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## NEWS ALERT

*Forum for Indian Science Diplomacy*

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## **GLOBAL**

### **Potential longer-lasting cholera vaccine**

Researchers from Michigan State University have developed a new type of cholera vaccine consisting of polysaccharides displayed on virus-like particles, which generates long-lasting antibody responses against *V. cholerae* in mice. The method efficiently links multiple copies of O-specific polysaccharide (OSP) to Q $\beta$ , a virus-like particle that infects bacteria. The team immunized mice with Q $\beta$ -OSP, observing that three doses caused a strong antibody response that persisted at least 265 days after the first dose. The immunized mice had antibodies that recognized the OSP from the natural lipopolysaccharide of *V. cholerae*. When the researchers mixed serum antibodies from the mice with other immune system proteins that kill bacteria and with live *V. cholerae*, antibodies from two of the five mice triggered more bacterial death than those from

mice immunized with Q $\beta$  alone. The virus-like particle could mimic natural bacteria by presenting multiple copies of OSP on its surface.

### **CROPSR to accelerate genetic discoveries**

A research team at University of Illinois at Urbana-Champaign has developed CROPSR, the first open-source software tool for genome-wide design and evaluation of guide RNA (gRNA) sequences for CRISPR/Cas9 experiments. The tool significantly shortens the time required to design a CRISPR experiment, reducing the challenge of working with crops and accelerating gRNA sequence design, evaluation, and validation. CROPSR provides the scientific community with new methods and a new workflow for performing CRISPR/Cas9 knockout experiments. The CROPSR scoring model provided much more accurate predictions, even in non-crop genomes.

### **DNA-based circuits assesses water quality**

Synthetic biologists at Northwestern University have developed a low-cost, easy-to-use, hand-held device that can let users know within minutes if the water is safe to drink. The new device works by using powerful and programmable genetic networks, which mimic electronic circuits to perform a range of logic functions. Among the DNA-based circuits, for example, the researchers engineered cell-free molecules into an analog-to-digital converter (ADC), a ubiquitous circuit type found in nearly all electronic devices. In the water-quality device, the ADC circuit processes an analog input (contaminants) and generates a digital output (a visual signal to inform the user). Equipped with a series of eight small test tubes, the device glows green when it detects a contaminant. The number of tubes that glow depend upon how much contamination is present. If only one tube glows, then the water sample has a trace level of contamination. But if all eight tubes glow, then the water is severely contaminated.

### **mRNA Vaccine technology to heal bone**

Researchers at Mayo Clinic, along with colleagues in the Netherlands and Germany, may have found a viable, less risky alternative messenger RNA that can enhance the regeneration of bone, by producing the FDA approved recombinant human bone morphogenetic protein-2, or BMP-2. The findings show that messenger RNA can be used at low doses to regenerate bone without side effects. Moreover, the quality of the new bone is superior to bone formed by BMP-2. The researchers also say that messenger RNA is a good choice for bone regeneration because it may not need repeat doses. They showed the new tissue growth that occurred after applying messenger RNA was biomechanically superior to the alternative method and remained so throughout eight weeks of monitoring.

### **Key protein in malaria parasite opens door to novel treatment**

An international team has discovered a protein that plays a key biological role in a parasite that causes malaria. Deactivating this protein reduces in vitro growth of Plasmodium falciparum, the protozoa behind the most virulent form of the disease, by more than 75 percent. This breakthrough could lead to the development of a treatment that targets a function of the parasite that no previous malaria drug has exploited. The protein discovered, PfPX1, is involved in transporting haemoglobin to these digestive vacuoles. The deactivate PfPX1 deprives the parasite of its main source of amino acids which impacts on its growth and survival and could be a potential new way to fight malaria. Since the protein is not present in humans, there would be decreased risk of disrupting any important functions in the human body.

