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NEWS ALERT

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RIS Science Diplomacy News Alert is your fortnightly update on Indian and global developments in science 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

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GLOBAL

[Improved energy harvesting thermoelectric devices](#)

A team from Korea Institute of Science and Technology (KIST) has developed flexible thermoelectric devices with high power generation performance by maximizing flexibility and heat transfer efficiency. They connected an inorganic-material-based high-performance thermoelectric device to a stretchable substrate composed of silver nanowires. The device showed excellent flexibility, allowing stable operation even when it is bent or stretched. Insertion of metal particles with high thermal conductivity inside the stretchable substrate improved the heat transfer capacity by 800% (1.4 W/mK) and power generation by a factor higher than three. The researchers automated the entire complex process, from the soft-platform process to the development of the thermoelectric device, thus enabling mass-production of the device. The developed device has many potential applications.

[Nanoparticle drug-delivery system to treat brain disorders](#)

A team from the USA has created a nanoparticle platform, which can facilitate therapeutically effective delivery of encapsulated agents into the brains of mice. This delivery system was three times more effective than conventional methods of delivery and was therapeutically effective as well. The technology developed could allow for the delivery of a large number of diverse drugs, including antibiotics, antineoplastic agents, and neuropeptides. The test agent used in this study was a small interfering RNA (siRNA) molecule designed to inhibit the expression of the tau protein, which is believed to play a key role in neurodegeneration. Poly(lactic-co-glycolic acid), or PLGA, a biodegradable and biocompatible polymer was used as the base material for nanoparticles. The researchers identified a unique nanoparticle design that maximized the transport of the encapsulated siRNA and significantly improved the uptake by brain cells. The

researchers have studies underway to attack alternative targets using the novel delivery platform.

[Optical frequency comb improves fluorescence microscopy](#)

Fluorescence microscopy allows scientists to directly observe cells and certain compounds in and around them which absorb light within a specific wavelength range and then re-emit it at the longer wavelength range. However, the results are very difficult to evaluate quantitatively. Scientists from Japan have developed a novel approach to acquire fluorescence lifetime images without necessitating mechanical scanning. One of the main pillars of their method is the use of an optical frequency comb (OFC), a light signal composed of the sum of many discrete optical frequencies with a constant spacing in between them. Owing to its superior speed and high spatial resolution, the microscopy method developed by researchers will make it easier to exploit the advantages of fluorescence lifetime measurements and provide deeper insight into biological processes.

[Innovative battery chemistry revolutionizes zinc-air battery](#)

The zinc-air battery has been an attractive energy storage technology of the future on count of high-performance, eco-friendliness, safety and cost-effectiveness, but has been plagued by high chemical instability and parasitic reactions. An international research team at the University of Muenster has now developed a new battery chemistry which overcomes these obstacles using a new electrolyte based on reversible zinc peroxide (ZnO₂)/O₂ chemistry. The newly developed non-alkaline aqueous electrolyte is based on zinc trifluoromethanesulfonate salt, has more efficiency, higher chemical stability and electrochemical reversibility. The full zinc-air batteries thus constructed can operate stably for 320 cycles and 1,600 hours under ambient air atmosphere. This technology however still requires further, intensive research and optimisation before its practical application.

[Supercapacitors challenge batteries](#)

A team of researchers at Technical University Munich (TUM) have developed a highly efficient supercapacitor with diverse applications. The new supercapacitor is made up of powerful and sustainable graphene hybrid material which serves as the positive electrode in the device. The researchers have combined it with a proven negative electrode based on titanium and carbon. With this, the new energy storage device can not only attain an energy density of up to 73 Wh/kg, which is roughly equivalent to the energy density of a nickel metal hydride battery, but also has a higher power density of 16 kW/kg.

[Unravelling the mystery that makes viruses infectious](#)

Researchers from the universities of Leeds and York for the first time have identified the way viruses like the poliovirus and the common cold virus package up their genetic code to infect cells. There has been a mystery until now as to how the virus assembles the daughter virions i.e., the newly formed infectious copies of the virus. The study suggested that the molecular features that control the process of virion formation are genetically conserved. Understanding in detail how this process works, will enable the pharmaceutical industry to develop antiviral agents that can block the key interactions and prevent diseases.

