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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

[New Battery Technology with Lower Energy Storage Costs](#)

An international team of researchers, led by the University of Sydney, has developed a new battery that has the potential to significantly reduce the cost of energy storage. The battery has four times the energy capacity of lithium-ion batteries and is much cheaper to produce. The team used sodium-sulfur, a more cost-effective alternative to lithium-ion batteries. Using a simple pyrolysis process and carbon-based electrodes to improve the reactivity of sulfur and the reversibility of reactions between sulfur and sodium, the researchers’ battery has exhibited super-high capacity and ultra-long life at room temperature. The Na-S battery is also a more energy-dense and less toxic alternative to lithium-ion batteries. It could provide a high-performing solution for large renewable energy storage systems, such as electrical grids, while significantly reducing operational costs. The lab-scale batteries (sulfur-ion batteries) have been successfully fabricated and tested and it is planned to improve and commercialize the recently fabricated Ah-level pouch cells.

[Billion-Qubit Quantum Computing Chips](#)

Australian researchers at the quantum computing start-up Diraq and UNSW Sydney have discovered a new way of precisely controlling single electrons nestled in quantum dots that run logic gates. What’s more, the new mechanism is less bulky and requires fewer parts, which could prove essential to making large-scale silicon quantum computers a reality. A quantum bit (or qubit) exists as a ‘superposition’ of two allowed states. This allows a multitude of

computation strategies – some exponentially faster, some operating simultaneously – that are beyond classical computers. Qubits themselves are made up of ‘quantum dots’, tiny nanodevices which can trap one or a few electrons. Precise control of the electrons is necessary for computation to occur. The team used a new way of manipulating the quantum state of a single qubit by using electric fields, rather than the magnetic fields. The newly discovered technique is known as trinsic spin-orbit electric dipole spin resonance (EDSR). Since it uses the same CMOS technology as today’s computer industry, it would be easier and faster to scale up for commercial production and achieve the goal of fabricating billions of qubits on a single chip. A quantum computer has the potential to deliver revolutionary tools for tackling otherwise impossible calculations, such as the design of complex drugs and advanced materials, or the rapid search of massive, unsorted databases. More details at <https://www.nature.com/articles/s41565-022-01280-4>

Japanese Fruit Juice May Help Prevent Lung Cancer

Using a mouse model, researchers from Okayama University have shown that Sarunashi juice and its component isoquercetin (isoQ) help prevent and reduce lung cancer. “Sarunashi” (*Actinidia arguta*) is an edible fruit cultivated in Japan’s Okayama Prefecture and is one of the richest sources of polyphenols and vitamin C. It is also known as the hardy kiwi, is a perennial vine that originates from Japan, Korea, Northern China, and the Russian Far East. It produces a small, smooth-skinned kiwifruit, unlike most other species within the genus, which have a hair-like fiber on the exterior. Previously, the researchers had demonstrated the inhibitory effect of Sarunashi juice (sar-j) on mutagenesis, inflammation, and mouse skin tumorigenesis. Using a series of experiments and controls, the team studied the effects of sar-j and isoQ on lung tumorigenesis in mice. The researchers concluded that sar-j’s antimutagenic effect could be by accelerating DNA repair.

CAR-T Cell Gel Kills Residual Cancer Cells Left Over From Surgery

Researchers at the University of Pennsylvania have added CAR-T cells to a gel designed to prevent bleeding after surgery. When they applied the gel to the surgical wounds of 20 mice right after they had hard-to-treat tumors resected, it prevented recurrence in 19 of them without interfering with healing. The therapy is on its way to being tested in humans. Tests of the gel were done in models of triple-negative breast cancer and pancreatic ductal carcinoma, the most common type of pancreatic cancer. Both tumor types are difficult to cure and cancer recurrence is common. The researchers engineered their CAR-T cells to target mesothelin, a protein that appears on the surface of cells in the two tumor types as well as other types of adenocarcinoma. At the end of the 90-day observation period, nearly all the mice that received the CAR-T gel treatment were still alive, compared with just 25% of the ones that received CAR-T cells alone and none that only had surgery. The CAR-T cell gel did not cause significant side effects. The researchers are moving forward to test it in humans. A clinical trial in patients with locally advanced breast cancer is planned.

