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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

[Health Sensor for Monitoring Muscle Atrophy](#)

Ohio State University researchers have fabricated the first wearable sensor designed to detect and monitor muscle atrophy. They fabricated 3D-printed limb molds and filled them with ground beef to simulate the calf tissue of an average-sized human subject. Their findings showed that the sensor could measure small-scale volume changes in overall limb size, and monitor muscle loss of up to 51 per cent. It could be used by healthcare providers to implement treatment plans for patients and to create less of a burden on the patient themselves. The study builds on previous work in creating health sensors for NASA for monitoring the health of astronauts who spend large amounts of time in space and can often experience detrimental effects on the human body. It can help an astronaut on a long mission or a patient at home could use it to keep track of their health without the help of a medical professional.

[High-precision and Secure 6G Communications](#)

A research team at City University of Hong Kong (CityU) invented a ground-breaking tunable terahertz (THz) meta-device that can control the radiation direction and coverage area of THz beams. By rotating its meta surface, the device can promptly direct the 6G signal only to a designated recipient, minimizing power leakage and enhancing privacy. It is expected to provide a highly adjustable, directional and secure means for future 6G communications systems. The meta-device consists of two or three rotary meta surfaces (artificial, thin-sheet material with sub-wavelength thickness), which work as efficient projectors to steer the focal spot of THz beams on a two-dimensional plane or in a three-dimensional space. This innovative design has demonstrated the capability of a meta-device to direct a 6G signal towards a specific location in two- and three-dimensional space. The meta surfaces are fabricated with high-temperature resin and a 3D printing method developed by the team. They are lightweight and small and can be easily produced in large scale at low cost for practical applications.

Advance in Super-resolution Fluorescence Microscopy

Scientists at the Max Planck Institute for Medical Research in Heidelberg have developed a super-resolution microscope with a spatio-temporal precision of one nanometer per millisecond. This improved version of their MINFLUX super-resolution microscopy allowed tiny movements of single proteins to be observed at an unprecedented level of detail: the stepping motion of the motor protein kinesin-1 as it walks along microtubules while consuming ATP. The work highlights the power of MINFLUX for observing nanometer-sized conformational changes in proteins. MINFLUX, however, requires only a standard 1-nm sized fluorescence molecule as a label attached to the protein, and therefore can provide both the resolution and the minimal invasiveness that are needed in studying native protein dynamics. The MINFLUX microscope can record protein movements with a spatiotemporal precision of up to 1.7 nanometers per millisecond. It requires the detection of only about 20 photons emitted by the fluorescent molecule. This can help us to understand the mechanisms behind many diseases and ultimately contribute to the development of therapies.

Novel Waste Removal Factor Treats Brain Haemorrhage

Researchers from the University of Helsinki, together with their Taiwanese colleagues investigated whether a protein called cerebral dopamine neurotrophic factor (CDNF) has potential as a treatment for brain haemorrhage. They found that the administration of CDNF accelerates haemorrhagic lesion resolution, reduces brain swelling, and improves functional outcomes in an animal model of brain haemorrhage. The CDNF acts on immune cells in the bleeding brain, by increasing anti-inflammatory mediators and suppressing the production of the pro-inflammatory cytokines that are responsible for cell signalling. It encourages immune cells in the brain to consume and remove the waste and debris, which is essential for the brain's recovery. The administration of CDNF also resulted in the alleviation of cell stress in the area that surrounds the hematoma. Researchers demonstrated that systemic administration of CDNF promotes scavenging by the brain's immune cells after brain haemorrhage and has beneficial effects in an animal model of brain haemorrhage.

Low-cost Device Can Measure Air Pollution

MIT researchers have developed a low-cost, mobile pollution detector and open-source tool to check air quality. It could enable people to track air quality more widely. The detector, called Flatburn, can be made by 3D printing or by ordering inexpensive parts. The researchers have now tested and calibrated it in relation to existing state-of-the-art machines, and are publicly releasing all the information about it -- how to build it, use it, and interpret the data. The research team found that the mobile detectors estimated somewhat lower concentrations of fine particulate matter than the devices already in use, but with a strong enough correlation so that, with adjustments for weather conditions and other factors, the Flatburn devices can produce reliable results.