COVID-19 (WORLD)

[WHO clears COVID-19 vaccine for emergency use](#)

To speed up access to COVID-19 vaccinations in the developing world, the World Health Organization (WHO) approved Pfizer and BioNTech's vaccines for emergency use. Regulatory experts convened by the WHO reviewed the data on the Pfizer/BioNTech vaccine and found that it met WHO's must-have criteria for safety and efficacy, with its benefits offsetting any potential risks. The move opens the door for countries to expedite their own regulatory approval processes to import and administer the vaccine and also enables procurement by UNICEF and the Pan-American Health Organization (PAHO). WHO's Strategic Advisory Group of Experts on Immunization (SAGE) has issued population prioritization recommendations for COVID-19 vaccines in September, and the group will formulate vaccine specific policies and recommendations.

[Mosaic nanoparticles could protect against many strains of coronaviruses](#)

A Caltech team has designed a protein-based nanoparticle onto which pieces of up to eight different types of coronavirus have been attached. When injected into mice, this vaccine induces the production of antibodies that react to a variety of different coronaviruses--including similar viruses that were not presented on the nanoparticle. This vaccine platform, called a mosaic nanoparticle, is shaped like a cage made up of 60 identical proteins, each of which has a small protein tag. The team took fragments of the spike proteins of different coronaviruses and attached a protein tag that would bind to those on the cage. When these viral pieces were mixed together with the nanoparticle cage structure, each virus tag stuck to a tag on the cage, resulting in a nanoparticle presenting spikes representing different coronavirus strains on its surface. Displaying eight different coronavirus spike fragments with this particle platform generated a diverse antibody response, able to react to many different strains of coronavirus and also reactive to related strains of coronavirus that were not present on the nanoparticle. This technology has potential applications for other multivalent vaccines.

[New promising antibodies against SARS-CoV-2](#)

A German research team has developed antibody fragments called nanobodies that could treat COVID-19. They injected a surface protein of the coronavirus into an alpaca and a llama, to produce antibodies and nanobodies directed against this virus. They obtained dozens of nanobodies, from which four molecules actually proved to be effective against the pathogen in cell cultures. The nanobodies also appear to trigger a structural change before the virus encounters its target cell and are no longer able to bind to host cells and infect them. The simple structure of nanobodies allows straightforward combinations to form molecules that can be several hundred times more effective. They have fused two nanobodies that target different parts of the spike protein and found this variant to be highly effective in cell culture, and drastically reduces the probability of the virus to become resistant to the active agent through escape mutations. These molecules could be developed into a novel and promising therapeutic option.

[Nanoparticle vaccine for COVID-19](#)

A team at Stanford University has developed a candidate vaccine containing nanoparticles studded with the same proteins that comprise the virus's distinctive surface spikes. Initial tests in mice suggest that the Stanford nanoparticle vaccine could produce COVID-19 immunity after just one dose. The researchers are also hopeful that it could be stored at room

temperature and are investigating whether it could be shipped and stored in a freeze-dried, powder form. This vaccine uses a shortened spike protein from SARS-CoV-2 combined with nanoparticles of ferritin, an iron-containing protein. In mouse tests, the shortened spike nanoparticle vaccine produced a significantly higher neutralizing response. This technology could be exploited to make a universal coronavirus vaccine to immunize against SARS-CoV-1, MERS, SARS-CoV-2 and future coronaviruses that are not yet known.

Allergy experts offer reassurance on COVID-19 vaccines

In response to accounts of potential allergic reactions in some people to COVID-19 vaccines produced by Pfizer-BioNTech and Moderna, a team of allergists at Massachusetts General Hospital (MGH) have examined all relevant information and noted that the vaccines can be administered safely even to people with food or medication allergies. The allergists explained that allergic reactions to vaccines are rare, with a rate of about 1.3 per 1 million people and that the allergic reactions to Pfizer-BioNTech and Moderna COVID-19 vaccine will have a similarly low rate of occurrence. They stress that individuals with a history of anaphylaxis to an injectable drug or vaccine containing polyethylene glycol or polysorbate should speak with their allergists before being vaccinated, while patients with severe allergies to foods, oral drugs, latex, or venom can safely receive the COVID-19 vaccines.

