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## NEWS ALERT

*Forum for Indian Science Diplomacy*

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## **GLOBAL**

[Producing highly efficient LEDs based on 2D perovskite films](#)

Researchers from Hong Kong have developed a 2D perovskite material for the most efficient LEDs. They worked with two-dimensional (2D) perovskites (also known as Ruddlesden-Popper perovskites) and succeeded in making very efficient and bright LEDs, with best-reported performance on both current efficiency and external quantum efficiency for devices based on this kind of perovskites. They added around 10% of a simple organic molecule called methanesulfonate (MeS) to the 2D perovskites of nanometre level thickness. The MeS reconstructs the structure of the 2D perovskite nanosheets, and greatly enhances the electroluminescence of the thicker, green-emitting perovskite sheets within the 2D structure. The MeS is also useful in reducing the number of defects in the 2D perovskite structure and improves light production. The devices produced brightness of 13,400 candela/m<sup>2</sup> at a low applied voltage of 5.5 V, with external quantum efficiency of 20.5%. The new 2D perovskites could be useful for future commercial LEDs, and display technology.

[Nuclear engineering researchers develop superior alloy](#)

Texas A&M University researchers have developed a new oxide dispersion strengthened (ODS) alloy for use in nuclear reactors. ODS alloys consist of a combination of metals interspersed with small, nanometer-sized oxide particles and are known for their high creep resistance and to keep their shape from deforming at high temperatures up to 1,000 C found in power generation and high performance aero engines. The nuclear community needs material which has high strength, radiation tolerance and resistance to void swelling due to intense neutron bombardment. The new ODS alloys have oxide particles embedded in the martensitic phase and are able to survive up to 400 displacements per atom and are some of the most successful alloys developed in the field, both in terms of high-temperature strength and superior-swelling resistance.

[Nanoprobes for precise cancer detection](#)

Researchers at Imperial College London have developed and patented new nanoprobes,

named bioharmonophores, which emit light using second harmonic generation. The nanoprobe have been tested in zebrafish embryos, which could target cancer cells and highlight tumours more brightly and for longer periods than fluorescent nanoprobe. The bioharmonophores with outstanding detection sensitivity can attach to specific tumour cells unlike fluorescence-enabled nanoprobe, which tend to misrepresent healthy cells as tumour cells, or vice versa. The bioharmonophores are biocompatible and biodegradable and can be powerful tools in diagnosing location, shape and size of cancers in the body. Future research is underway to determine how bioharmonophores could be used to guide surgical interventions during cancer surgery, and to kill tumour cells with high precision.

### [Novel hydrogen fuel purification membrane for greener future](#)

A group of researchers from Japan and France have successfully characterized a novel membrane that allows highly selective separation of hydrogen gas generated from the photoelectrochemical (PEC) water splitting reaction. Hydrogen is a clean source of fuel, but its purification has been challenging. The researchers first developed an organic-inorganic hybrid polymeric membrane i.e., polycarbosilane membrane which showed high hydrophobicity when tested under PEC reaction conditions. Later under the flow of a simulated highly humid gas mixture at 50°C, the PCS membrane exhibited excellent hydrogen selectivity, and the preferential hydrogen permeation was governed by the solid state diffusion mechanism. The commercial adoption of this new technology would facilitate environmental-friendly and sustainable hydrogen production and the use of hydrogen fuel for energy needs.

### [Gene editor to correct disease-causing mutations](#)

A team of researchers from the Genome Institute of Singapore have developed a CRISPR-based gene editor, C-to-G Base Editor (CGBE), to correct single nucleotide mutations that cause genetic disorders. The most common mutation by far is the single-based substitution, in which a single-base in the DNA (such as G) is replaced by another base (such as C) causing genetic disorders such as cystic fibrosis, sickle cell anemia etc. The CGBE gene editor can fix this substitution by precisely changing the defective C within the genome to the desired G base and, consequently treating the genetic disorder. The CGBE tool developed consists of three parts: 1) a modified CRISPR-Cas9 will pinpoint the mutant gene and focus the entire editor on that gene; 2) a deaminase (an enzyme that removes the amino group from a compound) will then target the defective C, and mark it for replacement, and 3) finally, a protein will initiate cellular mechanisms to replace that defective C with a G.

