



# Science Service

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### **New book delves into India's nuclear doctrine evolution**

India has come a long way from being a “nuclear pariah” to a nuclear weapons state and it now needs to maintain a “credible nuclear deterrent” while avoiding accidental and inadvertent escalation, an expert said.

Yogesh Joshi, a MacArthur Nuclear Security Post-Doctoral Fellow at the Center for International Security and Cooperation, Stanford University, and co-author of ‘India in Nuclear Asia: Evolution of Regional Forces, Perceptions, and Policies’, shared his views after the launch of the book at Teen Murti Bhawan in New Delhi.

“India has come a long way from being a nuclear pariah to a de facto nuclear weapons state. The need now is to see that India maintains a credible nuclear deterrent while avoiding dangers of accidental and inadvertent escalation,” he said.

Joshi has authored the book with American scholar Frank O'Donnell. The book sheds light on the evolution of India's nuclear doctrine since 1999 and the challenges it faces.

India's first nuclear doctrine was declared in 1999 after the nuclear tests in 1998; it was revised in 2003.

“Twenty years after India became a nuclear weapons state, its nuclear capabilities have seen tremendous improvement. In the book, we have made two broad suggestions - New Delhi, Beijing and Islamabad should hold dialogues on nuclear issues, and a public defence review must be done by India,” O'Donnell said.

### **Symposium on rise in drug resistant bacteria held at IMTECH**

The CSIR-Institute of Microbial Technology, a microbial institute under the Ministry of Science and Technology, organised a one-day symposium on the issue of the rise in drug resistant bacteria or super-bugs.

The symposium, titled ‘Antimicrobial Resistance (AMR): Need for a United Front’ aims to develop new collaborative research networks for building multi-institutional projects with specific focus on the discovery of novel anti-bacterials, exploring policy measures and developing tools to tackle issues of AMR in India.

The conference was presided over by Punjab Governor and Chandigarh Administrator V P Singh Badnore.

The governor suggested that it was crucial that the scientific community, along with other public health stakeholders, work towards delivery of new solutions for bacterial drug resistance.

The governor appreciated IMTECH's role in developing new drugs that can counter drug resistance bacteria.

He also stressed on the urgent need of Indian research and development institutions to deliver new solutions on the issues of AMR.

Eminent scientist N K Ganguly, former DG, ICMR, Delhi, advised steps India must take to tackle the vital issue of AMR.

Speaking on the occasion IMTECH Director Anil Koul said, “We are witnessing an alarming rise in the levels of antibiotic-resistant bacteria linked to misuse of antibiotics.

### **Nadda launches National Health Resource Repository**

Union Health Minister J P Nadda today launched the National Health Resource Repository (NHRR) — the country's first-ever national healthcare registry of authentic, standardised and updated geo-spatial data of all public and private healthcare establishments.

The vision of National Health Resource Repository project is to strengthen evidence-based decision making and develop a platform for citizen and provider-centric services by creating a robust,

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standardised and secured IT-enabled repository of India's healthcare resources, Nadda said.

NHRR will be the ultimate platform for comprehensive information of both private and public healthcare establishments including Railways, ESIC, Defence and Petroleum health establishments.

The Central Bureau of Health Intelligence (CBHI) has actively engaged with key stakeholders including leading associations, allied ministries, and several private healthcare service providers to frame the facility.

"This resource repository shall enable advanced research towards ongoing and forthcoming healthcare challenges arising from other determinants of health like - disease, environment etc," Nadda said.

Approximately 4,000 trained professionals are working to approach every healthcare establishment for information collection. The Indian Space Research Organisation (ISRO) is the project technology partner adhering to paramount data security.

### **Yoga helps reduce severity of depression: AIIMS study**

Yoga helps reduce the severity of depression by increasing levels of certain chemicals in the brain that maintain the sleep-wake cycle and regulate the mood, appetite and digestion, according a recent study by the All India Institute of Medical Sciences (AIIMS) here.

The study found that introducing yoga into lifestyle results in a decrease in cortisol, the main stress hormone, and reduces levels of certain inflammatory molecules in the body as well as brain, thereby reducing oxidative stress, said Rima Dada, Professor in-charge of Laboratory of Molecular Reproduction and Genetics, Department of Anatomy at AIIMS.

It also slows the pace of aging by reducing levels of oxidative and psychological stress and aids in maintaining the length of telomere, Dada said.

Telomere are DNA sequences which lie at the ends of chromosomes and act as biological clock.

