FORUM FOR INDIAN SCIENCE DIPLOMACY

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# NEWS ALERT

*Forum for Indian Science Diplomacy*

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## GLOBAL

### Graphene filter makes carbon capture more efficient and cheaper

A team from EPFL Switzerland has developed the world's thinnest filter from graphene which can separate carbon dioxide from a mix of gases such as those coming out of industrial emissions and did so with an efficiency and speed that surpasses most current filters. They made carbon dioxide-sized holes in graphene, which allowed carbon dioxide to flow through while blocking other gases such as nitrogen, which are larger than carbon dioxide. While current filters are required to exceed 1000 gas permeation units (GPUs), and "carbon dioxide/nitrogen separation factor" must be above 20, the new membranes show more than ten-fold higher carbon dioxide permeability at 11,800 GPUs, while their separation factor stands at 22.5. This technology could drop the cost of carbon capture close to $30 per ton of carbon dioxide. The team is now working on scaling up the process by developing a pilot plant demonstrator.

### New immunotherapy target for malignant brain tumors

Scientists from the US have discovered a potential new target for immunotherapy of malignant brain tumors by harnessing the body's immune system.The scientists found that the CD161 protein, encoded by the KLRB1 gene, inhibits the tumor cell-killing function of T cells. This strategy was tested in two different animal models and gene-edited T cells slowed the growth of the tumors, while conferring a significant survival benefit in both the animal models. This offers an opportunity for immunotherapy to diffuse gliomas and other human cancers in future.

**Novel two-polymer membrane boosts hydrogen fuel cell performance**

Scientists from Korea have developed a novel membrane for fuel cells that is both thin and strong, by chemically bonding two commercially available polymers, PPO and SEBS, without using a crosslinking agent. They also added a compound called triazole to PPO in order to increase the membrane's ion conductivity. Membranes fabricated using this method were up to 10 μm thin and had excellent mechanical strength, chemical stability, and conductivity at even a 95% room humidity. Together, these conferred a high overall performance to the membrane and to the corresponding fuel cell on which the scientists tested their membrane. When operated at 60°C, this fuel cell exhibited stable performance for 300 hours with a maximum power density surpassing those of existing commercial anion exchange membranes and matching cutting-edge ones. This technology can be applied not only to fuel cells that generate energy, but also to water electrolysis technology that produces hydrogen.

**Measuring the tRNA world**

Researchers at the Max Planck Institute of Biochemistry have used mim-tRNAseq, a method to quantify tRNAs in any organism. Measuring the amount of each tRNA in cells has been limited by technical challenges till now, but the team tackled these challenges with novel computational approaches, including the use of modification annotation to guide accurate read alignment, to assign each DNA read to the tRNA molecule it originated from. The resulting toolkit is packaged into a freely available pipeline for alignment, analysis and visualization of tRNA-derived sequencing data. Researchers can use mim-tRNAseq to not only measure tRNA abundance, but also to map and quantify tRNA modifications. This also opens up opportunities to help tackle many outstanding questions about tRNA biology in health and disease.

## COVID-19

### COVID-19 (WORLD)

**Micro Chip simplifies COVID-19 testing, delivers results quickly on a phone**

Rice University engineers have developed a stamp-sized microfluidic chip that measures the concentration of SARS-CoV-2 nucleocapsid (N) protein in blood serum from a standard finger prick. The nanobeads bind to SARS-CoV-2 N protein, a biomarker for COVID-19, in the chip and transport it to an electrochemical sensor that detects minute amount of the biomarker in 55 minutes time.The process simplifies sample handling compared to swab-based PCR tests.The entire system is easily transportable and easy to use. A capillary tube is used to deliver the sample to the chip, which is then placed on a magnet that pulls the beads toward an electrochemical sensor coated with capture antibodies. The beads bind to the capture antibodies and generate a current proportional to the concentration of biomarker in the sample and sends a signal to its phone app. If there are no COVID-19 biomarkers, the beads do not bind to the sensor and get washed away inside the chip.

