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

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SCIENCE & TECHNOLOGY

GLOBAL

Novel Way to Detect Bioluminescence in Brain Developed

Scientists at the Massachusetts Institute of Technology (MIT) have developed a new technique to detect bioluminescence in the brain using magnetic resonance imaging. It could enable researchers to explore the inner workings of the brain in more detail. They engineered blood vessels of the brain to express a protein that causes them to dilate in the presence of light. That dilation can then be observed with magnetic resonance imaging (MRI), allowing researchers to pinpoint the source of light. It could be used to map changes in gene expression, by linking the expression of luciferase to a specific gene. This could help researchers observe how gene expression changes during embryonic development and cell differentiation, or when new memories form. Luciferase could also be used to map anatomical connections between cells or to reveal how cells communicate with each other. The researchers aim to explore some of those applications, as well as adapting the technique for use in mice and other animal models.

AlphaFold3: Google Unveils Powerful New AI Tool for Studying Molecules

Google's DeepMind has revealed a newer version of its AlphaFold Artificial Intelligence (AI) tool that helps scientists study cells in the human body. The previous version of AlphaFold released in 2020 had drawn worldwide attention for helping scientists predict the shape of individual proteins by yielding three-dimensional models. The process is otherwise complex and time consuming. AlphaFold3, the new version can purportedly predict behaviour of other molecules such as DNA and RNA. While DNA stores the genetic information of a living being, RNA transmits information from DNA to the proteins. A paper published in Nature notes AlphaFold3 to have the ability to attain "accuracy well beyond the state of the art".

New Technique Developed to Transform Waste CO2 into High-value Chemicals

Researchers from the National University of Singapore (NUS) have developed a technique that could advance the conversion of waste CO2 into value-added chemicals and fuels. The new technique has enabled the direct conversion of CO2 from treated flue gas, a common by-product of industrial processes, into high-value multi-carbon (C2+) products. It can circumvent the need for high-purity CO2 and also repurpose a prevalent waste product, working towards closing the carbon cycle and reducing reliance on fossil fuels. They designed a nickel catalyst boasting exceptional performance for CO2 reduction, achieving an efficiency rate exceeding 99 per cent. The NUS team designed a composite system by sequentially layering this nickel catalyst onto a copper surface. The technique demonstrates a potential pathway for the development of efficient electrolysers for the direct conversion of CO2 in flue gas, using simple yet effective electrolyte

and catalyst design strategies to advance integrated sustainability solutions. The technique could be applied to synthesise other valuable chemicals, such as acetate and propanol which are used in the production of everyday products such as adhesives and disinfectants respectively.

Chip-scale Device Detects Lead Contamination

Engineers at MIT, Nanyang Technological University have developed a compact and inexpensive technology for detecting and measuring lead concentrations in water, potentially enabling a significant advance in tackling this persistent global health issue. The new system could detect lead concentrations as low as 1 part per billion, with high accuracy, using a simple chip-based detector housed in a handheld device. The technology gives nearly instant quantitative measurements and requires just a droplet of water. The team set out to find a simple detection method based on the use of photonic chips, which use light to perform measurements. In testing the new chip, the researchers showed that it can detect lead in water at concentrations as low as one part per billion. The system can be adapted to detect other similar contaminants in water, including cadmium, copper, lithium, barium, cesium, and radium.

INDIA

3D Printed PSLV Engine: ISRO Successfully Conducts Long-Duration Test

In a major milestone, the Indian Space Research Organisation (ISRO) has successfully conducted a long duration test of a 3D printed rocket engine. The PS4 engine, which is used in the fourth stage of the Polar Satellite Launch Vehicle (PSLV) was redesigned for production using additive manufacturing (AM). ISRO further noted that the engine was manufactured entirely by the Indian industry. A tweet from ISRO noted that the use of additive manufacturing techniques allows for a reduction in production time by 60 per cent, while saving 97 per cent raw material. The test reportedly lasted for 665 seconds during which the engine was able to meet all performance parameters as expected. ISRO stated that it plans to induct the AM PS4 into the PSLV programme in the future.

NCPOR Scientists Commence Research Expedition to Locate Critical Mineral Deposits

Scientists hailing from the National Centre for Polar and Ocean Research (NCPOR) have set out on their third Indian Ocean research expedition to identify and locate critical mineral deposits. The month-long expedition aboard the Norwegian Vessel, Argeo Searcher, would prospect for polymetallic sulphide deposits at 15 sites. Polymetallic sulphides are usually located next to hydrothermal vents at a depth of at least 5000 metres in the deep sea. These can be mined and extracted for critical minerals such as manganese, nickel, copper and zinc. Dr. Thamban Meloth, Director NCPOR, compared the mission to “looking for a needle in a haystack”, while noting that pinpointing the accurate locations of these deposits could take a long time. The NCPOR plans on using a Remotely Operated Vehicle (ROV) to collect samples from the identified sites. The exploration is being conducted as a part of the Government of India’s Deep Ocean Mission.