New Drugs Combination to Reduce Lung Tumours in Mice

A new study has revealed FDA-approved trametinib and entinostat (which is currently in clinical trials) can be given in tandem to treat tumours in mice with LKB1-mutated NSCLC. Tumours often become quickly resistant to trametinib, but co-treatment with a drug that inhibits a protein downstream of HDAC3 helps reduce this resistance. Mice with LKB1-mutated lung cancer treated with both entinostat and trametinib had 79 percent less tumour volume and 63 percent fewer tumours in their lungs than the untreated mice. Additionally, the team confirmed that

entinostat was a viable treatment option in cases where a tumour was resistant to trametinib. The findings may lead to clinical trials to test the new regimen in humans and could transform treatment of cancers beyond NSCLC, with potential applications in lymphoma, melanoma, and pancreatic cancer.

[Effectiveness of Bulevirtide in Treating Chronic Hepatitis D](#)

Studies on patients with advanced Hepatitis D Virus (HDV)-related compensated cirrhosis being treated with Bulevirtide (BLV) 2mg monotherapy and the consequences of discontinuing this treatment, have demonstrated significant improvement of liver function. They demonstrated that HDV could be successfully eradicated from both serum and liver following a three-year course of BLV monotherapy, despite the persistence of HBsAg, in a patient with HDV-related compensated cirrhosis and oesophageal varices. Patients with HDV-related chronic advanced liver disease have been treated with an antiviral therapy since 1977 when HDV was discovered.

[Nanotechnology Could Treat Lymphedema](#)

Georgia Institute of Technology researchers have developed a new treatment using nanoparticles that can repair lymphatic vessel pumping. This approach delivers a drug using a nanoparticle that can drain into the diseased vessels themselves. The drug, S-(-)-Bay K8644 or BayK, has side effects such as convulsions and spasms. Using nanoparticles the drug is made available within lymphatic vessels at a locally high dose. In mice models, the delivery system allowed the drug to act within the lymphatic vessel, and drastically reduced the concentration of BayK in the blood, which is associated with unwanted side effects. The researchers are expanding the formulation to more advanced disease models to move it closer to human application.

INDIA

[Laccase Shows Potential in Degrading Industrial Dye Effluents](#)

Scientists from S. N. Bose National Center for Basic Sciences (SNBNCBS), Kolkata tested the efficacy of laccase in degrading some standard dye molecules like Methyl Green, Crystal Violet, Thioflavin T, Coumarin 343, and Brilliant Blue. Laccase is generated by a group of fungi and has been found capable of degrading a variety of hazardous organic dye molecules that are regularly drained into water bodies after dyeing clothes in the textile industry. Combining UV/Visible spectroscopy and computer simulations they demonstrated that many organic dye molecules can be degraded by the enzyme laccase. Laccase contains 4 copper atoms in two different oxidation states, and degrades substrates through redox reactions, producing only water and simplest non-virulent or less virulent oxides of carbon, nitrogen and sulphur. This offers an immense potential for a broad-spectrum degrader for industrial dye effluents.

[Novel Database on COVID Antibodies](#)

Researchers at the Indian Institute of Technology (IIT) Madras have developed an online open-source database of coronaviruses' neutralising antibodies. The database called 'Ab-CoV' contains detailed information about all Covid-related antibodies identified so far, including the source of each antibody, and the viral protein(s) and virus strains they recognised. The Ab-CoV database includes 1,780 coronavirus-related antibodies, including 211 nanobodies, and contains more than 3,200 data points on half maximal inhibitory concentration, half maximal effective concentration and binding affinity. Some of the data in the Ab-CoV database has already been

used to understand the relationship between structural features and binding affinities of spike protein-antibody complexes as well as antibody repurposing.

