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NEWS ALERT

Forum for Indian Science Diplomacy

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GLOBAL

Novel CRISPR-based technique for medical diagnostics

Scientists from USA have repurposed the genetic modification technology CRISPR to identify antibodies in patient blood samples which could enable a new class of medical diagnostics in addition to a host of other applications. The technology involves customizable collections of proteins which are attached to a variant of Cas9, that bind to DNA but not cut it, as it would when used for genetic modification. When these Cas9-fused proteins are applied to a microchip sporting thousands of unique DNA molecules, each protein within the mixture will self-assemble to the position on the chip containing its corresponding DNA sequence. The researchers have called this technique 'PICASSO', short for peptide immobilization by Cas9-mediated self-organization. By applying a blood sample to the PICASSO microarray, the proteins on the microchip that are recognized by patient antibodies can be identified. The research team has demonstrated that the technology works to assemble thousands of different proteins, suggesting that it could be readily adapted as a broad-spectrum medical diagnostic tool.

Scientists develop genome-editing strategy for potential Alzheimer's disease therapy

An international research team led by scientists from the Hong Kong University of Science and Technology (HKUST) has developed a novel genome-editing strategy that can reduce Alzheimer's disease (AD) pathologies. The genome-editing system crosses the blood–brain barrier, and delivers an optimized genome-editing tool to the entire brain. The researchers used a newly engineered delivery vehicle for genome-editing, and the strategy achieved efficient brain-wide genome editing through a single non-invasive intravenous administration. It effectively disrupted FAD-inflicted mutations in AD mouse models and ameliorated AD pathologies throughout the entire brain, paving the way to novel therapeutic development for the disease. The results in the mouse model demonstrated that a single-shot genome-editing strategy has lasting effects without any side effects.

PULSAR-integrated radiotherapy with immunotherapy for improved tumour control

Researchers at UT Southwestern Medical Center have developed PULSAR (Personalized Ultra-Fractionated Stereotactic Adaptive Radiotherapy) that improves tumour control and can bolster systemic immunotherapy benefit. They tested one of the most common classes of immunotherapy, a-PD-L1 checkpoint inhibitor, along with the PULSAR radiation. The team found that splitting two pulses of radiation by 10 days was much more effective in combination with the checkpoint drug than the typical daily radiation schedule commonly used in radiotherapy clinics. In the PULSAR paradigm, patients receive only a few large dose "pulses," delivered with sophisticated, image-guided precision, at least a week, or even months, apart. They are less toxic and give oncologists time to fine-tune treatment after the new machines' imaging shows the tumour's changed shape, size, position, and its reaction to radiation.

New world record with Bifacial Solar Cells

Scientists at the Australian National University (ANU) have produced a more efficient type of solar cell, using laser processing and have set a new world record in the process. The solar cells are dual-sided, meaning both the front and back of the cell generate power. When deployed on a conventional solar farm, a bifacial cell absorbs direct incoming light, while also taking advantage of ground reflection, which can contribute up to an additional 30 percent power generation. The research team achieved a front conversion efficiency of 24.3 percent and a rear conversion efficiency of 23.4 percent, representing a bifacial factor of 96.3 percent. This performance represents an effective power output of approximately 29 percent, well exceeding the performance of the best single-sided silicon solar cell.

New nanomaterial resists projectile impact better than Kevlar

Engineers at Caltech, MIT, and ETH Zürich have developed a nano-structured material made from tiny carbon struts that is, better than Kevlar, a material commonly used in personal protective gear. The material, which is thinner than a human hair, consists of interconnected tetrakaidecahedrons made out of carbon struts that have been formed under extreme heat (known as pyrolytic carbon).The scientists created two versions of the material: a denser and a looser one. They tested both versions with 14-micron-diameter spherical silicon oxide particles, one at a time, impacting at between 40 and 1,100 meters per second. The researchers found that the denser version of the material was more resilient, with the micro-particles tending to embed in the material rather than tearing straight through. Pound for pound, the new material outperformed steel by more than 100 percent and Kevlar composites by more than 70 percent.

Increasing lifespan and stability of human implantable medical devices

A research team at the Korea Institute of Science and Technology has developed a coating technology for medical devices implanted into the human body, including the brain, and able to minimize tissue damage during the implantation process and inhibit the inflammatory response. The developed technology involves a method for creating a thin and uniform coating of a monolayer and lubricating oil on the surface of the implantable devices, which exhibits anti-bioadhesion properties. The team developed a lubricant-coated neural probe with 32 electrodes for measuring brain signals, and they showed the reduction of immune responses through in-vivo experiments. Brain signals were successfully observed from over 90 percent of the electrodes immediately after implantation. The number of signals was twice that obtained using uncoated neural probes, and it stably measured brain signals for four months, which was four times the lifespan of uncoated probes. The developed coating technology can be applied to human implantable devices for not only the brain but also other parts of the body and the technology can significantly extend the lifespan of such devices.

