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SCIENCE DIPLOMACY NEWS ALERT | 16-31 JULY 2022| ISSUE 90

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NEWS ALERT

*Forum for Indian Science Diplomacy*

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### [Silk Offers Alternative to Microplastics](#)

A team of scientists at MIT and elsewhere have developed a system based on silk added to agricultural products, paints, and cosmetics. It could provide an inexpensive and easily manufactured substitute to microplastics. Unlike the high-quality silk threads used for fine fabrics, the silk protein used in the new alternative material is widely available and less expensive. Silk-coated microcapsules samples prepared by ultrasonic spray freeze drying which was used by researchers to reveal greater detail of the process involved. The new method can make use of low-grade silk that is unusable for fabrics, large quantities of which are currently discarded because they have no significant uses. It can also use used, discarded silk fabric, diverting that material from being disposed of in landfills. The study describes a sustainable and biodegradable silk-based replacement for microplastic encapsulants, which are a pressing environmental challenge.

### [Biomarkers to Predict Specific Nanoparticles for Cancer Cells Identified](#)

A new study from MIT and Harvard researchers may help to overcome some of the obstacles to the development of nanoparticle-based drugs. The team's analysis of the interactions between 35 different types of nanoparticles and nearly 500 types of cancer cells revealed thousands of biological traits that influence whether those cells take up different types of nanoparticles. The findings could help researchers better tailor their drug-delivery particles to specific types of cancer, or design new particles that take advantage of the biological features of particular types of cancer cells. The approach maps out what types of nanoparticles are best to target certain cell types, from cancer to immune cells and other kinds of healthy and diseased organ cells. We are learning how surface chemistry and other material properties play a role in targeting.

### [WHO Declares Monkeypox a Global Emergency](#)

The World Health Organization (WHO) has declared the global Monkeypox outbreak a public health emergency of international concern (PHEIC), a step below that of a pandemic. The latest decision followed a seven-hour meeting on July 21 of the International Health Regulations Emergency Committee to discuss the monkeypox outbreak in several countries. Though the Committee did not reach a consensus on whether the outbreak constituted a PHEIC, Director General, Dr. Tedros Adhanom Ghebreyesus decided that the situation merited such a classification. As part of the PHEIC declaration which is said to be temporary and reviewed every three months, countries are expected to follow guidelines. They are grouped into three categories: those with no reported cases or where the last reported case from 21 days ago; those with recently imported cases and experiencing human-to-human transmission and finally, countries where cases are being reported and have a history of the presence of the virus. The guidelines direct countries to step up surveillance, spread awareness on the pandemic, and ensure that at-risk groups are not stigmatised.

### [Nanoparticle-Vaccine Combination to Target Melanoma](#)

Scientists at the University of Iowa have found that charged nanoparticles combined with a vaccine were effective in eliminating tumors or extending life span in cancerous mice. In the new approach, the nanoparticle could be mass manufactured, stored at room temperature, and

administered by general physicians to treat a variety of cancers. This could be an off-the-shelf, stable formulation that could be available as a powder. The charged nanoparticle spheres ranging in diameter from 100 to 160 nanometers were injected around melanoma tumors in mice. The nanoparticles enable melanoma-fighting cells triggered by the adenovirus vaccine to locate the tumor and overcome its defenses. In one set of experiments involving nine mice given the nanoparticle-adenovirus vaccine formula, five mice became cancer free, while the other four survived more than 100 days—more than three times longer than those given only the vaccine and five times longer than those given nothing at all. The charged nanoparticles, when injected near a tumor, create an inflammatory response which attracts circulating T cells.

### [Bacteria Could Help Capture Greenhouse Gases](#)

Researchers from Simon Fraser University are investigating how organisms sense and respond to CO<sub>2</sub>. Their research which could help advance human and environmental health and lead to new strategies for carbon capture, examined the important role CO<sub>2</sub> plays in cyanobacteria—photosynthetic organisms found in water. Cyanobacteria use carbon to create essential nutrients that sustain their life cycle and were responsible for the great oxygenation event in the earth's history. Understanding how cyanobacteria regulate CO<sub>2</sub> fixation may give us an avenue for developing improved CO<sub>2</sub> capture technologies. Leverage the system within these organisms, along with industrial processes, to help reduce CO<sub>2</sub> emissions. Using the CLS's CMCf beamline, the team could see detailed molecular structures and study how CO<sub>2</sub> binds to a bacterial protein.