**First complete coronavirus model developed**

Researchers at University of Chicago developed a new multiscale coarse-grained model of the complete SARS-CoV-2 virion, its core genetic material and virion shell, for the first time using supercomputers. The process involved computational modelling combined with experimental data to provide insights into the behaviour of the virion. The model offers scientists the potential for new ways to exploit the virus's vulnerabilities.The early results of the study showed how the spike proteins on the surface of the virus move cooperatively which provides information on how the coronavirus explores and detects the ACE2 receptors of a potential host cell.The ultimate goal of the model would be to study the virion attractions and

interactions with ACE2 receptors on cells and to understand the origins of that attraction and how those proteins work together to go on to the virus fusion process.

**A peptide inhibits virus transmission in ferrets**

Researchers from the US have designed lipopeptide fusion inhibitors that block the first step of infection, i.e., membrane fusion between the viral and host cell membranes. The study was carried out in ferrets where some ferrets were dosed with the peptide before being co-housed with SARS-CoV-2-infected ferrets for 24 hours while others were not. After a period of 24 hours, SARS-CoV-2 was not detected in the throats or noses of any treated ferrets, while infectious virus was detected in all untreated ones. In further experiments with ferrets, the researchers also found that administration of the peptide intranasally just two hours before exposure delayed infection. These lipopeptides are highly stable and could be applied for safe and effective intranasal prophylaxis to reduce transmission of SARS-CoV-2.

**Model to estimate false-negative rate for COVID-19 tests**

Researchers at Beth Israel Deaconess Medical Center (BIDMC) have developed a mathematical model to assess the sensitivity of clinical tests conducted for COVID-19, by determining the tests' false-negative rate i.e., how many people are missed in a given assay. The researchers estimated the clinical sensitivity and the false-negative rate first for all the in-house tests conducted in the medical center by analyzing repeat test results for the nearly 5,000 patients who tested positive. They found that the in-house test provided a false negative in about 10 percent of cases, giving the assay a clinical sensitivity of about 90 percent. The team did calculations on the basis of each tests' limit of detection (LoD), defined as the smallest amount of viral DNA detectable that a test will catch 95 percent or more of the time, to estimate the accuracy of assays. The LoD can be used as a proxy to estimate a given assay's clinical sensitivity.

**Real-world effectiveness of COVID-19 Pfizer vaccine**

The Clalit Research Institute, in collaboration with researchers from Harvard University, analyzed one of the world's largest integrated health record databases to examine the effectiveness of the Pfizer vaccine against COVID-19. The study examined data on 600,000 vaccinated individuals in Israel, along with 600,000 matched unvaccinated controls. The study showed two doses of Pfizer/BioNTech vaccine reduced symptomatic COVID-19 by 94%and severe disease by 92%. Single dose reduced symptomatic COVID-19 by 57%and severe disease by 62%. Vaccine effectiveness was found to be similar across age groups. During the study, B.1.1.7 variant became dominant in Israel.

**COVID-19 (INDIA)**

**Coronavirus survives longer on glass, plastic than on cloth and paper**

Researchers from the Indian Institute of Technology (IIT) Bombay have discovered how SARS-CoV-2 survives for less time on porous surfaces such as paper and clothes than on impermeable surfaces like glass and plastic. They analysed drying of droplets on impermeable and porous surfaces and found that a droplet remained liquid for a much shorter time on a porous surface, making it less favourable for the virus to survive. The study found that the virus can survive for four days on glass, and seven days on plastic and stainless steel. However, the virus survived for only three hours and two days on paper and cloth, respectively. The study suggested covering the furniture in hospitals and offices or seats in public places made of impermeable material, such as glass, stainless steel, plastic or laminated wood, by cloth can reduce the risk of infection upon touch.

## Biorepository for COVID-19 clinical samples

A biorepository for the COVID-19 clinical samples has been inaugurated at Institute of Life Sciences (DBT-ILS), Bhubaneswar. The repository now holds more than one thousand samples of nasopharyngeal swabs, blood, urine and saliva etc. from two hundred and two COVID patients. The institute has sequenced around five hundred viral genomes and established seventeen virus cultures to further the research and development efforts of COVID-19. Evaluation studies of potential drug and vaccine candidates are planned to be conducted in the coming days, for which the foundation stone of an Animal Challenge Study platform has been laid at DBT-ILS.