## COVID-19

### COVID-19 (WORLD)

#### [Nasal COVID-19 vaccine](#)

Finnish academic spin-out, Rokote Laboratories Finland Ltd. have developed a nasal spray vaccine against COVID-19. The vaccine is based on research carried out at the University of Helsinki and the University of Eastern Finland, and uses a safe adenovirus carrier that contains a cloned DNA strand, which causes nasopharyngeal cells to produce the virus protein which, in turn, produces a response to the vaccine. There is no actual SARS-CoV-2 virus in the vaccine. The vaccine performed well in animal studies, and human trials will start within a few months in Finland. Nasal administration of vaccine is expected to induce a wider immune response than intramuscular administration because nasal vaccines in addition to IgG antibodies produce an IgA response that protects mucous membranes.

### [Researchers discover SARS-CoV-2 inhibitors](#)

Researchers at the University of Bonn have discovered two families of active substances that can block the replication of the SARS-CoV-2 coronavirus. Customized compounds of both classes were synthesized and the drug candidates were able to switch off the key enzyme i.e., 'main protease' of the virus. The drug candidates stick to the main protease to block the crucial catalytic center, which prevents the enzyme from preparing the virus replication. The researchers also developed a new test system for high-throughput screening to find the main protease inhibitor. In the process, the enzyme was offered a substrate to couple and when the protease catalytically cleaved this coupling, the fluorescence of the product was measured and if the activity of the protease was successfully blocked by an inhibitor, there was no fluorescence. The study was based on laboratory experiments, and for further development of therapeutic drugs extensive clinical trial needs to be conducted.

### [Nanoparticle-delivered COVID-19 vaccine candidate shows promise](#)

Researchers from Cleveland Clinic's Global Center for Pathogen Research & Human Health have developed a promising new COVID-19 vaccine candidate that utilizes nanotechnology and has shown strong efficacy in animal models. The team's vaccine uses ferritin nanoparticles to deliver tiny, weakened fragments from the region of the SARS-CoV-2 spike protein. The researchers tested their vaccine candidate with intramuscularly and intranasally vaccine delivery on ferret COVID-19 models. After the second booster, all vaccinated models produced strong neutralizing antibodies. Ferritin nanoparticles are well-characterized for their strong temperature and chemical stability, suggesting the candidate vaccine may also be thermostable. These findings would soon be confirmed in human clinical trials.

### [Vaccine-induced antibodies may be less effective against several new SARS-CoV-2 variants](#)

Researchers at the Ragon Institute of MGH, MIT and Harvard and at Massachusetts General Hospital found that the neutralizing antibodies induced by the Pfizer and Moderna COVID-19 vaccines were significantly less effective against the variants first described in Brazil/Japan and South Africa. The team created assays to measure neutralizing antibodies for COVID-19, and compared how the antibodies worked against the original strain versus the new variants. The vaccine-induced neutralizing antibodies were tested against the different strains and found that the three new strains first described in South Africa were twenty to forty times more resistant to neutralization, and the two strains first described in Brazil and Japan were five to seven times more resistant, compared to the original SARS-CoV-2 virus. However, the study team mentioned that though the ability of these variants to resist neutralizing antibodies was of concern, the vaccines available would still be effective because the human body has other methods of immune protection besides antibodies.

### [Immunogenicity of Janssen/Johnson & Johnson vaccine for COVID-19](#)

The phase 1 clinical trial of Janssen/Johnson & Johnson vaccine candidate - Ad26.COV2.S conducted at a single clinical site in Boston, Massachusetts, revealed that single dose of the vaccine induced rapid binding and neutralization antibody responses along with cellular immune responses. The phase 1 clinical trial (randomized, double-blind, placebo-controlled) enrolled 25 participants and antibodies were detected in vaccine recipients by day 8 and were observed in all vaccine recipients by day 57 after a single dose. Two phase 3 clinical trials are currently underway to determine the efficacy of the Ad26.COV2.S vaccine.

