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NEWS ALERT

Forum for Indian Science Diplomacy

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Wearable sensors with wide-ranging strain sensitivity

A team from the Terasaki Institute for Biomedical Innovation has developed a wearable strain sensing device that can effectively detect a wide range of strains. The device uses layers of poly (3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) with a structure like the scales of a snake. The PEDOT:PSS bilayer affixed on top of a layer of hydrogel offers biocompatibility and wearable comfort. Copper wires and an elastomer seal were added to the sensor and the sensor yielded clearly defined signals with a sensitivity range of two orders of magnitude. The signals accurately reflected the degrees and angles of the corresponding movements that were detected. In addition, the sensor demonstrated excellent conductivity, durability and reproducibility. This wearable sensor can be used in monitoring cardiac or circulatory functions, aiding subjects with difficulties in vocalization or swallowing, or in the physical rehabilitation and evaluation of athletic performance. It can also be used in creative applications such as improving communication for those who work in noisy environments or in monitoring psychological conditions associated with facial expressions.

Snake derived ‘super glue’ that stops bleeding in seconds

A team led by Western University has made a body tissue ‘super glue’ that can stop life-threatening bleeding in seconds, using a blood clotting enzyme called reptilase or batroxobin found in the venom of lancehead snakes (Bothrops atrox),

which are amongst the most poisonous snakes in South America. The team designed a body tissue adhesive that incorporates the special enzyme into a modified gelatin that can be packaged into a small tube for easy, and potentially life-saving, application. This 'super glue' can be applied by simply squeezing the tube and shining a visible light, such as a laser pointer, or a smartphone flashlight. Compared to clinical fibrin glue, the new tissue sealant has 10 times the adhesive strength to resist detachment or washout due to bleeding and blood clotting time is also much shorter,45 seconds. This new biotechnology translates to less blood loss and more life-saving. The super-sealant was tested in models for deep skin cuts, ruptured aortae, and severely injured livers. It can also be used for suture-free, surgical wound closures.

New material could mean lightweight armor, protective coatings

Researchers at the Massachusetts Institute of Technology, Caltech and ETH Zürich found that materials formed from precisely patterned nanoscale trusses are tougher than Kevlar and steel. In experiments, the ultralight structures, called nanoarchitectured materials, absorbed the impact of microscopic projectiles accelerated to supersonic speeds. The team fabricated a repeating pattern known as a tetrakaidecahedron (a lattice configuration composed of microscopic struts) using two-photo lithography, and using a high-speed camera, they captured videos of the microparticles impacting the nanoarchitected material. They had fabricated material of two different densities. A comparison of the two materials' impact response, found the denser one to be more resilient, and microparticles tended to embed in the material rather than tear through it. Going forward, the team plans to explore various nanostructured configurations other than carbon, and ways to scale up the production of these nanostructures, all with the goal of designing tougher, lighter materials, opening the door to their widespread applications.

Llama nanobodies could hold key to preventing deadly post-transplant infection

A team of researchers in the Netherlands and the UK have developed nanobodies (a small fragment of a llama antibody) that are capable of chasing out the human cytomegalovirus (HCMV) which hides away from the immune system, to eliminate it. The nanobodies target a specific virus protein (US28) and interrupts the signals established through the protein (that helps the virus to remain in dormant state), to enable the host's immune cells to hunt down and kill the virus, purging the latent reservoir and clearing the blood of the virus. This new approach could lead to a much-needed new type of treatment for reducing and even preventing HCMV infections in patients eligible for organ and stem cell transplants. Majority of immunocompromised people in developing countries are infected with HCMV, and there are no effective vaccine or anti-viral drug against the virus.

Soft skin patch could provide early warning for strokes, heart attacks

Engineers at the University of California San Diego have developed a soft and stretchy ultrasound patch that can be worn on the skin to continuously monitor blood flow through major arteries and veins in a person's body, as well as blood pressure and heart function in real time. Wearing such a device could make it easier to identify cardiovascular problems early on. It can sense and measure cardiovascular signals as deep as 14 centimeters inside the body in a non-invasive manner. Embedded on the patch is an ultrasound phased array which consists of a 12 by 12 grid of ultrasound transducers controlled by computer. When electricity flows through the transducers, they vibrate and emit ultrasound waves that travel through the skin and deep into the body. The ultrasound waves penetrate through a major blood vessel, and the Doppler frequency shift is picked up by the patch and is used to create a visual recording of the blood flow. This same mechanism can also be used to create moving images of the heart's walls.

Eco-friendly plastic from cellulose and water

Researchers from University of Göttingen have developed an eco-friendly and reusable plastic using a process 'hydro-setting' that uses water to reshape plastic as needed, eliminating the need for expensive and complicated manufacturing techniques. By modifying a small portion of the chemistry of cellulose with the introduction of the 'cinnamoyl' group, the researchers have succeeded in developing a new kind of cellulose cinnamate or CCi that can form a new type of bioplastic with hydroplastic polymers. Hydro-setting allowed the researchers to produce a variety of shapes simply by immersing the bioplastic in water and leaving it to dry in the air. The moulded shapes maintained their stability in the long term and could be reshaped numerous times in a variety of 2D and 3D configurations. Bioplastics like this which are recyclable, economic and sustainable can be applied in biology, electronics, medicine to minimize the detrimental effects of plastics on the environment.

