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NEWS ALERT

Forum for Indian Science Diplomacy

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CONTENTS

RESOURCES AND EVENTS

SCIENCE POLICY AND DIPLOMACY

GLOBAL

NASA's Artemis I Mega Rocket Launches Orion to Moon

Following a successful launch of NASA's Space Launch System (SLS), the most powerful rocket in the world, the agency's Orion spacecraft is on its way to the Moon as part of the Artemis program. Carrying an uncrewed Orion, SLS lifted off for its flight test debut on 16 November from NASA's Kennedy Space Center in Florida. The launch is the first part of a mission in which Orion is planned to travel approximately 65,000 kms beyond the Moon and return to Earth over the course of 25.5 days. Known as Artemis I, the mission is a critical part of NASA's Moon to Mars exploration approach. After reaching its initial orbit, Orion deployed its solar arrays and engineers began performing checkouts of the spacecraft's systems. About 1.5 hours into flight, the rocket's upper stage engine successfully fired for approximately 18 minutes to give Orion the push needed to send it out of Earth orbit and toward the Moon. Orion has separated from its upper stage and is on its outbound coast to the Moon powered by its service module, which is the propulsive powerhouse provided by ESA (European Space Agency) through an international collaboration. Orion is expected to fly by the Moon on Nov. 21, performing a close approach of the lunar surface on its way to a distant retrograde orbit, a highly stable orbit thousands of kilometers beyond the Moon.

Prodrug Targets Cancer Cells, Leaving Healthy Cells Unharmed

Johns Hopkins Medicine researchers have revamped an anti-cancer drug to better target cancer cells and leave healthy tissues unharmed. The prodrug, called DRP-104 (sirpiglenastat), is in early-stage clinical trials in people with advanced solid tumors. Studies in mice show that the augmented drug preferentially eliminates cancer cells but does not harm healthy cells. The newly modified prodrug takes advantage of cancer cells' high appetite for an amino acid called glutamine. DRP-104 is a modification of a glutamine mimic drug called DON (6-Diazo-5-Oxo-L-norleucine), which inhibits multiple glutamine-utilizing enzymes in cancer cells. The team added chemical groups, called pro moieties, to DON that rendered it inactive in the body until it reached the tumor, where the pro moieties were removed by enzymes that are abundant in the tumor but not in the gut. The researchers gave the original DON drug and the souped-up DRP-104 drug to mice implanted with tumors. Both drugs completely wiped out the tumor, but DON caused more gut toxicity in the mice than DRP-104. The new prodrug has been licensed for clinical development and is in phase I/II clinical trials in the US for people with advanced-stage solid tumors. This prodrug approach may be useful for other anti-cancer drugs that have failed clinical trials because of toxicity problems.

Gossypetin Found in Hibiscus for Alzheimer's Disease

Researchers at POSTECH, South Korea, have found that the gossypetin, a flavonoid compound found in hibiscus, also known as Hibiscus sabdariffa or roselle, activates microglia, the resident immune cell in the brain. They also demonstrated that microglia scavenge amyloid-beta (Aβ) in the brain to ameliorate cognitive impairments brought on by Alzheimer's disease (AD). The research team treated AD model mice with gossypetin through intragastric administration for three months and concluded that their impaired memory and cognition were almost restored to the normal level. Furthermore, they saw a decrease in the various types of Aβ aggregates, which are commonly found in the brain tissue with AD-type dementia. Single-cell RNA sequencing demonstrated that gossypetin prevented the expression of genes associated with gliosis, which promotes chronic inflammatory reactions, while increasing the expression of genes associated with Aβ phagocytosis. and facilitating microglia's Aβ clearance. Clinical trials are planned for developing treatment for dementia prevention.