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

### **Phase 3 Clinical Trial of Covaxin shows 81% efficacy**

The Phase 3 clinical trial of Covaxin, developed by Indian Council of Medical Research (ICMR) in partnership with Bharat Biotech International Limited (BBIL) was jointly initiated by ICMR and BBIL in mid-November 2020. It was conducted in a total of 25,800 individuals across 21 sites. The results showed interim vaccine efficacy of 81%, analyzed as per the protocol approved by the Drug Controller General of India (DCGI). Covaxin is the first COVID-19 vaccine that has been developed completely in India. Phase 1 and Phase 2 clinical trials conducted in 755 participants demonstrated high safety profile of the candidate vaccine with seroconversion rates of 98.3% and 81.1% on day 56 and 104 respectively. Covaxin has been developed on the WHO prequalified verocell platform, which is globally recognized with a well-established track record of safety. Covaxin's ability to neutralize UK variant strain of SARS-CoV-2 has also recently been established.

### **Bharat Biotech Covaxin granted restricted emergency use authorisation**

The COVID-19 vaccine, Covaxin indigenously developed by India's Bharat Biotech International limited (BBIL), has been granted permission for restricted use in emergency situations, and will no longer be used in a clinical trial mode. The Subject Expert Panel on COVID-19 of the CDSCO has recommended granting emergency use authorisation to BBIL's vaccine candidate Covaxin. Now, both the COVID-19 vaccines available in India -Covaxin and Covishield manufactured by Serum Institute of India have the same licensure status.

### **Computational tool to track COVID-19 mutations worldwide**

Scientists at the Tata Memorial Centre, Mumbai created a computational tool called the Infectious Pathogen Detector (IPD) that gives information on abundance, mutations and lineage of a COVID-19 sample. The IPD tool can automatically determine the abundance of SARS-CoV-2 genome sequences, carry out mutation analysis with respect to the virus sequence originated at Wuhan and based on the mutations seen in each sample assign it to the respective phylogenetic clade. The phylogenetic clade describes the series of mutations that occurred over time and helps scientists to trace the evolution of a new variant. The tool is freely available at <http://www.actrec.gov.in/pi-webpages/AmitDutt/IPD/IPD.html>

### **India's total vaccination coverage nearing 30 million**

The cumulative number of COVID-19 vaccine doses administered in the country has crossed 29.7 million on the 58th day of the vaccination drive. The beneficiaries vaccinated include health care workers (7.3 million have taken the first dose and 4.3 million have taken the second dose); frontline workers (7.3 million have taken the first dose and 1.14 million have taken the second dose); beneficiaries more than 60 years (8.19 million have taken the first dose) and beneficiaries aged 45-60 with specific co-morbidities (1.44 million have taken the first dose). The day 56 witnessed administration of more than 2 million vaccine doses through 30,561 sessions, which amounted to the highest single day vaccine administration so far.

### **COVID-19 cases rising in six states**

Six states of India - Maharashtra, Kerala, Punjab, Karnataka, Gujarat and Tamil Nadu continue to report a surge in daily COVID-19 cases, accounting for 85.6 percent of the new cases. India saw the highest single day spike of new COVID-19 infections this year, with the

country reporting as many as 27,512 new cases on 12 March. Of the new cases registered in the last few days, Maharashtra has reported the highest daily new cases (about 60% of the daily new cases), followed by Kerala and Punjab. Also, Andhra Pradesh and national capital Delhi is witnessing a surge in new cases since the second week of March.

## INDIA – SCIENCE & TECHNOLOGY

### [Commercial launch of PSLV-C51/Amazonia-1 Mission](#)

India's Polar Satellite Launch Vehicle PSLV-C51 successfully launched Brazil's Amazonia-1 satellite along with 18 co-passenger satellites from Satish Dhawan Space Centre SHAR, Sriharikota. PSLV-C51/Amazonia-1 is the first dedicated commercial mission of New Space India Limited (NSIL), under the Department of Space. The vehicle successfully injected the Amazonia-1 into its intended orbit and all the 18 co-passenger satellites successfully separated from the PSLV in a predetermined sequence. This satellite would further strengthen the existing structure by providing remote sensing data to users for monitoring deforestation in the Amazon region and analysis of diversified agriculture across the Brazilian territory.