### [AI Speeds Sepsis Detection](#)

John Hopkins University researchers have developed an artificial intelligence tool designed to detect sepsis earlier. The AI tool, the Targeted Real-Time Early Warning System, looks through medical records and clinician notes to determine which patients are at risk of developing sepsis. During testing, in 82 percent of sepsis cases, the AI was accurate nearly 40 percent of the time. This is a significant improvement over previous sepsis detection AI systems. The approach used is foundationally different, adaptive and takes into consideration the diversity of the patient population, the unique ways in which doctors and nurses deliver care across different sites, and the unique characteristics of each health system, allowing it to be significantly more accurate and to gain provider trust and adoption.

## **COVID-19**

### **COVID-19 (WORLD)**

#### [WHO Releases Global COVID-19 Vaccination Strategy Update](#)

WHO published an update to the Global COVID-19 Vaccination Strategy on 22 July, in response to the spread of Omicron subvariants, advances in vaccine evidence, and lessons from the global vaccination program. Only 28 per cent of older populations and 37 per cent of health care workers in low-income countries have been vaccinated with their primary series. 27 of WHO's Member States have not yet started a booster or additional dose program, 11 of which are low-income countries. The strategy aims to use primary and booster doses to reduce deaths and severe disease, in order to protect health systems, societies and economies. To

ensure vaccines reach the highest priority groups, the strategy emphasizes the need for measuring progress in vaccinating these groups and developing targeted approaches to reach them. The strategy also has the goal of accelerating development and ensuring equitable access to improved vaccines to substantially reduce transmission as the top priority but also to achieve durable, broadly protective immunity. Other vital actions to take include: equitably distributing manufacturing facilities across regions and supporting strong vaccine delivery programs.

### **Modified Bacterial DNA Used in COVID-19 Vaccine**

Researchers at University of California leading a team have described a different way to build a COVID-19 vaccine, one that would, in theory, remain effective against new and emerging variants and could be taken as a pill, by inhalation or other delivery methods. The research involved building plasmids genetically altered to contain bits of genetic material specifically intended to target a vulnerability in the SARS-CoV-2 virus's spike protein, a portion of the virus critical to binding and infecting cells. This approach could increase the possibility of a more durable, and more broadly effective, COVID-19 vaccine. They built plasmids containing immunogens — molecules that cause B lymphocytes to create antibodies — that were specifically designed to display a knob of the spike protein that is part of the receptor binding motif or RBM. Specifically, these were amino acid residues that act like keys to unlock the cell door. The keys and lock do not change. Researchers then cloned the selected spike protein amino acids into a plasmid DNA so that, when injected into the spleen of mice, the introduced immunogen molecules would provoke the production of neutralizing antibodies specifically tuned to the targeted knob on the RBM of the virus protein spike. The researchers then tested their approach on mice with variants of the original SARS-CoV-2 strain (Beta, Delta and Omicron) and found that the immune response was similar across all variants.

### **Anti-inflammatory Compound Shows Potential in Treating Severe COVID-19**

A team of researchers conducted a Phase 2 trial evaluating the safety and efficacy of an anti-inflammatory compound, called OP-101, in patients with severe COVID-19. In the trial, 24 patients classified as having severe COVID-19 were randomized to receive a single intravenous dose of placebo or OP-101 at 2, 4, or 8 mg/kg. All patients received standard of care, including corticosteroids. Hyperinflammation triggered by SARS-CoV-2 is a major cause of disease severity in COVID-19. OP-101 was found to be better than a placebo at decreasing inflammatory markers, as well as better at reducing markers of neurological injury, including neurofilament light chain and glial fibrillary acidic protein. Additionally, risk for the composite outcome of mechanical ventilation or death at 30 or 60 days after treatment was 71 per cent for patients receiving the placebo, but just 18 per cent for patients in the pooled OP-101 treatment arms. At 60 days after treatment, 3 of 7 patients given placebo and 14 of 17 patients treated with OP-101 survived. The data showed that OP-101 was well tolerated in the critically ill patient population and could serve as an effective treatment for patients hospitalized with COVID-19.