Hearing Detection: IISc Researchers Develop Automatic Headband

Researchers at the Indian Institute of Science (IISc), Bengaluru, in collaboration with KIMS Hubballi have developed a customised headband for detecting hearing capacity in adults. The system works by facilitating the "automated extraction of electric signals in the brain" through studying two parameters: Auditory Brainstem Response (ABR) and Mismatch Negativity (MMN). ABR herein entails the tracking of soundwaves travelling from the ear to the brainstem. MMN on the other hand refers to a change in EEG response to "strategically presented auditory changes". The system captures both the parameters automatically and with a high degree of accuracy. The statement released by IISc noted that the headband had been successfully tested on five individuals with satisfactory results. It also referred to the potential of the technology to be deployed at a large scale.

Garbhini-GA2: New AI Tool Can Analyse Scans to Detect Pregnancy Complications

A collaborative research effort between the IIT Madras and the Translational Health Science and Technology Institute has resulted in a new AI tool that can help reduce Maternal Mortality Rates (MMR). Named Garbhini-GA2, the tool can read pregnancy scans to identify foetal abnormalities as well as gauge gestational age. The tool has been trained using data gathered from the Government of India's Garbh-Ini initiative launched in May 2015. Launched at a hospital in Gurgaon, the study involved a group of women from whom data was collected throughout their pregnancies and afterwards. Garbhini-GA2 is said to especially help in cases of women who consult medical practitioners during the later stages of their pregnancies. This would in turn allow doctors to accurately schedule scans and tests and manage potential complications. The tool is soon expected to be integrated into ultrasound machines at six hospitals in National Capital Region, Puducherry, Assam, Telengana and Gujarat.

Chandrayaan-2 Data Reveals Crucial Insights on Water-Ice on the Moon

An assessment of data collected by the Chandrayaan-2 spacecraft has presented a comprehensive understanding regarding the presence of water-ice in the lunar poles. Among other key findings, the study has indicated that the water-ice content is 5-8 times more in the subsurface at the poles compared to the surface of the lunar regolith. It further indicated that the water-ice content at the lunar north pole is about double the amount found at the lunar south pole. The study was jointly conducted by ISRO's Space Application Centre, Ahmedabad, NASA's Jet Propulsion Laboratory, IIT Kanpur and IIT Dhanbad.

GLOBAL CHALLENGE

Proactive Vaccinology: New Vaccine Can Protect Against Future Pandemics

A new study published in Nature Nanotechnology has described a simple vaccine that can protect against a range of coronaviruses, including those that are yet to be identified. This has been described as an important step in enhancing humanity's preparedness to face future pandemics. The vaccine described in the study is produced by genetically fusing Receptor Binding Domains (RBDs) from four sarbecoviruses (a subset of coronaviruses) to form a type of protein called "quartet". A protein glue is employed to tie these quartets to a protein nanocage. This unique employment of mosaic nanoparticles allows the immune system to respond to viruses even though they may mutate. When tested in mice, the vaccine reportedly produced antibodies against a range of viruses. The researchers intend to commence human trials at the next stage.

New Tool to Helps in Tackling Childhood Undernutrition

A new tool has been developed at the University of Virginia School of Medicine to understand and overcome childhood undernutrition that contributes to almost half of all deaths of children under 5. The research model studies the effects of undernutrition on the microbiome, the microbes that naturally live inside the gut, and, in turn, on growth and the immune system. The model can help to investigate major challenges facing undernourished children, including higher rates of infection and changes in cognitive development. It will help scientists better understand the underlying biological causes of stunted growth and other harmful effects of undernutrition in developing countries. The understanding will advance efforts to develop new approaches to prevent those effects and help children live longer, healthier lives.

New Method for Making High-performance Solar Cells

Researchers at UC Santa Barbara have developed a method to make high-quality perovskite films at room temperature. The team's innovation has simplified the production process and also increased the material's efficiency from under 20 per cent to 24.4 per cent. Perovskite solar cell production also has the potential for a smaller carbon footprint than silicon photovoltaics, which require high temperatures and a cleanroom environment. The researchers developed a perovskite ink that created high-quality films much more effectively. The simpler fabrication technique also meshes better with standard manufacturing processes and reduces the overall energy use, which lowers its carbon dioxide emissions. It also opens up a wide range of possible applications. It's well suited for flexible indoor and outdoor energy generation.

RESOURCES & EVENTS

UN Forest Forum: Forest Fire Mitigation Mechanisms Discussed

The 19th session of the United Nations Forum on Forests (UNFF) was held from May 6-10 in New York, USA, at the UN headquarters. Among other key matters concerning forest conservation and the environment, discussions focused on addressing forest fires and wildfires as a major challenge. The specific challenges faced by developing countries were also highlighted in this regard. The delegates discussed measures that could be used to mitigate forest fires including

early warning systems and considered practices such as controlled burning. They further agreed to implement the UN Strategic Plans for Forests 2017-2030 and recognised the importance of forests for sustainable development.