### **Engineered bacterial strains could fertilize crops, reduce waterways pollution**

Researchers from Washington State University used gene editing techniques to engineer strains of the ubiquitous, nitrogen-fixing soil bacterium Azotobacter vinelandii to

produce ammonia at a constant level, regardless of environmental conditions surrounding the bacteria, and excrete it at high concentrations, transferring it into crop plants in lieu of conventional chemical fertilizers to effectively fertilize crops. The work helps provide a more complete, fundamental understanding of the factors that underpin gene expression in a model nitrogen fixing microorganism and defines the biochemistry that brings about ammonia excretion in *A. vinelandii*. Successful widespread adoption of these bio fertilizers for farming would reduce pollution, provide sustainable ways of managing the nitrogen cycle in soil, lower production costs and increase profit margins for farmers and enhance sustainable food production by improving soil fertility.

## COVID-19

### COVID-19 (WORLD)

#### [Rogue antibodies may trigger blood clots in COVID-19 patients](#)

Scientists at Michigan Medicine and the National Heart, Lung and Blood Institute have discovered that 'rogue' antibodies found in the blood of COVID-19 patients have the potential to cause endothelial cells to lose their resistance to clotting. These antiphospholipid auto-antibodies can trigger blood clots in the arteries and veins of patients with autoimmune disorders, including lupus and antiphospholipid syndrome. The findings provide an even stronger connection between auto-antibody formation and clotting in COVID-19.

### COVID-19 (INDIA)

#### [Potential antiviral agent serves as shield against viruses](#)

The researchers at the Indian Institute of Science (IISc), Bangalore, have through tests on lab-grown cells and experimental animals discovered that the biochemical called picolinic acid has strong antiviral activity against a wide range of enveloped viruses that cause illness in humans. In the cells, picolinic acid showed antiviral effects against the Hong Kong, alpha, beta, gamma, and delta variants of SARS-CoV-2 and against the seasonal and H1N1 pandemic influenza, dengue, Japanese encephalitis, Zika, human parainfluenza and herpes simplex viruses. In animal tests, picolinic acids obstructed virus replication and the disease products in hamsters infected with SARS-CoV-2 and in mice infected with an influenza virus. They have shown through their experiments that picolinic acid blocks the viral entry process by disrupting the viral membrane — a microscopic envelope-like coating on the virus — and blocking the fusion of the virus with its target cell.

## INDIA – SCIENCE & TECHNOLOGY

#### [Organic polymers to remove polar organic micropollutants from water](#)

Indian Institute of Science Education and Research Bhopal (IISER-B) researchers have developed organic polymers, which can remove highly polar organic micropollutants (POMs) from water. This process will render the water safe for consumption. These polymers have already been tested for polar organic micropollutants removal at a laboratory scale. Large-scale fabrication of these materials in collaboration with industrial partners will open up a promising avenue for real-time scavenging of toxic polar organic micropollutants from water. Called 'Hyper-cross linked Porous Organic Polymers' (HPOP), a teaspoon of the powder of these polymers will cover an internal surface area of 1,000-2,000 m<sup>2</sup>/g, which is close to 10 tennis courts.

#### [Technology for the repair and restoration of high-value components](#)

An IIT Bombay scientist has developed a novel technology that uses a laser for excellent process control and is completely autonomous with minimal to zero human

intervention. This ensures restoration with enhanced quality and repeatability. The technology can help repair and restore high-value components such as moulds, turbine blades, and other aerospace components. With the help of the technology, the defective component which requires repair will be scanned autonomously for damage detection via a laser scanner, and the deposition path will be determined based on certain algorithms. The laser-directed energy deposition (LDED) technique will be used to deposit the material, followed by finishing and automated inspection of the restored product. In addition, the process parameters will be obtained from physics-based models to induce favourable residual stress, which is one of the key limitations in restoration via additive manufacturing.