Improved water splitting method

A team of researchers from Pusan National University, Korea, have developed a novel electrocatalyst by depositing cobalt and manganese ions, in varying proportions, on a Polyaniline (PANI) nanowire array using a simple hydrothermal process. By tuning the Co/Mn ratio, they have achieved an overall high surface area for the reactions to occur, and combined with the high electron conducting capacity of the PANI nanowire, faster charge and mass transfer was facilitated on this catalyst surface. In tests of the performance of this catalyst, they found improved voltage efficiency of the system. Even after 40 hours of continuous hydrogen production at 100 mA/cm2, its performance

remained consistent, and water splitting was possible at a low input voltage of merely 1.54V. Another advantage is the low cost of transition metals. The system can be scaled and adapted for application to a myriad of settings. Possible future applications could be water-splitting devices installed onsite where hydrogen fuel is required, and can function using a low energy input or a completely renewable source of energy.

Synthetic biology to build muscle fibers tougher than Kevlar

Researchers at Washington University in St. Louis have developed a synthetic chemistry approach to polymerize proteins inside of engineered microbes. This enabled the microbes to produce the high molecular weight muscle protein, titin, which was then spun into fibers. The team engineered bacteria to piece together smaller segments of the protein into ultra-high molecular weight polymers around two megadaltons in size – about 50 times the size of an average bacterial protein. They then used a wet-spinning process to convert the proteins into fibers that were around ten microns in diameter. These fibers have a unique combination of exceptional toughness, strength, and damping capacity, or the ability to dissipate mechanical energy as heat. These materials have many potential biomedical applications such as sutures, tissue engineering. In future more unique materials could be enabled by this microbial synthesis strategy, by taking proteins from different natural contexts, then put them into this platform for polymerization and create larger, longer proteins for various material applications with a greater sustainability.

COVID-19

COVID-19 (WORLD)

New rapid and sensitive COVID-19 test

Researchers from the University of Birmingham, U.K., have developed a novel, highly sensitive testing method for COVID-19. The Exponential Amplification Reaction (EXPAR) method is as sensitive, but faster, than both PCR and LAMP tests. The test, called RTF-EXPAR uses a new RNA-to-DNA conversion step that avoids reverse transcription and uses EXPAR, which amplifies DNA at a single temperature, thus avoiding lengthy heating and cooling steps found in PCR. The RTF-EXPAR method converts under 10 strands of RNA into billions of copies of DNA in less than 10 minutes, using a one-pot assay that is compatible with more basic, benchtop equipment than that used with current testing methods. The RTF-EXPAR method can be quickly adapted should new variants emerge, or for testing other viral pathogens such as Influenza, Respiratory Syncytial Virus (RSV), or Ebola, where near-patient testing is required to prevent more widespread transmission. The team is now seeking commercial partners for rapid licensing, to make the RTF-EXPAR test available as widely as possible.

Online portal to rapidly accelerate coronavirus research worldwide

To further accelerate COVID-19 research on a global scale, investigators from the University of Colorado Anschutz Medical Campus have created a multi-dimensional dataset, known as the COVIDome dataset, derived from hospitalized COVID-19 patients versus negative controls. The team has launched a public online portal called the COVIDome Explorer to share that data in real time. The datasets include demographics and clinical data, along with matched analysis of the whole blood transcriptome, analysis of the plasma and red blood cell metabolomes, deep immune phenotyping by mass cytometry and seroconversion assays. To facilitate quick and broad access to the COVIDome dataset, each dataset (after data curation and quality

control) is linked at the sample level with a unique identifier, enabling cross-referencing among platforms. Leveraging the leading-edge tools and technologies of the TrisomExplorer, the team was able to create the COVIDome Explorer in a matter of weeks and make it available to the public to help advance COVID-19 research.

Using nasal bacteria to develop better intranasal vaccines for COVID-19 and flu

Researchers from Japan have explored the role of nasal bacteria to provide clues to developing better intranasal vaccines for flu and COVID-19. To determine the effects of nasal bacteria in the induction of mucosal immune responses to influenza virus infection, the researchers treated mice intranasally with an antibiotic cocktail to kill the nasal bacteria before influenza virus infection. They found that disruption of nasal bacteria by antibiotics before influenza virus infection enhanced the virus-specific antibody responses. The intranasal application of antibiotics could release bacterial pathogen-associated molecular patterns (PAMP), which are bacterial components that stimulate innate immunity that act as mucosal adjuvants for influenza virus-specific antibodies response. The findings provide clues to develop effective intranasal vaccines for influenza and COVID-19 in the near future.