### [IIT Delhi researchers develop technology to recycle e-waste](#)

Researchers at Indian Institute of Technology, Delhi have adopted a methodology that uses e-waste as an "Urban Mine" for metal recovery and energy production. In the three step process the e-waste is shredded and pyrolyzed to yield liquid and gaseous fuels, leaving behind a metal-rich solid fraction. On further separation using a novel technique, the leftover solid residue yields a 90-95% pure metal mixture and some carbonaceous materials. The carbonaceous material is further converted to aerogel for oil spillage cleaning, dye removal, carbon dioxide capture, and usage in supercapacitors. The developed technology has been an initiative to cater to the needs of smart cities.

### [Indigenously designed and developed spectrograph, commissioned on Devasthal Optical Telescope](#)

Researchers at Aryabhata Research Institute of observational sciences (ARIES), Nainital, designed and developed a low-cost optical spectrograph that can locate sources of faint light from distant quasars and galaxies in a very young universe, regions around supermassive black-holes around the galaxies, and cosmic explosions. The spectrograph, the largest of its kind in the country, has been successfully commissioned on the 3.6-m Devasthal Optical Telescope (DOT), near Nainital, Uttarakhand. Expertise from various national institutes, organizations, including the Indian Space Research Organization (ISRO) and some micro-small-medium-enterprises, were involved to review and build parts of the instrument. ARIES with these expertises further plans to commission more complex instruments such as spectro-polarimeter and high spectral resolution spectrograph on the 3.6-m Devasthal telescope in the near future.

### [Indo-French researchers develop molecular sensor to spot new drugs of therapeutic value](#)

Researchers from Institute for Stem Cell Science and Regenerative Medicine, Bangalore, in collaboration with Curie Institute, France, funded by Indo-French Centre for the Promotion of Advanced Research (CEFIPRA), have developed a molecular sensor, which can identify cancer drugs of therapeutic value by detecting how such chemicals modify microtubules inside the living cells. The researchers have devised a method to design synthetic proteins, known as nanobodies (similar to antibodies), which can bind specifically to modified microtubules. The nanobody was then coupled with a fluorescent molecule to serve as a detection tool or sensor.

A live cell sensor against a unique microtubule modification called tyrosinated form of microtubule has been developed and validated. The tyrosination sensor is the first tubulin nanobody or sensor that can be used to study the dynamics of microtubule modifications in living cells.

### [MINT for Indian army under the self-reliance vision](#)

The Indian Army is set to procure 'Made in India' Mobile Integrated Network Terminal (MINT) systems under Make II Category of Defense Acquisition Procedure (DAP) 2020, to enhance its operational communication capability. The system is envisaged as a lightweight, portable, state of art integrated communication solution with satellite backhaul and wireless access system to support voice, video and data. Indian industries have submitted responses and after evaluation a total of eleven firms have been issued with the Project Sanction Order for the development of prototype. The contract will subsequently be placed with one of the firms on successful development of prototype as per provisions of buy (Indian- Indigenously Designed, Developed and Manufactured) of DAP - 2020.

## IN BRIEF

### [Unique sensor network for measuring greenhouse gases](#)

Scientists at the Technical University of Munich developed a fully automated sensor network for measuring urban greenhouse gas emissions by ground-based remote sensing of the atmosphere. The sensor network - Munich Urban Carbon Column network consists of five high-precision optical instruments that analyze the sun's light spectra and measure the concentration of the gases like carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and carbon monoxide (CO). The concentrations of these gases can be determined in the columns of air between the instruments and the sun, based on the unique spectral fingerprint of the gases. Based on the inputs of the sensor data and meteorological parameters, high-performance computers can create a spatially resolved emission map of the city.

### [Action mechanism of a new antibiotic-Nybomycin](#)

Scientists from Skoltech and MSU, Russia, explored the mechanism of an antibiotic called nybomycin and found it to be effective against bacteria which are resistant to other antibiotics. The scientists studied in detail the inhibition of topoisomerases II in gram-negative bacteria using nybomycin, which blocked fluoroquinolone-sensitive and fluoroquinolone-resistant forms of gyrase in *Escherichia coli*. Type II topoisomerase mostly acts as a target for antibiotics, including the fluoroquinolones (FQ) which is a common group of antibiotics comprised of levofloxacin, ciprofloxacin, and others. Unfortunately, bacteria easily acquire resistance to FQs through mutations in topoisomerase-encoding genes.