New virtual screening strategy identifies existing drug that inhibits COVID-19 virus

Researchers from Shenzhen Institutes of Advanced Technology, China combined multiple computational techniques to screen 1,906 existing drugs for their potential ability to inhibit replication of SARS-CoV-2 by targeting a viral protein called RNA-dependent RNA polymerase (RdRP). The screening approach identified four promising drugs, which were then tested against SARS-CoV-2 in lab experiments. Two of the drugs, pralatrexate and azithromycin, successfully inhibited replication of the virus, and pralatrexate, in particular, strongly inhibited viral replication of SARS-COV-2 during lab experiments. However, the repurposing of pralatrexate - used for people with terminal lymphoma, can prompt significant side-effects. The researchers are now developing new computational methods for identifying molecular structures that could have the potential to treat COVID-19.

New COVID-19 test gives positive result in just a few minutes

Researchers at the University of Birmingham have developed a new COVID-19 test that reduces testing time from 30 minutes to less than five and delivers accurate results. The new test is a single step method that uses an alternative amplification method called EXPAR (Exponential Amplification Reaction), which uses very short, single strands of DNA for the replication process, and can be completed in a matter of minutes, making a significant reduction in the overall time needed to produce results. The entire test can be run on standard laboratory equipment at lower temperatures compared to PCR tests, which require higher temperatures to separate out strands of DNA as part of the amplification process. Thus, delivering a test that is not only fast but also sufficiently sensitive. University of Birmingham Enterprise has filed a patent application covering this novel method for amplifying RNA sequences, and its use for detecting RNA in a sample.

Detecting COVID-19 antibodies in 10-12 seconds

Researchers at Carnegie Mellon University have developed an advanced nanomaterial-based

biosensing platform that detects, within seconds, antibodies specific to SARS-CoV-2. The testing platform identifies the presence of two of the virus' antibodies, spike S1 protein and receptor binding domain (RBD), in a very small drop of blood (about 5 microliters). Antibody concentrations can be extremely low and still detected below one picomolar (0.15 nanograms per millilitre). This detection happens through an electrochemical reaction within a handheld microfluidic device which sends results almost immediately to a simple interface on a smartphone. The proposed sensing platform can be used for the rapid detection of biomarkers for other infectious agents such as Ebola, HIV, and Zika. Such a quick and effective test could be a game-changer for controlling the spread of diseases.

COVID-19 (INDIA)

[DNA Vaccine Candidate by Zydus Cadila, approved for Phase III clinical trials](#)

The Drugs Controller General of India (DCGI) has granted approval to India's first indigenous DNA vaccine candidate against COVID-19, ZyCoV-D developed by Zydus Cadila for conduct of the Phase III clinical trials. Phase-I/II clinical trials in more than 1,000 participants and interim data indicated that the vaccine is safe and immunogenic when three doses were administered intradermally. The candidate has been supported by the National Biopharma Mission (NBM) under the aegis of BIRAC and the Department of Biotechnology, Government of India. Dr Renu Swarup, Secretary DBT said that DBT's partnership with Zydus Cadila exemplifies Government's focus on creating an ecosystem that nurtures and encourages new product innovation with societal relevance.

[DCGI Statement on Restricted Emergency approval of COVID-19 virus vaccine](#)

The Subject Expert Committee of Central Drugs Standard Control Organisation (CDSCO) met on 1st and 2nd January, 2021 and made important recommendations, namely, permitting Restricted Emergency Approval of COVID-19 virus vaccine of M/s Serum Institute of India and M/s Bharat Biotech; and Phase III clinical trial of M/s Cadila Healthcare Ltd. The committee granted emergency use approval for Serum Institute's Recombinant Chimpanzee Adenovirus vector vaccine (Covishield). The committee also cleared M/s Bharat Biotech's Whole Virion Inactivated Coronavirus Vaccine (Covaxin) developed with ICMR and NIV (Pune). Lastly, the committee also approved M/s Cadila Healthcare's Novel Corona Virus-2019-nCov-Vaccine using DNA platform technology for conducting Phase-III clinical trial in 26000 Indian participants.