### **COVID-19 (INDIA)**

### **Covaxin Induces Robust Immune Memory**

Scientists have found that Covaxin, which is an inactivated whole-virion vaccine manufactured by Bharat Biotech, induces robust immune memory to SARS-CoV-2 (the virus that causes COVID-19) and variants of concern that persist for at least six months after vaccination and induces memory T cells that can respond robustly against the variants. According to the study, This may help in controlling the virus load and thus, reduce the disease severity. A multi-institutional collaboration investigated 97 SARS-CoV-2 unexposed individuals who had received vaccines, up to six months after 2-dose vaccination. The vaccine-induced responses were compared with the immune memory in 99 individuals who recovered from mild COVID-19. This study showed that the vaccine is capable of inducing memory B cells. The researchers found this satisfying because antibodies may decline with time, but these memory B cells can replenish antibodies against the virus, whenever required. Their study provided the first-ever evidence of the detailed traits of immune memory generated in humans in response to an inactivated virus vaccine.

### **India's COVID-19 Vaccination Exceeds 2 Billion**

India's COVID-19 vaccination coverage has exceeded 2.0168 billion (2,01,68,14,771). This has been achieved through 2,66,09,306 sessions. COVID-19 vaccination for the age group 12-14 years was started on 16 March, 2022. So far, more than 38.4 million (3,84,35,980) adolescents have been administered with the first dose of COVID-19 vaccine. Similarly, the COVID-19 precaution dose administration for age group 18-59 years also started from 10th April, 2022 onwards.

## **INDIA-SCIENCE & TECHNOLOGY**

### **New Theory to Explain 'Karakoram Anomaly'**

Researchers at the Indian Institute of Science Education and Research (IISER), Bhopal have taken a significant leap toward solving the mystery of why few pockets of glaciers in the Karakoram Range are resisting glacial melt due to global warming, defying the trend of glaciers losing mass across the globe, with the Himalayas being no exception. They have attributed this phenomenon called 'Karakoram Anomaly' to the recent revival of western disturbances (WDs). They have found this peculiar because the behaviour seems to be confined to a very small region, with only Kunlun ranges being another example of showing similar trends in the whole of Himalaya. They postulated a new theory to explain this defiance of the impacts of global warming in certain pockets as opposed to other glaciers of the region. Calculations by the scientists reveal that contribution of WDs in terms of snowfall volume over the core glacier regions of Karakoram have increased by about 27 per cent in recent decades, while precipitation received from non-WD sources have significantly decreased by around 17 per cent, further strengthening their claims.

### **New Ingredients Can Counter Multidrug-Resistant Bacteria**

Scientists at JNCASR have come up with the approach of revitalising the efficacy of existing antibiotics by using them in combination with antibiotic adjuvants - ingredients that can help counter resistance to existing antibiotics. They incorporated cyclic hydrophobic moieties (portion of a molecule) in a triamine-containing compound and the adjuvants thus developed when used in combination with antibiotics were more effective in killing bacteria. The study highlights the extent of membrane-perturbation required for the design of non-active and non-

toxic adjuvants. The choice of non-active adjuvant would also put less pressure on the bacteria to develop resistance to it. Moreover, weak membrane perturbation would result in less toxicity. However, the work requires proper validation in *in-vivo* model systems, followed by preclinical studies, which will further add value to the work.

### **IISc Sets Up Viral Genome Sequencing Lab**

The Indian Institute of Science (IISc) has expanded its Viral Biosafety level three facility (BSL-3) to include a viral genome sequencing lab. The Viral BSL-3 has been working with the state government to help provide COVID-19 RT-PCR diagnostic services as well as conducting research around the virus. The addition of the viral genome sequencing lab will be used in studies related to the SARS-CoV-2 virus, mainly tracking and constant surveillance to detect variants and mutations. The lab was inaugurated with the help of funding from CryptoRelief Fund. The viral genome sequencing lab will contribute not only towards tackling the threat that COVID-19 poses, but will also ensure we are ready to handle future health emergencies as well.

### **NIV Uses CRISPR to Develop Poliovirus-Free Cell Line**

Researchers from the Mumbai unit of the National Institute of Virology (NIV) have used the cutting-edge gene-editing tool, CRISPR/Cas9, to develop a poliovirus-free cell line. They used the CRISPR/Cas9 tool to knock out cells that support the growth of poliovirus. It is the first-ever cell line in the world with 'poliovirus nonpermissive cell stans'. They edited out cells that would let the polio grow in a culture sample. This development is important in the backdrop of the global polio eradication programme.

