



NEWS ALERT

Forum for Indian Science Diplomacy

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

Discovery of Liver Cancer-killing Compounds

Hepatocellular carcinoma (HCC) accounts for 85 per cent of liver cancer occurrence. The lack of effective therapeutic interventions for HCC has made liver cancer the second leading cause of cancer death worldwide. Current drugs, such as sorafenib and regorafenib, used to treat HCC are not durable, and are typically only used to treat patients with advanced-stage HCC. Advances in therapeutic discovery for HCC are needed to address this unmet need. In this context, four potential drug compounds that target hepatocellular

carcinoma (HCC) have been discovered by scientists from the Cancer Science Institute of Singapore (CSI), National University of Singapore, and the Agency for Science, Technology and Research (A*STAR)'s Genome Institute of Singapore (GIS), while diagnosing the most common type of liver cancer. The research was done using a cancer gene-targeting drug-screening platform engineered by the team, which is expected to pave the way for new and more effective treatments for liver cancer as well as other cancers. It was a collaborative study with Brigham and Women's Hospital, Boston as well as the Harvard Medical School. The discovery of potential drug compounds could pave the way for more effective and personalised liver cancer treatments in the future.

Use of silk to make Biomedical Devices

In exploring different materials to develop affordable and simple biomedical products, an efficient fabrication method for silk has been developed that can be heated and molded into solid forms for a wide range of applications, including medical devices. The end products have superior strength compared to other materials, have physical properties that can be functionally modified with bioactive molecules, such as antibiotics and enzymes. The new method evolved by the researchers at Tufts University involves solid-state thermal processing of silk, resulting in the molding of the silk protein polymer directly into bulk parts and devices with tunable properties. The method involves the fabrication of nanostructured 'pellets' with diameters from 30 nanometers to 1 micrometer that are produced by freeze drying an aqueous silk fibroin solution. The pellets are stable over long periods and thus can be shipped to manufacturing sites. The properties of the heat molded silk, such as flexibility, tensile and compression strength, can be tuned to specific ranges while the bulk materials can be further machined into devices, such as bone screws and ear tubes, or imprinted with patterns during or after the initial molding. Adding molecules such as enzymes, antibiotics or other chemical dopants allows for the modification of the bulk materials into functional composites. Being a major producer of silk, this technology could open up avenues for new technology development and commercialization in India.

China-Russia to boost cooperation in Artificial Intelligence

China and Russia are moving forward to explore more avenues for scientific collaboration after their agreement on developing information technology, artificial intelligence and other strategic areas. With the growing pressure from the West, China and Russia are getting closer and cultivating technological collaboration to counter the impact. Other areas could include robots, facial recognition and artificial intelligence, including dual-use technologies that can be applied for military use. Russia has designated 2020 as the year of 'Russian-Chinese science, Technical and Innovationcooperation' with the focus expected to be on communications, AI and 'the internet of things'.

INDIA

Launch of Atal Bhujal Yojana

On the Birth anniversary of former Prime Minister Atal Bihari Vajpayee, The Atal Bhujal Yojana (ATAL JAL) was launched, with the principal objective of strengthening the institutional framework for participatory groundwater management and bringing about behavioral changes at the community level for sustainable groundwater resource management in seven States, viz. Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh. A total of Rs. 600 billion is to be invested over a period of 5 years (2020-21 to 2024-25) in the programme. This programme reflects the proactive attitude towards the growing crisis of groundwater supply, impacting both agriculture and industrial sectors.

India-US to boost Science and Technology Cooperation

The Second India-U.S. 2+2 Ministerial Dialogue held on 19 December welcomed the conclusion of a new Science and Technology (S&T) Agreement, which will further strengthen collaboration on science and technology, particle research, and innovation. The Ministers recognized space cooperation, including on Earth science and lunar exploration, as a unique facet of the India-U.S. partnership. Both sides expressed intent to discuss areas of potential space defense cooperation in the next year. The Ministers welcomed the signing of the Industrial Security Annex (ISA) which will facilitate the exchange of classified military information between Indian and the U.S. defense industries. The Ministers were pleased to announce important progress under the Defense Technology and Trade Initiative (DTTI), including the finalization of a Statement of Intent to co-develop several projects. Recalling the successful recent meetings of the India-U.S. Cyber Dialogue and Information and Communication Technology (ICT) Working Group, the Ministers reaffirmed the importance of cyber security cooperation. The India-U.S. Strategic Energy Partnership was important to modernize power grids in support of India's goal to provide reliable and affordable energy to its population, develop greater integration of modern energy sources into India's power systems, and increase the focus on energy efficiency and combatting air pollution.