Mechanism Behind Emergence of New COVID Strains Identified

Researchers at the Indian Institute of Science (IISc) have identified several new mutations SARS-CoV-2 that accumulated through recombination at a high rate and affected different parts (domains) of the viral spike protein. The team analysed genomic sequences of all the viral strains that appeared between November 2019 and July 2022 in various databases worldwide. showed that with the aid of these mutations, several such Omicron recombinant and mutant strains were able to escape from the host's defences and bind more tightly to the host cell. Their observations add to growing evidence about how efficient new strains of the virus are at escaping immune attack and at causing infections.

Defence-adopted Technologies and R&D Programmes

Indian Institute of Science (IISc) and the Air Force Technical College (AFTC) will collaborate to promote scientific understanding of defence-related technologies and undertake research and development programmes. As part of an agreement signed on 23 March 2023 the training institute in Bengaluru established by the Indian Air Force (IAF) — and IISc will engage in joint research to offer solutions in areas including aerospace engineering, Artificial Intelligence and Machine Learning, radar and microwaves, guided weapons, drone technologies, computer science and cyber security, mechanical engineering, electronics and communication engineering, and electrical engineering.

International Liquid Mirror Telescope Inaugurated in Uttarakhand

Asia's largest 4-metre International Liquid Mirror Telescope (ILMT) at Devasthal (altitude 2450 metres) in Uttarakhand at the Aryabhata Research Institute of Observational Sciences (ARIES) was launched in the 2nd week of May 2022. ILMT employs a 4-metre-diameter rotating mirror made up of a thin layer of liquid mercury, to collect and focus light. The ILMT is designed to survey the strip of the sky passing overhead each night, allowing it to detect transient or variable celestial objects such as supernovae, gravitational lenses, space debris, and asteroids. LMT is the largest aperture telescope available in the country at present and is also the first optical survey telescope in India. While scanning the strip of the sky every night, the telescope will generate nearly 10-15 Gigabytes of data and the wealth of ILMT generated data will permit the application of Big Data and Artificial Intelligence/Machine Learning (AI/ML) algorithms that will be implemented for classifying the objects observed with the ILMT. The data will be analysed quickly to discover and discern variable and transient stellar sources.

Bimetallic Composite for Engineering Applications

Researchers at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) have developed a novel bi-metallic joining process using a technique called laser powder bed fusion (L-PBF) or selective laser melting (SLM) technique of metal 3D printing. This technique involves layer deposition by metal powder melting. The laser beam interaction with metal during the L-PBF process creates an impact on the degree of intermixing of both copper and steel. The researchers demonstrated the formation of the composite made from copper and steel, which has high thermal and electrical conductivity for engineering applications, such as heat exchangers, hydraulic pump components, cooling staves, guide plates,

and hot-work tooling applications. The process has the potential to revolutionize the engineering industry by offering customizable and strong bimetallic structures with enhanced properties.

G-20 AND GLOBAL CHALLENGES

Maritime Verticals for G20

Under the G20 University Connect initiative during India's Presidency, the Indian Maritime University (IMU) and National Institute of Advanced Studies (NIAS) organised a discussion in Chennai on 17 March 2023 on 'One World, One Ocean'. In the forum the importance of the ocean was emphasised. The nine verticals discussed included S&T in maritime, maritime education and training, blue economy, polar regions, maritime domain awareness, marine pollution, maritime heritage and global maritime initiatives. The discussions would lead to the preparation of a policy brief for the consideration of G20.