[Indian Testing rises to more than 180 million tests](#)

India has demonstrated a sharp rise in the number of COVID-19 cumulative tests. On January 9th, the country crossed 180 million total tests. With 2,316 testing labs in the country including 1,201 Government laboratories and 1,115 Private laboratories, the daily testing capacity has got a substantial boost. High level of comprehensive testing on a sustained basis has also resulted in bringing down the national positivity rate. The national cumulative positivity rate has reduced from 8.93 percent to 5.79 percent in a span of five months. With the increase in testing infrastructure, India's Tests per Million (TPM) has increased exponentially standing at 130,618.

The gap between Recovered cases and Active cases is steadily increasing and presently stands at 9,832,461.

PM Modi reviews status of COVID-19 and vaccination plans

PM Modi took a detailed review of the status of COVID-19 vaccination program after the regulators granted an emergency use authorisation to two vaccines, namely Covishield and Covaxin. Underpinned by the principles of people's participation (Jan Bhagidari), the vaccination exercise will prioritise the healthcare and frontline workers who are estimated to be around 30 million, followed by some 270 million above 50 years of age or with co-morbidities. PM Modi also reviewed the digital platform Co-WIN Vaccine Delivery Management System, that will provide real time information support. The government is also training more than 61,000 programme managers, 200,000 vaccinators and 370,000 other vaccination team members, in what is the largest such exercise in the world.

Regulatory approval for Non-invasive Indian Ventilator

CSIR-NAL scientists have designed and developed a non-invasive bilevel positive airway pressure ventilator – Swasth-Vayu to treat COVID-19 patients. SwasthVayu is a microcontroller based precise closed-loop adaptive control system with a built-in biocompatible “3D printed manifold and coupler” with HEPA filter. It has features like CPAP, Bi-Timed, Spontaneous/AUTO modes with provision to connect Oxygen concentrator or Enrichment unit externally. An expert committee concluded that SwasthVayu may be used on COVID-19 patients who require oxygen supplementation up to 35 percent. CSIR-NAL has commercialized this technology with six private companies. An order for supply of 1,200 SwasthVayu machines to Delhi Government is being executed including installation at various hospitals in Delhi.

INDIA – SCIENCE & TECHNOLOGY

Indigenously developed 10 Lynx U2 Fire Control systems for Indian Navy

Ministry of Defence (MoD) has signed a contract with Bharat Electronics Limited (BEL) for procurement of 10 Lynx U2 Fire Control systems for frontline warships of Indian Navy at a cost of Rs. 14 billion. The LYNX U2 GFCS is a Naval Gun Fire Control System designed to acquire, track and engage targets amidst sea clutter. It is capable of accurately tracking air/surface targets, generating required target data for predicting weapon aiming points and engaging targets. The system including the Tracking Radar, Servo and Weapon Control Modules has been completely designed and developed by BEL.

Indigenously developed Laser Dazzlers

Bharat Electronics Limited (BEL) has signed a contract with Indian Navy for initial supply of 20 Light Amplification by Stimulated Emission of Radiation Dazzlers (Laser Dazzlers). The Laser Dazzler is used as a non-lethal method for warning and stopping suspicious vehicles/boats/aircrafts/UAVs/pirates etc. from approaching secured areas during both day and night. It is a portable, shoulder operated and ruggedized for military use in adverse

environmental conditions. Laser dazzler technology was developed by Defence Research and Development Organisation (DRDO).

Indian 700 MWe Nuclear Reactor Connected to grid

The unit 3 of Kakrapar Nuclear Power Plant (KAPP) has been synchronised with the grid. The reactor is India's first indigenously designed 700 MWe pressurised heavy water reactor (PHWR), which achieved criticality (controlled self-sustaining nuclear fission chain reaction) in July last year. KAPP-3 and the fourth unit, which is also coming up has been part of Indian Government approved plans back in April 2007 to be built using indigenous technology.