## GAVI inks pact with Serum Institute of India

GAVI, the vaccine alliance, has signed a Memorandum of Understanding with US vaccine maker Novavax and Serum Institute of India (SII) for the supply of about 1.1 billion doses of COVID-19 vaccine - NVX-CoV2373 to the WHO backed Covax facility. The vaccine technology developed by Novavax was transferred to SII with no upfront, milestone or technology transfer payments. The vaccine is to be manufactured and distributed globally by SII and Novavax. Novavax will supply the doses to high-income countries while SII will supply to the majority of the low, middle-income and upper-middle income countries utilising a 'tiered pricing schedule'.

## SARS-CoV-2 variants in India

The genetic sequencing study conducted by Centre for Cellular and Molecular Biology (CSIR-CCMB), Hyderabad during the course of the pandemic in 2020 analysed over 5,000 different variants of SARS-CoV-2 and their evolution over time in India. The study suggested that a few mutant variants of coronavirus are spreading more in some states in India and one such variant - the N440K which was found in very small numbers in September and October last year, is now getting a much bigger proportion in southern states. The study suggests a closer surveillance by extensive genome sequencing to properly understand the spread of N440K and other mutant strains in order to stop their spread.

## Third COVID-19 vaccination drive from March 1

The Centre gave nod to 24,000 designated private hospitals empanelled under Pradhan Mantri Jan ArogyaYojana to administer the COVID -19 vaccines along with the government hospitals to widen the ambit of the vaccination drive from March 1. The third phase will cover senior citizens above 60 and those above 45 years with comorbidities. The government hospital centres will administer the vaccine free of cost while the private ones will seek a charge for the same.

## India's vaccine diplomacy

India has sent consignments of COVID-19 vaccine to 20 countries. Around 36.194 million doses of vaccine vials have been sent to various countries, of which 6.75 million doses have been supplied as grant assistance and 29.444 million doses on commercial basis. India has offered COVID-19 vaccine to all UN peacekeepers - nearly 95,000 troops in 12 missions

around the world received vaccine doses. India also planned to create a regional network with 10 neighbouring countries to collate, compile and study data about the effectiveness of COVID-19 vaccines and also to promote technology-assisted epidemiology for preventing future pandemics.

## INDIA – SCIENCE & TECHNOLOGY

### Successful user trials of DRDO-developed Anti-Tank Guided Missile Systems

Joint user trials of indigenously designed and developed missile systems - Helina (Army Version) and Dhruvastra (Air Force Version) by Defence Research and Development Organisation (DRDO) has been carried out successfully from Advanced Light Helicopter (ALH) platform in desert ranges. The Helina and Dhruvastra are third generation, Lock on Before Launch (LOBL) fire and forget anti-tank guided missiles that can engage targets both in direct hit mode as well as top attack mode. The system has all-weather day and night capability and can defeat battle tanks with conventional armour as well as with explosive reactive armour. These missile systems are one of the most advanced anti-tank weapons in the world and are ready for induction now.

### CSIR and Bill & Melinda Gates Foundation, India sign MoU

Council of Scientific and Industrial Research (CSIR) and Bill & Melinda Gates Foundation have signed a Memorandum of Understanding (MoU) to work together in order to initiate scientific and technological collaborations towards development and promotion of health research in India. As per the MoU, the areas of research collaboration would include genetic diseases that impact infant and neonatal mortality; new diagnostics and devices for infectious disease and environmental surveillance; development of cost-effective processes for drug, vaccines, biologics, and diagnostics manufacturing; novel microbiome-directed foods; socio-economic impact of science and technological tools; and other areas of health and development with the objective to solve major health concerns that affect India and other developing countries.

### CSIR-CMERI unveils the Outdoor Air Purifier at its residential campus

CSIR-Central Mechanical Engineering Research Institute developed and unveiled an outdoor air purifier at its residential campus in Durgapur, West Bengal. The air purifier can reduce air pollution by 50% depending on the environment and pollution level, within a radial range of 5 meters.The air purifiers have been installed on the street light poles of the campus and run on solar power. It also has a customized adjustable timer that can be set for a specific time period of the day depending on the pollution level. The machine is cost effective and needs low maintenance, basically can be cleaned with vacuum cleaner.