G20 Digital Innovation Alliance

Centre for Cellular and Molecular Platforms (C-CAMP) in collaboration with The GAIN accelerator organised the Bengaluru Meet of G20 Digital Innovation Alliance for digital startups and innovators. The Ministry of Electronics and Information Technology (MeitY), Government of India has launched a flagship G20 Digital Innovation Alliance (G20-DIA) to recognise and support innovators with digital solutions for various world economies under India's G20 presidency. MeitY has chosen the six themes which are of critical significance for global communities. These themes are: Health-tech, Ed-tech, Agri-tech, Fin-tech, Secured Digital Infrastructure, and Circular Economy. The theme of the Meet was 'driving digital innovation for world economies'. The key takeaways from the panel discussions were, (a) how a Digital India has boosted global innovation ecosystem with countries in the Global North like Switzerland viewing India as a knowledge capital and not just a large market, (b) how Govt support for Digitalisation is driving impact at the national scale for otherwise Tier 1 innovators for business expansions in Tier 2 and 3 geographies.

Building Sustainable and Circular Bio-economy

Delegates from G20 members, guest countries, and International Organizations, and invited participants from the scientific community will deliberate on the ways towards building a sustainable and circular bio-economy at the G20 Research and Innovation Initiative Gathering (RIIG) Conference to be held on 23-24 March 2023 at Dibrugarh, Assam, India. The focus areas will include challenges and opportunities in agriculture, de-carbonization of industry, and bio-energy and bioresource management. The conference will also discuss national and regional programs and country experiences in creating new, resource-efficient, sustainable, and more circular bio-based technologies, products and services, and cooperation between G20 members on specific thematic areas. This interactive event will further promote active engagement between all key stakeholders, for a conceptual framework to mainstream circular bio-economy models across different sectors.

G20-Chief Science Advisers Roundtable meeting

The First Meeting of G20-Chief Science Advisers Roundtable (G20-CSAR), held in Ramnagar, Uttarakhand, witnessed intense discussion on issues of transboundary S&T issues of mutual interest under the broad themes of Opportunities in One Health; Synergizing Global Efforts to Expand Access to Knowledge; Diversity, Equity, Inclusion, and Accessibility in Science &

Technology (S&T); and An Institutional Mechanism for Global S&T Policy Dialogue. Discussions under One Health covered Pandemic preparedness plan, Integrated disease surveillance mechanisms for humans, livestock, and wildlife, R&D roadmap for diseases of One Health importance, and Investing in analytics (such as disease modelling, AI/ML tools) and data standards. Under Access to Scholarly Scientific Knowledge, discussions covered the need for free, immediate, and universal, high subscription and reduction in Article Processing Charges levied by journals, the establishment of Interoperable inter-linking of national repositories with international repositories/ archives, and having Open Access mandate to make knowledge outputs of public-funded scientific research widely available. Under Diversity, Equity, Inclusion, and Accessibility in Science & Technology (S&T).discussions covered advancing access to the under-represented, under-privileged, marginalized, minority as well as tribal/ native communities in the larger scientific enterprise. The Inclusion of Traditional Knowledge Systems (TKS) in the formal system of knowledge through due scientific validation process, and Recognizing the potential of language diversity and addressing the bottlenecks in accessing scientific knowledge were also discussed. Under Global S&T Policy Dialogue, it was agreed upon that the scientific advisers play a critical role in shaping policy choices by providing evidence-driven science advice and that the in the spirit of cooperation and dialogue, and that it is the responsibility of chief science advisers to collaborate and engage in international dialogue to address transboundary issues affecting the entire scientific enterprise so that the science and technology can benefit all. The next meeting is scheduled in August 2023 in which a Science Policy Communiqué will be released.

IN BRIEF

[New Drug Candidate for Mpox](#)

Scientists at Goethe University and the University of Kent have identified a new drug candidate *nitroxoline* that could potentially be used to treat Monkeypox (mpox), based on experiments using cell culture and skin explant models. Nitroxoline is also effective against a tecovirimat-resistant strain of the mpox virus, as well as other bacterial and viral pathogens that are frequently co-transmitted with mpox viruses, meaning it simultaneously suppresses multiple pathogens that are often involved in severe courses of mpox. Since nitroxoline is a well-tolerated antibiotic that has long been used to treat humans, it can be tested directly against mpox in clinical trials.