"The study which was published in the 'Restorative Neurology and Neuroscience' journal in March found that meditation and yoga could reduce severity of depression and lead to improvement in systemic biomarkers of neuroplasticity," she said.

The study was conducted by the Laboratory for Molecular Reproduction and Genetics in collaboration with Department of Psychiatry. It studied the impact of yoga on depression after a 12-week yoga intervention on around 236 subjects.

### **Expert panel will be set up to use advanced technology to deal with air pollution: Env Ministry**

The Environment Ministry said today a committee of experts would be formed to look into the technological advances, including application of satellite-based measurement, to improve air quality and reduce pollution.

Every winter smog causes deterioration of air quality, raising the pollution to dangerous levels in the national capital.

The ministry said a meeting with expert institutions was held to discuss the application of advanced technologies to deal with the rising air pollution and improve the overall air quality management framework.

"An expert group will be constituted, which will provide its recommendation in a month's time on early warning system, including dissemination protocol and application of satellite-based measurement for improving air quality information and management," the ministry said in a statement.

“The Department of Science and Technology will take lead on technology interventions for possible use before the onset of winter. They should provide the results of their assessments in two weeks, so that pilots could be quickly rolled out,” it said.

The institutions that were part of today’s meeting with ministry officials included Satellite Application Centre of ISRO, Department of Science & Technology, Council of Scientific and Industrial Research-National Physical Laboratory, IIT Delhi, IIT Mumbai, National Environmental Engineering Research Institute, India Meteorological Department, Indian Institute of Tropical Meteorology and Bureau of Indian Standards.

### **Satya Pal Singh asks IIT-G to also work on ancient technologies**

Union Minister Satya Pal Singh today asked teachers and professors of the Indian Institute of Technology here to work on ancient technologies along with modern innovations, as he exhorted Indians to work towards winning top global awards in science, technology or applied science.

Singh, the union minister of state for HRD in charge of higher education, told the 20th Convocation of IIT-Guwahati here that the professors should explore ancient technology and work on it to provide a judicious balance between modern and older technologies.

“I would like to tell that India as a whole is doing quite well but as far as innovation and research is concerned, much more is required to be done.

Stating that simply publishing papers in journals would not help, he said: “We have to find out how many journals, how many papers are ultimately ending in patents; any start-ups, or helping some entrepreneurs and starting some industry.”

Stressing that a “holistic mindset” was crucial, he said the aim was to create a good human being and a good citizen.

He said efforts must be made to get the highest awards in the field of science, applied science and technology.

“When we are sharing our technological and scientific advancements today, we should not forget our cultural roots,” Singh said.

### **Use of diesel generators increased pollution levels in Gurgaon residential societies: CSE**

The use of diesel generator (DG) sets increased pollution levels by over 30 per cent in residential societies in Gurgaon, the CSE said, amid demands for concerted action to boost usage of solar rooftop panels.

The Centre for Science and Environment (CSE) report revealed that solar rooftops (SRTs) are clean and cheaper alternatives to highly polluting DG sets.

“Per unit cost of electricity generated by DG is Rs 35 per unit (inclusive of the cost of the DG set), while SRT costs less than Rs 6 per unit,” the study said.

The study shows that in societies in Gurgaon where DG sets were operated for several hours a day, PM2.5 and PM10 increased by over 30 per cent compared to levels before the usage of DG sets.

“When DG usage exceeded eight hours, the PM levels were persistently high throughout the day – on an average PM2.5 and PM10 levels were 130 and 300; peak PM2.5 and PM10 levels were 300 and 1,900 respectively,” it said.

Findings from another CSE research said pollution in residential societies from DG sets shows that they are widely used for power back-up during electricity cuts, causing a huge spike in air pollution levels in the local surroundings.

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### **Govt sets up panels under task force for implementing drone tech**

The government today announced the formation of three committees to help a task force set up in April to prepare a road map for implementing the drone technology in the country.

The committees would separately make their recommendations on manufacturing and licensing of drones, airspace and air traffic management and policy and law related issues, the Civil Aviation Ministry said.

The decision was taken during the first meeting of the drone task force chaired by Minister of State for Civil Aviation Jayant Sinha.

Members of the task force such as Civil Aviation Secretary R N Choubey, Director General of Civil Aviation B S Bhullar, Airports Authority of India Chairman Guruprasad Mohapatra among others attended the meeting.