Researchers develop a method to control gene therapy

Researchers at Children's Hospital of Philadelphia (CHOP) have developed a "dimmer switch" system that can control levels of proteins expressed from gene therapy vectors. The system is based on alternative RNA splicing (a process that allows a single gene to code for multiple proteins, depending on how the RNA is spliced) using an orally available small molecule and works effectively in tissues throughout the body, including the brain. Using the Xon system, a gene therapy vector's cargo is inactive until the oral drug is used, which then drives the splicing of the desired corrective gene into its active form. The newly developed switch not only controls protein levels, but if needed, those proteins can be induced again and again by the simple ingestion of an orally bio-available drug. The system could be used for patients with chronic kidney disease.

COVID-19

COVID-19 (WORLD)

A rapid method to quantify antibodies against SARS-CoV-2

Japanese Scientists have developed a rapid, highly accurate 20 minute test to detect antibodies against the spike protein of SARS-CoV-2 in human serum. The method is called non-competitive fluorescence polarization immunoassay (FPIA). It uses fluorescently-labelled recombinant SARS-CoV-2 spike proteins (F-RBD) and human serum mixed together for the test. Anti-spike protein antibodies in the serum bind to F-RBD, and emit polarised light, while F-RBD alone emits depolarized light. By measuring the degree of polarisation the concentration of antibodies can be determined. The test was demonstrated to be highly accurate, quick and easy to perform, with high throughput. The equipment required for the test is highly portable, weighing only 4.3 kg. The test can be used for screening large populations to determine the exact extent of the pandemic, and evaluating the effectiveness of SARS-CoV-2 vaccines based on the antibody response.

COVID-19 Delta variant spreads in Africa

The highly infectious COVID-19 Delta variant has been reported in 22 of the 55 African states, and it could cause hundreds of thousands of deaths in the coming months, according to a report by the Africa Center for Strategic Studies. The numbers of COVID-19 cases have nearly tripled with 30,000 fatalities on the continent since the end of April when the Delta variant emerged in Uganda. Africa's COVID-19 deaths could rise from 103,000 to 500,000 by October if vaccines are not made available to contain the variants. New COVID-19 cases progressively increased in Africa for six weeks running and rose by 25 percent weekly to almost 202,000 by 27 June, according to the World Health Organization (WHO). Deaths increased by 15 percent across 38 African countries to almost 3,000 in the same period. The surge comes as less than three percent of people have received even a single vaccine dose.

Breakthrough in detection of SARS-CoV-2 variant in wastewater

Researchers from the Singapore-MIT Alliance for Research and Technology (SMART) have successfully developed an innovative, open-source molecular detection method that is able to detect and quantify the B.1.1.7 (Alpha) variant of SARS-CoV-2. The breakthrough paves the way for rapid, inexpensive surveillance of other SARS-CoV-2 variants in wastewater. The method is based on allele-specific RT-qPCR that detects and quantifies the B.1.1.7 (Alpha) variant. The developed assay, tested and validated in wastewater samples across 19 communities in the US, is able to reliably detect and quantify low levels of the B.1.1.7 (Alpha) variant with low cross-reactivity, and at variant proportions down to 1 percent in a background of mixed SARS-CoV-2 viruses. Targeting spike protein mutations that are highly predictive of the B.1.1.7 (Alpha) variant, the method can be implemented using commercially available RT-qPCR protocols. The team is also currently developing specific assays that will be able to detect and quantify the B.1.617.2 (Delta) variant. The technology can help in the detection of COVID-19 and its variants, serving as an early warning system and guidance for policymakers as they trace infection clusters and consider suitable public health measures.

Novel method predicts if COVID-19 clinical trials will fail or succeed

Researchers from Florida Atlantic University developed a model using machine learning algorithms to predict whether a COVID-19 clinical trial will be completed or terminated, withdrawn or suspended. The team collected 4,441 COVID-19 trials from ClinicalTrials.gov to build a test-bed and developed features for accurate trial prediction. By using ensemble learning and sampling, the model achieved more than 0.87 areas under the curve (AUC) scores and more than 0.81 balanced accuracy for prediction, indicating high efficacy of using computational methods for COVID-19 clinical trial prediction. This new method of designing a computational approach to predict trials can be used by the stakeholders to plan resources, reduce costs, and minimize the time of the clinical study.

Second dose of COVID-19 RNA vaccine increases immunity

Researchers from Stanford University designed an experiment to determine the effects of the Pfizer Inc. vaccine on the numerous components of the immune response. The researchers analyzed blood samples from individuals inoculated with the vaccine. They counted antibodies, measured levels of immune-signalling proteins and characterized the expression of every single gene in the genome of 242,479 separate immune cells' type and status. They found that the first shot increases SARS-CoV-2-specific antibody levels and the second shot stimulated a manifold increase in antibody levels, a terrific T-cell response that was absent after the first shot alone, and a strikingly enhanced innate immune response. Also, after the second shot, the monocyte numbers expanded 100-fold to account for a full 1 percent of all blood cells.