CSIR and CNRS sign MoU

Council of Scientific & Industrial Research (CSIR), India and the National Centre for Scientific Research (CNRS), France have signed a MoU to establish a framework for cooperation between the two towards promotion and support of scientific and technological research. The two partners are the leading scientific research agencies in the respective countries, and their collaborations have grown manifolds in 2019. The broad research areas of mutual interest involve biotechnology including plant and marine biotechnology; health research; environment and climate change studies; engineering science and technology; material science and technology; energy science and technology and water research.

Agri-tech platform to improve farmers' livelihoods

A digital platform, SafalFasal (www.safalfasalonline.in) has been launched, that gives small and marginal farmers greater access to finance, technology, markets, and risk-management tools. The SafalFasal Marketplace, developed by Global fintech solution provider BPC, connects buyers and sellers and improves the income of the farmer by enabling access to multiple buyers, multiple input companies at reduced prices, credit at affordable rates, financial services lifting them into the real economy and access to advisory services for a more efficient and sustainable crop productivity. Buyers benefit from access to a large and varied segment of credible and vetted farmers and their produce, ease of procurement and planning in a fragmented market, better logistics and tracing and therefore a better and more balanced price with reduced risk.

Launching of Society of Biotechnology of India

Former biotechnologists and technocrats of the Union Department of Biotechnology, Ministry of Science and Technology launched 'Society of Biotechnology of India', a non-profit organization which would focus on some salient objectives. It aims to (1) promote transformation changes and approaches towards core research in modern biotechnology so that the outcome could lead to more products and technologies for economic and social gain; (2) complement India's efforts towards enhancing research funding of "gap areas" in infrastructure, human resources, regulatory frameworks and converting research and development leads into applications. The members have experience and expertise in promoting biotechnology in areas such as BT cotton, introduction of recombinant therapeutic proteins and vaccines and fostering international collaborations.

Technology Development Projects Inaugurated

Department of Heavy Industry (DHI), Government of India has set up five Technology Development Projects recently, which involves application of AI, robotics and machine learning. Under the project, Indian Institute of Science (IISc), Bangalore has developed a technology for metal additive printing machine with the support from DHI. The development of this niche technology is being done for the first time in India. An Industry 4.0 SAMARTH UDYOG Centre is coming up at IISc to support Indian manufacturing to adopt and assimilate Industry 4.0 technology. A sensor technology manufacturing/fabrication facility is also envisaged at Central Manufacturing Technology Institute (CMTI), Bengaluru to help in making smart products and machines through deployment of function specific sensors, specially designed for data extraction. Another Facility for Nanotechnology is to come up at CMTI to provide better alternative route for precision manufacturing in strategic sectors. PSG College of Technology, Coimbatore along with Industry partners have developed Welding Robots, and special alloy electrodes for power supply. Indigenous technology has been developed at Scientific and Industrial Testing and Research Centre (SiTARC), which focus on development of Smart Submersible Pumping Solutions for Industrial and Water Supply Applications. These projects are being aligned with national priorities and development agenda.

IN BRIEF

Development of New Biodegradable Adhesive

Boston University team of researchers unveiled a biodegradable adhesive that is made entirely of naturally derived chemical components. It is made of biodegradable polymers that can effectively stick to anything just as well as plastic-based products on the market today. By adjusting the ratio of polymers and CO₂ in each batch of adhesives the material's adhesion can be made stronger, weaker, or able to respond to certain kinds of surfaces. The adhesive strength can range from that of Scotch tape to permanent wood glue, and it can be tailored to stick to metal, glass, wood, Teflon, and even wet surfaces. The naturally derived and biodegradable materials are also completely safe to use on or in the human body and could potentially replace metal used in surgeries to hold bone together, making some surgical procedures less invasive and also be used on the surface of skin to protect cuts, scrapes, wounds, or post-surgical incisions opening up many applications.