The 13-member task force is expected to submit its report on the unmanned aerial vehicle technology in six months, focussing on research and development of drones, acquisition and commercialisation, preparing a regulatory framework as well as preference for Make in India.

“We are working towards making UAVs a sustainable, globally-competitive industry based in India. A strategic roadmap for India to emerge as a large drone player is being put in place,” the ministry said in a tweet.

At present, aircraft rules do not cover use of drones, their sale and purchase. Aviation regulator

DGCA had restricted use of drones and unmanned aircraft system by civilians in October

### **Most people aware of harmful effects of plastics but still use it: Study**

A majority of people are aware of the harmful effects of plastic on environment, but still use it due to lack of availability of cheaper alternatives, a study said.

With a sample size of 3,600, the national study conducted by market research and analysis company Velocity MR found that 90 per cent of respondents are aware of the harmful effects of plastic and 85 per cent of the respondents are even aware of the ban on polythene bags.

The study was conducted in most of the major cities of the country, including Mumbai, Delhi, Bengaluru, Kolkata, Hyderabad, Chennai, Ahmedabad and Pune.

“It has been observed that even with plastic ban in 25 states of India, 15,000 tonnes of plastic is still procured from cities on a daily basis. From our study, we clearly understood that while the people are aware of the adverse effects of plastic, the usage of this environmental poison is high, primarily due to lack of availability of proper alternatives,” Managing Director and CEO of Velocity MR Jasal Shah said.

The study also revealed that seven out of 10 respondents believe that the ban is only on the use of plastic carry bags and not on other variants of plastic like pouches, garbage bags and containers.

### **World's smallest computer device created**

Scientists have developed the world's smallest computer – a device that measures just 0.3 millimetres and could help find new ways to monitor and treat cancer

Previous systems, including the 2x2x4 millimetre Michigan Micro Mote, retain their programming and data even when they are not externally powered.

Unplug a desktop computer, and its program and data are still there when it boots itself up once the power is back. However, these new microdevices lose all prior programming and data as soon as they lose power.

“We are not sure if they should be called computers or not. It's more of a matter of opinion whether they have the minimum functionality required,” said David Blaauw, a professor at the University of Michigan in the US, who led the development of the new system.

In addition to the RAM and photovoltaics, the new computing devices have processors and wireless transmitters and receivers. Since they are too small to have conventional radio antennae, they receive and transmit data with visible light. A base station provides light for power and programming, and it receives the data.

### **Novel keyboard can be crumpled, carried in pockets**

Scientists have developed an inexpensive, flexible keyboard that can be crumpled up and tucked in a pocket without damaging it.

Bendable portable keyboards for use with computers and other electronic devices are already on the market, but they have limited flexibility, and they are fairly sizable when rolled up for transport.

Existing keyboards incorporate either rigid push buttons inserted in a rollable sheet or a tactile sensor array patterned on a multilayered soft sheet. These devices require complicated fabrication processes,

and because of their brittle components, can only withstand a slight amount of bending or rolling.

Researchers including those from Sejong University from South Korea wanted to develop a keyboard that could withstand the rigors of everyday life, including complete folding and harsh crumpling.

The team based the device on a sensor sheet they had previously developed. Here, they used a sheet of soft silicone rubber embedded with conductive carbon nanotubes that respond to the push of a finger by changing electrical resistance.

To guide users where to press, the researchers drew squares on the surface of the sheet to represent keys for each letter, number or other character.

### **Printed sensors may turn gummy bears into ingestible medical probes**

Scientists have successfully printed electrodes on edible gummy bears, an advance that could lead to ingestible medical sensors that can be easily administered to children in the future.

Microelectrodes can be used for direct measurement of electrical signals in the brain or heart. These applications require soft materials, however. With existing methods, attaching electrodes to such materials poses significant challenges.

Researchers including those from Technical University of Munich (TUM) in Germany have succeeded in printing electrodes directly onto a gummy bear – a popular chewy candy.

The microelectrode array could detect voltage changes resulting from activity in neurons or muscle cells.

Microelectrode arrays have been around for a long time. In their original form, they consist of hard materials such as silicon. This results in several disadvantages when they come into contact with living cells.

In the laboratory, their hardness affects the shape and organisation of the cells, for example. Inside the

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body, the hard materials can trigger inflammation or the loss of organ functionalities.

### **New ‘e-skin’ brings sense of touch to prosthetic hands**

Scientists have created an electronic skin that can lend a sense of touch to prosthetics or robotic limbs, allowing amputees to regain sensation.