Existing drugs kill SARS-CoV2 in cells

A study from University of Michigan revealed several drug contenders already in use for other purposes including one dietary supplement to block or reduce SARS-CoV2 infection in cells. The team used artificial intelligence-powered image analysis of human cell lines during infection with the novel coronavirus. They treated the cell with more than 1,400 individual FDA-approved drugs and compounds, either before or after viral infection, and screened it, resulting in 17 potential hits. Ten of those hits were newly recognized, with seven identified in previous drug repurposing studies. The team would soon launch clinical trials of the compounds to examine the ability to reduce viral loads and inflammation in patients with SARS-CoV2 infection. The team also identified a class of compounds called MEK-inhibitors, typically prescribed to treat cancer, that appear to worsen SARS-CoV2 infection. The finding sheds light on how the virus spreads among cells.

Antibody that protects against a broad range of COVID-19 virus variants

Researchers at Washington University School of Medicine in St. Louis have identified an antibody that is highly protective at low doses against a wide range of COVID-19 variants. It binds to a unique spot on the spike protein that is not targeted by other antibodies under development. The researchers screened the several antibodies and selected two antibodies that were most effective at protecting mice from disease and tested them against a panel of viral variants (alpha, beta, gamma, delta, kappa, iota and several unnamed variants that are being monitored as potential threats). They found an antibody - SARS2-38, which easily neutralized all the variants. Moreover, a humanized version of SARS2-38, in mice, prevented disease caused by two variants: kappa and a virus containing the spike protein from the beta variant. The findings could be a step toward developing new antibody-based therapies that are less likely to lose their potency as the virus mutates.

Building a better vaccine for SARS CoV-2

Researchers from Japan highlight the potential benefits of S gene mutants as immunogens. They employed SARS-CoV-2 mutants lacking the S protein cleavage site and characterized their growth and pathogenicity using hamsters, a laboratory animal model for SARS-CoV-2 infection. These mutants exerted low pathogenicity but induced sufficient levels of neutralizing antibodies in hamsters, which protected hamsters from

re-challenge with pathogenic clinical SARS-CoV-2 strains. These virus mutants may be used as protective immunogens against SARS-CoV-2 infection. Also, the researchers caution that these variants rapidly emerge through SARS-CoV-2 propagation in some cell lines, including Vero cells (lineage of cells used in cell cultures), so there remains the possibility of unexpected contamination with these variants.

NIH launches study of extra COVID-19 vaccine dose in people with autoimmune disease

The National Institutes of Health has begun a clinical trial to assess the antibody response to an extra dose of an authorized or approved COVID-19 vaccine in people with autoimmune disease who did not respond to an original COVID-19 vaccine regimen. The trial will investigate whether pausing immunosuppressive therapy for autoimmune disease improves the antibody response to an extra dose of COVID-19 vaccine in this population. The trial will initially include people with one of five autoimmune diseases: multiple sclerosis, pemphigus, rheumatoid arthritis, systemic lupus erythematosus or systemic sclerosis. The study team will enroll approximately 600 participants aged 18 years and older at 15 to 20 sites nationwide. The study participants will be followed for a total of 13 months and preliminary results of the trial are expected in November 2021.

Delta variant doubles risk of COVID-19 hospitalisation, new UK study confirms

A study of more than 40,000 COVID-19 cases from England between 29 March and 23 May 2021 confirmed by virus genome sequencing finds a two- fold increased risk of hospitalisation from delta versus alpha variant infections. The risk of emergency care visits or hospital admission was also 1.5 times higher for people infected with the delta variant compared to the alpha variant. The findings suggest that outbreaks of the delta variant are likely to lead to a greater burden on health services than the alpha variant, particularly in unvaccinated people and other vulnerable populations. Study findings primarily reflect the increased risk of hospitalisation among unvaccinated or partially vaccinated people, since these individuals made up the majority of cases in the study.

COVID-19 (INDIA)

India grants Zydus Cadila's COVID Vaccine Emergency Use Authorization

Zydus Cadila's indigenously developed needle-free COVID-19 vaccine ZyCoV-D has been granted the emergency use authorisation (EUA) by the drug regulator, making it the first vaccine to be administered to beneficiaries in the age group of 12-18 years in the country. ZyCoV-D is the world's first DNA-based vaccine against the coronavirus and when injected, produces the spike protein of the SARS-CoV-2 virus and elicits an immune response, which plays a vital role in protection from the disease as well as viral clearance. The plug-and-play technology on which the plasmid DNA platform is based can be easily adapted to deal with mutations in the virus. It is the sixth vaccine to get EUA in the country, after Covishield, Covaxin, Sputnik V and the vaccines of Moderna and Johnson and Johnson. The interim results from a phase 3 trial revealed an efficacy of 66.6 percent against symptomatic COVID-19.

