

If you can't see this message, [view it in your browser.](#)

SCIENCE DIPLOMACY NEWS ALERT | 1-15 JANUARY 2023| ISSUE 101

www.fisd.in

NEWS ALERT

Forum for Indian Science Diplomacy

RIS Science Diplomacy News Alert is your fortnightly update on Indian and global developments in scientific research, technological advancements, science diplomacy, policy, and governance. The archives of this news alert are available at <http://fisd.in>. Please email your valuable feedback and comments to science.diplomacy@ris.org.in

CONTENTS

GLOBAL

[New Solar Panel for Sustainable Hydrogen](#)

[Electrochemistry Converts Carbon to Useful Molecules](#)

[‘Lab Grown’ Neurons Hold Promise for Neurodegenerative Disease](#)

[Solar Technology to Harvest Water from Air](#)

COVID-19 (WORLD)

[‘Safety Concern’ in Pfizer Bivalent COVID Shot](#)

[China Asked to Release Information on COVID Infections](#)

COVID-19 (INDIA)

[Market Clearance for Covovax as Covid Booster](#)

[Covid-19: Active Cases in India drops to 2,149](#)

INDIA– SCIENCE & TECHNOLOGY

[Aqueous Electrolyte to Help Ammonia Synthesis](#)

[Zebrafish Protein can Regenerate Discs in Human Vertebrae](#)

[IISER Pune Develops New Material to Remove Water Pollutants](#)

[Corrosion-resistant Nickel Alloy can Replace Toxic Coating](#)

[IISc Develops Computational Models for Speeding Antimicrobials Screening](#)

IN BRIEF

[Reactor Powered by Sun can Convert Plastic, CO₂ into fuel](#)

[Smaller, Cheaper Flow Batteries for Clean Energy](#)

[Rice Breeding Breakthrough to Feed Billions](#)

RESOURCES AND EVENTS

[PM Modi Addresses the 108th Indian Science Congress \(ISC\)](#)

[Lithium Sulfur Flow Battery with 250 Wh/L Energy Density](#)

[PM Modi Announces Key Initiatives at Global South Summit](#)

SCIENCE POLICY AND DIPLOMACY

[US NSF Discusses Cooperation with India](#)

GLOBAL

[New Solar Panel for Sustainable Hydrogen](#)

A new kind of solar panel, developed at the University of Michigan, has achieved 9 per cent efficiency in converting water into hydrogen and oxygen -- mimicking a crucial step in natural photosynthesis. Outdoors, it represents a major leap in the technology, nearly 10 times more efficient than solar water-splitting experiments of its kind. The team's self-healing semiconductor withstands concentrated light equivalent to 160 suns. Within that panel, the semiconductor catalyst was covered in a layer of water, bubbling with the hydrogen and oxygen gasses it separated. The catalyst is made of indium gallium nitride nanostructures, grown onto a silicon surface. That semiconductor wafer captures the light, converting it into free electrons and holes -- positively charged gaps left behind when electrons are liberated by the light. The nanostructures are peppered with nanoscale balls of metal, 1/2000th of a millimeter across, that use those electrons and holes to help direct the reaction.

[Electrochemistry Converts Carbon to Useful Molecules](#)

A US-China research collaboration has found a way to convert carbon dioxide via electrosynthesis, into a series of organic molecules that are vital to pharmaceutical development. By changing the type of electrochemical reactor, they could produce two completely different products, both of which are useful in medicinal chemistry. The team was able to successfully create carboxylated pyridines using an undivided electrochemical cell (in which the anode and cathode that supply the electric current are in the same solution). The team found that by switching from a divided to an undivided cell they could selectively attach the carbon dioxide molecule on different positions of the pyridine ring, creating two different products: C4-carboxylation in the undivided cell and C5-carboxylation in the divided cell. The same method could be used for other molecules.