Made of fabric and rubber laced with sensors to mimic nerve endings, e-dermis recreates a sense of touch as well as pain by sensing stimuli and relaying the impulses back to the peripheral nerves.

“We’ve made a sensor that goes over the fingertips of a prosthetic hand and acts like your own skin would,” said Luke Osborn, a graduate student at the Johns Hopkins University in the US.

“It’s inspired by what is happening in human biology, with receptors for both touch and pain,” said Osborn.

“We can have a prosthetic hand that is already on the market and fit it with an e-dermis that can tell the wearer whether he or she is picking up something that is round or whether it has sharp points,” he said.

The work - published in the journal *Science Robotics* - shows that it is possible to restore a range of natural, touch-based feelings to amputees who use prosthetic limbs.

The ability to detect pain could be useful, for instance, not only in prosthetic hands but also in lower limb prostheses, alerting the user to potential damage to the device.

### **NASA’s Curiosity rover captures photos of Mars dust storm**

NASA’s Curiosity rover has beamed back pictures of a dust storm that has engulfed much of Mars over the last two weeks and prompted NASA’s Opportunity rover to suspend science operations, the US space agency said today.

However, the Curiosity rover, which has been studying Martian soil at Gale Crater, is expected to remain largely unaffected by the dust.

While Opportunity is powered by sunlight, which is blotted out by dust at its current location, Curiosity has a nuclear-powered battery that runs day and night.

The Martian dust storm has grown in size and is now officially a “planet-encircling” dust event.

Though Curiosity is on the other side of Mars from Opportunity, dust has steadily increased over it, more than doubling over the weekend.

The atmospheric haze blocking sunlight, called “tau,” is now above 8.0 at Gale Crater - the highest tau the mission has ever recorded. Tau was last measured near 11 over Opportunity, thick enough that accurate measurements are no longer possible for Mars’ oldest active rover.

For NASA’s human scientists watching from the ground, Curiosity offers an unprecedented window to answer some questions such as why some Martian dust storms last for months and grow massive, while others stay small and last only a week.

### **Faster, cheaper way to synthesise DNA developed**

Scientists have pioneered a new way to synthesise DNA sequences through a creative use of enzymes that promises to be faster, cheaper and more accurate.

The discovery, by researchers at Lawrence Berkeley National Laboratory (Berkeley Lab) in the US, could address a critical bottleneck in biology research.

“Nature makes biomolecules using enzymes, and those enzymes are amazingly good at handling DNA and copying DNA. Typically our organic chemistry processes are not anywhere close to the precision that natural enzymes offer,” said Sebastian Palluk, graduate student at Joint BioEnergy Institute (JBEI) in the US.

The idea of using an enzyme to make DNA is not new - scientists have been trying for decades to find a way to do it, without success.

The enzyme of choice is called TdT (terminal deoxynucleotidyl transferase), which is found in the immune system of vertebrates and is one of the few enzymes in nature that writes new DNA from scratch rather than copying DNA.

The problem with existing approaches to using enzymes for DNA synthesis is that the catalytic site of the enzyme is not large enough to accept the nucleotide with a blocking group attached.

### **Smart stents can better prevent heart attacks**

Scientists have created a 'smart stent' that can monitor even subtle changes in the flow of blood through the artery, and detect the narrowing in its earliest stages - potentially preventing heart attacks.

The device uses medical-grade stainless steel and looks similar to most commercial stents.

It is the first angioplasty-ready smart stent, researchers said. It can be implanted using current medical procedures without modifications.

"We modified a stent to function as a miniature antenna and added a special micro-sensor that we developed to continuously track blood flow. The data can then be sent wirelessly to an external reader, providing constantly updated information on the artery's condition," said Kenichi Takahata, from University of British Columbia (UBC), who led the study published in the journal *Advanced Science*.

For every three individuals who have had a stent implanted to keep clogged arteries open and prevent a heart attack, at least one will experience restenosis - the renewed narrowing of the artery due to plaque buildup or scarring - which can lead to additional complications.

"X-rays such as CT or diagnostic angiograms, which are the standard tools for diagnosis, can be

impractical or inconvenient for the patient," said York Hsiang, a professor at UBC.

"Putting a smart stent in place of a standard one can enable physicians to monitor their patient's health more easily and offer treatment, if needed, in a timely manner," he added.

