when draft decisions on the remaining issues were eventually posted and adopted by the closing plenary. Parties adopted a decision on the GST that recognizes the need for deep, rapid, and sustained reductions in GHG emissions in line with 1.5°C pathways. The decision also calls on parties to contribute, in a nationally-determined manner, to global efforts on: (1) tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030; (2) accelerating efforts towards the phase down of unabated coal power; (3) accelerating efforts globally towards net zero emission energy systems, utilizing zero- and low-carbon fuels well before or by around mid-century; (4) transitioning away from fossil fuels in energy systems, in a just, orderly, and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science; (5) accelerating zero- and low-emission technologies, including, inter alia, renewables, nuclear, abatement and removal technologies such as carbon capture and utilization and storage, particularly in hard-to-abate sectors, and low-carbon hydrogen production; (6) accelerating and substantially reducing non-carbon-dioxide emissions globally including, in particular, methane emissions by 2030; (7) accelerating the reduction of emissions from road transport on a range of pathways, including through development of infrastructure and rapid deployment of zero and low-emission vehicles; and (8) phasing out inefficient fossil fuel subsidies that do not address energy poverty or just transitions, as soon as possible. The UAE Climate Change Conference convened from 30 November to 13 December 2023. The conference consisted of the 28th meeting of the Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC), the 18th meeting of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP 18), the 5th session of the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement (CMA 5), and the 59th sessions of the Subsidiary Body for Scientific and Technological Advice (SBSTA 59) and the Subsidiary Body for Implementation (SBI 59). In total, 97,372 people were registered for on-site attendance, including 51,695 delegates from parties. COP 29 will be held in Baku, Azerbaijan (11-22 Nov 2024), while COP 30 will be held in Rio, Brazil (10-25 Nov 2025).

Science-Policy Panel on Management of Chemicals and Waste

Air, water, and soil pollution are responsible for an estimated 9 million premature deaths and cost the world trillions of dollars every year. This is about three times the death burden from malaria, HIV/AIDS, and tuberculosis combined. To bridge this gap, United Nations Environment Assembly (UNEA) resolution 5/8, adopted in 2022, decided that a science policy panel (SPP) should be

established to contribute further to the sound management of chemicals and waste, and the prevention of pollution. The ad hoc open-ended working group (OEWG) for the SPP is tasked with developing this panel. The second meeting of the OEWG (Nairobi, 11-15 December) focused on developing proposals for the SPP's establishment. The main outcomes of OEWG-2 are contained in six conference room papers (CRPs) and address: institutional arrangements; operating principles; Conflicts of Interest; scope, objective, and functions; intersessional work; and the provisional agenda for OEWG-3, scheduled for June 2024. The official meeting was preceded by an informal meeting and regional consultations on 9-10 December.

India-Russia strengthen relations

The recent visit of India's foreign minister S. Jaishankar, to Moscow has strengthened the partnership between the two nations. Agreements on expansion of exports of hydrocarbons to India as well as on further cooperation in the peaceful use of nuclear energy, in fields of medicines, pharmaceutical substances and medical devices were signed. Two important amendments were signed for further cooperation in upcoming units at the Kudankulam nuclear power project. This assures Russian support for the fifth and the sixth reactors. Russia has also shown interest in developing jointly floating nuclear power plants. The cooperation in space programmes, rocket engines, satellite navigation systems, and military hardware was especially focused during the visit. Russian side respects India's aspiration to diversify its military links while mentioning that 'Russia is ready to produce military equipment under the "Make-in-India" initiative.' The issue of connectivity to bolster trade was discussed in detail including the International North-South Transport Corridor INSTC), the Chennai-Vladivostok Maritime Corridor, and the Northern Polar Route. India is also interested in the Polar route for trade. The two sides finalised the programme of cooperation in the Far East and it was decided to hold an early meeting of EaEU-India FTA negotiations.

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.