['Lab Grown' Neurons Hold Promise for Neurodegenerative Disease](#)

Northwestern University researchers have created highly mature neurons from human induced pluripotent stem cells (iPSCs). They also demonstrated enhanced signaling capabilities and greater branching ability, which is required for neurons to make synaptic contact with one another. And, unlike typical stem cell-derived neurons which tend to clump together, these neurons did not aggregate, making them less challenging to maintain. Researchers believe these mature neurons could be transplanted into patients as a promising therapy for spinal cord injuries as well as neurodegenerative diseases, including amyotrophic lateral sclerosis (ALS), Parkinson's disease, Alzheimer's disease, or multiple sclerosis. The mature neurons also present new opportunities for studying neurodegenerative diseases like ALS and other age-related illnesses in culture dish-based vitromodels. By advancing the age of neurons in cellular cultures, researchers could improve experiments to better understand late-onset diseases.

[Solar Technology to Harvest Water from Air](#)

Chemical engineers from the Ecole Polytechnique Fédérale de Lausanne have invented a solar-powered artificial leaf, built on a novel electrode which is transparent and porous, capable of harvesting water from the air for conversion into hydrogen fuel. They have developed an ingenious yet simple system that combines semiconductor-based technology with novel electrodes that have two key characteristics: they are porous, to maximize contact with water in

the air; and transparent, to maximize sunlight exposure of the semiconductor coating. When the device is simply exposed to sunlight, it takes water from the air and produces hydrogen gas. The semiconductor-based technology is scalable and easy to prepare.

COVID-19

COVID-19 (WORLD)

[‘Safety Concern’ in Pfizer Bivalent COVID Shot](#)

The Centers for Disease Control and Prevention (CDC) has said that a preliminary COVID-19 vaccine "safety signal" has been identified and is investigating whether the Bivalent Pfizer-BioNTech vaccine creates an increased risk of ischemic stroke in people 65 and older. Recipients of the Bivalent vaccine were more likely to have an ischemic stroke in the 21 days following vaccination compared with days 22-44 following vaccination. Compared to published incidence rates of ischemic stroke in this older population, the companies to date have observed a lower number of reported ischemic strokes following the vaccination with the Omicron BA.4/BA.5-adapted bivalent vaccine. The CDC continues to recommend vaccination with the Pfizer-BioNTech Omicron BA.4/BA.5-adapted bivalent COVID-19 vaccine for all authorized ages and indications.

[China Asked to Release Information on COVID Infections](#)

The World Health Organization is asking China to release new information about COVID-19 infections in the country, after the country reported nearly 60,000 deaths since rolling back their coronavirus policies last month. From December 8, 2022, to Jan. 12, roughly 60,000 people died in China due to either respiratory struggles or coronavirus ailments coupled with preexisting medical conditions. However, the death count only reflects those that occurred in hospitals, so additional fatalities at home were likely not counted. WHO has asked for the "public release of information on the overall situation," a WHO press release stated. The organization said that, while China has been sharing information about different variants of the coronavirus, the WHO is continuing to ask for open access databases for deeper analysis. China's death count of 59,938 people dramatically multiplied the previous official death count of nearly 5,200 people. Previously, the nation omitted cases that involved underlying health conditions.

COVID-19 (INDIA)

[Market Clearance for Covovax as Covid Booster](#)

The subject expert committee (SEC) of the central drug regulatory authority has recommended market authorisation for Serum Institute of India's Covid vaccine Covovax as a heterologous booster dose for adults who have been administered two doses of Covishield or Covaxin. The DCGI had approved Covovax for restricted use in emergency situations in adults on December 28, 2021, in the 12-17 age group on March 9, 2022, and in children aged 7-11 years on June 28, 2022, subject to certain conditions. Covovax is manufactured through technology transfer from Novavax. It has been approved by the European Medicines Agency for conditional marketing authorization. It was granted an emergency-use listing by the World Health Organization (WHO) on December 17, 2021. In August 2020, US-based vaccine maker Novavax Inc.

announced a license agreement with SII for the development and commercialization of NVX-CoV2373, its COVID-19 vaccine candidate in India and low-and-middle-income countries.

Active Cases in India Drops to 2,149

India logged 104 new coronavirus infections, while the active cases declined to 2,149, according to the Union Health Ministry data updated on 15 January. The total cumulative Covid case tally was recorded at 45 million and the death toll at 530,726, the data updated at 8 am stated. The active cases comprise 0.01 per cent of the total infections, while the national COVID-19 recovery rate increased to 98.80 per cent, according to the ministry website. 2.20 billion doses of Covid vaccine have been administered in the country so far under the nationwide vaccination drive.