### **New system lets you control robots with brain waves, hand gestures**

MIT scientists have developed a system that allows humans to control robots using brainwaves and simple hand gestures, preventing machines from committing errors in real time.

By monitoring brain activity, the system can detect in real time if a person notices an error as a robot does a task. Using an interface that measures muscle activity, the person can then make hand gestures to scroll through and select the correct option for the robot to execute.

The team from Massachusetts Institute of Technology (MIT)'s Computer Science and Artificial Intelligence Laboratory (CSAIL) in the US demonstrated the system on a task in which a robot moves a power drill to one of three possible targets on the body of a mock plane.

They showed that the system works on users it has never interacted with before, meaning that organisations could deploy it in real-world settings without needing to train it on users.

"This work combining EEG and EMG feedback enables natural human-robot interactions for a broader set of applications than we've been able to do before using only EEG feedback," said CSAIL director Daniela Rus, who supervised the work.

"By including muscle feedback, we can use gestures to command the robot spatially, with much more nuance and specificity," said Rus.

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## **China to set up varsity for nuclear power research**

China is planning to build a university dedicated to nuclear power research to meet the severe shortage of qualified people at its rapidly-expanding atomic energy facilities at home and abroad.

China National Nuclear Corporation (CNNC), the country's leading nuclear power developer and nuclear power plant operator, has signed a contract with the government of Tianjin municipality to invest in a nuclear technology university in the northeastern city, the official newspaper of the country's science and technology ministry reported.

The university would be built as a national-level institution and would function as a base for skill-training, master's, PhD programs, and core-technology research and development (R&D), the Science and Technology Daily reported.

China has a comparatively an integral nuclear industrial system. However, few nuclear related fields such as nuclear fusion, uranium enrichment and post-processing "differ widely from each other, and the existing nuclear related majors in universities and colleges cannot satisfy the demand for talent," the report said, citing Wan Gang, director of the China Institute of Atomic Energy.

## **Evidence of rare black hole spotted**

In a first, scientists have spotted the evidence of a rare intermediate-mass black hole - an elusive object whose existence has been hotly debated.

Scientists have been able to prove the existence of small black holes and those that are super-massive, but the existence of intermediate-mass black holes (IMBHs) was never proven.

Researchers from the University of New Hampshire (UNH) in the US found the strongest evidence to date that such middle-of-the-road black

holes exist, by serendipitously capturing one in action devouring an encountering star.

"We feel very lucky to have spotted this object with a significant amount of high quality data, which helps pinpoint the mass of the black hole and understand the nature of this spectacular event," said Dacheng Lin, a research assistant professor at UNH.

"Earlier research, including our own work, saw similar events, but they were either caught too late or were too far away," Lin said.

In the study, published in the journal *Nature Astronomy*, researchers used satellite imaging to detect for the first time this significant telltale sign of activity.

They found an enormous multiwavelength radiation flare from the outskirts of a distant galaxy. The brightness of the flare decayed over time exactly as expected by a star disrupting, or being devoured, by the black hole.

## **Space tourists may not be prepared for trip beyond Earth: NASA astronaut**

People who sign up with space tourism companies for a trip beyond the Earth may be unprepared for the rigours of spaceflight, according to a NASA astronaut.

To date, only the Russian Space Agency, Roscosmos, has taken tourists into space, between 2001 and 2009, at a cost between USD 20 and 40 million.

However, aerospace companies like Blue Origin, Virgin Galactic and SpaceX are hoping to launch commercial flights within the next decade.

Hundreds of people including the Hollywood actors like Angelina Jolie, Kate Winslet and Leonardo DiCaprio, have already bought tickets.

Nasa astronaut Anna Fisher, who became the first mother in space, has warned many are unprepared for the rigours of spaceflight and the toll it will take on their bodies.

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Fisher said she was sick for the first two days of her mission on the Discovery space shuttle in 1984, expressing concern that people paying hundreds of thousands of pounds did not fully appreciate what might happen.

“It’s not like riding a commercial aircraft, not at all, and I can see all these problems with people up there and throwing up and messing up somebody’s flight that they paid USD 250,000 for,” Fisher was quoted as saying by “The Telegraph”.

### **Last of universe’s missing ordinary matter found**

The last reservoir of ordinary matter that had so far evaded detection has been located in the space between galaxies - existing as extremely hot filaments of oxygen gas, scientists say.

Ordinary matter, or “baryons,” make up all physical objects in existence, from stars to the cores of black holes.