New Nanoparticle for Anti-Inflammatory Treatment

A team from Geneva and Munich has developed a transport nanoparticle to make an anti-inflammatory drug much more effective and less toxic. Necrosulfonamide (NSA) is a new molecule that inhibits the release of several important pro-inflammatory mediators, therefore constituting a promising advance to reduce certain types of inflammation. However, being extremely hydrophobic in nature, it travels poorly in the bloodstream and could target many cell

types, triggering potentially toxic effects. The scientists found that a porous silica nanoparticle was fully biodegradable, of the right size to be swallowed by macrophages, and was able to absorb the drug into its numerous pores without releasing it too early. The anti-inflammatory effect was remarkable. The team then replicated their tests by coating the nanoparticles with an additional layer of lipid, but with no greater benefit than silica nanoparticles alone. Other silica nanosponges developed by the German-Swiss team had already proven their effectiveness in transporting anti-tumor drugs. Mesoporous silica is increasingly revealing itself as a nanoparticle of choice in the pharmaceutical field, as it is very effective, stable and non-toxic. Nevertheless, each drug requires a tailor-made carrier: the shape, size, composition and destination of the particles must be reassessed each time. The combination of this potent anti-inflammatory drug and these mesoporous silica nanoparticles shows a promising synergism to be further studied by the team.

New AI Tool Could Improve Gene-editing

Researchers at NYU Grossman School of Medicine and the University of Toronto have developed an artificial intelligence program that could enable the simple production of customizable proteins called zinc fingers to treat diseases by turning genes on and off. One such technique is zinc-finger editing, which can both change and control genes by grabbing onto scissor-like enzymes and directing them to cut faulty segments out of DNA. The new technology, called ZFDesign, uses artificial intelligence (AI) to model and design these interactions. The model is based on data generated by screening nearly 50 billion possible zinc finger-DNA interactions. It can identify the right grouping of zinc fingers for any modification, making this type of gene editing faster than ever before and a potentially safer alternative to CRISPR which relies on bacterial proteins to interact with genetic code. Besides posing a lower immune risk, the small size of zinc-finger tools may also provide more flexible gene therapy techniques by enabling more ways to deliver the tools to the right cells in patients. To test the computer's AI design code, the team used a customized zinc finger to disrupt the coding sequence of a gene in human cells. In addition, they built several zinc fingers that successfully reprogrammed transcription factors to bind near a target gene sequence and turn up or down its expression, demonstrating that their technology can be used for epigenetic changes. However, zinc fingers can be difficult to control, as some combinations can affect DNA sequences beyond a particular target, leading to unintended changes in genetic code. The team next plans to refine their AI program so it can build more precise zinc-finger groupings that only prompt the desired edit.

Targeting Cancer with Bottle-brush Shaped Nanoparticles

MIT chemists have designed a bottlebrush-shaped nanoparticle that can be loaded with multiple drugs, in ratios that can be easily controlled. Using these particles, the researchers were able to calculate and then deliver the optimal ratio of three cancer drugs used to treat multiple myeloma. In a study of mice, the researchers showed that nanoparticles carrying three drugs in the synergistic ratio they identified shrank tumors much more than when the three drugs were given at the same ratio but untethered to a particle. This nanoparticle platform could potentially be deployed to deliver drug combinations against a variety of cancers. Using the bottlebrush particles, the researchers were also able to analyze many different drug combinations to evaluate which were the most effective. They are also working on using these particles to deliver

therapeutic antibodies along with drugs, as well as combining them with larger particles that could deliver messenger RNA along with drug molecules.

NUS Revisits Existing Drug to Better Fight T-cell Acute Lymphoblastic Leukaemia

Researchers from the National University of Singapore breathed new life into an existing drug—combatting a type of blood cancer called T-cell acute lymphoblastic leukaemia, or T-ALL. The drug, called PIK-75, was initially discovered over a decade ago but was dismissed in favour of newer ones. Now researchers established that the drug could block not just one but two crucial cancer-causing pathways of T-ALL, enabling them to develop new treatments that could effectively stem the disease. Among roughly 3,000 compounds, PIK-75 stood out for exhibiting the ability to block TAL1 transcription factor activity as well as the PI3K-AKT-PTEN signalling pathway, thereby greatly reducing the survivability of T-ALL cells. PIK-75 produced a strong cytotoxicity against T-ALL cells at low doses compared to previous studies involving other types of drugs that required higher concentrations to inhibit their growth.

INDIA

Summit Discusses Disaster and Climate Induced Risks

The Resiliency & Sustainability Summit: Vision 2047 brought together experts from all over India and deliberated upon the key aspects of present and futuristic disaster risks and climate contexts as well as their changing scenarios. Experts shared recent lessons, innovations, good practices, and case studies in science, policy-planning-practice interface specific to disaster resilience and risk reduction on the first day of the summit. They also discussed methods for localising the resilience agenda for region-specific, sectoral and strategic interventions with futuristic perspectives. The summit deliberations are expected to identify key contexts of futuristic ‘risk and resilience’ along with a realistic roadmap for ‘localization’ agenda under an integrated strategic framework for Disaster Risk Reduction and Climate Resilience. It would also discuss present recent, past, and proposed initiatives as well, including those relating to G-20 Summit, UN Decade for Eco-restoration, and UN Convention to Combat Desertification (UNCCD), etc.