### [Colour blindness-correcting contact lenses](#)

Researchers at American Chemical Society infused contact lenses with gold nanoparticles to treat colour blindness, which improved red-green contrast safely and effectively. Most people with this genetic disorder have trouble discriminating between red and green shades, and use red-tinted glasses which make those colours prominent to see, however these lenses are bulky and cannot fix vision problems. Using gold nanoparticles into contact lens material instead of dye, the gold nanocomposite lenses are more selective in the wavelengths they block than the glasses. The new lenses matched the wavelength range of the dyed contact lenses, and were suitable for people with red-green color issues without the potential safety concerns.

### [Red ginseng for suppression of lung cancer metastasis](#)

Researchers at the Korea Institute of Science and Technology and two other Korean institutes identified two components of red ginseng, Rk1 and Rg5, which can significantly suppress lung cancer metastasis induced by TGF- $\beta$ 1, opening opportunities for future development of anti-cancer drugs derived from natural products. However, the composition and activities of red ginseng vary depending on the processing method. The researchers developed a new microwave processing method for red ginseng that increases the concentration of three main active components, Rg3, Rk1, and Rg5, more than 20 times. This processing method can control the active ingredient contents of red ginseng leading to the possibility of developing customized functional materials for various diseases.

#### **[Recyclable bio-plastic membrane to clear oil spills from water](#)**

Scientists from universities in the Netherlands have developed a polymer membrane from biobased malic acid which can separate water and oil. The membrane is a super amphiphilic vitrimer epoxy resin membrane which enables developing a water film on the membrane's surface to keep the oil out of the pores and separate it from the water. The vitrimer plastic behaves like a thermoplastic and can be depolymerized and reused i.e., when the pores of the membrane are blocked by foulants, it can be depolymerized, cleaned and reused. The membrane is also fully recyclable as they form a dynamic network which enables recycling.

#### **[India's rice production needs adaptation to climate change to meet future needs](#)**

Researchers from University of Illinois conducted a study at the Borlaug Institute for South Asia's research farm in Bihar, India to estimate rice yield and water demand by 2050, and to evaluate how farmers can adapt to the effects of climate change. The researchers collected data on rice yield and climate conditions, then used computer simulations to model future scenarios based on four global climate models. The results show that the crop growth stage is shrinking and as a result the farmers do not get the full potential of the yield. If the farmers maintain current practices, then rice yield will decrease substantially by 2050. The study also provided a series of recommendations regarding management strategies like using direct-seeded rice instead of transplants, keeping crop residue on the ground to reduce water loss due to evaporation, reduction of post harvest loss etc. to mitigate the effects of climate change.

#### **[New genes for eye colour identified](#)**

Researchers at King's college London have identified 50 new genes for eye color in a study involving the genetic analysis of almost 195,000 people across Europe and Asia. Previously, scientists thought that variation in eye colour was controlled by one or two genes only, with brown eyes dominant over blue eyes. The team found that eye colour in Asians with different shades of brown is genetically similar to eye colour in Europeans ranging from dark brown to light blue. These findings will help to improve the understanding of eye diseases such as pigmentary glaucoma and ocular albinism, where eye pigment levels play important role.

## **RESOURCES AND EVENTS**

#### **[Perseverance Rover Successfully Performs Its First Drive on Mars](#)**

On 4 March 2021, NASA's Perseverance rover covered 6.5 m across the Martian landscape. Its first drive lasted about 33 minutes. The rover's software was updated to investigate the planet. The Radar Imager for Mars' Subsurface Experiment (RIMFAX) and Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) instruments were checked and the Mars Environmental Dynamics Analyzer (MEDA) instrument's two wind sensors were deployed. On

2 March the rover's 2-m long robotic arm was deployed. The mission's cameras have already sent over 8,000 images.

### **China announces major boost for R&D**

China is targeting annual increases of 7% or more on R&D spending in each of the next 5 years to 2025, according to a draft outline of the country's 14th Five-Year Plan. China's R & D spending could reach 2.8% of GDP by 2025, up from an estimated 2.3% to 2.4% for 2020. The plan calls for the central government to increase spending on basic research by more than 10% in 2021 and gives tax incentives for manufacturers to invest in research. A new Medium- and Long-Term Program for Science and Technology Development is to be released later. The 14th Five-Year Plan will be approved by the National People's Congress on 11 March.