Turning Asphaltene into Graphene for Composites

Rice University scientists have found a process to convert Asphaltenes, a byproduct of crude oil production, into useful graphene. The unique flash Joule heating process convert asphaltenes instantly into turbostratic (loosely aligned) graphene and which can be used in composites for thermal, anti-corrosion and 3D-printing applications. The process makes good use of material otherwise burned for reuse as fuel or discarded into tailing ponds and landfills. Using the world's reserve of more than 1 trillion barrels of asphaltene as a feedstock for graphene would be good for the environment as well. Asphaltenes are 70 per cent to 80 per cent carbon already. The Rice lab combines it with about 20 per cent of carbon black to add conductivity and flashes it with a jolt of electricity, turning it into graphene in less than a second. Other elements in the feedstock, including hydrogen, nitrogen, oxygen, and sulfur, are vented away as gases. The process works on asphaltene and on various other feedstocks, including plastic, electronic waste, tires, coal fly ash and even car parts. The team mixed the graphene into composites, and polymer inks for 3D printers.

New CRISPR Tool 'PASTE' has Potential for Treating Diseases

Building on the CRISPR gene-editing system, MIT researchers have designed a new tool that can snip out faulty genes and replace them with new ones, in a safer and more efficient way. Using this system, the researchers showed that they could deliver genes if 36,000 DNA base pairs to several types of human cells, as well as to liver cells in mice. The new technique, known as PASTE, could hold promise for treating diseases that are caused by defective genes with many mutations, such as cystic fibrosis. The new tool combines the precise targeting of CRISPR-Cas9, a set of molecules originally derived from bacterial defense systems, with enzymes called integrases, which viruses use to insert their own genetic material into a bacterial genome. Just like CRISPR, these integrases come from the ongoing battle between bacteria and the viruses that infect them.

Novel AI Blood Test Detects Liver Cancer

The John Hopkins Kimmel Cancer Center developed a novel artificial intelligence blood testing technology for early detection of liver cancer. The blood test, called DELFI detects fragmentation changes among DNA from cancer cells shed into the blood stream, known as cell-free DNA, or cfDNA. This is the first genome-wide fragmentation analysis independently validated in two high-risk populations and across different racial and ethnic groups with

different causes associated with their liver cancers. The DELFI technology uses a blood test to measure the way DNA is packaged inside the nucleus of a cell by studying the size and amount of cell-free DNA present in the circulation from different regions across the genome. It requires low-coverage sequencing, enabling this technology to be cost-effective in a screening setting. This technology detected liver cancers at their cancers, with an overall ability to accurately detect a cancer of 88 per cent and a specificity of 98 per cent among people at average risk.

Machine Learning Can Predict Patient Response to Cancer Immunotherapy

Researchers at the Johns Hopkins Kimmel Cancer Center and its Bloomberg~Kimmel Institute for Cancer Immunotherapy successfully trained a machine learning algorithm to predict, in hindsight, which patients with melanoma would respond to treatment and which would not respond. The open-source program, DeepTCR, proved valuable as a predictive clinical tool, as well as functioned as a powerful instructor, teaching the researchers about the biological mechanisms underlying patients' responses to immunotherapy. This can be further exploited to develop more robust models, and possibly better treatment approaches, for many diseases, even those outside of oncology.

Magnetic Material Removes Microplastics from Water

Researchers at RMIT University have developed adsorbents, in the form of a powder, that remove microplastics 1,000 times smaller than those currently detectable by existing wastewater treatment plants and dissolved pollutants. The researchers have successfully tested the adsorbents in the lab, and they plan to engage with industry to further develop the innovation to remove microplastics from waterways. The adsorbent was prepared with special surface properties so that it can effectively and simultaneously remove both microplastics and dissolved pollutants from water.