Himalayan Biodiversity Conservation: University of Kashmir Organizes Workshop

The University of Kashmir organised a three-day workshop on biodiversity conservation in the Himalayan region. Discussions at the workshop focused on the best means of protecting the intricate Himalayan ecosystem amid aggravating effects of climate change. The workshop was attended by over 150 undergraduate and graduate students. Delivering the keynote address, Professor Uma Shanker, IIT Jammu noted the need to encourage interdisciplinarity and facilitate the exchange of ideas. A 'Science Academies Lecture Workshop on Himalayan Mountains and Their Life', sponsored by the Joint Education Panel, Indian Academy of Sciences, Bengaluru was also organised as a part of the workshop.

Emerging Technologies for Infrastructure Development: DRDO Holds Symposium

The Defence Research and Development Organisation (DRDO) organised a symposium on Emerging Technologies in Infrastructure Development in New Delhi on 9 May 2024. The symposium sought to foster dialogue on innovative approaches in infrastructure development that could help address the challenges and opportunities presented by emerging technologies. Speaking at the symposium, Giridhar Aramane, Defence Secretary, Government of India, stressed upon the need for India to achieve self-reliance in every field as a means to face future challenges. He further spoke about infrastructure development along India's borders and called on the private sector to evolve innovative solutions. Meanwhile, Dr. Samir V Kamat, Chairman, DRDO, emphasised upon the need for infrastructure to be sustainable and green.

Seventy-seventh World Health Assembly

The Seventy-seventh World Health Assembly is being held in Geneva, Switzerland, on 27 May – 1 June 2024. The theme of this year's Health Assembly is: All for Health, Health for All. The World Health Assembly is the main decision-making body of WHO and is comprised of 194 Member States. Every year, generally in May, delegates from all Member States come together to agree on the Organization's priorities and policies. At the Health Assembly, country delegates make decisions on health goals and strategies that will guide their own public health work and the work of the WHO Secretariat to move the world towards better health and well-being for all. The Health Assembly also serves as a forum for reporting back on the implementation of the areas of work set, in order to determine what has been achieved and decide on strategies for addressing the gaps. During the Seventy-seventh World Health Assembly, a series of strategic roundtables will be held. During these sessions, WHA delegates, partner agencies, representatives of civil society and WHO experts will discuss current and future priorities for public health issues of global importance.

SCIENCE POLICY AND DIPLOMACY

African Science Diplomacy Center Initiated in Kigali

A new research centre focusing on African science diplomacy was launched in Kigali, Rwanda during the fifth international conference on Governmental Science. The centre is a collaborative effort involving SciTech DiploHub, a non-profit organisation, the city governments of Barcelona and Kigali and several universities and academic institutions hailing from over 50 African nations. The centre is reportedly, "the largest-ever investment in scientific cooperation with Africa made by a Europe-based organization". The centre is expected to coordinate various initiatives from scientists, diplomats, entrepreneurs and companies to foster collaborative research on science and technology. The Centre also plans on undertaking training programs and assisting about twenty national and local governments with science policymaking in Africa. Its work shall focus on addressing the main developmental challenges facing Africa in areas including health, climate change and building city resilience.

International Day of Plant Health: FAO Emphasises on Prioritising Digital Solutions

Observing the International Day of Plant Health (IDPH) on 12 May 2024, the Food and Agriculture Organization (FAO) Deputy General, Beth Bechdol stressed on the need to leverage technology tools to protect plants. "The unprecedented global challenges we face, such as the unrelenting climate crisis, demand innovative approaches and digital technologies to support countries with stronger pest surveillance and early warning systems", she noted. The IDPH resulted from the International Year of Plant Health which was observed in 2020. It was instituted by the United Nations as a means to raise awareness on the importance of prioritising plant health as a means for reducing poverty and hunger and bolster measures for environmental protection.

Steady Progress on Proposed Pandemic Agreement

Governments on 10 May agreed to continue working on a proposed pandemic agreement, and to further refine the draft, ahead of the Seventy-seventh World Health Assembly that starts 27 May 2024. Governments meeting at the World Health Organization headquarters in Geneva agreed to resume hybrid and in-person discussions over coming weeks to advance work on critical issues, including around a proposed new global system for pathogen access and benefits sharing (i.e. life-saving vaccines, treatments and diagnostics); pandemic prevention and One Health; and the financial coordination needed to scale up countries' capacities to prepare for and respond to pandemics. The Member State-led Intergovernmental Negotiating Body (INB) was established over two years ago to take this effort forward. The Bureau of the INB, which is guiding the process, will submit its outcome for consideration at the World Health Assembly. In March 2021, heads of state and government from two dozen countries issued a statement of commitment calling for global collaboration to prepare for, prevent and respond to pandemics. In December 2021, WHO Member States decided to launch a global process to draft and negotiate a legally binding convention, agreement or other international instrument to strengthen pandemic prevention, preparedness and response.

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