[Treating Vancomycin-resistant Bacterial Infections](#)

Researchers at the Singapore-MIT Alliance for Research and Technology have developed a novel combination therapy using the anticancer agent mitoxantrone (MTX), together with an antibiotic, vancomycin, for treating vancomycin-resistant *Enterococcus faecalis* or VRE. The therapy uniquely targets both VRE and the host, stimulating the host immune system to more effectively clear bacterial infections and accelerate infected wound healing. The team tested MTX's effectiveness and antibiotic activity against VRE, both in vitro and in vivo. MTX was found to inhibit the growth of VRE more effectively when used in the presence of vancomycin. The research also demonstrated that MTX improved wound healing by enhancing the ability of macrophages — a type of white blood cell that kills microorganisms, removes dead cells, and stimulates the action of other immune cells — to fight off VRE infections, and by recruiting more immune cells to the site of infection.

COVID-19 or Flu -Answers in Just 10 Seconds

Scientists from the University of Texas at Austin have developed a device using single-atom-thick nanomaterials capable of simultaneously detecting the presence of viruses causing COVID-19 and the flu. The device offers much lower detection levels and faster results compared to conventional tests. The symptoms of both flu and COVID-19 overlap considerably, making it difficult to distinguish between them. The COVID-19 and flu sensor is made using single layer graphene, highly sensitive to any electrical changes in its environment. The researchers linked antibodies against SARS-CoV-2, and against the flu virus to graphene. When a sample from an infected person is placed on the sensor, these antibodies bind to their target proteins, prompting a change in the electrical current. The sensor detect the presence of viral proteins at extremely low quantities and also worked quickly, returning results within about 10 seconds of dropping in a sample. The team is working to improve its performance further, including to test for SARS-CoV-2 variants, such as omicron and delta.

Unusually Tough New Material

Caltech engineers have made a significant breakthrough in the field of nano- and micro-architected materials by creating a novel material composed of multiple interconnected microscale knots. Compared to structurally identical but unknotted materials, the presence of knots in this new material significantly enhances its toughness by enabling it to absorb more energy and deform more before returning to its original shape without any damage. These new knotted materials may find applications in biomedicine as well as in aerospace applications due to their durability, possible biocompatibility, and extreme deformability. Each knot is around 70 micrometers in height and width, and each fiber has a radius of around 1.7 micrometers (around one-hundredth the radius of a human hair). The knotted materials, which were created out of polymers, exhibit a tensile toughness that far surpasses materials that are unknotted but otherwise structurally identical, including ones where individual strands are interwoven instead of knotted. When compared to their unknotted counterparts, the knotted materials absorb 92 percent more energy and require more than twice the amount of strain to snap when pulled. The knots were not tied but rather manufactured in a knotted state by using advanced high-resolution 3D lithography capable of producing structures in the nanoscale. The samples developed contain simple knots—an overhand knot with an extra twist that provides additional friction to absorb additional energy while the material is stretched. In the future, the team plans to explore materials constructed from more complex knots.

RESOURCES & EVENTS

UN Report on Climate Change Released

The [Synthesis Report of the United Nations Intergovernmental Panel on Climate Change \(IPCC\)](#), released at its 58th session (Interlaken, 13-19 March) has said that the unprecedented challenge of keeping global warming to 1.5 degrees below pre-industrial levels has become even more acute in recent years due to the relentless rise in global greenhouse gas emissions. According to the report, this is making extreme weather events more frequent and intense, with increasingly dangerous impacts on nature and people in all regions of the world. Limiting warming to 1.5 degrees Celsius will require significant, rapid and sustained cuts in greenhouse gas emissions across all sectors. The United Nation’s Secretary General remarked, ‘In short, our world needs climate action on all fronts - everything, everywhere, all at once.’ This is the IPCC’s first comprehensive report since the 2015 Paris Agreement and marks the final chapter of the

group's sixth assessment cycle. Extracted from over 10,000 pages of research across six assessment reports, the findings are intended to serve as a handbook for addressing the climate emergency.