New Gene Discovery for Drought Resilient Wheat

Researchers at the John Innes Centre have discovered a new height-reducing gene Rht13 which can enable seeds to be planted deeper in the soil giving access to moisture, without the adverse effect on seedling emergence seen with existing wheat varieties. Varieties of wheat with the Rht13 gene could be rapidly bred into wheat varieties to enable farmers to grow reduced-height wheat in drier soil conditions. Additional agronomic benefits of the new semi-dwarfing gene may include stiffer stems, better able to withstand stormier weather. The researchers found a one- point mutation change in a sequence of DNA on the Rht13 gene encodes an autoactive NB-LRR gene, a defence related gene, that is switched on all the time. The Rht13 dwarf gene acts in tissues higher up in the wheat stem and only takes effect once the seedling has fully emerged giving a significant advantage when planting deeper in dry conditions. The Rht13 gene is located on chromosome 7B on the wheat genome, but the underlying gene had not been identified. The Rht13 variation represents a new class of reduced height gene -- more commonly associated with disease resistance as opposed to widely used Green Revolution genes (Rht-B1b and Rht-D1b)) which are associated with hormones and therefore affect overall growth. Further research will test how this gene works in diverse agronomic environments from the UK to Australia.

Converting Waste Paper into Battery Parts

Scientists from Nanyang Technological University, Singapore (NTU Singapore) have developed a technique to convert waste paper, from single-use packaging and bags, and cardboard boxes, into electrodes of lithium-ion batteries. To produce the carbon anodes, the researchers joined and laser cut several thin sheets of kraft paper to form different lattice

geometries, some resembling a spikey piñata. The paper was then heated to 1200°C in a furnace without the presence of oxygen, to convert it into carbon, forming the anodes. The carbonisation process emits negligible amounts of carbon dioxide, and the process is a greener alternative to disposing of kraft paper through incineration, producing large amounts of greenhouse gases. The carbon anodes produced by the research team also demonstrated superior durability, flexibility, and electrochemical properties. The method also uses less energy-intensive processes and heavy metals compared to current industrial methods of manufacturing battery anodes.The current innovation presents an opportunity to upcycle waste products and reduce our dependence on fossil fuels, The research team has filed for a patent with NTUitive, NTU's innovation and enterprise company. They are also working towards commercialising their invention.

COVID-19

COVID-19 (WORLD)

Neutralizing Stronger COVID-19 Variants

A Korean research team has developed a tailored COVID-19 neutralizer that can adapt to all kinds of mutations in the virus in treating the viral infection. This neutralizing agent is designed to exhibit stronger effect by utilizing the same mechanism that viruses use to become stronger in infection through evolutionary processes. The newly developed hybrid neutralizer, consisting of a protein fragment and nucleic acids, can strongly bind to the coronavirus, which causes the virus not to interact with the hACE2 receptor, eventually inhibiting its penetration into the cells. The team used in vitro evolution technology called Hotspot-Oriented Ligand Display (HOLD) to select the candidate materials for binding to the virus. The hybrid agent has an excellent neutralizing effect not only against the Alpha, Beta, Gamma, and Delta variants but also the Omicron variant, which is known to be the most contagious. This self-evolving neutralizer-developing platform shows increasingly better performance with the occurrence of viral mutations and could have wider applications.

New Omicron subvariant BQ.1.1 resistant to antibodies

German researchers have found that the Omicron sub-lineage BQ.1.1, currently on the rise worldwide, is resistant to all approved antibody therapies. SARS-CoV-2 variants, particularly the Omicron variant, with mutations in the spike protein can evade neutralizing antibodies and cause symptomatic infections even in vaccinated or convalescent persons. The researchers found that the Omicron subvariant BQ.1.1 could not be neutralized by either individual antibodies or antibody cocktails. In contrast, the currently predominant Omicron subvariant BA.5 was still neutralized by one approved antibody and two approved antibody cocktails. This suggests that in regions where BQ.1.1 is widespread, physicians should not rely on antibody therapies alone when treating infected high-risk patients. The ever-increasing development of antibody resistance of SARS-CoV-2 variants calls for the development of new antibody therapies that are specifically targeted to currently circulating and future viral variants.