### **ICMR Develops Technology to Kill Mosquitoes**

The Indian Council of Medical Research (ICMR)'s research centre in Puducherry has developed a technology to produce *Bacillus thuringiensis israelensis* (Bti strain VCRC B-17), a strain of bacteria that kills mosquito and black fly larvae without harming other animals. The strain kills only mosquito and blackfly larvae and harms no other insects, aquatic fauna or mammals. VCRC's Bti technology is equivalent to the WHO standard strain of bacteria in terms of its effectiveness. Bti B-17 strain is extensively tested and is now designated as the Indian Standard strain by the Central Insecticide Board of India. So far, this technology has been licensed to 21 companies. The commercial production of Bti will be important for India's fight against vector-borne diseases such as malaria, filariasis, Japanese encephalitis, dengue, chikungunya and zika. The Bti technology was handed over to Hindustan Insecticides Ltd for commercial production and use in India. The state-run company plans to export the Bti bio-larvicides to tropical and sub-tropical regions burdened by mosquito-borne diseases and black flies, which transmit river blindness in African countries.

## **IN BRIEF**

### **Biotech Rice Produces Higher Yield**

By giving a Chinese rice variety a second copy of one of its own genes, researchers from China have boosted its yield by up to 40 per cent. The change helps the plant absorb more fertilizer, boosts photosynthesis, and accelerates flowering, all of which could contribute to larger harvests. The team found 13 genes that turned on when rice plants were grown in

nitrogen-poor soil; five led to a fourfold or greater boost in nitrogen uptake. They inserted an extra copy of one of the genes, known as OsDREB1C, into a rice variety called Nipponbare. They also knocked out the gene in other individual rice plants. Greenhouse experiments showed plants without the gene grew less well than control plants, whereas those with extra copies of OsDREB1C grew faster as seedlings and had longer roots. The modified plants took up extra nitrogen through their roots and moved more of it to the shoots, and were also better equipped for photosynthesis. Planted in the field over 2 to 3 years, the enhanced rice gave higher yields at three sites in China with climates ranging from temperate to tropical. Importantly, the researchers also transformed a high-yielding rice variety often planted by farmers by adding an extra copy of the gene and produced up to 40 per cent more grain per plot than did controls. Editing the plant's own genes could reduce fertilizer use, and increase food supply.

### **New Semiconductor Material Found**

Researchers at MIT and other institutions carried out experiments showing that a material known as cubic boron arsenide provides high mobility to both electrons and holes, and has excellent thermal conductivity making it potentially the best semiconductor material ever found. More work will be needed to determine whether it can be made in a practical, economical form, to replace the ubiquitous silicon. But even in the near future, the material could find some uses where its unique properties would make a significant difference. The electronic properties of cubic boron arsenide were initially predicted based on quantum mechanical density function calculations. Not only is the material's thermal conductivity the best of any semiconductor, the researchers say, it has the third-best thermal conductivity of any material — next to diamond and isotopically enriched cubic boron nitride.

### **DeepMind's AlphaFold Illuminates 3D structure of almost Every Protein**

DeepMind's AlphaFold program has now expanded to nearly every protein known to science. The new details will help researchers visualize the nearly 200 million proteins that form the basis of life for animals, plants, bacteria and more—spanning nearly every organism on the planet that has had its genome sequenced. AlphaFold is the first big proof that artificial intelligence can dramatically accelerate scientific discovery, and bring researchers a big step closer to finding ways to manipulate them, not only to help combat diseases, but to address issues such as plastic pollution and food insecurity. DeepMind first launched the public AlphaFold database in July 2021 starting with only about 350,000 protein structures and spanning the entire human proteome. Over the following 12 months, it has grown in size to support more than 500,000 researchers from over 190 countries. AlphaFold has already enabled exploring how proteins interact with potential medicines, and became an essential tool for biopharma research. It has also helped drug designers be more accurate and avoid potential side effects, by not only offering predictions on the proteins that will connect with a therapy, but also those that will not.