#### **Mobile solar pump for remote areas**

Researchers at the Indian Institute of Technology Bhubaneswar have developed a solar power system that can be easily moved between farms to pump water for irrigation. The kit comprises solar panels and an inverter to power a surface-mounted pump. The kit is useful for pumping water in remote areas and helps small scale farmers who could pool money to use the equipment on a shared basis. The technology has already been deployed in hard-to-reach areas of the state of Odisha. The system uses a tractor trolley with a foldable structure holding six panels. The system works with two different types of pumps, one submersible and the other surface-mounted. The movable structure is equipped with an inverter. The system can generate enough power to operate submersible and monoblock-pump AC motors even at low irradiation. The inverter circuitry is designed to achieve maximum solar energy harvesting with single-stage power conversion from DC to AC, thereby increasing reliability and reducing the overall cost. The system can also be operated from a single-phase grid electricity supply, if needed, and is designed to operate a 2hp AC pump with the inverter able to accommodate up to 5hp loads. The mobile solar pumps have been installed in 13 locations.

#### **Potential diagnostic biomarker for Japanese encephalitis virus**

National Institute of Animal Biotechnology, Hyderabad developed Fluorine Doped Tin Oxide (FTO) electrode fabricated with reduced Graphene Oxide (rGO) for as an electrochemical based immunosensor for the rapid, sensitive and specific detection of the Non-Structural 1 (NS1) secretory protein, which is a suitable biomarker for Japanese encephalitis virus (JEV) in the blood. The LOD (limit of detection) was determined to be more sensitive than other sensors developed for JEV and can detect the minimal infective dose of circulating NS1 ranging anywhere from 7-284 ng/ml in clinical samples as tested in other flaviviral infections. The fabricated immunosensor was also specific towards JEV NS1Ag. Therefore, the proposed immunosensor could be a promising candidate for the development of an accurate, and rapid, diagnosis for specific and sensitive detection of JEV from clinical samples.

#### **IIT Delhi designs new strategy for developing drug molecules**

Researchers from Indian Institute of Technology (IIT) Delhi have designed and demonstrated a new strategy for developing potential drug molecules for treating various diseases. They utilised tools of organic chemistry and biophysics to design molecules that target protein interfaces. The researchers have come up with a chemical strategy based on macromolecular mimicry. The research group developed a universal privileged scaffold approach for the design of a variety of inhibitors. The universal scaffold could be converted to a specific inhibitor for a given Protein-Protein Interaction (PPI), which makes the drug design approach relatively easier. It could be useful for treatment of Japanese Encephalitis Virus (JEV), the main cause for viral encephalitis in Southeast Asian countries, and protein aggregation diseases such as Alzheimer's. The JEV inhibitor drug molecule has also been patented.

### **Semiconductor sector in India takes a step forward**

The first call for applications has elicited a good response. Three companies Vedanta in JV with Foxconn; IGSS ventures pte, Singapore; ISMC have submitted applications for setting up 28 nm to 65nm Semiconductor Fabs with capacity of approx. 120,000 wafers per month and the projected investment of USD 13.6 Bn. Two companies viz., Vedanta and Elest have submitted applications for Display Fabs with the projected investment of USD 6.7 Bn. SCL Mohali has also been handed over to MeitY and is being opened up as a commercial fab for wider participation by Indian semiconductor design companies.

## **IN BRIEF**

### **Gene therapy for thalassemia ends need for transfusions in young children**

Over 90 percent of patients with transfusion-dependent thalassemia, an inherited blood disorder, no longer needed monthly blood transfusions years after receiving gene therapy, according to an international Phase 3 clinical trial led by researchers in Chicago, covering 22 patients ranging in age 4-34 years. This gene therapy uses the patient's own stem cells that were treated in the lab with a modified virus to add functional copies of the gene that is defective in thalassemia. Before the new cells can be infused, the patients need to receive chemotherapy, which typically involves a hospital stay of at least four to five weeks for close monitoring for fevers, infections, and other potential complications. Patients typically reached transfusion-free status about one month after the autologous stem cell transplantation. Patients had been monitored for a range of 13 months to four years after receiving their new cells. The trial sponsor, has applied for the FDA review, which is expected to be completed in the summer