Air Quality Monitoring System (AI-AQMS v1.0) Released

The Centre for Development of Advanced Computing (C-DAC), Kolkata in collaboration with TeXMIN, ISM, Dhanbad has launched the Technology for Air Quality Monitoring System (AI-AQMS v1.0). The outdoor air quality monitoring station can monitor environmental pollutants which includes parameters like PM 1.0, PM 2.5, PM 10.0, SO₂, NO₂, CO, O₂, ambient temperature, relative humidity etc., for continuous air quality analysis of the environment. The Air Quality Monitoring System (AI-AQMS v1.0), was also transferred to the selected industry J.M. EnviroLab Private Limited for further commercialization of the same technology for deployment at different mine and cement industries. The transfer of technology (ToT) was done under a ToT agreement.

Indigenous Mobile Operating System Developed

An Indian Institute of Technology Madras (IIT Madras)-incubated firm JandK Operations (JandKops) has developed an Indigenous Mobile Operating System called

‘BharOS,’ which can be installed on commercial off-the-shelf handsets. BharOS Services are currently being provided to organisations that have stringent privacy and security requirements whose users handle sensitive information that requires confidential communications on restricted apps on mobiles. BharOS Service gives users more freedom, control, and flexibility to choose and use only the apps that fit their needs. It provides access to trusted apps through organization-specific Private App Store Services (PASS) to a curated list of apps that have been thoroughly screened and have met certain security and privacy standards set by organizations. BharOS comes with No Default Apps (NDA). This means that users are not forced to use apps that they may not be familiar with or that they may not trust. Additionally, this approach allows users to have more control over the permissions that apps have on their device, as they can choose to only allow apps that they trust to access certain features or data on their device. In addition, BharOS offers ‘Native Over The Air’ (NOTA) updates that can help to keep the devices secure. NOTA updates are automatically downloaded and installed on the device, without the need for the user to manually initiate the process. This ensures that the device is always running the latest version of the operating system, which includes the latest security patches and bug fixes.

IISER-Bhopal Develops Organic Crystalline Material

Indian Institute of Science Education and Research (IISER) Bhopal researchers have developed a new, flexible organic crystal that shows great potential for use in highly sensitive pressure sensors. The device fabricated with this material has high sensitivity to pressure, when compared to existing materials, making it a promising component for the future development of the technology of pressure sensors. These materials are environment friendly and can be used in designing flexible electronic devices in healthcare, intelligent systems, wearables, and self-powered devices. The new organic crystal – 4-trifluoromethyl phenyl isothiocyanate (4CFNCS) – that is flexible enough to be bent, twisted, and coiled.

Fuel Cell-based Air Independent Propulsion System for Indian Submarine

DRDO’s Naval Materials Research Laboratory (NMRL) has developed a Fuel Cell-based Air Independent Propulsion (AIP) system to be fitted onboard INS Kalvari. An agreement was signed between senior officials of NMRL and Naval Group France in Mumbai for the detailed design phase for integration of indigenous AIP in the Kalvari class submarines. As part of the agreement, Naval Group France will certify the AIP design for integration in the submarines. The AIP has a force multiplier effect on lethality of a diesel electric submarine as it enhances the submerged endurance by several folds. It has merits in performance compared to other technologies and is unique as the hydrogen is generated onboard. This technology has been successfully developed by NMRL with the support of Indian industry partners. The technology has now reached the stage of maturity for industrialisation. The land-based prototype of the NMRL’s AIP has been tested successfully.

Converting CO₂ and Plastic Waste

Indian researchers at Cambridge University have developed a reactor that converted greenhouse gases and plastic waste into sustainable fuels and other valuable products. The reactor runs solely on solar power and uses a light absorber based on perovskite - a material considered a cost-effective alternative to silicon to create solar cells. The reactor has two compartments. One compartment converts carbon dioxide while the other turns plastic waste into useful products.

The reactor can help create products like syngas, formic acid and glycolic acid through the conversion of carbon dioxide and plastic waste. These products have several industrial uses. The reactor produced these products at a rate much higher than conventional photocatalytic carbon dioxide reduction processes. The conversion process uses photoelectrodes, an important component of the reactor that contains catalyst material for converting waste. The researchers now plan to scale up their innovation and tune the system to make far more complex products just by changing the catalyst, and using bigger electrodes and photosensitizers.