### **Sustainable Environmental Remediation**

Persistent organic pollutants (POPs) like per- and polyfluoroalkyl substances (PFAS) are expensive to clean up once emitted and are very harmful to human health. Texas A & M researchers have developed an in-situ PFAS remediation system using a plant-derived biomimetic nano-framework to achieve highly efficient adsorption and subsequent fungal



biotransformation synergistically. The multiple component framework called Renewable Artificial Plant for In-situ Microbial Environmental Remediation (RAPIMER) exhibits high adsorption capacity for the PFAS compounds and diverse adsorption capability toward co-contaminants. It provides a natural substrate for bacterial and fungal growth, on which the white rot fungus (*Irpex lacteus*) decomposes the PFAS and the later the RAPIMER itself without creating secondary pollutants. RAPIMER is a single plant-based nanomaterial that enables the whole treatment train within itself. It exhibits high capacities of adsorption, empowers efficient toxics degradation and ultimate source material degradation, plus is made from low-cost materials. Thus, it presents a cost-effective and sustainable way to remediate PFAS and more generally POPs. A patent has been filed for this research.

## RESOURCES & EVENTS

### [Investment in Genomics Needed in Poorer Countries](#)

The World Health Organization (WHO) has issued an urgent call to accelerate access to genomics, especially in resource-poor countries, in a report that examines technology gaps and opportunities. Genomics has massive potential beyond pathogen surveillance for human health. The full potential of genomics is yet to be realised globally, especially in low- and middle-income countries (LMICs), according to the WHO Science Council's inaugural report on accelerating access to genomics for global health (see <https://www.who.int/publications/i/item/9789240052857>). A series of measures has been proposed aimed at making the technology more accessible in LMICs, including modified pricing models, sharing of intellectual property rights for low-cost versions and cross-subsidisation — where profits in one area are used to fund another. But challenges remain in addressing shortfalls in financing, laboratory infrastructure, materials and highly trained personnel, according to the analysis. The authors highlight four thematic areas to promote the adoption and expanded use of genomics: advocacy, implementation, collaboration and tackling legal and ethical concerns. The Science Council puts forward a number of recommendations to address ethical, legal and social issues associated with genomics and urges the WHO to become the authoritative source for mediation and guidance on these.

### [India's Bioeconomy Report 2022 Released](#)

Releasing India's Bioeconomy Report 2022, Union Minister of State Dr Jitendra Singh said that Bioeconomy would be key to India's future economy over the next 25 years. He pointed out that India's Bioeconomy has reached over 80 billion US Dollars in 2021 recording 14.1 per cent growth over \$70.2 billion in 2020. Noting the rapid growth in the sector, the Minister said, Bioeconomy is likely to touch 150 billion dollars by 2025 and over 300 billion dollars by 2030. He urged all the stakeholders of the Biotech sector, particularly Industry, Startup Ecosystem, Investors, Scientists, Scholars, Entrepreneurs and enablers like DBT, BIRAC to collectively work to achieve the ambitious target. The number of Biotech Start-ups in the country have increased from 50 to over 5,300 in the last 10 years. Dr Jitendra Singh also launched a special Biotech Ignition Grant call for North East Region (BIG-NER) and announced financial support of up to Rs 5 million each to 25 startups and entrepreneurs from North East Region to develop biotech solutions. North East has huge potential and talent to take forward the Biotech sector and asked the Ministry to reach out to them. He informed that

India is among the top 3 in South Asia and top 12 destinations for biotechnology in the world with approximately 3 per cent share in the global Biotechnology industry.

### **Rich Countries Fall Short of 2020 Climate Finance Goal**

Rich countries have fallen almost \$17bn short of their pledge to collectively deliver \$100 billion of climate finance a year by 2020, according to the latest data by the Organisation for Economic Co-operation and Development (OECD). In 2020, rich nations mobilised \$83.3 billion of climate finance, a 4 per cent increase on the previous year but short of the \$100bn target that they set themselves in 2009. 2020 was the deadline for achieving the \$100bn climate finance goal. Developed countries are now only expected to meet it in 2023. Previous research suggests that the US is responsible for the vast majority of the shortfall. The bulk of the funding was in the form of loans rather than grants and went to Asian and middle income countries. Asia received 42 per cent of the finance, roughly equal to its share of the global population, while Africa got 26 per cent and the Americas received 17 per cent. Lower middle income countries received 43 per cent of the funding while upper middle income countries got 27 per cent. Low income countries, which represent about 9 per cent of the global population and are most in need of finance, received 8 per cent. Increasing finance for countries worst hit by climate impacts is one of the key issues at Cop27 in Egypt. Developing countries have long called for a greater share of finance to go towards adapting to climate change rather than reducing emissions.