Highly potent, stable nanobodies stop SARS-CoV-2

Göttingen researchers have developed mini-antibodies that efficiently block the SARS-CoV-2 and its dangerous new variants. These so-called nanobodies can bind and neutralize the virus up to 1000 times better than previously developed mini-antibodies. In addition, these mini-antibodies were optimized for stability and resistance to extreme heat. The team extracted around one billion blueprints for nanobodies from the alpacas' blood and used bacteriophages to select the very best nanobodies from the initially vast pool of candidates. These were then tested for their efficacy against SARS-CoV-2 and further improved in successive rounds of optimization. Since, nanobodies can be produced at low costs in large quantities; they could meet the global demand for COVID-19 therapeutics. The new nanobodies are currently in preparation for clinical trials.

Scientists model 'true prevalence' of COVID-19 throughout pandemic

University of Washington scientists have developed a statistical framework to model the true prevalence of COVID-19 in the United States and individual states. They incorporated three factors: the number of confirmed COVID-19 cases, the number of deaths due to COVID-19 and the number of COVID-19 tests administered each day as reported by the COVID Tracking Project to devise the model. In addition, they incorporated results from random COVID-19 testing of Indiana and Ohio residents as an anchor for their method. Their approach projects that in the U.S. as many as 60 percent of COVID-19 cases went undetected as of March 7, 2021.This framework could help officials determine the true burden of disease in their region and what fraction of them are being missed by current testing and treatment efforts.

Effectiveness of mix-and-match vaccination

The research team from Saarland University analysed the heterologous prime boost vaccination and found that people who receive the vaccine from AstraZeneca as their first dose and the BioNTech vaccine as their second shot show a significantly stronger immune response than those who receive the AstraZeneca vaccine on both occasions. The study determined the strength of the immune responses in 216 individuals two weeks after they had completed their vaccination series. Analysis of antibody production levels and two types of T cells showed that a combined AstraZeneca/BioNTech vaccination or a double dose of BioNTech is significantly more effective than a double dose of the AstraZeneca vaccine. The combination strategy also yielded more neutralizing antibodies than the rest. The results have also been picked up by Germany's Standing Committee on Vaccination (STIKO), which is now recommending a combination vaccination for adults including those over the age of sixty.

New tool for early identification of COVID-19 surges

A research team from Kaiser Permanente developed an early warning system - CHOTS for the COVID-19 hospital surge. The investigators chose 10 indicators and determined how many weeks of lead time they could provide health system and community officials. The individual indicators could forecast an upcoming surge in the next 1 to 3 weeks, but the combined CHOTS — the COVID-19 HotSpotting Score — significantly increased the lead time to as far as 6 weeks prior to a surge. CHOTS relies on data from a robust electronic health record system. It includes 4 major variables (cough and cold calls, relevant subject headers from patient emails, positive COVID-19 test rates, and current COVID-19 hospital census) along with 6 minor variables. The team evaluated CHOTS against actual COVID-19 hospital activity throughout Northern California and compared CHOTs with individual leading indicators. CHOTS proved to be the most indicative of future activity with the most lead time. The tool is simple and can help hospitals and communities identify early signs of a large community spread of infectious diseases.

COVID-19 (INDIA)

Several candidate COVID-19 vaccines in human trial stage

Science and Technology Minister Jitendra Singh said that four COVID-19 vaccine candidates are currently in different stages of human trials. Cadila Healthcare Ltd.'s DNA-based vaccine candidate is in phase three clinical trial and it has submitted the interim data for emergency use authorisation. Biological E Ltd.'s vaccine candidate and Bharat Biotech International Ltd.'s adeno-intranasal vaccine candidate are in phase three clinical trials. Gennova Biopharmaceuticals Ltd.'s mRNA-vaccine candidate is in phase one clinical trial. Gurgaon-based Genique Life Sciences Pvt. Ltd.'s vaccine candidate is in the advanced pre-clinical stage. Currently, three vaccines - Serum Institute of India's (SII) Covishield, Bharat Biotech's Covaxin and Russian vaccine Sputnik V are being administered in India. India may become the first country in the world to develop a DNA-based vaccine developed by Cadila. Zydus Cadila and Bharat Biotech have started trials on children.

IIT Ropar develops Oxygen rationing device – AMLEX

The Indian Institute of Technology, Ropar has developed a first-of-its-kind Oxygen Rationing Device – AMLEX to increase the life of medical oxygen cylinders three fold. AMLEX supplies a required volume of oxygen to the patient during inhalation and trips when the patient exhales CO2. This process saves oxygen which otherwise unnecessarily gets wasted. The device can operate on both portable power supply (battery) as well as line supply (220V-50Hz). It uses a sensor which senses and successfully detects inhalation and exhalation of the user in any environmental condition. IIT would transfer this technology free of cost, to those interested to go in for mass production of the device.

ICMR sero-survey finds two-thirds of Indians with COVID-19 antibodies

India's fourth national sero-survey conducted by Indian Council of Medical Research (ICMR), which examined the prevalence of COVID-19 antibodies either through infection or vaccination, found that 67.6 percent of the population above the age of six has coronavirus antibodies. The ICMR surveyed 36,227 people across 21 states in June and July. For the first time, the survey included children, between six and 17 years and more than half of the 8,691 samples that were tested had antibodies. The survey also included 7,252 healthcare workers - and 85 percent of them had antibodies.