INDIA–SCIENCE & TECHNOLOGY

Aqueous Electrolyte to Help Ammonia Synthesis

Scientists from Institute of Nano Science and Technology (INST) Mohali have found a new electrolyte called (NaBF₄), which not only acts as a Nitrogen (N₂)-carrier in the medium but also works as a full-fledged “co-catalyst” along with active material transition metal-doped nanocarbon (MnN₄) to deliver high yield of ammonia (NH₃) at ambient experimental conditions. The high production rate of NH₃ approached industrial scale and exceeded almost all the standard catalysts in any other electrolyte medium. The source of NH₃ was thoroughly studied and confirmed to be chiefly from the electrochemical reduction of N₂ gas to NH₃. The new aqueous electrolyte that can help make electrochemical ammonia synthesis more efficient will be useful for industries producing green energy or hydrogen.

Zebrafish Protein can Regenerate Discs in Human Vertebrae

A study by Agharkar Research Institute (ARI), Pune, discovered that a protein called Cellular communication network factor 2a (Ccn2a) secreted from intervertebral disc cells induces disc regeneration in aged, degenerated discs by promoting cell proliferation and cell survival by modulating the pathway called the FGFR1-SHH (Fibroblast growth factor receptor-Sonic Hedgehog) pathway. A protein found in the backbone of zebrafish that plays a positive role in disc maintenance and promotes regeneration in aged discs between vertebrae can have potential therapeutic implications to promote regeneration in degenerated human discs. The study used Zebrafish as a model organism is the first in vivo study showing that it is possible to induce disc regeneration in a degenerated disc by activating an endogenous signaling cascade. The scientists also found that the Ccn2a-FGFR1-SHH signaling cascade takes a positive role in disc maintenance and augmenting disc regeneration.

IISER Pune Develops New Material to Remove Water Pollutants

Indian Institute of Science Education and Research (IISER), Pune came up with a custom-designed unique molecular sponge-like material — macro/microporous ionic organic framework — which can swiftly clean polluted water by soaking up harmful contaminants. The group prepared a newly engineered material called viologen-unit grafted organic-framework (iVOFm). The material employs amalgamation of electrostatics driven ion-exchange combined with nanometer-sized macropores and specific binding sites for the targeted pollutants. The size and number of tunable macropores along with the strong electrostatic interaction of iVOFm can quickly remove various toxic pollutants from water. They employed a make-and-break strategy

to grow a charged porous organic polymer (POP) as a sponge-like infinite framework on silica nanoparticles that is used as a template. Following this, the silica nanoparticles were strategically removed to create ordered hierarchical interconnected macro/microporosity throughout the material.

Corrosion-resistant Nickel Alloy can Replace Toxic Coating

Scientists at the Centre for Engineered Coatings at International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI) have developed a lab-scale process to deposit novel nanostructured Nickel alloy coatings. The process uses pulsed current electroplating, with pulses of duration of a few milliseconds for electroplating purposes. The process consists of an environmentally friendly electrolyte consisting of nickel and tungsten ions that is the source of strengthening elemental tungsten (W) and nickel (Ni). The pulsed current is applied between the components to be coated, acting as cathode and non-consumable anode. The coatings developed at ARCI can withstand temperatures up to 500°C without thermal softening and can improve the life of die components by at least two times than conventional chrome plating. They were successfully applied to die-casting components used in plastic bottling industry, wherein the temperatures at the die interface can be over 280°C. With numerous applications in automotive, defense, and aerospace for these coatings, the process know-how is ready for transfer as a replacement for conventional chrome plating.

IISc Develops Computational Models for Speeding Antimicrobials Screening

Researchers at the Indian Institute of Science (IISc) and Unilever have collaborated to develop computational models of bacterial cell walls that can speed up the screening of antimicrobials. Antimicrobials are molecules which can kill disease-causing bacteria. The team created an 'atomistic model', a computer simulation that recreates the structure of the cell wall down to the level of individual atoms. They incorporated parameters such as the sizes of sugar chains in the peptidoglycans, the orientation of peptides, and the distribution of void size. They used their model to compare the movement of different surfactant molecules through the peptidoglycan layer in *E. coli*. The team showed for the first time the link between the length of the tail and antimicrobial efficacy of surfactants. Surfactants like laurate with shorter chains translocated more efficiently than longer chain oleate. This was corroborated by experiments carried out by scientists in the Unilever team, which showed that shorter chain surfactants killed bacteria at a higher rate than surfactants with longer chains.