COVID-19 (INDIA)

Bharat Biotech's iNCOVACC Gets Approval

iNCOVACC, world's first intranasal vaccine by Bharat Biotech has received both primary series and Heterologous booster approval from the Central Drugs Standard Control Organisation (CDSCO) under Restricted Use in Emergency Situation for ages 18 and above, in India, for heterologous booster doses. The intranasal vaccine had earlier received approval under Restricted Use in Emergency Situation for ages 18 and above for the primary 2-dose schedule. Phase III trials were conducted for safety, immunogenicity in~3100 subjects, at 14 trial sites across India. Meanwhile, the heterologous booster dose studies were conducted for safety and immunogenicity in ~875 subjects, with BBV154 intranasal vaccine administered post 2 doses of the two commonly administered COVID-19 vaccines. The trials were conducted at 9 trial sites across India. The iNCOVACC is a recombinant replication-deficient adenovirus vectored vaccine with a pre-fusion stabilized spike protein. This vaccine candidate was evaluated in phase I, II and III clinical trials with successful results. This vaccine has been specifically formulated to allow intranasal delivery through nasal drops. The nasal delivery system has been designed and developed to be cost-effective in low and middle-income countries.

INDIA–SCIENCE & TECHNOLOGY

Graphene-stabilised Tunable Photonic Crystal Developed

A research team from the Centre for Nano and Soft Sciences (CeNS), has developed a Blue Phase (BP) liquid photonic crystal which operates in the visible spectrum with high optical purity and enhanced thermal stability. The team confined the BP between a pair of graphene substrates, prepared using a facile technique developed by collaborators of this work. The non-covalent interaction between the hexagonal 2-D arrangement of carbon atoms of graphene and the liquid crystal molecules and the improved wettability helped improve the thermal stability and optical purity. The enhancement in the optical and thermal properties of BP has been achieved using an easy-to-fabricate cost-effective technique making the process highly suitable for large-scale applications. An additional dimension of tunability of colours is added by incorporating a UV-light-sensitive dye into the system. The prototype device developed at the lab level is found to be stable at room temperatures for over six months. A patent has been filed for this technology.

India's First Privately Developed Rocket Launched

Vikram-S Rocket, India's first privately developed rocket was launched from the Indian Space Research Organization (ISRO) Sriharikota launchpad. The Vikram-S Rocket is developed by Hyderabad-based start-up Skyroot Aerospace Private Limited, and it is 6-meter tall and hits a peak altitude of 89.5 kilometers. After five minutes of launch, the Vikram-S Rocket splashed into the Bay of Bengal. The Vikram-S Rocket is a single-stage solid fuelled, sub-orbital rocket developed over two years by incorporating advanced technologies that include carbon composite structures and 3D printer components. It has a gross lift-off mass of 545kg, and a payload mass of 80kg. Vikram-S carries three customer payloads which will map the measurement and validation of certain flight parameters and payload integration processes. Skyroot Aerospace was launched in June 2018 by two engineers. After the Indian government opened the sector to private firms, it signed an agreement with ISRO in September 2011. The present test will help validate the technologies that will be used in the subsequent Vikram-1 orbital vehicle of Skyroot.

Anti-Hepatitis Drug Repositioned to Treat Resistant Malaria

Researchers at Jawaharlal Nehru University (JNU) have re-positioned an anti-hepatitis C drug, Alisporivir, to treat malaria caused by drug-resistant strains. The research will help in formulating better strategies for the effective treatment of drug-resistant parasites. The team repositioned Alisporivir and studied its antimalarial potential against Plasmodium parasites. Alisporivir showed potent Antiparasitic activity against Plasmodium both in blood stage culture and in the mouse model. In addition, Alisporivir does not induce eryptosis, the suicidal death of red blood cells.Alisporivir, having an approximate plasma half-life of 90 hours, was found effective against Artemisinin-resistant parasites in combination with Artemisinin. These findings represent Alisporivir as a potential drug candidate for malaria treatment, either alone or as a partner drug for ACT.