Smart Windows with Energy-storing Capability

Scientists from the Centre for Nano and Soft Matter Sciences (CeNS), and Jawaharlal Nehru Centre for Advanced and Scientific Research (JNCASR) have developed a cost-effective polymeric electrochromic smart window which can store energy using hybrid transparent electrodes, as well as carry out transparency switching. It has the potential of replacing the costly traditional smart windows in modern structures. They used a chemically synthesized conducting polymer, poly(*o*-methoxyaniline) (PMOANI), as an electrochromic layer over a low-cost transparent conducting electrode (ITO--60 nm/Al-mesh) to form a smart window. The electrochromic device exhibited an excellent optical contrast of 57 per cent between coloured and transparent states. It has a rapid switching ability and can perform several transparency switches as well as charging/discharging cycle (energy storage) without any degradation in performance of the device. They demonstrated that the smart window device shows dual functionality by switching its colour from a Dark (Blue) state to a transparent (bleached) state while discharging to power a small electronic gadget.

Artificial Synapse Developed for Brain-like Computing

A team of scientists at Bengaluru's Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) have used scandium nitride (ScN), a semiconducting material with supreme stability and Complementary Metal-Oxide-Semiconductor (CMOS) compatibility, to develop brain-like computing. This work demonstrates an artificial optoelectronic synapse with ScN thin films that can mimic synaptic functionalities like short-term memory, long-term memory, the transition from short-term to long-term memory, learning–forgetting, frequency selective optical filtering, frequency-dependent potentiation and depression, Hebbian learning, and logic-gate operations. Additionally, with varying magnesium (Mg) dopant concentrations, both excitatory (increase in current/synaptic strength) and inhibitory (decrease in current/synaptic strength) operations can be achieved in the same material. The increase in resistivity (negative photoconductivity) in ScN and decrease in resistivity (positive photoconductivity) in Mg-doped ScN on shining light was used as the excitatory and inhibitory nature of the synapse, respectively. The persistence in the photoconductivity after turning off the light acts as a memory that lasts for several minutes to several days, depending on the nature of the stimuli. This work is the first demonstration of an optoelectronic synapse with a CMOS chip-compatible group-III nitride semiconductor that can be seamlessly integrated with existing Si technology. Response to the optical stimuli also has the advantage of possible integration with photonic circuits known for higher speed and broader bandwidth than electronic circuits.

World's First Intranasal COVID-19 Vaccine Released in India

Dr. Mansukh Mandaviya, Union Minister of Health & Family Welfare released the iNNCOVACC COVID19 vaccine on 26 January/ iNNCOVACC is the world's first intranasal

COVID19 vaccine to receive approval for the primary 2-dose schedule, and as a heterologous booster dose. It is developed by Bharat Biotech International Limited (BBIL) with support from the Dept of Biotechnology, Ministry of Science and Technology. iNCOVACC is a cost effective covid vaccine which does not require syringes, needles, alcohol wipes, bandage, etc, saving costs related to procurement, distribution, storage, and biomedical waste disposal, that is routinely required for injectable vaccines. It utilizes a vector-based platform, which can be easily updated with emerging variants leading to large scale production, within a few months. These rapid response timelines combined with the ability of cost effective and easy intranasal delivery, makes it an ideal vaccine to address future infectious diseases. A rollout of iNCOVACC is expected to begin in private hospitals that have placed advance orders. Initial manufacturing capacity of several million doses per annum has been established, this can be scaled up to a billion doses as required. iNCOVACC is priced at INR 325/dose for large volume procurement by state agencies.

G-20 AND GLOBAL CHALLENGES

G20 Presidency's First Health Working Group Meeting

The G20 member countries held a constructive discussion during India G20 presidency's first Health Working Group meeting held at Thiruvananthapuram, Kerala. One of the highlights of the three days meeting was a side event on Medical Value Travel. Holistic Health and wellbeing is only possible when high quality, affordable and accessible health services are being provided to all equitably. Connecting the globe through medical value travel based on integrated health care will serve to address the disparities in existing healthcare systems. Integrative healthcare based on evidence based traditional medicine practices and modern systems would be helpful in achieving Universal Health Coverage. During the three-day G20 meeting delegates discussed health priorities like Health emergencies prevention and preparedness, strengthening cooperation in pharmaceutical sector and digital health innovation & solutions. The delegates also participated in a morning yoga session held on day 2 and visited the Somatheeram Ayurveda Village at Kovalam, Kerala to understand holistic healthcare service delivery system. Representatives from the G20 member countries attended the event. Special invitee countries included Bangladesh, Egypt, Mauritius, Nigeria, Singapore, Spain, Sultanate of Oman, Netherlands and United Arab Emirates also participated.