India's First COVID-19, mRNA vaccine to move into Phase II/III trial

India's first COVID-19 mRNA vaccine was found to be safe and given the go-ahead from the Drug Controller General of India to move into the phase II/III clinical trials. Pune-based biotechnology, Gennova Biopharmaceuticals Ltd developed the mRNA-

based COVID-19 vaccine and submitted the interim clinical data of the Phase I study to the Central Drugs Standard Control Organisation (CDSCO). The vaccine Subject Expert Committee (SEC) reviewed the interim Phase I data and found that the vaccine candidate was safe, tolerable and immunogenic in the participants of the study. Phase II study will be conducted in India at approximately 10-15 sites and Phase III in 22-27 sites.

Indian Scientist partners with BRICS Group to study the overlap of SARS-CoV-2 with tuberculosis

The Department of Biotechnology, Government of India in collaboration with BRICS countries is implementing the SARS-CoV-2 NGS-BRICS consortium and multicentric programme to study the impact of severe COVID-19 conditions on tuberculosis patients. An interdisciplinary team of researchers from India, Brazil and South Africa would investigate the impact of severe COVID-19 on transient peripheral immune-suppression and lung hyper-inflammation conditions in tuberculosis patients for epidemiology and comorbidity. This collaborative study is expected to provide valuable co-morbidity data pertaining to pulmonary tuberculosis patients with or without COVID-19 co-infection for better disease management.

India's COVID-19 vaccination

The cumulative number of COVID-19 vaccine doses administered in the country has reached more than 630 million till 30th August. The beneficiaries vaccinated include health care workers (10.3 million have taken the first dose and 8.3 million have taken the second dose); frontline workers (18.3 million have taken the first dose and 13 million have taken the second dose); between the age group 18-44 years (244 million have taken the first dose and more than 26 million have taken the second dose); beneficiaries aged 45-59 (129 million have taken the first dose and more than 53 million have taken the second dose); and beneficiaries more than 60 years (86 million have taken the first dose and 44 million have taken the second dose).

INDIA – SCIENCE & TECHNOLOGY

India hosts world's second-largest gene bank

The world's second-largest state-of-the-art National Gene Bank was inaugurated at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. The new gene bank with state-of-the-art facilities for germplasm would benefit agri-farmers. The National Gene Bank was established in the year 1996 to preserve the seeds of Plant Genetic Resources (PGR) for future generations, and has the capacity to preserve about one million germplasm in the form of seeds. Presently, it is protecting 450,000 accessions, of which 270,000 are Indian germplasm and the rest have been imported from other countries. NBPGR is meeting the need of in-situ and ex-situ germplasm conservation through Delhi Headquarters and 10 regional stations in the country.

Nano carrier-based oral drugs for Visceral Leishmaniasis therapy

Researchers from the Institute of Nano Science and Technology (INST) have developed a non-invasive potential therapeutic strategy against Visceral Leishmaniasis, a neglected tropical disease. They developed a nanocarrier utilizing the natural intrinsic Vitamin B12 pathway present in the human body to mitigate stability challenges and drug-associated toxicity. This strategy minimized the side effects, while the natural intrinsic Vitamin B12 pathway enhanced the oral bioavailability and anti-leishmanial therapeutic efficacy by more than 90 percent, as shown in the associated animal studies. The team also critically evaluated the efficacy and properties of Vitamin B12 coated solid lipid

nanoparticles and their subsequent potential ramification in evading cytotoxicity and escalating stability.

Indigenous memory technology adoption for 180 nm CMOS production

IIT Bombay has partnered with SCL Mohali to successfully demonstrate CMOS 180nm based production-ready 8-bit memory technology. IIT Bombay invented the one-time programmable (OTP) memory based on ultra-thin deposited silicon dioxide (a few atoms thick) instead of the existing gate oxide-based OTP technology. In contrast to the high voltage required by gate oxide breakdown, IIT Bombay's memory chip requires less power and chip-area, since the need for boosted voltage supply is avoided. This development will enable secure memory and encryption hardware for the country.

Indigenously developed powders from unused scrap materials

A team of scientists from the International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI) indigenously developed powders suitable for the additive manufacturing process called the Directed Energy Deposition (DED) process. They used an inert gas atomizer and melted unused scrap material. The team has for the first time repaired aero-engine components made of Ni-based super-alloy through an emerging additive manufacturing or 3D printing technique. The team further developed a technology to refurbish pinion housing assembly by machining out the damaged layer and rebuilding it using a laser cladding process followed by final machining. A patent has been filed for the technology.