Tech startup develops 3D-printed sanitisation stations

Tvasta, a startup founded by IIT Madras alumni has developed the country's first 3D-printed doffing unit to safeguard

healthcare workers. Doffing units are used by healthcare workers to sanitise themselves after their shifts, to safely remove the PPE kits and dispose of them properly. The 3D printed units offer a unique advantage by lowering the presence of construction workers near a hospital where COVID-19 patients are admitted. The units are printed off-site and assembled at the hospital. Two of these units have already been launched in two government hospitals in Chennai, while the third is under construction.

Scientists synthesize compounds to inhibit maturation and propagation of COVID 19 virus

Scientists from India, Russia, Brazil, and South Africa will work together to repurpose, validate and synthesise lead compounds against main protease and RNA replicas of SARS-CoV-2. Inhibiting these effects would be crucial to develop/repurpose a drug molecule against COVID-19. A consortium of scientists from different universities in India, Russia, Brazil and South Africa has been formed and they will work to identify and synthesize phytochemicals against the main protease and RNA-dependent RNA polymerase of SARS-CoV-2. They will also conduct biochemical assays, including cytotoxicity lead compounds against main protease and RNA dependent RNA polymerase of SARS-CoV-2, and conduct target validation of lead compounds through molecular dynamics simulation and biochemical methods.

INDIA – SCIENCE & TECHNOLOGY

Cheap Train Toilet sewerage disposal system developed

An automated technology for collection of toilet waste which is easy to maintain and a seven times cheaper alternative to the bio-toilets, developed by an Indian scientist, can be used by Indian Railways. The automated system collects toilet waste from running trains and segregates different materials and processes them into usable things. The automated system consists of a septic tank (which is placed under the track). The top cover gets opened when train approaches to the septic tank using Radio Frequency Identification (RFID) sensors at the Engine and septic tank position respectively, sewerage material in toilet tanks is dropped into the septic tank when they are mutually synchronized, and finally the septic tank cover gets closed when train departs away from it. The collected sewerage material from train toilets is segregated such that human waste is stored in one tank, and other materials such as plastic materials, cloth materials, and so on are stored in another tank and processed separately. This technology has been developed with the aim of cost reduction and to obviate the necessity of time-consuming anaerobic bacteria generation. The new technology brings down the cost to INR 15000 only.

Polar Biology agreement signed in India

An Agreement (MoU) has been signed between the Ministry of Earth Sciences (MoES) and the Department of Biotechnology (DBT) on cooperation in the area of polar biology. Particularly, biotechnological applications of polar microbes could be the centre point of this collaboration. Initially, these efforts would be taken up through collaborative proposals by the researchers at the MoES institutes, making use of its presently available set-ups in the polar regions. The MoES has research stations in both the Arctic and the Antarctica regions. In order to strengthen this association and expedite the research in the polar region, joint laboratories will be set up at the MoES stations.

IIT Roorkee develops paper from pine needle waste

Researchers at IIT Roorkee have developed ethylene scavenging functional paper from pine needle waste, which could be a sustainable packaging material in the future. On the forest floor, the deep layer of dry pine needles is the leading cause of forest fires. This paper-based product made from pine needle paper by adding nano zeolite, has the ability to scavenge ethylene gas due to the porous structure and active compound incorporated in the paper, and can extend the shelf life of fresh fruits and vegetables for at least an extra one week rather than the regular shelf life. It will also preserve the nutritional quality of fresh produce. Pine needle can be a substitute for wood, which is the primary raw material for papermaking.

Novel and Cheap 3D Robotic Motion Phantom to reproduce human lung motion

A group of scientists has developed a novel and cheap three-dimensional (3D) robotic motion phantom that can reproduce human lung motion to enable focused delivery of radiation in cancer patients. The phantom is part of a platform over which any dosimetric or imaging quality assurance devices can be placed, and can be used to check if the radiation is being correctly focused on a moving target. During irradiation, the phantom placed inside a CT scanner consistently obtains high-quality images of advanced 4D radiation therapy treatments with minimum exposure of the patients and workers and guides targeted radiation to a human subject. This indigenously developed robotic phantom is cost-effective and is under final stage of testing at the SGPGIMS, Lucknow.

Indian start-up makes affordable and dual-powered defibrillator

A start-up funded by the Department of Biotechnology has developed an affordable, low-weight defibrillator - SanMitra 1000 HCT, which works with both AC mains and a hand-cranked generator built into the unit, and does not require any battery change. The device's battery has been tested for a large number of charge-discharge cycles, thereby making it cost-effective and ideal for hospitals located in cities and remote areas. SanMitra 1000 HCT is designed to international IEC standards for medical devices and has received four patents in the U.S. and India. So far, over 200 devices have been deployed across India and Africa and the device costs about one-fourth of the cost of the big MNC brands.