Planning Meeting of G20 Chief Science Advisers

The planning meeting of the G20 Chief Science Advisers Roundtable (G20-CSAR) was held virtually on 20 January to discuss agenda topics and planning for the proposed high-level roundtables. One health, open access to scholarly scientific knowledge, emerging technologies, and scientific data Sharing were indicative sets of agenda topics for G20-CSAR during the meeting. G20-CSAR is a government-to-government level initiative conceptualised through India's G20 presidency. The motivation of this initiative is to bring together the Chief Science Advisers and their equivalents of G20 member countries, as well as the invited countries, to deliberate upon and develop collaborative frameworks for some of the common pressing global science and technology (S&T) policy issues. The G20-CSA roundtables are an effective platform to discuss and achieve solutions to some of the long pending as well as anticipated issues related to scientific research, technology development and deployment. The G20-CSAR

initiative will complement and cross-feed into other working groups and initiatives under the larger G20 framework. It aims to achieve an effective institutional arrangement to discuss global S&T policy issues which can evolve into an effective and coherent global science advice mechanism; and solutions to some, if not all, of the transboundary issues faced by the global S&T ecosystem. During India's G20 presidency, two high-level G20-CSAR meetings will be organized – the first G20-CSAR during 26-28 March at Hyderabad and the second G20-CSAR during 27-29 August at Bengaluru. Senior officials representing Argentina, Australia, Brazil, Canada, China, European Union, France, Germany, Indonesia, Italy, Japan, Korea, Mexico, Netherlands (invitee country), Russia, Saudi Arabia, South Africa, Turkey, United Kingdom, United States participated and provided their comments and suggestions on the topics of mutual interest for this initiative during the meeting.

Science20 Inception Meeting Held in Puducherry

The Science-20 (S20) Inception Meeting was held as a part of India's G20 Presidency on January 30 and 31, 2023 in Puducherry. Indian National Science Academy (INSA) President Dr Ashutosh Sharma was the country's chair of the deliberations. The focus of the meeting was on scientific and technology aspects that would help the growth of nations. The theme of the meeting is "disruptive science for innovative and sustainable development". Fifteen delegates from 11 G20 countries — Australia, Brazil, China, European Union, France, India, Republic of Korea, Turkey, Russia, United Kingdom and United States of America were to join the deliberations. About 50 delegates and special invitees from various research and academic institutions across India also participated. The goal of the S20 inception meeting is to set the overarching agenda – universal holistic health, adoption of clean energy for a greener future and connecting science and technology to society and culture – for the rest of their meetings so that detailed inputs will be provided by the scientific academies of the G20 member states. The S20 inception meeting would promote and encourage fruitful scientific dialogue among the G20 member nations providing constructive solutions for problems such as climate change, healthcare and making science an integral part of society and culture.

India to Hold G20 RIIG Meetings on Scientific Cooperation

During its G20 presidency India will hold one mega ministerial summit on science in Mumbai and five other meetings on different aspects of technological progress and challenges under the G20's Research and Innovation Initiative Gathering (RIIG). The RIIG aims to address the challenges of achieving socio-economic equity through research and innovation. It proposes the establishment of a G20 working group on research, innovation, and equity, which would bring together leading economic powers to address these challenges. The RIIG's first (inception) meeting will be held in Kolkata on February 8-9 followed by side events in Ranchi on March 2-3, in Dibrugarh/Itanagar on March 24-25, in Dharamshala on April 19-20, in Diu on May 18-19 and the final ministerial summit in Mumbai on July 4-6. Different departments and research institutions of the ministries of science & technology and earth sciences will participate as lead partners in these meetings. The ministry of earth sciences (MoES) will host the RIIG meetings for the G20 engagement group in Diu on "Scientific Challenges and Opportunities for a Sustainable Blue Economy" as its theme.

IN BRIEF

[Converting Ocean Plastic into Ingredients for Drug Industry](#)

Researchers at the University of Kansas have used a genetically modified fungus to transform polyethylene plastic waste from the Pacific Ocean into key components for making pharmaceuticals. They first converted polyethylenes using oxygen and some metal catalysts to break the plastics into diacids. They then used a common soil fungus called *Aspergillus nidulans* that has been genetically altered which metabolized the long chains of carbon atoms resulting from the decomposed plastics into an array of pharmacologically active compounds, including commercially viable yields of asper benzaldehyde, citreoviridin and mutilin. Unlike previous approaches, this method breaks the plastics down fast and is more efficient. 42 percent of the mass of diacids that goes into the culture comes back as the final compound. Changing the expression of genes in *Aspergillus nidulans* and other fungi could produce new compounds. Further research aims to develop procedures to break down all plastics into products that can be used as food by fungi, eliminating the need to sort them during recycling.