### GINSERV Launches Gincelerator 2.0 with 18 Startups

India's technology business incubator GINSERV (Global Incubation Services) launched Gincelerator 2.0 with 18 startups to accelerate the growth and scale of Tech start-ups sustainably by providing access to mentors, industry experts, investors, and pilot access to potential customers. Gincelerator 2.0 is an accelerator program, designed to nurture startups from all over India. The 18 startups selected would be provided with a ‘startup kit’ worth INR 2.5 million for scaling up and to further strengthen the presence of GINSERV in education, medical and healthcare sectors.

### Liberalised guidelines for geo-spatial data

The Indian Government liberalised the guidelines for geo-spatial data. All geospatial data produced using public funds, except classified geospatial data collected by security/law enforcement agencies, will be made accessible for scientific, economic and developmental purposes to all Indian Entities and without any restrictions on their use. For Indian entities, there would be complete deregulation with no prior approvals, security clearances, licenses, etc. for acquisition and production of geospatial data and geospatial data services including maps. This move would help small businesses and corporations to gain tremendously from the application of innovative technologies based on modern geospatial data technologies and mapping services.

## IN BRIEF

### Cerium sidelines silver to make drug precursor

Rice University scientists developed a greatly simplified method to make fluoroketones, precursors for drug design and manufacture that typically required a silver catalyst. The researchers have introduced a process for the rapid and scalable synthesis of fluoroketones that have until now been challenging and expensive to make. The new process replaced silver with cerium-based ceric ammonium nitrate (CAN), which produces functional precursors under mild conditions in about 30 minutes. Using this process they have been able to put fluorine in specific places in the molecule where it could make a difference instead of the usual process that requires a lot of silver to act as a catalyst, longer exposure time at high temperature and carefully controlled nitrogen or argon atmosphere.

### Ecosystem collapse from the tropics to the Antarctic

A paper authored by 38 Australian, UK and US scientists from universities and government agencies, based on empirical studies and extensive case studies that examined the current state and recent trajectories of 19 marine and terrestrial ecosystems across all Australian states, spanning 58° of latitude from coral reefs to Antarctica showed the key ecosystems around Australia and Antarctica are collapsing i.e., irreversible change to ecosystem structure, composition and function. The drivers of ecosystem collapse are pressures from global climate change and regional human impacts. The paper recommends a new '3As' framework – Awareness, Anticipation and Action, to guide decision-making about actions to combat irreversible damage.

### Improved carrier for mRNA vaccine for cancer immunotherapy

Researchers from Institutes under Chinese Academy of Sciences, China developed an injectable hydrogel (ovalbumin, a model antigen) which can release mRNA and adjuvants nanovaccines for at least 30 days after subcutaneous injection. The released nanovaccines can protect the mRNA from degradation and confer targeted delivering capacity to lymph nodes. The study was conducted on mice with melanoma tumors to show that the mRNA vaccine released after injection, activated T cells and stimulated antibody production, causing tumors to shrink in the treated mice in contrast to untreated mice. Also the vaccinated mice did not show any metastasis to the lung. The results demonstrate that the hydrogel has great potential for achieving long-lasting and efficient cancer immunotherapy with only a single treatment.

### Graphene creates tiniest microchips yet

Researchers at the University of Sussex, have created kinks in the structure of graphene and other 2D materials to behave like a microchip, which is around 100 times smaller than conventional microchips. This next generation microchips has the potential to lead computers and phones run thousands of times faster. The development is greener and is a sustainable

technology, as no additional materials are added, and the process works at room temperature rather than high temperature, thereby, consuming less energy to create.

**3D-printed perovskites on graphene makes next-gen X-ray detectors**

Scientists from Switzerland have used 3D aerosol jet-printing for producing highly efficient X-ray detectors that can be easily integrated into standard microelectronics to considerably improve the performance of medical imaging devices. The new detectors are made up by graphene and perovskites, which are materials made up of organic compounds bound to a metal. They are versatile and easy to synthesize. In a device, the perovskite acts as the photon detector and electron discharger while the graphene amplifies the outgoing electrical signal. The research team used the methylammonium lead iodide perovskite (MAPbI3), and produced X-ray detectors with a record sensitivity and a four-fold improvement on the best-in-class medical imaging devices. Another advantage of the perovskite-graphene detector is that it is simple to form images using it.