New self-healing organic material developed

Scientists from the Indian Institute of Science Education and Research (IISER) Kolkata and IIT Kharagpur, have discovered a new self-healing material which can repair itself quickly. The new class of piezoelectric organic crystalline materials can self-propel and re-join rapidly using its own electric charges, and repair themselves so precisely that they become indistinguishable from the original materials. This new class of solid material developed is 10-times harder than other competing material. The application possibilities of the new material range from mobile screens to modern microscopes.

DRDO successfully flight-tests indigenously developed MPATGM for minimum range

Defence Research and Development Organisation (DRDO) successfully flight-tested indigenously developed low weight, fire and forget Man Portable Anti-tank Guided Missile -MPATGM. The missile was launched from a man portable launcher integrated with a thermal site and the target was mimicking a tank. The missile hit the target in direct attack mode and destroyed it with precision. The test has validated the minimum range successfully and all the mission objectives were met. The missile has already been successfully flight tested for the maximum range. The missile is incorporated with state-of-the-art Miniaturized Infrared Imaging Seeker along with advanced avionics. The test brings the development of indigenous third generation man portable Anti-Tank Guided Missile close to completion.

DRDO successfully flight-tests surface-to-air missile Akash-NG

Defence Research & Development Organisation (DRDO) successfully flight-tested the New Generation Akash Missile (Akash-NG), a surface-to-air Missile from Integrated Test Range (ITR) off the coast of Odisha. In order to capture flight data, ITR deployed a number of Range stations like, Electro Optical Tracking System, Radar and Telemetry which captured the complete flight data and confirmed flawless performance of the entire weapon system. During the test, the missile demonstrated high manoeuvrability required for neutralising fast and agile aerial threats. Once deployed, the Akash-NG weapon system will prove to be a force multiplier for the air defence capability of the Indian Air Force.

Nano Urea Liquid fertiliser to be produced

National Fertilisers Limited (NFL) and Rashtriya Chemicals and Fertilisers Ltd (RCF) signed Memorandum of Understanding (MoU) with Indian Farmers Fertiliser Cooperative Limited (IFFCO) for transfer of technology for liquid Nano Urea. This technology transfer will ramp up the production leading towards consistent supply resulting in faster adoption and would also result in more savings to farmers and government subsidies. NFL and RCF will establish new Nano Urea production plants to increase the supply of Nano Urea to farmers of the country. India has become the first country globally to start commercial production of Nano Urea which will reduce the use of urea by upto 50 percent besides being an eco-friendly product. Nano Urea (Liquid) contains nanoscale urea particles (size 20-50 nanometre) which have more surface area which makes it more effective. Trials have indicated that Nano Urea (liquid) increases crop productivity and improves yield, biomass, soil health and nutritional quality of the produce. The efficiency of one bottle of Nano Urea (500 mL) is equivalent to one bag of urea. When sprayed on leaves Nano Urea easily enters through stomata and other openings and is assimilated by the plant cells.

Ultra-sensitive, Easy-to-use Sensor for Detecting Arsenic

A scientist at the National Agri-Food Biotechnology Institute, Mohali, has developed an ultra-sensitive and easy-to-use sensor for detecting arsenic contamination in water and food within 15 minutes. It can be easily operated and one can know about contamination by matching the colour change on the sensor's surface with reference labels. The sensor can be used in three modes- spectroscopic measurements, colour intensity measurement, and with naked eyes. It uses a mixed metal (cobalt/molybdenum) based metal-organic framework. In the case of paper and colorimetric sensors, the colour of the metal-organic framework (MOF) changes from purple to blue after interaction with arsenic. The intensity of the blue colour increases with an increase in the concentration of arsenic. It has been tested successfully with groundwater and food items. The developed testing kit is 500 times more sensitive in comparison to the improved version of the molybdenum-blue test and is also economical and simple.

Nano-structured self-cleaning aluminium surface that reduces bacterial growth

Researchers from Shiv Nadar University have developed a nano-structured self-cleaning sustainable aluminium surface by utilizing a simple and environment-friendly fabrication route. They used a Raman spectrometer to develop a flake-like nano-structure on aluminium surface by heating the aluminium sample in water with a temperature maintained at 80 deg C for an hour, without using any chemical reagents and toxic solvents. The surface obtained by this approach showed immense mechanical, chemical, and thermal durability. A coating of low surface energy hydrocarbon material on the surface enables water droplets to immediately roll off. This property enables the nano-structured surface for multiple applications ranging from biomedical to aerospace and automobiles to household appliances, and its development process is easily scalable to industrial-level production.

CSIR-CMERI developed Tractor Mounted Spading Machine

The CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur has developed a tractor-operated spading machine for agricultural seed bed preparation. The spading machine reduces the cost of tillage operation and improves its effectiveness and the design of the spading mechanism is advantageous in reducing vibration

and enhancing the comfort of the tractor operator. The machine can also incorporate large organic material due to its homogeneous working and uniform turning of the soil. The spading machine is powered by tractor PTO (Power Take-off) which rotates at standard speed of 540 rpm, power is transmitted to the crank through the speed reduction gear. The machine has a working width of 1,800 mm, and it can be operated with any tractor having power greater than 45 HP.