### **Promotion of Domestic Manufacturing of drug intermediates and APIs**

To reduce India's import dependence of critical bulk drugs like drug intermediates and Active Pharmaceutical Ingredients (APIs), the Department of Pharmaceuticals launched a 'Production Linked Incentive Scheme' for promotion of domestic manufacturing by setting up Greenfield plants with minimum domestic value addition in four different target segments with a total outlay of Rs. 69.4 billion for the period 2020-21 to 2029-30. In total, 215 applications have been received for production of 36 products spread across the 4 target segments. The applications have been processed, scrutinised and approval has been accorded to about 40 applications. Setting of these plants will make the country self-reliant to a large extent with respect to these bulk drugs.

## **SCIENCE POLICY AND DIPLOMACY**

### **Quad leaders commits to boosting vaccine production**

The leaders of the four Quad countries – India, Japan, United States and Australia, meeting at the first Quad virtual summit held recently pledged to promote a free, open rules-based order, both in the Indo-Pacific and beyond and agreed to commit to manufacturing one billion doses of COVID-19 vaccine by 2022, for distribution in Asia. The US and Japan will contribute to the funding to expand India's manufacturing capacity, while Australia would provide the logistical support to strengthen access and 'last-mile' vaccine delivery in Southeast Asia and the Pacific. Formation of three new working groups have also been agreed which would devise implementation plans. The first one will comprise of vaccine experts, followed by two other working groups on climate change, and critical and emerging technology.

### **India and Norway agree to conduct marine spatial planning**

India and Norway have agreed to jointly work in the area of marine spatial planning in the oceanic space for the next five years to ensure that human activities at sea take place in an efficient, safe, and sustainable manner in areas such as energy, transportation, fisheries, aquaculture, tourism etc. across multiple sectors. This is a part of the Indo-Norway Integrated Ocean Initiative under the Memorandum of Understanding signed between the two countries in 2019. Lakshadweep and Puducherry have been identified as pilot sites for the project in view of unique opportunities for multiple sectors (such as industries, fisheries, and tourism) to flourish, and the programme can be replicated in other coastal regions of the country. It is part of India's (draft) Blue Economic Policy being developed by the Ministry of Earth Sciences.

### **New EU Trade Strategy for Climate Neutrality and Digital transition**

The European Commission has set out a new trade policy strategy for the EU in line with its commitment to fully implement the SDGs. The Commission places sustainability at the heart of the new trade strategy, and supports transformation towards a climate-neutral economy. The strategy aims to strengthen the capacity of trade to support both a climate and a digital transition. The strategy includes WTO reform including commitments on climate and trade and new rules on digital trade. The strategy seeks to ensure that trade tools accompany and support a global transition towards a climate-neutral economy, including by promoting circular, responsible, and sustainable value chains, accelerating investments in clean energy.

### **India, Fiji cooperation in the field of Agriculture and Allied Sectors**

The cabinet has approved the Memorandum of Understanding (MoU) between the Ministry of Agriculture and Farmers' Welfare of the Republic of India and Ministry of Agriculture of the Republic of Fiji for cooperation in the field of Agriculture and Allied Sectors. The MoU would facilitate exchange of research personnels, technology transfers, infrastructure development for agricultural development, joint ventures, direct trade of agriculture products through market access, etc. A Joint Working Group will be constituted to set down procedures and plan and recommend programs of cooperation towards achieving its aims through the Executing agencies of the two countries.

### **Call for Papers - Science Diplomacy Review (closing on 25th April 2021)**

RIS-FISD programme invites contributions for the next (July 2021) issue of its peer reviewed journal Science Diplomacy Review. For more details, see the call for papers:

[http://www.fisd.in/sites/default/files/Call%20for%20Papers\\_July%202021%20Issue\\_SDR9.pdf](http://www.fisd.in/sites/default/files/Call%20for%20Papers_July%202021%20Issue_SDR9.pdf)

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