BRICS-ARP operationalized to strengthen cooperation in agricultural research and innovations

BRICS-Agricultural Research Platform (BRICS-ARP) has been prepared and set up in India to encourage research co-operation amongst the BRICS member States and to improve the use and application of agricultural technologies for meeting the needs of producers and processors. The platform has been operationalized at the 11th meeting of BRICS Agriculture Ministers. The Coordinating Centre of the BRICS-ARP is housed at the NASC Complex, Pusa, New Delhi. BRICS-ARP as a global platform for science-led agriculture will help in addressing the issues of world hunger, under-nutrition, poverty and inequality by promoting sustainable agricultural development through strategic cooperation in agriculture and allied sector. The platform would intensify cooperation in the areas of agricultural research, technology, policy, innovations and capacity building including technologies for smallholder farming and to sustainably increase yields and farmers' income in the BRICS member countries. The platform will escalate the exchange of research findings and innovation and best practices for up-scaling in the BRICS countries.

Multi-storeys constructed with Thermocol could be the future earthquake-resistant buildings

Researchers at IIT Roorkee have found that thermocol or Expanded Polystyrene (EPS) could be the future material for construction of earthquake-resistant buildings with thermal insulation and could also save the energy required to develop construction materials. They used EPS as a composite material in the core of reinforced concrete sandwich in the form of welded wire mesh. The researchers tested a full-scale building and a number of wall elements at the National Seismic Test Facility. They evaluated the behaviour of the constructions under lateral forces, and supplemented them with detailed computer simulation of a realistic 4-storey building. The analysis showed that a four-storey building constructed with this technique is capable of resisting earthquake

forces, even in the most seismic zone, without any additional structural support. The core also provides the necessary insulation against the heat transfer between building interior and exterior environment.

New advanced oxidation technology can enhance waste-water reuse at lower cost

The Energy and Resources Institute, New Delhi, has developed a technology called 'The Advanced Oxidation Technology' or TADOX® which can reduce dependence and load on biological and tertiary treatment systems and help achieve Zero Liquid Discharge (ZLD). It can bring down capital expenditure on ZLD by 25-30 percent and operating expenses by 30-40 percent for industrial waste-water treatment. The technology involves UV-Photocatalysis at the secondary treatment stage leading to oxidative degradation and mineralization of targeted pollutants. It can treat municipal sewage and highly polluting industrial wastewater streams and increase its reuse. TADOX® could be integrated and retro-fittable in existing treatment systems making it a viable option as a novel Decentralized Wastewater Treatment Technology (DWTT) applicable in upcoming and existing infrastructural projects, townships, commercial complexes, green buildings, and smart cities. It has been chosen for pilot trials and augmentation plans for identified industrial sectors.

NTPC commissions largest Floating Solar PV Project in the country

The National Thermal Power Corporation (NTPC) Ltd, has commissioned the largest floating solar photo voltaic (PV) project of 25 megawatt on the water reservoir of its Simhadri thermal station in Visakhapatnam, Andhra Pradesh. The floating solar installation has a unique anchoring design and is spread over 75 acres in an RW reservoir. This project has the potential to generate electricity from more than 0.1 million solar PV modules. The project is part of NTPC's plan to have 60 gigawatt renewable energy capacities by 2032 from around 4 gigawatts at present. NTPC is also planning to set up a hydrogen-based micro-grid system on a pilot basis at Simhadri. This project would help to light around 7,000 households and meet water requirements of 6,700 households with low carbon footprints.

IN BRIEF

Bio-process for converting plant materials into valuable chemicals

A team of scientists at the University of Illinois Urbana-Champaign developed a bio-process using engineered yeast that completely and efficiently converted plant matter into high-value bioproducts. Their methodology fully utilized the xylose and acetate from the cell walls of switchgrass, transforming the acetate from an unwanted byproduct into a valuable substrate that boosted the yeast's efficiency at converting the sugars in the hydrosolates. The two carbon sources from xylose and acetate formed synergies to promote efficient metabolism of both compounds. This strategy was deployed to economically produce fine chemicals such as triacetic acid lactone, and vitamin A and can be seamlessly integrated into cellulosic bio-refineries.

New CRISPR-based technology to speed identification of genes involved in health and disease

A new technology, 'MIC-Drop' developed by scientists at University of Utah Health, allows researchers to efficiently deploy the CRISPR gene editing system into zebrafish to rapidly evaluate the functions of hundreds of genes in a single experiment. To demonstrate MIC-Drop's potential, the team tested 188 different zebrafish genes for a potential role in heart development. After creating guide RNAs targeting those genes and introducing the CRISPR system into hundreds of fish embryos, they identified

several animals that developed heart defects as they matured. Using the DNA barcodes in those fish, the team was able to trace the defects back to 13 different inactivated genes. Because of the similarities between zebrafish and human genes, the finding may point toward previously unknown aspects of heart development in humans. This technology would enable researchers to do genome-scale screening.