Artificial Photosynthetic System to Capture Solar Energy

Researchers from IISER-Thiruvananthapuram and IIT-Indore have developed a new artificial light-harvesting system that can efficiently capture light for power conversion by mimicking photosynthesis, the process by which plants absorb sunlight and produce sugars. Scientists across the globe are trying to replicate the light-harvesting step of photosynthesis in engineered systems for use in solar cells or artificial leaves. The researchers also showed that this harvested energy could generate current with much enhanced yields compared to the individual components. They utilised an atom-precise nanocluster in such an application. The opposite charges on the surfaces and the matched electronic energy distribution result in a 93 per cent energy transfer efficiency with a great antenna effect from the UV-to-visible region of the light spectrum.

ISRO Launches Bhutan Satellite

The India-Bhutan satellite, jointly developed by the two countries, was launched into space by ISRO's Polar Satellite Launch Vehicle. The satellite will provide high resolution images to Bhutan for its natural resources management. Foreign Minister S Jaishankar called for harnessing space technology for improving the lives of people in both nations while describing the launch as a historic milestone in bilateral cooperation. He added that the partnership between India and Bhutan has been taken to a new era in the 21st century, through achievements in space and technology. PM Narendra Modi during his visit in August 2019 had jointly inaugurated the ground earth station of the South Asia Satellite in Thimphu, which was constructed with the support of ISRO.

IN BRIEF

Solid-state Energy Storage Systems for Residential Applications

Amptricity (USA) has announced solid-state batteries for home energy storage. The company plans to deliver its first solid-state energy storage systems of up to 4 GWh or up to 400,000 homes within the next 30 months. The battery technology represents eight-hour discharge, simultaneous charging and discharging, no thermal runoff, zero toxicity, 100 per cent recyclable, fully functional in extreme cold and hot temperatures, and high energy storage efficiency with an annual retention rate of more than 96 per cent. Its proprietary solid-state batteries include a cell capacity above 500 Ah (amp-hour) up to 3,000 Ah with an 11,000-deep discharge cycle.

Residential energy storage systems of 12 kWh to 48 kWh and commercial systems from 60 kWh to 80 kWh are to be marketed.

Skin-like Electronics to Monitor Health Continuously

Researchers at University of Chicago have developed a flexible skin-like wearable device for health monitoring. They used neuromorphic computing which mimics operation of the brain by training on past data sets and learning from experience. Its advantages include compatibility with stretchable material, lower energy consumption and faster speed than other types of AI. The team's skin-like neuromorphic "chip" consists of a thin film of a plastic semiconductor combined with stretchable gold nanowire electrodes. Even when stretched to twice its normal size, their device functioned as planned without formation of any cracks. In a test, the team built an AI device and trained it to distinguish healthy electrocardiogram (ECG) signals from four different signals indicating health problems. After training, the device was more than 95 per cent effective at correctly identifying the ECG signals. The molecules that make up the skin-like device material reorganize upon doubling in length.

Navigation System with 10 centimeter Accuracy

Researchers in the Netherlands have developed an alternative positioning system that is more robust and accurate than GPS, especially in urban settings. The working prototype achieved an accuracy of 10 centimeters. This new technology is important for the implementation of a range of location-based applications, including automated vehicles, quantum communication and next-generation mobile communication Tsystems. Global navigation satellite systems may be unreliable if the radio signals are weak or reflected or blocked by buildings. The project titled SuperGPS aims to develop an alternative positioning system that makes use of the mobile telecommunication network instead of satellites and that could be more robust and accurate than GPS. One innovation is to connect the mobile network to a very accurate atomic clock, through the existing fiber-optic network. Such a network has many new applications such as very accurate positioning through mobile networks. The hybrid optical-wireless system forms an extremely accurate radio clock that is good to one billionth of a second. The system uses a number of related small bandwidth radio signals spread over a large virtual bandwidth.