India and Belgium Cooperation Workshop in Space Sciences

Experts from India and Belgium and also from United States, Canada, Poland, Sri Lanka, South Africa, Ethiopia, Kenya highlighted the advantages of scientific collaborations in stimulating activities in space sciences at the international workshop of the Belgo-Indian Network for Astronomy and astrophysics (BINA) organised by The Aryabhata Research Institute of Observational Sciences (ARIES). The Belgian Science Policy Office (BELSPO) and the Department of Science and Technology (DST) work together on projects like cyber security, bioscience, marine science, black hole, climate change and many more and this workshop will emphasize the scientific potential of Indo-Belgian cooperation. BINA is a network that fosters collaborations in space research between Belgian and Indian institutes. The BINA collaboration has strengthened the Indo-Belgian observational facilities in India, namely the 3.6-m DOT and 4-m ILMT, the largest-sized optical telescopes in India. The output of this collaboration has been commendable in terms of both scientific publications and manpower training for the next generation.

SCIENCE POLICY AND DIPLOMACY

India and Japan to Expand Global Strategic Partnership

Prime Minister Narendra Modi and his Japanese counterpart Fumio Kishida met in New Delhi on March 20, 2023. The two prime ministers largely focused on significantly boosting cooperation in areas of clean energy, semiconductors and co-development of military hardware besides exploring ways to deal with regional security challenges. One of the areas of cooperation identified was co-innovation, co-design co-creation in the defence manufacturing sector. They also vowed to work together to deal with pressing global challenges under India's presidency of the G20 and Japan's chairship of the G7 grouping. The strengthened partnership between the two countries would promote peace, prosperity and stability in the Indo-Pacific region. The progress in bilateral relations was also reviewed during the meeting. exchanged views on defence equipment and technology collaboration, trade, health, and digital partnership. There was also a discussion on the importance of reliable supply chains in semiconductors and other critical technologies.

UN 2023 Water Conference

The UN 2023 Water Conference, formally referred to as the Midterm Comprehensive Review of the Implementation of the Objectives of the 2018-2028 International Decade for Action, convened from 22-24 March 2023 at UN Headquarters in New York. The event brought together over 6,500 participants. The Water Action Agenda received approximately 700 commitments in the form of financial pledges, collaborative projects, and actions to protect the world's most precious and irreplaceable resource. India announced investments, including USD 50 billion to provide safe and adequate drinking water to all rural Indian households before 2030. These commitments collectively amounted to USD 300 billion to achieve SDG 6. The meeting outcomes reflected the need to consider water as a global common good and radically change the world's value for water; the water-food-energy nexus approach; innovative finance; and the need to include a human rights-based approach. A Special UN Envoy for Water would be appointed by the UN Secretary-General.

International Seabed Authority (ISA) 28th Session

The 28th session of the ISA will be held in 2023 in three parts. The first one comprises a meeting of the Legal and Technical Commission (LTC) (7-15 March) and the Council (16-31 March). Regular meetings of bodies under the ISA have been attracting increasing attention over the last few years. Exploitation of mineral resources from the deep ocean floor such as nickel, manganese, cobalt, or copper and the need to protect the Ocean, already facing numerous challenges, are under discussion. The ISA has been trying to evolve a “Mining Code,” to regulate prospecting, exploration, and exploitation of minerals in the international seabed area (Area) beyond the limits of national jurisdiction. So far, the Authority has issued regulations on Prospecting and Exploration and issued relevant exploration contracts. The development of regulations for the exploitation of mineral resources have been under discussion for a number of years, with the first working draft submitted in 2016. Discussions heated up recently due to a request dated 25 June 2021 by Nauru for exploitation by a contractor Nauru Ocean Resources Inc. Under UNCLOS (Part XI -the Area, 1994 Agreement), if the ISA’s Council has not completed the elaboration of the regulations relating to exploitation within two years following the request of a state who intends to apply for approval of a plan of work for exploitation, then the Council “shall nonetheless consider and provisionally approve such plan of work”

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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.