### **New material offers remarkable combination of toughness and stretchiness**

Researchers at North Carolina State University have made ionogels (polymer networks that contain salts that are liquid at room temperature) that are nearly 70 percent liquid, but have remarkable mechanical properties. They are tough and also easy to make, easy to process, and 3D printed. They are also electrically and thermally stable and conduct electricity well. The researchers started with monomers of polyacrylic acid and polyacrylamide (used in contact lenses) and copolymerized them in a solution of ionic liquid using ultraviolet light. The ionogels also have self-healing and shape memory properties. The team is discussing applications with industry partners.

### **Bacteria recycle carbon waste into valuable chemicals**

Researchers from Northwestern University have engineered a strain of Clostridium Autoethanogenum (C. Auto) bacteria to break down carbon dioxide (CO<sub>2</sub>), converting it into commonly used, expensive industrial chemicals such as acetone and isopropanol (IPA). The researchers developed a new gas fermentation process. They started with Clostridium autoethanogenum, an anaerobic bacterium and used synthetic biology tools to reprogram the bacterium to ferment CO<sub>2</sub> to make acetone and IPA. The approach also could potentially be applied to create streamlined processes for generating other valuable chemicals while also reducing greenhouse gases and recycling industrial wastes.

### **Self-healing materials for robotics made from hydrogels and salt**

Researchers at Cambridge University have developed low cost, self-healing, biodegradable, 3D-printed materials that could be used in the development of realistic artificial hands and other soft robotics applications. The material can sense strain, temperature and humidity and can also partially repair themselves at room temperature. Such material could have wide applications in robotics, tactile interfaces and wearable devices. The team added sodium chloride into hydrogels, and found that the electrical



resistance of the printed materials varied linearly with changes in strain. The self-healing materials are cheap and easy to make, either by 3D printing or casting. They are preferable to many existing alternatives since they show long-term strength and stability without drying out, and they are made entirely from widely available, food-safe, materials.

## RESOURCES AND EVENTS

### [IIT Hyderabad and Cyient sign MoU for 5G Networks Center of Excellence](#)

IT company Cyient has launched the Private 5G Networks Centre of Excellence and signed a pact with the Indian Institute of Technology, Hyderabad, as a research partner for the centre. As part of the collaboration, Cyient will leverage a 5G core developed by IIT-Hyderabad for testing various digital use cases and interoperability with components. The CoE will create, test and prove robust network solutions. The CoE will combine the company's enterprise and network experience with IIT-Hyderabad's research and technology expertise to develop and test private 5G network solutions.

### [GITA to focus on taking forward collaborative initiatives](#)

Dr. S Chandrasekhar, Secretary, Department of Science & Technology, Govt. of India stressed on working with leading countries in their areas of expertise and connecting Indian industries and startups with the best minds in the world to produce technologies of global standard. Global Innovation and Technology Alliance (GITA) completed 10 years and nurtured innovation and industrial R&D by fostering bilateral academic industry and government collaborations. Dr. Chandrasekhar emphasized the need for robust engagement with stakeholders to take these collaborative activities to more countries. He highlighted the need to take the success stories to the masses and proper propagation of the technologies throughout the length and breadth of the country for societal benefits. He also underlined the necessity to enhance the visibility of the programme for greater participation by people in the projects.

### [India introduces Green Hydrogen Policy](#)

India has unveiled its green hydrogen policy as a step towards meeting the objectives of the National Hydrogen Mission launched by the Prime Minister last year. India consumes about 6 million tons of hydrogen annually, primarily in ammonia and methanol production and for use in refineries. The demand for hydrogen could grow to as much as 28 million tons by 2050. The Green Hydrogen Policy is designed to promote the production of green hydrogen and green ammonia by easing the process of renewable energy purchase, storage, and transmission for the manufacturers. Green hydrogen/ammonia manufacturers can purchase renewable power from the power exchange or set up renewable energy capacity themselves or through any other developer anywhere. Green hydrogen and green ammonia manufacturers will be given incentive benefits.