Implantable AI platform for real-time biosignal classification

TU Dresden scientists have succeeded in developing a bio-compatible implantable AI platform that classifies in real time healthy and pathological patterns in biological signals such as heartbeats. It detects pathological changes even without medical supervision. The research team used polymer-based fiber networks that structurally resemble the human brain and enable the neuromorphic AI principle of reservoir computing. The random arrangement of polymer fibers forms a so-called "recurrent network," which allows it to process data, analogous to the human brain. In trials, the AI was able to differentiate between healthy heartbeats from three common arrhythmias with an 88 percent accuracy rate. In the process, the polymer network consumed less energy than a pacemaker. The potential applications for implantable AI systems are manifold.

Combining perovskite with silicon, solar cells convert more energy from sun

Researchers from Oxford Photovoltaics describe how pairing metal halide perovskites with conventional silicon leads to a more powerful solar cell that overcomes the 26 percent practical efficiency limit of using silicon cells alone. The researchers found adding perovskite onto existing silicon photovoltaics as the fastest way to improve silicon performance, as it bypasses the industry disruptions associated with the introduction of a brand-new technology. The researchers focused on tandem solar cells for seven years, and the group is now close to starting mass commercial production in its factory in Brandenburg, Germany. The potential of perovskite-on-silicon tandem technology can boost the efficiency of solar installations and help the world reach the goal of providing sustainable energy for all.

Human protein can deliver molecular medicines to cells

Researchers from MIT have developed a new way to deliver molecular therapies to cells. The system, called SEND (Selective Endogenous eNcapsidation for cellular Delivery), can be programmed to encapsulate and deliver different RNA cargoes. SEND harnesses natural proteins in the body that form virus-like particles and bind RNA, and it may provoke less of an immune response than other delivery approaches. To develop the SEND technology, the team identified the molecular sequences in PEG10's (PEG10 protein exists naturally in humans and is derived from a "retrotransposon") mRNA and used these signals to engineer both PEG10 and other RNA cargo so that PEG10 could selectively package those RNAs. Next, the team decorated the PEG10 capsules with additional proteins, called 'fusogens' to help them fuse together. This enabled the researchers to target the capsule to a particular kind of cell, tissue, or organ. This new delivery platform works efficiently in cell models, and could open up a new class of delivery methods for a wide range of molecular medicines including those for gene editing and gene replacement.

Cancer therapy breakthrough in vitro using self-assembled drugs

A team of scientists at the University of Huddersfield have discovered chemical systems that self-assemble into molecular capsules which are highly toxic towards human cancer

cells of a range of different tumour types. They have demonstrated unprecedented cancer selectivity and many thousands of times more toxic to the cancer cells compared to healthy, normal cells in the laboratory. Their research showed that the new potential drug can be assembled with zinc, copper, or manganese, with the three metal ions imparting significantly different chemotherapeutic properties via different mechanisms depending upon the metal ion used. Such assembly can generate different chemical systems, each of which may have specificity for different cancers. Future studies will test if this may be useful for cancers for which effective treatments are not currently available.

Smallest biosupercapacitor provides energy for biomedical applications

A team of researchers at Chemnitz University of Technology has developed the smallest micro-supercapacitors to date which functions in (artificial) blood vessels and can be used as an energy source for a tiny sensor system to measure pH. They produced a tubular nano-biosupercapacitors (nBSC), which, with a volume of 0.001 mm3 (1 nanolitre), can deliver up to 1.6 V supply voltage for microelectronic sensors. The nBSC were produced by placing the materials required on a wafer-thin surface under high mechanical tension. The team used an nBSC based ring oscillator and integrated a pH-sensitive BSC into the ring oscillator so that there is a change in output frequency depending on the pH of the electrolyte. The hollow inner core of this micro sensor system serves as a channel for the blood plasma. In addition, three nBSCs connected in series with the sensor enable particularly efficient and self-sufficient pH measurement. These properties open up a wide range of possible applications, for example in diagnostics and medication.

First study to investigate the role of RNA tags in Alzheimer's disease

Researchers from Boston University School of Medicine (BUSM) have discovered a new type of molecular pathology that accumulates in the nerve cells of patients with Alzheimer's disease (AD). They have found that as the injured nerve cells accumulate mis-folded tau protein, they put a tag on RNA which is the genetic material that codes for proteins. Over the course of the disease, the amount of tagged RNA called N6-Methyladenosine (m6A) increases about four-fold. Further, the researchers found that inhibiting the RNA-tagging pathway protects against nerve cell injury (neurodegeneration) associated with the accumulation of mis-folded tau. This important result raises the possibility that blocking the RNA-tagging pathway might provide a novel approach to treat AD.