[New Material Speeds Up Healing of Diabetic Wounds](#)

Researchers from the University of Nottingham have found a new class of polymer that promotes healing in hard-to-treat diabetic wounds. The polymer that actively drives fibroblasts and immune cells to promote healing. They made small particles decorated with this polymer on their surface to be directly applied to the wound area. This new material, when delivered to a wound on an animal model, produces three times more fibroblast activity over a period of up to 96 hours and achieved more than 80% wound closure. This new polymer could be applied as a coating to standard wound dressings to provide a fast and effective treatment. This could enable a new, low cost, effective treatment for diabetic wounds. The medical potential of novel polymers that can prevent infection by changing the bacterial cell behaviour at the polymer surface is worth exploring.

[Recycling Previously Unrecyclable Plastic](#)

University of Michigan researchers have discovered a way to chemically recycle polyvinyl chloride (PVC) into usable material. The researchers found a way to use the phthalates in the plasticizers—one of PVC's most noxious components—as the mediator for an electrochemical chemical reaction to break down PVC. The plasticizer improves the efficiency of the method, and the electrochemical method resolves the issue with hydrochloric acid. The team used electrochemistry to introduce an electron into the system, which breaks the carbon-chloride bond and results in a negatively charged chloride ion. Because the researchers are using electrochemistry, they can meter the rate at which electrons are introduced into the system—which controls how quickly hydrochloric acid is produced. The acid can then be used by industries as a reagent for other chemical reactions. The chloride ions can also be used to chlorinate small molecules called arenes. These arenes can be used in pharmaceutical and agricultural components. The study could be relevant for chemically recycling other difficult materials with additives.

Novel Microneedle Bandage Could Stop Blood Loss from Wounds

Researchers from Penn State, have designed a novel microneedle patch that can immediately stop bleeding after injury. The hemostatic microneedle technology can be applied like a typical adhesive bandage to quickly stop bleeding. The biocompatible and biodegradable microneedle arrays (MNAs) on the patch increase its surface contact with blood and accelerate the clotting process. The needles also increase the adhesive properties of the patch via mechanical interlocking to promote wound closure. In vitro, the engineered MNAs reduced clotting time from 11.5 minutes to 1.3 minutes; and in a rat liver bleeding model, they reduced bleeding by more than 90 per cent. The microneedle patch is pre-engineered for immediate application that anyone can use to stop bleeding like a typical over-the-counter adhesive bandage. The researchers are now working to translate the patch from the lab to the market, with plans to further test the technology.

AI Technology Generates Original Proteins from Scratch

US Scientists have created an AI system capable of generating artificial enzymes from scratch. In laboratory tests, some of these enzymes worked as well as those found in nature, even when their artificially generated amino acid sequences diverged significantly from any known natural protein. The AI program, called ProGen uses next-token prediction to assemble amino acid sequences into artificial proteins. To create the model, the team used the amino acid sequences of 280 million different proteins of all kinds into the machine learning model and priming it with 56,000 sequences from five lysozyme families, along with some contextual information about these proteins. The model quickly generated a million sequences, and the research team selected and tested five artificial proteins in cells and compared their activity to a natural enzyme hen egg white lysozyme (HEWL). Two of the artificial enzymes were able to break down the cell walls of bacteria with activity comparable to HEWL. The possible combinations of amino acids in proteins is almost limitless. The new AI tool could enable easy design of proteins for various applications.

Ultra-light, Low Carbon 'Aerogel' Insulation Materials

A team of engineers from the University of Bath has created a new company, Aerogel Core Ltd, specialising in ultra-light 'aerogels' that can be used as soundproofing and heat-shielding materials for the aerospace and automotive industries. The team has found a way to use graphene to produce aerogels that retain their shape and strength, without the gel structure collapsing. As well as tuneable acoustic properties, these ultralight aerogels have other functional properties such as thermal, fire and electromagnetic interference shielding. The coupling of both acoustic and other functional properties provides a material that can have a large impact within many industrial sectors. The material meets the functionalities of specific engineering applications for the aerospace sector, creating the best acoustic properties for a material with incredibly low density. The team is scaling up the technology through automation of the manufacturing process and further material development.

New Hybrid Catalyst Could Help Decarbonization

Scientists led by Ames National Laboratory, have developed a new hybrid catalyst that converts carbon dioxide into ethylene in one pot. This new catalyst consists of only earth-abundant materials, such as nickel and copper, and requires less energy for chemical reaction. Atomically dispersed nickel anchored on nitrogen assembly carbon (NAC) works to catalyze CO₂ to CO at

low voltage and high current. The catalyst is effective over a wide range of voltages and its effectiveness at higher currents means a higher rate of CO production. The team used a second catalyst, which is a copper nanowire, and by combining these two gives a very selective process that has up to 60% efficiency going from CO₂ to ethylene in one pot. The catalyst's ordered mesoporous structure enhances its effectiveness. Using CO₂ as a feedstock for this reaction addresses the global need to reduce the amount of CO₂ released into the atmosphere and eliminates the use of fossil resources to make ethylene.