Low-cost Innovation for solar Energy Production

Lithuanian and German researchers have come up with a novel solution for developing low-cost solar technology using material which self-assembles to form a molecular-thick electrode layer, realizing highly efficient perovskite single-junction and tandem solar cells. The self-assembled monolayers (SAMs) are as thin as 1-2 nm, covering all the surface; the molecules are deposited on the surface by dipping it into a diluted solution based on carbazole head groups with phosphonic acid anchoring groups and can form SAMs on various oxides. By integrating a SAM-based perovskite solar cell into a tandem architecture, a 23.26%-efficient monolithic CIGSe/perovskite tandem solar was realized, which is currently a world record for this technology. Moreover, one of the lately developed SAMs used in the Si/perovskite tandem cell achieved the nearly record-breaking efficiency of 27.5%. Using traditional technologies, 1 g of silicon (Si) is enough to produce only a couple of square centimetres of the solar element; however, 1 g of the SAM material is enough to cover up to 1000 m² of the surface. In addition, the self-assembling organic material is significantly cheaper than the alternatives used in photovoltaic elements currently. The material called 2PACz and MeO-2PACz will soon appear in the market.

RESOURCES AND EVENTS

Deteriorating State of Global Biodiversity

With current biodiversity assessments failing to take into account the impacts of past land changes, the researchers at University of Sussex, United Kingdom, believe that the natural world could be in a far worse state than currently thought. The study shows that fewer species and fewer individuals are observed at sites that have been disturbed by an abrupt land change in past decades. The study combined global data on biodiversity from the PREDICTS database, which is one of the largest databases of terrestrial plants, fungi and animals across the world. It is entwined with quantitative estimates of abrupt land change detected using images from NASA's Landsat satellites from 1982 to 2015. Comparing numbers of plants, fungi and animals at 5,563 disturbed sites with those at 10,102 undisturbed sites across the world from Africa to Asia, the researchers found that biodiversity remains affected by a land change event for several years after it has occurred, due to a lag effect. Species richness and abundance were found to be 4.2% and 2% lower, respectively, at sites where an abrupt land change had occurred. However, at sites where a land change had taken place 10 or more years ago, species richness and abundance were indistinguishable from sites without a past land change in the same period, indicating that biodiversity can recover after such disturbances. The results indicate that regional and global biodiversity assessments need to consider looking back at the past in order to have more accurate results in the present.

Green New Deal Report

This report is drafted by researchers from developed and developing nations, offering an updated vision for 143 countries, in order to attain 100% clean, renewable energy by the year 2050. The new roadmaps project the transition to clean, renewable energy, which could reduce worldwide energy needs by 57%, create 28.6 million more jobs, and reduce energy, health, and climate costs by 91% compared with a business-as-usual analysis. The report takes into account data on how each country's energy use is changing, acknowledges lower costs and greater availability of renewable energy and storage technology, and also includes new countries in its analysis, accounting for recently built clean, renewable infrastructure in some countries. The roadmaps call for the electrification of all energy sectors, for increased energy efficiency leading to reduced energy use, and for the development of wind, water, and solar infrastructure that can supply 80% of all power by 2030 and 100% of all power by 2050. All energy using sectors include electricity; transportation; building heating and cooling; industry; agriculture, forestry, and fishing; and the military. The researchers' modeling suggests that the efficiency of electric and hydrogen fuel cell vehicles over fossil fuel vehicles, of electrified industry over fossil industry, and of electric heat pumps over fossil heating and cooling, along with the elimination of energy needed for mining, transporting, and refining fossil fuels, could substantially decrease overall energy use. The transition to wind, water, and solar would require an initial investment of \$73 trillion worldwide, but this would pay for itself over time by energy sales. In addition, clean, renewable energy is cheaper to generate over time than fossil fuels, so the investment reduces annual energy costs significantly. In addition, it reduces air pollution and its health impacts, and only requires 0.17% of the 143 countries' total land area for new infrastructure and 0.48% of their total land area for spacing purposes, such as between wind turbines.

'Call for Action' to conserve global groundwater supply

Under the leadership of International Water Management Institute (IWMI), more than 700 groundwater scientists, managers and development actors have issued a Call for Action to manage and conserve the world's groundwater supply. It highlights that groundwater is frequently mismanaged and urges for action to match the SDGs' timeline of 2030. The joint statement calls for a Global Groundwater Summit in 2022 and for sustainability plans to be implemented for over-exploited aquifers. The Call to Action features three main items: (1) to draw attention to groundwater sustainability, through a UN World Water Development

Report and a Global Groundwater Summit in 2022; (2)to apply sustainability guiding principles by 2030 for managing groundwater, from local to global scales; and (3) to invest in groundwater governance, through planning for nature-based solutions, capacity building, awareness raising, and monitoring and reporting systems. IWMI's research indicates that such actions are critical for developing countries; in context to India, 60% of groundwater aquifers are in critical condition; the rapid growth in cities and urban populations in sub-Saharan Africa will require a quadrupling of water supply services by 2035, wherein the major source is groundwater.

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