IN BRIEF

Reactor Powered by Sun can Convert Plastic, CO2 into Fuel

Cambridge University researchers have developed a system that can transform plastic waste and greenhouse gases into sustainable fuels and other valuable products – using just the energy from the sun. The researchers developed an integrated reactor with two separate compartments: One for plastic and one for greenhouse gases. The reactor uses a light absorber based on perovskite — a promising alternative to silicon for next-generation solar cells. The team designed different catalysts, which were integrated into the light absorber. By changing the catalyst, the researchers could then change the end product. Tests of the reactor under normal temperature and pressure conditions showed the reactor could efficiently convert polyethylene terephthalate (PET) plastic bottles and CO₂ into different carbon-based fuels such as CO, syngas, or formate, in addition to glycolic acid. The reactor produced these products at a rate that is also much higher than

conventional photocatalytic CO₂ reduction processes. Over the next five years, the team hopes to develop the reactor further to produce more complex molecules.

Smaller, Cheaper Flow Batteries for Clean Energy

Researchers at Georgia Tech have developed a more compact flow battery cell configuration that reduces the size of the cell by 75 per cent, and correspondingly reduces the size and cost of the entire flow battery. The researchers used a sub-millimeter, bundled microtubular (SBMT) membrane that reduces membrane-to-membrane distance by almost 100 times. The microtubular membrane in the design works as an electrolyte distributor at the same time without the need for large supporting materials. The bundled microtubes create a shorter distance between electrodes and membranes, increasing the volumetric power density and maximizes flow batteries' potential. The researchers found zinc iodide was the most energy-dense chemistry option, making it the most effective for residential units. Zinc-iodide offers many advantages even compared to lithium: It has less of a supply chain issue and also can be turned into zinc oxide and dissolve in acid, making it much easier to recycle. With zinc-iodide chemistry, the battery could run for more than 220 hours, or to > 2,500 cycles at off-peak conditions. It could also potentially reduce the cost from \$800 to less than \$200 per kilowatt hour by using recycled electrolyte. The researchers are already working on commercialization. The SBMT cells could also be applied to different energy storage systems like electrolysis and fuel cells. The technology could even be strengthened with advanced materials and different chemistry in various applications.

Rice Breeding Breakthrough to Feed Billions

An international team led by UC Davis has succeeded in propagating a commercial hybrid rice strain as a clone through seeds with 95 percent efficiency, using a commercial hybrid rice strain, and has shown that the process could be sustained for at least three generations. The single-step process involves modifying three genes called MiMe which cause the plant to switch from meiosis, the process that plants use to form egg cells, to mitosis, in which a cell divides into two copies of itself. Another gene modification induces apomixis. The result is a seed that can grow into a plant genetically identical to its parent. The method would allow seed companies to produce hybrid seeds more rapidly and at larger scale, as well as providing seed that farmers could save and replant from season to season. The resulting increase in yields can help meet global needs of an increasing population without having to increase use of land, water, and fertilizers to unsustainable levels. The results could be applied to other food crops. In particular, rice is a genetic model for other cereal crops including maize and wheat, that together constitute major food staples for the world.

RESOURCES & EVENTS

PM Modi Addresses the 108th Indian Science Congress (ISC)