Indian scientists develops ultra-high mobility electron gas with multiple applications

Scientists at Institute of Nano Science and Technology (INST), Mohali have produced an ultra-high mobility 2d-electron gas (2DEG) at the interface of two insulating oxide layers. The ultra-high mobility electron gas can speed up transfer of quantum information and signal from one part of a device to another and increase data storage & memory. The need for attaining new functionalities in modern electronic devices has led to the manipulation of property of an electron called spin degree of freedom along with its charge. This has given rise to an altogether new field of spin-electronics or 'spintronics'. The phenomenon called the 'Rashba effect' might play a key role in spintronic devices. According to the INST team, realization of large Rashba-effect at such oxide interfaces containing highly mobile electron gas may open up a new field of device physics, especially in the field of quantum technology applicable for next-generation data storage media and quantum computers.

IN BRIEF

Composites of gallium metal with promising properties

A research team from South Korea has invented a new method for incorporating filler particles in liquid gallium to create functional composites of liquid metal enabling it to form pastes or putties. It can be coated or "painted" onto almost any surface, or molded into a variety of shapes or fashioned into a porous foam-like material with extreme heat resistance. Four different materials as fillers were studied: graphene oxide, silicon carbide, diamond, and graphite. Reduced graphene oxide (rG-O) gave rise to electromagnetic interference (EMI) shielding and diamond particles were useful for thermal interface materials. The composite was its ability to provide EMI shielding property to any everyday common material. The researchers demonstrated that a similar 20-micron thick coating of Ga/rG-O applied on a simple sheet of paper yielded a shielding efficiency of over 70 dB. The diamond containing composite had bulk thermal conductivities of up to $\sim 110 \text{ W m}^{-1} \text{ K}^{-1}$. A composite made from a mixture of gallium metal and commercial silicone putty is stretchable in addition to being malleable.

A safer, less expensive and fast charging aqueous battery

Researchers from the USA have found a new 3D zinc-manganese nano-alloy anode resulting in a stable, high-performance, dendrite-free aqueous battery using seawater as the electrolyte. The discovery offers promise for energy storage and other applications, including electric vehicles and provides a low-cost, high energy density, stable battery. Testing determined that the novel 3D zinc-manganese nano alloy anode remained stable without degrading throughout 1,000 hours of charge/discharge cycling under high current density (80 mA/cm^2). Dendrite formation was reduced by controlling surface reaction thermodynamics with a zinc alloy and

reaction kinetics by a three-dimensional structure. The team is investigating other metal alloys, in addition to the zinc-manganese alloy.

Bacterium that protects rice plants against diseases

An international research group at Graz University of Technology who has been studying the microbiome of rice plant seeds for some time have identified a bacterium inside the seed that can lead to complete resistance to a particular pathogen and is naturally transmitted from one plant generation to another. The findings provide a completely new basis for designing biological plant protection products and additionally reducing harmful biotoxins produced by plant pathogens. In the future, this strategy can be used to reduce pesticide usage in agriculture and at the same time achieve good crop yields.

Antibody that blocks dengue virus found

A team of researchers led by the University of California Berkeley has discovered an antibody that blocks the spread within the body of the dengue virus. The dengue virus uses a particular protein, called Non-Structural Protein 1 (NS1), to latch onto the protective cells around organs. It weakens the protective barrier, allowing the virus to infect the cell, and may cause the rupture of blood vessels. The research team's antibody, called 2B7, physically blocks the NS1 protein, preventing it from attaching itself to cells and slowing the spread of the virus. Moreover, because it attacks the protein directly and not the virus particle itself, 2B7 is effective against all four strains of the dengue virus. Researchers showed that the 2B7 antibody effectively blocks the spread of the dengue virus in live mice. This same antibody could potentially provide new treatments for other flaviviruses like dengue, a group that includes Zika and West Nile.

Innovative zinc-air battery

A team led by the University of Muenster has developed a new battery chemistry for the zinc-air battery based on reversible zinc peroxide (ZnO_2/O_2) chemistry and a non-alkaline aqueous electrolyte, using zinc trifluoromethanesulfonate salt. The zinc anode is used more efficiently with a higher chemical stability and electrochemical reversibility. The full zinc-air batteries thus constructed can long-term operate stably for 320 cycles and 1,600 hours under ambient air atmosphere. The identified increased energy density has the potential to compete with the lithium-ion battery and provides a potential alternative battery technology with environmental friendliness, high safety and low costs.