New Fertilizer From Food Chain Waste

Researchers from Italy have used the waste of the production of lactic acid bacteria, several thousand tons of which are produced each year in Italy as a fertilizer. The researchers showed that in greenhouse cultivation of tomatoes and lettuce the use of these industrial wastes makes it possible to reduce the amount of chemical nitrogen fertilizers by 30 per cent, without reducing production at all and improving some physiological characteristics of the plant. In addition, they estimated that this approach could reduce by 40 per cent greenhouse gas emissions associated with chemical fertilizer production. This fertilizer could nourish the plant (with direct and indirect nutrients), the soil bacteria that have positive effects on the plant, and the soil itself (enriching the humification rate of the soil). A company involved in the project is now recycling more than 700 tons per year of residues from their production process with this approach.

New Material Helps Diabetic Wounds Heal Quickly

Researchers from the University of Nottingham have discovered a new class of polymer that can aid healing in hard-to-treat diabetic wounds. The team identified a polymer type that actively

drives fibroblasts and immune cells to promote healing and made small particles that are decorated with this polymer on their surface. These particles could be directly applied to the wound area. Using polymer microparticles the team showed how this new material, when delivered to a wound on an animal model, produces three times more fibroblast activity over a period of up to 96 hours and achieved more than 80% wound closure. This new polymer could be applied as a coating to standard wound dressings to provide a fast and effective treatment. The team is working with industry partners to develop ways to help wound healing in this way.

Drug Triggers Immune Cells to Attack Prostate Cancer

Researchers from Washington University, St. Louis have found a single drug compound that simultaneously attacks hard-to-treat prostate cancer on several fronts, in mice and human cells. It triggers immune cells to attack, helps the immune cells penetrate the tumor, and cuts off the tumor's ability to burn testosterone as fuel. The drug may offer a promising new strategy for treating patients whose tumors don't respond to standard therapy. The drug, called (R)-9b, is a small molecule that blocks an oncogene called ACK1. The drug also increased signaling molecules that allow the T cells to penetrate the tumor and kill cancer cells more effectively. The tumors in these (R)-9b treated mice were much smaller than those of mice in control groups. The drug spurs multiple responses because of the nature of the gene it blocks. The role of ACK1 in expression of the androgen receptor and in inhibiting the immune system make it an appealing target for cancer therapy, especially against solid tumors with a hormonal growth component, such as prostate and breast cancers. The team is planning to test the drug in a clinical trial for patients with prostate cancer.

RESOURCES & EVENTS

Tool to Assess Policies, Projects Against All 17 SDGs

The Stockholm Environment Institute (SEI) has launched its Agenda 2030 Compass – a tool that allows users to evaluate the merits of a given investment option, research strategy, or policy by assessing direct and indirect impacts on the SDGs, to achieve maximum societal benefits. The Agenda 2030 Compass helps to quantify, visualize, and compare how different action options contribute “societal value” across the SDGs, to maximize co-benefits, minimize trade-offs, and enable stakeholders to make more informed decisions. The Agenda 2030 Compass is described in a report by the same title as a “scientifically robust process” that consists of two stages: (1) The Context Mapper, which identifies potential positive or negative interactions among the SDGs in a particular context, based on socioeconomic conditions, the energy mix, and the physical environment, among other factors; and (2) The Strategy Analyzer, which provides “a simple, robust workshop-based process and toolbox to analyze the sustainability implications of a planned intervention within that context.” The tool can be used to analyze a single strategy in a single context, several alternative strategies in a single context, or a single strategy across several contexts. The Agenda 2030 Compass was developed through an inclusive, co-creation-based process, whereby an online platform helped gather input on SDG interactions from around the world, with greater participation from experts in the Global South. The tool was launched on 10 November, in the margins of the Sharm El-Sheikh Climate Change Conference.