## **SCIENCE POLICY AND DIPLOMACY**

### **High-Level Political Forum on Sustainable Development Meets**

The 2022 session of the High-level Political Forum on Sustainable Development (HLPF) met from 5-15 July in New York to review progress on the 17 Sustainable Development Goals (SDGs) and 169 targets. This first in-person meeting of the HLPF in three years reviewed five SDGs in particular: SDGs 4 (quality education), 5 (gender equality), 14 (life below water), 15 (life on land), and 17 (partnerships for the Goals). The impacts of the COVID-19 pandemic across all SDGs and the needs of developing countries, including a Multidimensional Vulnerability Index (MVI) were discussed. Forty-four countries presented their Voluntary National Reviews (VNRs) during HLPF 2022, which also began planning for the second “SDG Summit, which will be convened in September 2023 during the UN General Assembly. HLPF adopted a 142-paragraph Ministerial Declaration that had been negotiated by Member States over a period of six months. Differences in approach to sustainable development were visible, on issues such as sexual and reproductive health and rights for women and girls. The meeting was attended by six Heads of State and Government, more than 130 deputy prime-ministers, ministers, and vice-ministers, as well as other representatives from governments, intergovernmental organizations, and civil society. A more detailed summary is available at <https://enb.iisd.org/sites/default/files/2022-07/enb3383e.pdf>.

### **Parties to the Montreal Protocol hold Meetings**

The Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (OEWG 44), met during 11-16 July in Bangkok and took up discussion on strengthening monitoring arrangements to address discrepancies between atmospheric monitoring and on-the-ground

observations and gaps in global monitoring of ozone depleting substances (ODS) and specific usage and production of some substances, namely methyl bromide and carbon tetrachloride (CTC). Also discussed was Energy efficiency and phasedown of hydrofluorocarbons (HFCs) in view of the January 2024 deadline, when Article 5 countries (developing countries) will freeze HFC use. Parties also discussed options for a possible restructuring of the Protocol's Technology and Economic Assessment Panel (TEAP). The thirty-fourth Meeting of the Parties (MOP 34) discussed stocks and quarantine and pre-shipment uses of methyl bromide, CTC; a European Union proposal on identifying sources of emissions originating from industrial processes. The replenishment of the MLF was agreed with a budget of USD 540 million, of which USD 475 million is expected in new contributions. Significant remaining carryover funds from the 2018-2020 triennium will be held as investments for future implementation of the Protocol. An Extraordinary Meeting of Parties (Ex-MOP 5) convened at the close of OEWG 44, on 16 July to adopt the MLF decisions. For more details see [https://enb.iisd.org/sites/default/files/2022-07/enb19158e\\_2.pdf](https://enb.iisd.org/sites/default/files/2022-07/enb19158e_2.pdf)

### **RIS course on Science Diplomacy Planned in January 2023**

RIS is planning to organise a course on Science Diplomacy For international participants from partner countries of the ITEC programme of the Ministry of External Affairs, Government of India. This course will be similar to the courses organised in 2017, 2018, 2019, and 2020, and is planned for January 2023, for two weeks duration. Details will be indicated as soon as the course is finalised. The participation is open to science policy makers, diplomats and scientists from ITEC partner countries.

### **RIS and GSEJ Invite Papers for Science Diplomacy Review Special Issue**

The Science Diplomacy Review (SDR) is a peer-reviewed and open access journal published by the Forum for Indian Science Diplomacy (FISD) based at Research and Information System for Developing Countries (RIS), an autonomous independent policy research think tank with India's Ministry of External Affairs. SDR's special issue titled '*New Dimensions of Science Diplomacy for the Twenty-First Century*' will be published in collaboration between RIS and the Centre for Global Science and Epistemic Justice (GSEJ) at the University of Kent, UK. We invite contributions that unpack the idea of 'science diplomacy' through examinations on past and emerging experiences. Authors may submit full length research articles (4,000-5,000 words) as well as shorter articles and commentaries (1,500-3,000 words). Papers that focus on non-state actors and/or from the Global South perspectives, and papers with novel research methods are particularly welcome. The last date for submission of the full paper is 2 August 2022. The details are available at <http://fisd.in>.

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

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