Highly conductive and elastic nanomembrane for skin electronics

Researchers at the Institute for Basic Science (IBS), South Korea have developed a new method to fabricate a composite material in a form of nanomembrane, which is of ultrathin thickness, has metal-like conductivity, high stretchability, and ease of patternability. The new composite material consists of metal nanowires that are tightly packed in a monolayer within ultrathin rubber film, made using a three step process called a "float assembly method." The method consists of a three-step process. The material has excellent physical properties, such as a stretchability of over 1,000 percent, and a thickness of only 250 nm. The structure also allows cold welding and bi-layer stacking of the nanomembrane onto each other, which leads to a metal-like conductivity over 100,000 S/cm. Furthermore, it can be patterned using photolithography. It is expected that the nanomembrane can serve as a new platform material for skin

electronics. The float assembly method can open new research fields involving various types of nanomembranes with different functions.

Electric gains in battery performance

A KAUST team has developed a new electrolyte and electrode combination that improved several aspects of zinc-ion battery performance, particularly the stability over multiple charge and discharge cycles. The team developed a water electrolyte with a very high salt concentration. The team added sodium to produce a highly concentrated electrolyte of zinc perchlorate and sodium perchlorate. This combination delivered very high solubility to suppress water activity, without lowering the key attributes of zinc-ion batteries, including their high ionic conductivity, safety or environmental friendliness. In addition to the novel electrolyte, the team also developed a new nanofiber-based cathode material for batteries, which ensures faster charge and discharge rates of the aqueous Zn-ion batteries.

4 in 1 blood pressure pill: Safe and more effective than usual hypertension treatment

An Australian clinical trial of a potential future combination pill for hypertension termed Quadruple UltrA-low-dose tReatment for hypErTension (QUARTET), has demonstrated that a single pill containing ultra-low quadruple combination is much more effective than the traditional approach of starting with monotherapy (single drug). The study with 591 participants indicated significant reduction of blood pressure at 12 weeks. The differences were sustained, with better controlled blood pressure compared to the standard approach at 12 months, and with no differences in side effects. The trial has overwhelmingly demonstrated the efficacy, tolerability and safety of this ultra-low-dose combination strategy which will be soon translated into a product available for the general public.

System powers lights, phones, laptops without wires

Researchers at the University of Michigan and University of Tokyo have developed a system to safely deliver electricity over the air, potentially turning entire buildings into wireless charging zones. The technology can deliver up to 50 watts of power using magnetic fields. The team demonstrated the technology in a purpose-built aluminum test room measuring approximately 10 feet by 10 feet. They wirelessly powered lamps, fans and cell phones could draw current from anywhere in the room regardless of the placement of people and furniture. The technology uses a conductive surface on room walls and a conductive pole to generate magnetic fields. Devices harness the magnetic field with wire coils, which can be integrated into electronics like cell phones. The system could easily be scaled up to larger structures like factories or warehouses while still meeting existing safety guidelines for exposure to electromagnetic fields.

New Insulation material enables better electrical cables

Scientists from Chalmers University of Technology, Sweden, have developed a new insulation material up to three times less conductive than usual insulating materials, offering significant improvements to the properties and performance of high voltage direct current (HVDC) cables. The basis of the new material is polyethylene, with the addition of very small amounts – 5 parts per million – of the conjugated polymer known

as poly (3-hexylthiophene). The additive, also known as P3HT, opens up new possibilities for manufacturers. The discovery could lead to numerous new applications and directions for research of improved plastic materials by additives.

RESOURCES AND EVENTS

IIT-H establishes astronomical observatory

A large telescope facility has been established in the Indian Institute of Technology, Hyderabad (IIT-H) campus. The telescope is equipped with a huge mirror with an optical diameter of 355 mm and a focal length of 1650 mm. Such a large mirror along with a Crayford focuser and elegant truss tube design will enable observation of the deep sky and faint objects which cannot possibly be detected with a small telescope. Small craters on the lunar surface, rings of Saturn are some of the small features that can be resolved with the telescope. An advanced digital camera will be used to record images and transient astronomical phenomena like meteor showers. With this Telescope, IIT-H will be a part of the Indian astronomical community hosting a large telescope for an effective outreach with high-quality deliverance. The facility will be used for outreach and night sky observational training programs.