IN BRIEF

Hydrogel-based flexible brain-machine interface

A South Korean research team has developed a hydrogel-based flexible brain-machine interface using a custom-made multifunctional fiber bundle into a hydrogel body. The device has an optical fiber that controls specific nerve cells with light in order to perform optogenetic procedures, an electrode bundle to read brain signals and a microfluidic channel to deliver drugs to the brain. The interface is easily inserted into the body when dry, and in the body, the hydrogel absorbs body fluids and resemble the properties of its surrounding tissues, thereby minimizing foreign body response. In animal models, the device worked for up to six months, and long-term optogenetic and behavioural experiments could be conducted on freely moving mice with a significant reduction in foreign body responses. The device could be useful for research on neurological disorders that require long-term observation.

Novel approach for developing new antibiotics

Researchers at Children's Hospital of Philadelphia (CHOP) have developed a novel method for producing new antibiotics to combat resistant bacteria. The researchers proposed structure-guided design to create pro-drugs that act as a “Trojan Horse”, allowing antibiotics to reach resistant bacteria. The pro-drug used needs to be resistant to host enzymes. The researchers were able to find structure-guided development of S. aureus-specific pro-drugs and established a pipeline for the identification of additional microbial pro-drug activating enzymes. These approaches will both guide the development of novel antimicrobials and lead to a more robust arsenal of anti-infective compounds with targeted specificity for the microbe over the human host.

Accurate protein structure prediction now accessible to all

Researchers at the University of Washington School of Medicine in Seattle have created a freely available method, RoseTTAFold, to provide access to highly accurate protein structure prediction. The tool uses deep learning to quickly predict protein structures based on limited information. The team used RoseTTAFold to compute hundreds of new protein structures, including many poorly understood proteins from the human genome and also generated structures directly relevant to human health. Their method works on not just simple proteins, but also on complexes of proteins. The creators of the tool have made their computer code freely available. RoseTTAFold can be used to build models of complex biological assemblies in a fraction of the time previously required. The new tool will benefit the research community to understand proteins and could speed treatment development for many diseases.

Removing micropollutants from the environment with chemistry discovery

Cornell University researchers have developed an innovative technique that can eradicate harmful micropollutants from the environment. The team employed a pioneering imaging technique called COMPetition Enabled Imaging Technique with Super-Resolution or COMPEITS to attain high-resolution images of how ligands – molecules that attach to other metals or molecules – interact with the surface of nanoparticles. In doing so the researchers found that altering the concentration of an individual ligand can exploit the shape of the particle it is attached to, potentially creating a strategy to remove micropollutants. Using COMPEITS on a gold nanoparticle, the team was able to quantify the strength of ligand adsorption, and they discovered the diverse ligand behavior. This approach could be utilised for several daily applications, such as developing chemical sensors that are sensitive at an extremely low level to a specific chemical in the environment.

Ramping up internet speed to 40 Tb/s

An industrial research collaboration between scientists and engineers from Ireland, the Netherlands, and Germany have found a way to use existing internet cables at speeds to 40 Terabits per second. Instead of using a single channel, the team used multiple wavelengths to deliver information – all on a single Photonic Integrated Circuit (PIC). Using optical combs – a single laser that generates a broad spectrum of equally-spaced optical frequencies, this innovation project enables higher capacity internet traffic on a single fibre without upgrading existing infrastructure. It does this by eliminating “guard-bands” – or wasted chunks of bandwidth needed in traditional systems that prevent interference between data channels. This technology uses a highly specialised platform technology called monolithic Indium Phosphide photonic integrated circuits.

Blue Origin's First Passenger Spaceflight

A New Shepard rocket designed and built by Blue Origin, a private spaceflight company founded by Jeff Bezos made its first passenger flight with 4 passenegers from a launchpad in West Texas. The rocket booster separated from the capsule, pushing it past 100 km above sea level. As the capsule plunged back toward the ground, a panel of heat-resistant tiles protected it as friction superheated the surrounding atmosphere. Three parachutes slowed the capsule to a landing in the

Texas desert. The rocket booster, meanwhile, returned itself to a landing pad in order to be reused. The entire launch and flight were autonomous – with no pilots – and lasted just 11 minutes.

Wearable brain-machine interface turns intentions into actions

A team of researchers led by Georgia Institute of Technology combined wireless soft scalp electronics and virtual reality to develop a new wearable brain-machine interface (BMI) system. It allows the user to imagine an action and wirelessly control a wheelchair or robotic arm. BMI technology analyzes a person's brain signals and translates that neural activity into commands, turning intentions into actions. The team designed a system integrating imperceptible micro-needle electrodes with soft wireless circuits, offering improved signal acquisition. The new system was tested with four human subjects, but has not yet been studied with disabled individuals.

The naturally abundant CRISPR-Cas system to edit superbugs

A team of researchers from The University of Hongkong have developed a transferable and integrative type I CRISPR-based platform that can efficiently edit the diverse clinical isolates of a superbug (Pseudomonas aeruginosa). They developed a genome-editing method applicable in the Multidrug-resistant (MDR) isolate based on the native type I-F CRISPR-Cas system. In this system, the transferred type I-F Cascade displays a significantly greater DNA interference capacity and higher strain stability than the transferrable Cas9 system and can be employed for genome editing with efficiency (>80%) and simplicity. The method enabled rapid identification of the resistance determinants of the MDR clinical isolate and the development of a novel anti-resistance strategy. The research opened a new avenue to genomically edit wild bacterial species and isolates with clinical and environmental significance and also provided a framework to expand the CRISPR-based toolkits.