**Pesticide imidacloprid threatens future for key pollinator**

Researchers at University of Guelph, Canada studied the impacts of pesticide- imidacloprid (used to control pest infestations on squash and pumpkins), on ground-nesting bees, one of the major pollinators, in a real-world context. The study was conducted for three years to determine the long term impacts of the pesticide and the result showed that, imidacloprid exposure led to 85 percent fewer nest building among female hoary squash bees. They collected less pollen from crop flowers and produced 89 percent fewer offspring than unexposed bees. The neonic imidacloprid kills insects by attacking their nervous systems, affecting learning, foraging and navigation in many kinds of bees. The study provides evidence to farmers and regulators on the need to look at alternatives for imidacloprid application to soil for controlling pests.

## RESOURCES AND EVENTS

**Perseverance Mission arrives at Mars surface**

NASA's Mars 2020 Perseverance mission's rover landed successfully in Jezero Crater on Mars at 2055 GMT on February 18, 2021. Perseverance's aluminum wheels made contact with the surface at 2.6 km per hour, after being lowered from the hovering descent stage by cables from a sky crane. The descent stage then flew off to crash at a safe distance. The descent stage had entered the Martian atmosphere at a speed of 5.8 km per second, protected by a heat shield, and slowed down by deploying a massive parachute. All these manoeuvres were done by onboard computers and AI systems. The Ingenuity helicopter on board the Perseverance rover will be used to explore the Martian surface while the rover will collect samples of Martian rock and soil for future recovery to Earth by another mission. The spectacular videos of the landing can be seen at https://youtu.be/4czjS9h4Fpg

**India introduces Information Technology Rules regarding digital media**

Amidst growing concerns around lack of transparency, accountability and rights of users related to digital media, Government of India has framed new rules, after elaborate consultations with stakeholders. These Rules shall be administered by Ministry of Electronics and IT and the Ministry of Information and Broadcasting.The Rules prescribe due diligence that must be followed by intermediaries, including social media intermediariesand provide a grievance redressal mechanism for receiving and resolving complaints from the users or victims.The Rules require the social media intermediaries with larger number of users to follow

certain additional due diligence. A Digital Media Ethics Code Relating to Digital Media and OTT Platforms has been provided, administered by Ministry of Information and Broadcasting.

### US formally re-joins the Paris Agreement

The executive order notifying the UN that the US was re-joining the Paris Agreement has now entered into force. The US is expected to submit a new national contribution to the agreement, prior to the next COP 26 in Glasgow. Net zero pledges and upgraded 2030 emissions targets from major emitters such as China, Japan and the EU has put pressure on the US to catch up. Under Obama, the US had committed to reducing emissions by 26-28% by 2025, compared to 2005 levels – a target which it may not meet. Climate groups are calling on Biden to ensure that the US contributes its "fair share" to limiting global warming to 1.5 degree Celsius, the toughest target in the Paris Agreement and to commit $8 billion to the Green Climate Fund.

### UNFCCC Report calls for More Ambitious Targets of Paris Agreement

The United Nations Framework Convention on Climate Change (UNFCCC), released its Nationally Determined Contributions (NDC's) report on February 26. The report said that for limiting global warming to below 2 degree Celsius, carbon dioxide emissions need to decrease by about 25 percent by 2030 from the 2010 level and reach net zero around 2070. It warned that the estimated reductions fall far short of what is required, though many countries have strengthened their commitments to reducing or limiting emissions by 2025 or 2030.The report urges parties to further strengthen their mitigation commitments under the Paris Agreement. The UNFCCC report is based on information from 48 NDC's that represent 75 members of the Conference of the Parties of the UNFCCC. The final version is scheduled for release before the Glasgow Climate talks in November 2021. Data from some major greenhouse gas emitters such as the US, China and India is awaited.