Inaugurating the 108th session of the Indian Science Congress, Prime Minister Modi said that the role of India's scientific power will be very important in the next 25 years. India has data and technology in abundance. India had moved up from 81 to 40 rank in the Global Innovation Index. India is among the top three countries in the world in terms of PhDs, and start-up ecosystem. He called for greater participation of women in science and technology and to apply scientific achievements to the grassroots. An institutional framework was needed which would

attract young talent and give them an opportunity to progress through a proper roadmap including the 'guru-shishya' tradition of India. Science in India must meet the needs of the country and make India self-reliant. Science should work on issues which are important for humanity, for example, energy. Scientists and industry must work together. Science should be mobilized to face the threat of new diseases including through new vaccines and disease surveillance and take measures to deal with them. The scientific community can be of great help in moving towards LiFE i.e., Lifestyle for Environment. Science should help reduce post-harvest losses with the help of biotechnology, and in waste management and curbing pollution. India is also making progress in the space sector, with more activity of private companies and start-ups. India is moving fast in the direction of quantum computers, quantum chemistry, quantum communication, quantum sensors, quantum cryptography and new materials. Indian science should also focus on the works which are not being done anywhere and which are futuristic ideas, such as AI, AR and VR semiconductors. This will help enable Industry 4.0.

Lithium Sulfur Flow Battery with 250 Wh/L Energy Density

Edinburg-based startup StorTera has developed a single liquid flow battery (SLIQ), which combines the advantages of lithium-ion technology – namely, high energy density and rapid response, with the benefits of flow batteries, such as a lower levelized cost of storage. With an energy density of 250 Wh/L, the SLIQ is the most energy dense flow battery now under development. The technology provides millisecond response times and up to eight hours of energy storage for more than 20 years and a minimum of 7,500 cycles. The system is said to offer improved safety with no cooling requirements and high flash point materials. The system works by pumping energy-dense single liquid through a proprietary membrane stack to provide long-duration storage. The single liquid design means less system components, whereas low-cost materials and manufacturing techniques further contribute to cost savings. StorTera has a stated goal of reaching capital costs of approximately GBP 120 (\$146.20)/kW and GBP 75/kWh when commercialized. StorTera secured about GBP 5 million from the UK government to help build a large-scale, eight-hour demonstrator of the SLIQ, which will be installed in Edinburgh in 2024. The prototype SLIQ will use a novel cylindrical cell architecture in a modular format to optimize the manufacture, installation, and maintenance of the system.

PM Modi announces key initiatives at Global South Summit

The 2-day long Voice of Global South Summit has seen the participation of more than 120 developing countries, the largest-ever virtual gathering of the Global South. PM Modi called for a 'human-centric globalisation', and a fundamental reform of the major international organisations, including the United Nations Security Council and the Bretton Woods institutions. These reforms should focus on giving voice to the concerns of the developing world and reflect the realities of the 21st Century. India's G20 Presidency will attempt to voice the views of the Global South on these important issues. The Global South has a lot to learn from each other's development experiences, and India will establish a "Global-South Center of Excellence". This institution will undertake research on development solutions or best-practices, which can be scaled and implemented in other members of the Global South. As an example, the digital public goods developed by India in fields like electronic-payments, health, education, or e-governance, can be useful for many other developing countries. India will launch a 'Global-South Science & Technology initiative' to share expertise with other developing nations. He announced a new 'Aarogya Maitri' project under which India will provide essential medical

supplies to any developing country affected by natural disasters or humanitarian crisis. He also proposed a 'Global-South Young Diplomats Forum', to connect youthful officers of our foreign ministries, and 'Global-South Scholarships' for students from developing countries to pursue higher education in India.

SCIENCE POLICY AND DIPLOMACY

US NSF Discusses Cooperation with India

A high-level US delegation of the National Science Foundation (NSF) discussed and proposed deeper cooperation with India in areas like Artificial Intelligence (AI), Cyber Security, Quantum, Semiconductor, Clean Energy, Advanced Wireless, Biotechnology, Geosciences, Astrophysics and Defence. India and America to forge a durable and strong bond for global leadership in fighting global challenges. Both sides agreed to strengthen collaboration in areas like healthcare, technology, Space, earth and ocean science and emerging technologies. New avenues of cooperation were discussed such as Critical Minerals, Smart Agriculture, Bio-Economy and 6G technologies. More joint calls for proposals would be invited March 2023 on identified projects.

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

NOTE TO OUR READERS AND STAKEHOLDERS:

The Science Diplomacy Programme at RIS has been sending you the fortnightly issues of Science Diplomacy Alerts regularly. We request your cooperation to review the Alerts and improve its content. For this purpose, please complete the form at <https://forms.gle/o4d869FxaM9t3KNw7> and submit it. Your support and cooperation is appreciated.