DeepMind's AI predicts structures for a vast trove of proteins

A transformative artificial intelligence (AI) tool called AlphaFold, developed by Google's sister company DeepMind in London, has predicted the structure of nearly the entire human proteome (the full complement of proteins expressed by an organism). In addition, the tool has predicted almost complete proteomes for various other organisms, ranging from mice and maize (corn) to the malaria parasite. More than 350,000 protein structures, which are available through a public database, vary in their accuracy. But researchers say the resource, which is set to grow to 130 million structures by the end of the year, has the potential to revolutionize the life sciences. Researchers aim to validate the predictions and more importantly, apply them to experiments that were hitherto impossible. DeepMind has released the source code behind the latest version of AlphaFold, and a detailed description of how it was developed.

RNA modification may protect against liver disease

UCLA researchers have found that RNA modification may offer protection against non-alcoholic fatty liver. They conducted a study in mice and found that chemical modification of RNA molecules like m6A (in which a methyl group attaches to an RNA chain) appears to act as a protective checkpoint that slows the accumulation of fat in the liver. Their study also suggested that this modification may occur at a different rate in females than in males, and without the m6A modification, differences in liver fat content between the sexes were reduced dramatically. In a preclinical model, the investigators demonstrated that gene therapy can be used to enhance or add modifications to key RNAs to slow down or reduce the severity of liver disease.

Scientists Develop a New Vaccine For Plague

A team from the Oxford Vaccine Group has developed an intramuscular vaccine against plague bacteria (Yersina pessis) using a modified cold virus (adenovirus) that cannot multiply in humans, similar to the one used in the AstraZeneca COVID-19 shot. The virus is used to deliver the gene code for a protein from Y. pestis that is essential to its ability to infect us, in order to teach our immune system to recognize it as an invader similar to many COVID-19 vaccines which target its spike protein. Studies on laboratory animals have been promising. Human Phase 1 trials are planned.

World's first commercial re-programmable satellite

The world's first commercial fully re-programmable satellite the 3500 kg Eutelsat Quantum can be reprogrammed rapidly using software, while orbiting in a fixed position 35,000 kilometers above the Earth. It has eight communications beams, each of which can be modified to change its area of coverage and also the power of the telecommunications signal it emits. Quantum is able to pinpoint the origin of signals emitted with or without malicious intent and take action to remedy the interference and will cover a large geographical area from West Africa to Asia for 15 years.

RESOURCES AND EVENTS

EU's proposed border carbon adjustment mechanism

The European Union has revealed the details of its carbon border tax, piling pressure on other countries to adopt carbon pricing by 2026 or face the levy. The tax will apply to energy-intensive products imported into the EU from countries with weaker environmental regulations. It will initially apply to electricity, iron and steel, aluminum, fertilisers, and cement. There is a transition period between 2023 and the end of 2025, during which time emissions data on imports will be collected but will not be taxed. From 2026 to 2035, imports will be taxed but at a reduced rate, so that foreign producers are not at a competitive disadvantage with EU producers, who will benefit from free emissions trading allowances until 2035. While most of the world's poorest countries are not expected to be hit hard by the levy, the EU has ignored calls to exempt them and to spend the revenue raised on climate finance for developing countries. Large emerging economies like China, Brazil, South Africa and India have said they have "grave concerns" about the tax. The EU's proposal states that "agreements with third countries could be considered as an alternative to the application of [carbon border tax] in case they ensure a higher degree of effectiveness and ambition to achieve the decarbonisation of a sector."

China launches world's largest carbon market

China has launched its first national emissions-trading scheme, using intensity of emissions (the amount of emissions per unit of energy generated) rather than absolute emissions to help reduce its impact on climate. Power companies are incentivized to reduce the intensity of emissions, which means producing greater amounts of energy per unit of emissions. Each year, the cap is recalculated and reduced, which drives greater efficiency by requiring companies to reduce the amount of emissions they generate for the energy they produce. China's economy is expected to grow by 4–5 percent per year, which requires an increase in power consumption, and therefore emissions. The intensity target allows for "future economic development" while also meaning China can still "reduce the carbon emission per unit of economic output". The same situation exists in India. In 2019, China was responsible for 27 percent of global carbon emissions — more than 10 billion tonnes of carbon dioxide. However, its per capita emission (at about 6.8 tonnes of CO2 per person) is less than half of those of nations including the United States, Australia and Canada.

Pegasus Project shakes the world

Pegasus is a spyware developed by the Israeli cyberarms firm NSO Group that can be covertly installed on mobile phones (and other devices) running most versions of iOS and Android. Once installed, Pegasus has been reported to be able to run arbitrary code, extract contacts, call logs, messages, photos, web browsing history, settings, as well as gather information from apps including but not limited to communications apps iMessage, Gmail, Viber, Facebook, WhatsApp, Telegram, and Skype, as well as use the mobile phone's microphone and camera, thus turning it into a constant surveillance device. It was leased by the NSO Group to governments for tracking terrorists and criminals but was used in attempted and successful hacks of smartphones with more than 50,000 numbers of users. The numbers on the list belonged to more than 1,000 people in over 50 countries including business executives, human rights activists, journalists, politicians and government officials. Among the 37 phones confirmed to have been targeted, 10 were in India and another five in Hungary, most linked to journalists, activists or businesspeople. Hundreds more numbers from India and Hungary appear on the broader global list. A third country, Mexico, was home to nearly one-third of the numbers of the list.