NITI Aayog releases North Eastern Region District SDG Index and Dashboard 2021–22

The first edition of the North Eastern Region District Sustainable Development Goals (SDGs) Index Report and Dashboard 2021–22 has been released by NITI Aayog. It is an effort towards localising the SDGs at the district level. The Index measures the performance of the districts of the eight north-eastern states on the SDGs and their corresponding targets, and ranks the districts based on the same. The index is based on NITI Aayog's SDG India Index –the principal and official tool for monitoring progress on the SDGs at the national and State/ Union Territory levels. Out of the 103 districts considered for ranking, 64 districts belonged to the Front Runner category while 39 districts were in the Performer category in the composite score and ranking of districts. This index will contribute immensely to providing reliable and high-quality data to design initiatives to address inter-state and intra-state disparities and accelerate SDG achievements in the region.

UNEP report spotlights best alternatives to Single-Use Plastic Products

The UN Environment Programme (UNEP) has published a report titled, 'Addressing Single-Use Plastic Products: Using a Life Cycle Approach,' on single-use plastic products (SUPPs) and recommendations for alternatives, based on life cycle assessment (LCA) studies. The report summarizes lessons learned and key findings from several country-specific case studies of national action to address pollution from SUPPs using a life-cycle approach. The report recommends a mix of policy interventions, as well as understanding the underlying economic drivers for behaviour and inclusion of all stakeholders (in particular the private sector, civil society, and women's groups) in developing and implementing policy across the life cycle of SUPPs. The summary for decision makers can be accessed at https://saicmknowledge.org/sites/default/files/publications/Addressing-SUP-Products-using-LCA_UNEP-2021_Ex-Summary.pdf

SpaceX launches Dragon cargo capsule to space station

SpaceX launched its 21st rocket of the year on August 29, sending a robotic Dragon

cargo capsule toward the International Space Station (ISS) before landing at sea. A two-stage Falcon 9 rocket took off from NASA's Kennedy Space Center at 0714 GMT, on the company's 23rd cargo resupply mission to the orbiting lab for NASA. The Dragon is packed with more than 2,200 kilograms of supplies, scientific experiments and hardware, including a new robotic arm that will be tested inside the space station's Bishop Airlock. A little less than eight minutes after liftoff, the Falcon 9's first stage returned to Earth, landing on a SpaceX drone ships in the Atlantic Ocean called "A Shortfall of Gravitas," a recovery vessel designed to catch falling boosters and return them to port for later reuse.

SCIENCE POLICY AND DIPLOMACY

Least Developing Countries Issue Position Paper ahead of COP 26

A paper on the perspective of Least Developed Countries says COP 26 cannot succeed without delivering for the most vulnerable. It calls for stronger emissions cuts and financial compensation for the impacts they are expected to suffer from climate change. The paper titled 'COP 26: Delivering the Paris Agreement: A five-point plan for solidarity, fairness and prosperity,' was published by Power Shift Africa and is supported by developing country negotiating blocs, including the Africa Group, the Climate Vulnerable Forum, Least Developed Countries, and the Alliance of Small Island States (AOSIS). The paper [https://powershiftafrica.org/wp-content/uploads/2021/07/COP26-A-five-point-plan-for-solidarity-fairness-and-prosperity.pdf] indicates five areas in which governments must deliver on their promises – (1)Mitigation/ cutting emissions, (2) Adaptation, (3) Loss and Damage, (4) Finance, and (5) Implementation.

BRICS Environment Ministers adopt the New Delhi Statement on Environment

Environment ministers of India, Brazil, Russia, China and South Africa (BRICS) participated in the 7th BRICS Environment Ministerial meeting 2021, and have adopted the 'New Delhi Statement on Environment', ahead of the COP 15 Biodiversity meet in October and COP26 in November. During the meeting, India stressed on the need for taking concrete collective global actions against the climate challenge, guided by equity, national priorities and circumstances, and the principles of "Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC)". The countries have agreed to focus on cooperation on waste management, observing that the "efficient management of wastes including recovery of energy and secondary raw materials is crucial for resource conservation, healthy ecosystem and quality of life of our people". India has launched an initiative of BRICS Resource Efficiency and Circular Economy Dialogue which is to facilitate an exchange of knowledge and best practices on waste management, resource efficiency and circular economy. The countries will also engage in dialogues on construction, agriculture, solar, biofuels, packaging, electronic wastes, food, water and textiles.

RIS holds webinar on Horizon Europe

Research and Information Systems (RIS) organized a webinar on the EU's newly launched Research and Innovation programme, Horizon Europe, 2021-27, with a budget of Euro 95 billion. The webinar was addressed by speakers from the EU's Research and Innovation Department, the Department of Science and Technology, and Office of the Principal Scientific Adviser to the Government of India, and the ministry of External Affairs. It focused on the opportunities and challenges for the Indian research

community in participating in Horizon Europe funded programmes and activities. For more details visit http://fisd.in

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