RESOURCES & EVENTS

[UN Experts to Intervene in Zambia Lead Pollution Case](#)

A South African court has allowed a group of UN-appointed experts to intervene in a class action lawsuit against mining giant Anglo American on behalf of women and children in Zambia's central Kabwe District, who are the alleged victims of lead poisoning. The applicants allege that Anglo American South Africa, through its prior involvement in the activities of the local lead mine in Kabwe, assumed a duty of care towards residents, especially protection against lead exposure. Lead is a cumulative toxicant that affects multiple body systems and is particularly harmful to young children. According to the WHO, there is no level of exposure to lead that is known to be without harmful effects. Young children can suffer profound and permanent adverse health effects and disabilities, including in the development of the brain and the nervous system. Pregnant women's exposure to lead can cause miscarriage, stillbirth, and premature birth and low birth weight. The 13 experts were appointed by the UN Human Rights Council in Geneva and serve in their individual capacities.

[WHO to Accelerate the Development of TB Vaccine](#)

Recently, Director-General of the World Health Organization (WHO), announced the creation of the TB Vaccine Accelerator Council. Although many countries have committed to eradicating TB by 2030 the disease continues to persist without any sign of slowing down. In 2021, about 10.6 million individuals contracted TB, 1.6 million of whom died. According to a recent report, every year, approximately 500,000 individuals develop drug-resistant TB globally, thus implying that drug resistance has been a significant barrier to tackling TB prevalence. The key role of the Council is to expedite the licensing and effective use the novel TB vaccines by bringing together global agencies, funders, governments, and end users. Additionally, the Council will focus on identifying all complexities associated with TB vaccine development and formulate strategies to overcome them. At present, the Bacillus Calmette-Guérin (BCG) vaccine is the only licensed vaccine for TB. Although this vaccine is moderately effective in preventing severe TB infection in infants and young children, it fails to suitably protect adolescents and adults. Importantly, 90% of global TB transmissions occur in adolescents and adults. Later this year, Heads of States and Governments will meet to review the progress on TB. This meeting will provide opportunities to overcome the setbacks in the TB response, which include urgent development and the establishment of novel TB vaccination programs.

[MeitY Invites Comments on Amendment Proposed to 'IT Rules'](#)

In pursuance of the Government's commitment to ensure an Open, Safe and Trusted and Accountable Internet for citizens (Digital Nagriks), the Ministry of Electronics and Information Technology (MeitY) has invited comments from stakeholders and general public on amendment

proposed to the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021 (“IT Rules”) with respect to obligations of social media and other intermediaries regarding sharing of information which is patently false and untrue or misleading in nature. Under the proposed amendment, the due diligence by intermediaries shall include making such efforts to not upload, publish, transmit or share information identified as fake or false by the Fact Check Unit of the Press Information Bureau which takes cognizance of fake information both suo motu and by way of queries sent by citizens on its portal or through e-mail and WhatsApp and responds with correct information when the same pertains to the Government. In addition, it will also cover information which relates to government business and which is identified by the Department concerned as false. The rules also in addition mention other agencies may be included in list of authorised agencies for such fact-checking in future by Govt. Stakeholders have been invited to comment on the amendments.

SCIENCE POLICY AND DIPLOMACY

[New Global Body Aims to Improve Biosecurity and Biosafety](#)

A new global organization the International Biosecurity and Biosafety Initiative for Science (IBBIS) is trying to prevent dramatic advances in bioscience from unleashing engineered pathogens from the lab, and wants research funders, scientists and journals to help. It warns that scientists might be able to order the DNA of dangerous pathogens like smallpox from unregulated companies, and wants much tighter screening of the industry. IBBIS was set up by the Nuclear Threat Initiative (NTI), to improve biological safety and security in civilian science. A recent Lancet commission on COVID-19 recommended “new global regulations on biosafety to regulate pathogen-related fieldwork and laboratory work”. The number one priority for IBBIS is ensuring that all companies offering DNA for sale screen their customers and the genetic material they order, to weed out bad actors or scientists seeking unusual pathogens. Benchtop gene printers that can create DNA in the lab are also a cause for concern. A voluntary screening system was set up in 2009 by the International Gene Synthesis Consortium (IGSC) largely made up of North American and European companies, with a few Chinese firms. IBBIS is trying to create a Common DNA Sequence Screening Mechanism, which should allow all DNA companies to screen their orders. IBBIS is also hoping to work with research funding agencies to firm up their safeguards against potentially risky research.