Millenium Tech Prize for DNA sequencing technique

The Solexa-Illumina Next Generation DNA Sequencing (NGS) technology co-invented by Professor Sir Shankar Balasubramanian and Professor Sir David Klenerman has been awarded the 2020 Millennium Technology Prize. This next-generation sequencing technology is responsible for about 90 percent of the total DNA and RNA sequenced in the world and the technology has enabled fast, accurate, low-cost and large-scale genome sequencing. The technology is also being used to track and explore the novel coronavirus mutations.

Montreal Protocol Task Force meets

The Open-ended Working Group of the Parties to the Montreal Protocol discussed the unexpected increase in emissions of trichlorofluoromethane (CFC-11) and related calls for improved monitoring and enforcement, and the need to shift to energy-efficient and lower global warming potential (GWP) technologies The increase in emissions of trichlorofluoromethane (CFC-11), which seemed to be coming from illegal production in northeast China was addressed, and levels have since returned to pre-2012 concentrations. A pilot project is envisaged to identify gaps in monitoring and potential locations for new atmospheric monitoring stations, established in partnership with countries around the world. The meeting stressed the need for transitioning to energy-efficient technologies for ozone recovery, and for critical co-benefits for the climate. A shift to low GWP refrigerants and use of equipment with greater energy efficiency; could decrease emissions and energy consumption.

SCIENCE POLICY AND DIPLOMACY

2021 HLPF Ministerial Declaration Adopted

Governments have adopted the 2021 HLPF Ministerial Declaration, which reaffirms the 2030 Agenda as a plan of action and global blueprint to respond to the COVID-19 pandemic, build back better, and prevent future pandemics. It also: reaffirms the importance of addressing regional challenges and welcomes contributions of regional multi-stakeholder platforms to the voluntary national reviews (VNRs); commits to involving and empowering local authorities to ensure local ownership of SDGs, noting voluntary local reviews (VLRs) as a useful tool; and emphasizes the importance of the participation of youth in implementation, follow-up, and review of the 2030 Agenda. Nine SDGs were reviewed by the meeting. The Major Groups and Other Stakeholders Coordination Mechanism says the 2021 HLPF had failed to come up with bold and transformative recommendations for action during this world crisis. Text of the Declaration is available at,
https://sustainabledevelopment.un.org/content/documents/28939Draft_HLPF_HLS_Ministerial_Declaration_14_July.pdf

G20 climate and energy ministers fail to reach agreement

Talks between G20 climate and energy ministers reached agreement on 58 out of 60 paragraphs. A joint statement published on 25 July called for accelerating the transition to clean energy. China, Russia, India, Turkey and Saudi Arabia were among those opposing ending fossil fuels. High income countries have been urged to phase out coal in 2030 and developing nations by 2040, but many G20 countries still have significant coal industries. Indonesia submitted a long term climate strategy to the UN that foresees continuing to burn coal past 2050, relying on carbon capture and storage to mitigate the emissions. Japan published a draft energy plan that involves generating 19 percent of electricity from coal in 2030. China gets over 60 percent of its electricity from coal, has the world's biggest pipeline of new domestic coal power stations and is the world's biggest backer of coal power overseas. Ministers also failed to agree on a date by which they would phase out "inefficient" fossil fuel subsidies. G20 members collectively provided $3.3 trillions of subsidies to fossil fuels 2015-19. These issues will be considered by the leaders of G20 nations at the Rome G20 summit on 30 October. Ministers have agreed to submit improved national climate plans ahead of the Cop-26 climate talks in November. South Africa, China, India, Turkey, Saudi Arabia and South Korea are yet to update their climate targets for 2030.

Divisions emerge over UN food systems summit

A UN summit which aims to tackle food insecurity has run into controversy and disagreement, with one group of scientists joining a parallel event in protest. The United Nations Food Systems Summit will begin three days of "pre-summit" discussions starting 26 July, with the main talks coming later on in September. The summit aims to spur action towards the Sustainable Development Goals and drive collaboration to transform the way the world produces, consumes and thinks about food. However, over 300 global civil society organisations of small-scale food producers, researchers and indigenous communities will boycott the three-day event, instead holding a tandem, alternative pre-summit which started 25 July. They say the UN event has been "deeply compromised by a top-down exclusion of many food systems actors and an impoverished view of whose food system knowledge matters". The groups say that a 30 member scientific panel involved in setting the agenda for the UN summit was "imbalanced in its composition and biased in its perspectives and sources of knowledge" and said the selection process for members was unclear. Critics say the summit is focused on technology-driven agricultural approaches and excludes key actors in food systems, such as small-scale farmers. A petition, signed by more than 150 scientists who support the approach of agroecology, where ecological concepts are combined with farming techniques, calls on researchers to boycott the summit.

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

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