### Waste reduction solutions provided at India-Australia Circular Economy Hackathon

The India-Australia Circular Economy hackathon (I-ACE) which saw more than 200 participants in 39 teams from India and 33 teams from Australia, provided waste reduction technologies and waste to wealth solutions. The I-ACE Hackathon was organised jointly by Atal Innovation Mission, NITI Aayog, India and Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia. Two university teams and two start-up/MSMEs from India and Australia were declared as winners and each will be supported by the innovation and incubation ecosystems of Atal Innovation Mission, NITI Aayog and CSIRO Australia to develop their solutions into products

## SCIENCE POLICY AND DIPLOMACY

### India inks new agreement with Australia on space collaboration

India signed a new agreement with Australia to expand on space collaboration. The Memorandum of Understanding between the Australian Space Agency and the Indian Space Research Organisation (ISRO), builds on the Comprehensive Strategic Partnership between Australia and India to collaborate on new areas in space technology, applications, education, and outreach. The space agencies of India and Australia have been working together to position Indian tracking facilities in Australia as part of India's Gaganyaan missions, which will place India as the fourth country to put humans in space.

## EU proposes reforms of Energy Charter Treaty

The European Union has renewed its push for reforming the Energy Charter Treaty (ECT, 1990) which protects energy investment and allows fossil fuel companies to sue nations when climate policies affect their profits.While the EU can leave the treaty, the ECT's rules apply for 20 years after leaving. The EU has submitted reform proposals to the ECT to be discussed at negotiations on 2-5 March. The proposal would protect existing fossil fuel infrastructure for ten years after the amendment comes into force. New power generation would be protected during that period if it emitted less than 380g of CO2 per kWh, covering efficient gas-fired plants as well as renewables. This is well above the EU target of less than 100g of CO2 per kWh, requiring carbon capture and storage. The EU also seeks to extend protection to hydrogen, biomass and biogas investments. Some observers say that full alignment with the Paris Agreement on climate change is incompatible with the ECT.

## Climate linked trade wars loom at WTO

Former Nigerian finance minister Okonjo-Iweala was appointed Director General of WTO which is set to become a battleground for climate action. The European Union is drawing up plans to tax polluting products at its border, with the US and UK considering similar measures. Russia and Australia argue such carbon border taxes are against the WTO's anti-protectionism rules.Any member of the WTO could challenge a carbon tariff in front of a dispute settlement panel and then an appeal panel. The EU has proposed removing tariffs on renewable energy technology and services, for discussion at a WTO ministerial conference in Kazakhstan in June.

## Deep seabed mining must benefit all humankind

The International Seabed Authority (ISA) is currently developing regulations to govern the exploration and exploitation of the mineral resources of the international seabed (known as "the Area"), including a financial mechanism for the distribution of benefits, as required by the UN Convention of the Law of the Sea (UNCLOS). The current proposals focus substantially on the financial burden facing contractors and fails to adequately consider the potential environmental and socio-economic damage. A new IASS Policy Brief offers three messages to guide the development of the financial mechanism - (1) A holistic accounting system based on true cost and natural wealth (2) A payment regime responsive to the concerns and priorities of diverse stakeholders (3) Keep the interests of humankind, and in particular of developing countries at its centre.

## UNEP Report Offers Blueprint for Tackling Planetary Crises

The UN Environment Programme (UNEP) has issued a report 'Making Peace with Nature: A Scientific Blueprint' calling for ambitious, coordinated action by governments, businesses, and people around the globe to prevent and reverse the worst impacts of environmental degradation by transforming our energy, water, and food systems. Transformation of social and economic systems, it says, can be achieved by improving our relationship with nature and putting its value at the heart of decision making. The report recommends reforming trade systems to make them fairer and environmentally sustainable and eliminating perverse subsidies and taxes that promote wasteful and harmful use of natural resources. The report comes ahead of the online session of the fifth session of the UN Environment Assembly (UNEA-5).

## India-EU Joint Committee on S&T Cooperation creates action-oriented agenda

The India-EU 13th Joint steering committee on science and technology has agreed to develop and adopt a long-term strategic perspective for India-EU collaboration in research and innovation. Taking into account the joint statement and the 'EU-India Strategic Partnership: A Roadmap to 2025', adopted at the EU-India July Summit, both sides showed keen interest for possible cooperation on ICT, in particular, cyber-physical-systems (ICPS), including artificial intelligence and robotics, circular economy and resource efficiency (waste-to-energy; plastics; etc.), electric mobility and sustainable agro-food processing etc. Both the sides also reiterated their commitment to human capital development, including researchers' training and mobility, based on mutual interests and reciprocate promotion of each other's equivalent programmes, for a balanced flow of researchers between Europe and India.

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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