### [Technology Innovation Hubs boost emerging technologies](#)

Twenty-five Technology Innovation Hubs (TIH) were set up across the country through the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS). They are boosting new and emerging technologies to power national initiatives in key areas. They are bringing out technological solutions for people-centric problems. Several technologies and technology platforms established under the mission have helped push impact in multiple sectors. A total of 496 technological products, including 46 new technologies, have been developed through these TIHs. They include the first-of-its-kind, Internet of Things (IoT) device that monitors ambient temperature during the transportation of vaccines, including Covid-19, medicines, blood samples, food and dairy products, meat products, and animal semen developed by researchers at the IIT

Ropar Technology Innovation Hub - AWaDH and its startup ScratchNest. Scientists from IIT Bombay have developed a tapestry method for screening COVID-19 under Remedial Action, Knowledge Skimming, and Holistic Analysis of COVID-19 (RAKSHAK), an effort supported by the Technology Innovation Hub (TIH) at IIT Jodhpur. An AI-driven platform that helps Chest X-ray interpretation of images sent over WhatsApp was developed by ARTPARK at IISc Bangalore. TIHs have also led to the establishment of 13 Technology Business Incubator (TBI), 54 Start-ups & Spin-off companies.

## SCIENCE POLICY AND DIPLOMACY

### [India, France adopt roadmap for partnership in Blue Economy and Ocean Governance](#)

India and France have adopted a Roadmap on the Blue Economy and Ocean Governance under which they will set up a bilateral partnership whose scope will encompass maritime trade, ports, naval industry, fisheries, scientific research and international law of the seas. The roadmap adopted during the bilateral meeting between External Affairs Minister S Jaishankar and his French counterpart Jean-Yves Le Drian, aims to enhance partnership in the field of blue economy by way of institutional, economic, infrastructural and scientific cooperation. The NITI Aayog in India, and the Ambassador for Poles and Maritime Affairs in the MoFA in France will be contact points for coordinating the implementation of the roadmap. Both countries will coordinate their positions in multilateral bodies and negotiations, on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ), and on marine plastic waste and microplastic. Bilateral cooperation will cover areas such as aquaculture, coastal and waterways infrastructure, knowledge of the ocean, marine biology and biotechnology, etc.

### [IPCC's latest report on adaptation calls for urgent action](#)

The IPCC's latest report issued on 28 February contains a strong warning about the impact of climate change on people and the planet, and calls for urgent action. The report, prepared by Working Group II, is part of the IPCC's sixth Assessment process. It says that human-induced climate change is causing dangerous and widespread disruption in nature and affecting billions of lives all over the world, despite efforts to reduce the risks, with people and ecosystems least able to cope being hardest hit. Increased heat waves, droughts and floods are already exceeding plants' and animals' tolerance thresholds, driving mass mortalities in species such as trees and corals. These weather extremes are occurring simultaneously, causing cascading impacts that are increasingly difficult to manage. They have exposed millions of people to acute food and water insecurity, especially in Africa, Asia, Central and South America, on Small Islands and in the Arctic. To avoid mounting loss of life, biodiversity and infrastructure, ambitious, accelerated action is required to adapt to climate change, at the same time as making rapid, deep cuts in greenhouse gas emissions. So far, progress on adaptation is uneven and there are increasing gaps between action taken and what is needed to deal with the increasing risks, the new report finds. These gaps are largest among lower-income populations. The report provides a detailed assessment of climate change impacts, risks and adaptation in cities, and urban areas, where more than half the world's population lives. [For the full report of over 3600 pages go to [https://report.ipcc.ch/ar6wg2/pdf/IPCC\\_AR6\\_WGII\\_FinalDraft\\_FullReport.pdf](https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_FinalDraft_FullReport.pdf) ]

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