SCIENCE POLICY AND DIPLOMACY

$20bn Pledge for Indonesia's Coal-to-Clean Switch

A group of rich nations and banks plan to invest $20 billion in speeding up Indonesia's transition from coal to clean energy. Japan and the US coordinated financial contributions from seven other national governments and the EU, as well as private sector partners. The money will be spent retiring some of Indonesia's huge, young fleet of coal-fired power stations and installing renewable energy to meet the country's electricity demand instead under the "just energy transition partnership" (JETP) launched on the sidelines of a G20 leaders' summit in Bali. The deal could help Indonesia to meet its net zero emissions goal by 2060 or sooner. Indonesia will aim to peak emissions from its power sector by 2030 rather than the previous target of 2037. It has raised its 2030 target for the renewable share of electricity generation from 17 per cent to 34 per cent. The government will "freeze the existing pipeline" of coal-fired power plants. Roughly half the $20bn package is to come from governments: the US, Japan, UK, Canada, Denmark, the EU, Germany, France, Norway, and Italy. Banks are mobilising the rest. The package includes grants, loans at both concessional and commercial rates, guarantees and technical assistance. As of July 2022, Indonesia had 19GW of new coal capacity under construction and 7GW in planning stages. The $20bn is due to be invested in the next three to five years. The total cost of Indonesia's energy transition is estimated at $1.2 trillion.

COP-27 to Set up Loss and Damage Funding Mechanism

COP-27 adopted the Sharm el-Sheikh Implementation Plan at dawn on Sunday 20 November 2022, after intense two-weeks of negotiations. A big breakthrough was the decision to set up a loss and damage fund with details to be worked out. On mitigation, progress was modest, falling short of phasing out all fossil fuels, not just the coal power targeted at COP 26. The presidency made a push to "keep 1.5 alive", referring to the most ambitious temperature limit in the Paris Agreement, and it named coal as a problem for the first time, with countries agreeing to phase down its use. The final text promotes renewables but also "low-emission" energy which could be interpreted as gas, or fossil fuels with carbon capture and storage. There is recognition that the 1.5C target "requires rapid, deep and sustained reductions in global greenhouse gas emissions reducing global net greenhouse gas emissions by 43 per cent by 2030 relative to the 2019 level". Finance for "loss and damage" came on the formal agenda at COP-27. Wealthy nations offered up a "mosaic of solutions" like insurance and early warning systems. Developing countries sought to get a dedicated new fund. EU announced they would support a fund if the donor base was broadened, if it was targeted at the most vulnerable developing countries and if COP-27 also agreed strong action to reduce emissions. These conditions were partly met and developing nations accepted the offer and all agreed "to establish a fund for responding to loss and damage". A transitional committee will investigate what funding is needed and where the money should come from, including widening the donor base to countries like China or Qatar and report to COP-28. Some of the money is to come through "existing funding arrangements", like development banks or debt relief. Some from "innovative sources", which could mean taxes on fossil fuels, aviation, or shipping. The EU specified that support should only go to "vulnerable" countries – a term for the transitional committee to define. UN Climate Change has been tasked with holding two workshops on the issue before COP-28 and reporting back. It was agreed to set up a "work programme to urgently scale up mitigation ambition and implementation in this critical decade". Countries called on multilateral development banks (MDBs) and international financial institutions to scale up and simplify access to climate finance and ensure their activities contribute to "significantly increasing climate ambition". These

echoes recommendations made by a G20 expert group on the issue. Progress on a new global carbon trading scheme was made. The text creates a two-tier carbon market, applying different rules depending on who buys the credits and for what purpose. A technical body made recommendations on how to define “removals” – sucking carbon dioxide out of the air – for trading purposes. COP-27 decided to establish a work programme on “just transition” and convene an annual ministerial roundtable as part of this process. Work to define the Global Goal on Adaptation made limited progress. A process was agreed for arriving at a new collective climate finance goal for 2025. A proposal for Africa's special needs and circumstances to tackle climate action was not agreed.

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