RESOURCES AND EVENTS

France hosts One Planet Summit aimed at protecting global biodiversity

France hosted a one day global summit, 'One Planet summit' to build momentum for action on climate change and biodiversity. The summit witnessed participation by around 30 leaders, government officials and heads of international organizations with the aim to protect global biodiversity. The summit focused on four topics, protecting marine and terrestrial ecosystems; promoting more sustainable ways to grow food; mobilise funding to protect biodiversity; and protect tropical forest, species and human health. During the summit at least 50 countries committed to protecting 30% of the planet, including land and sea, over the next decade to halt species extinction and address climate change issues.

OECD Science, Technology and Innovation Outlook 2021

The OECD has published the “STI Outlook Report 2021” which underlines the unprecedented global collaboration between scientists that has greatly accelerated research, testing, therapies and vaccines to treat and prevent COVID-19. The report notes the unified efforts of research agencies, organisations, private foundations and charities, and the health industry that have set up an array of newly funded research initiatives worth billions of dollars in record time. The pandemic has highlighted that S&T offers the only exit to COVID-19 and underscored its importance in more than in other recent crises as well as in both preparing for and reacting to future crises. The report notes that COVID-19 serves as a wake-up call that highlights the need to recalibrate STI policies and to better orient research and innovation efforts towards sustainability, inclusivity and resiliency goal.

SCIENCE POLICY AND DIPLOMACY

Draft National Science, Technology, and Innovation Policy 2020 released

The draft of the 5th National Science Technology and Innovation Policy has been made available for public consultation. The policy aims to bring about profound changes through short, medium and long-term mission mode projects by building a nurtured ecosystem that promotes research and innovation on the part of both individuals and organizations. It aims to foster, develop, and nurture a robust system for evidence and stakeholder driven STI planning, information, evaluation, and policy research in India. The objective of the policy is to identify and address strengths and weaknesses of the Indian STI ecosystem to catalyse socio-economic development of the country and also make the Indian STI ecosystem globally competitive. The STIP will be guided by its broad vision of achieving technological self-reliance and position India among the top scientific superpowers in future. It aims to double the number of Full-Time Equivalent (FTE) researchers, Gross Domestic Expenditure on R&D (GERD) and private sector contribution to the GERD every 5 years and to build individual and institutional excellence in STI. The process so far involved nearly 300 rounds of consultations with more than 40,000 stakeholders. Suggestions, comments and inputs on the draft Policy may be shared by Monday the 25th January 2021 on email: india.stip@gmail.com. The policy draft is available at <https://dst.gov.in/draft-5th-national-science-technology-and-innovation-policy-public-consultation>

MoU between India and UAE for Scientific and Technical Cooperation

The Union Cabinet has approved the Memorandum of Understanding (MoU) on Scientific and Technical Cooperation between National Centre of Meteorology (NCM) United Arab Emirates (UAE) and Ministry of Earth Sciences (MoES) India. The MoU will provide knowledge sharing, sharing of data and operational products for meteorological, seismological and oceanic services, such as Radar, Satellite, Tide gauges, seismic and Meteorological stations. Such collaborative participation within MoES (India) and NCM-UAE will foster activities related to multi-hazard early warning systems and more reliable forecasts of Tsunamis propagating through the Oman Sea and Arabian Sea, which affect the coastal areas of both India and North East of UAE.

U.S. law sets stage for boost to artificial intelligence research

The US Congress has passed the National Artificial Intelligence Initiative Act (NAIIA) of 2020 to bolster Artificial Intelligence (AI) activities at more than a dozen agencies, including creating a national research cloud, expansion of a network of research institutes launched last summer,

and the creation of a White House AI office and an advisory committee to monitor those efforts. The new law is meant to keep the country at the forefront of global AI research in the face of growing investments by other countries. The Pentagon's Joint Artificial Intelligence Center formed in 2018 has been enhanced and given new authority to use AI to improve combat readiness and fight wars. The NAIIA both codifies what some federal agencies are already doing and gives them an extensive to-do list.

**Call for Papers - Science Diplomacy Review
(closing on 5th February 2021)**

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http://fisd.in/other/call%20for%20paper/Call%20for%20Papers_March%202021_Issue_F.pdf

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