[Rapid Scale-up of CO2 Removal Crucial for Climate Goals](#)

Capping global warming at liveable levels will be impossible without massively scaling up the extraction of carbon dioxide from the atmosphere, according to a State of Carbon Dioxide Report led by the University of Oxford on global assessment of CO2 removal. The persistent failure to reduce greenhouse gas emissions has forced carbon dioxide removal (CDR) options into climate policy, investment and research. Across methods ranging from tree planting to factory-sized machines that remove CO2 from the air and store it underground, CDR worldwide currently captures two billion tons of the gas each year with over 99 percent extracted through "conventional" techniques such as restoring and expanding CO2-absorbing forests and wetlands. Only a tiny fraction—about 0.1 percent—is removed by "novel" technologies such as direct air capture, converting organic waste into rock-like biochar, or capturing the CO2 from plants grown and burned for fuel. By the end of the century, the report calculates for the first time, CDR must extract between 450 billion and 1.1 trillion tons of CO2 to meet the 1.5C target. One

novel CDR technology has attracted more attention and money than any other - direct air capture combined with carbon storage (DACCS). Three quarters of the \$200 million (185 million euros) invested in new CDR capacity from 2020 to 2022 went to direct air capture—a big chunk of it to Switzerland-based Climeworks. The firm announced last week the world's first certified CO2 removal and storage on behalf of paying clients, including Microsoft and software service company Stripe. Direct air capture needs to be stepped up by more than 40 percent for the next 30 years, a huge challenge.

[Artemis Accords for Collaboration in Space Exploration](#)

The Artemis Accords are a set of statements that set out common principles, guidelines, and best practices that are applicable to the safe exploration of the moon and eventually beyond as humanity extends the duration of space missions and its reach to Mars. International partnerships with numerous countries and private companies are vital to its success. One of the key principles of the Artemis Accords is to affirm the importance of countries complying with 1967's Outer Space Treaty (or the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the moon and Other Celestial Bodies to give it its full title). Additionally, the accords affirm the importance of the Rescue and Return Agreement, 1968, which emphasizes the responsibility of nations to safely return astronauts and equipment to Earth and further space-related policies such as 1972's Liability Convention and 1975's Registration Convention. The Artemis Accords were first launched by eight nations in October 2020 and cover activities on in orbit, on the surface, and in the subsurface of the moon, Mars, comets, and asteroids. It also covers the stable orbital points known as the Lagrangian points for the Earth- moon system and is applied to objects in transit between these celestial bodies and locations. 23 countries have so far signed the Artemis Accords: Australia, Bahrain, Brazil, Canada, Columbia, France, Israel, Italy, Japan, Luxemburg, Mexico, New Zealand , Nigeria, Poland, Republic of Korea, Romania, Rwanda, Saudi Arabia, Singapore, Ukraine, United Arab Emirates, United Kingdom, and United States of America

[Virologists Views on Gain of Function Research](#)

A group of 150 experts in a new commentary called on policymakers to recognize the need for more rational discourse and a more nuanced, evidence-based discussion around gain of function research and provide evidence to support the benefits of this type of research for human health. These concerns are especially focused on enhanced potential pandemic pathogen (ePPP) research and dual use research of concern (DURC). Responding rapidly to emerging viral threats requires application of modern biology tools to viruses to reduce the burden of future disease outbreaks. Research on dangerous pathogens requires oversight, but the ability of scientists to generate the knowledge needed to protect ourselves from these pathogens should not be over restricted. It is important for policy makers, virologists, and biosafety experts to work together to ensure that research is conducted safely, with the common goal of reducing the burden of disease caused by viruses.

[Stricter US Guidelines for 'Gain-of-Function' Research](#)

A [report on regulating research involving dangerous pathogens](#) was discussed by a panel of experts on 27 January at a virtual meeting of the US National Science Advisory Board for Biosecurity (NSABB). The meeting ended with an agreement to modify the report, but without a firm plan for how to do so. Panel members were concerned about the draft report's vague

language and recommendations for expanded oversight of such experiments that could stifle crucial research, and responses to public-health emergencies. Other issues of concern were how regulation of privately-funded risky research, identifying potentially dangerous research, and funding to meet US biosafety standards. The report will be sent to the US Department of Health and Human Services (HHS) for consideration for making new policy guidelines. The new report's recommendations include increased transparency in the review process, a role for research institutions in evaluating the risks and benefits of proposed experiments and improved regulation of NIH-funded research performed in other countries. The report also suggests that HHS evaluate all experiments that could be "reasonably anticipated" to make a pathogen more transmissible or dangerous.

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:

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