However, until now, astrophysicists had only been able to locate about two-thirds of the matter that theorists predict was created by the Big Bang.

Researchers from the University of Colorado Boulder in the US pinned down the missing third, finding it in the space between galaxies.

That lost matter exists as filaments of oxygen gas at temperatures of around 1 million degrees Celsius, according to the study published in the journal Nature.

“This is one of the key pillars of testing the Big Bang theory: figuring out the baryon census of hydrogen and helium and everything else in the periodic table,” said Shull.

Researchers have a good idea of where to find most of the ordinary matter in the universe - not to be confused with dark matter, which scientists have yet to locate: About 10 per cent sits in galaxies, and close to 60 per cent is in the diffuse clouds of gas that lie between galaxies.

### **NASA delays James Webb Space Telescope launch to 2021**

The launch of NASA’s James Webb Space Telescope - world’s premier science observatory - has been further delayed to March 2021, a move that will cost the agency an additional USD 8.8 billion. The telescope was expected to launch in 2020.

The Independent Review Board (IRB) established by NASA to assess progress on the Webb telescope has unanimously recommended that development on it should continue.

The report issued by the review board addresses a range of factors influencing Webb’s schedule and performance, including the technical challenges and tasks remaining by primary contractor Northrop Grumman before launch.

“Webb should continue based on its extraordinary scientific potential and critical role in maintaining US leadership in astronomy and astrophysics,” said Tom Young, the chair of the review board.

“Ensuring every element of Webb functions properly before it gets to space is critical to its success.” Young said.

The board also reaffirmed Webb’s significant complexity, incredible scientific potential, and importance to astrophysics. The report includes several recommendations for moving forward, some of which NASA has already initiated.

NASA Administrator Jim Bridenstine sent a message to the NASA workforce Wednesday about the report.

### **Don’t be over the moon yet! Buying a piece of lunar landscape still a distant dream**

With real estate prices sky high, pollution choking our cities, and civic amenities stretched to the limit, it might be a good idea to move to a quiet, clean

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neighbourhood. How about the moon? That too for just a couple of thousand rupees!

Owning pristine, untouched property on the Moon may sound too good to be true. That is because it probably is.

That has not deterred Bollywood actor Sushant Singh Rajput who claims to have recently bought property on Earth's natural satellite, complete with a legal looking certificate of purchase. But in fact he may be in possession of nothing more than an overpriced piece of paper, say experts.

While a quick internet search will yield names of many companies that are willing to sell you properties on the Moon and even planet Mars, in reality India has signed an international treaty which makes it impossible for anyone to legally lay claim on a piece of land in space.

"The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the moon and Other Celestial Bodies" more commonly known as the "The Outer Space Treaty" came into effect in October 10, 1967.

It states that "outer space, including the Moon and other celestial bodies" are the 'common heritage of mankind' and cannot be owned by any nation.

### **Milky Way full of 'space grease': study**

The galaxy is rich in grease-like molecules, say scientists who have estimated the amount of 'space grease' found in the Milky Way.

Organic matter of different kinds contains carbon, an element considered essential for life. There is though real uncertainty over its abundance, and only half the carbon expected is found between the stars in its pure form.

The rest is chemically bound in two main forms, grease-like (aliphatic) and mothball-like (aromatic).

The researchers from University of New South Wales (UNSW) in Australia used a laboratory to create material with the same properties as interstellar dust.

They mimicked the process by which organic molecules are synthesised in the outflows of carbon stars, by expanding a carbon-containing plasma into a vacuum at low temperature.

The material was collected and then analysed by a combination of techniques. Using magnetic resonance and spectroscopy (splitting light into its constituent wavelengths) they were able to determine how strongly the material absorbed light with a certain infrared wavelength, a marker for aliphatic carbon.

"Combining our lab results with observations from astronomical observatories allows us to measure the amount of aliphatic carbon between us and the stars," said Tim Schmidt, from UNSW.

The study, published in the journal *Monthly Notices of the Royal Astronomical Society*, found that there are about 100 greasy carbon atoms for every million hydrogen atoms, accounting for between a quarter and a half of the available

### **Organic molecules on Saturn's moon indicate possibility of life**

Scientists found that large, carbon-rich organic molecules are ejected from cracks in the icy surface of Saturn's moon Enceladus, indicating it satisfies all of the basic requirements for life.

Researchers, who used data from the NASA's Cassini spacecraft, think chemical reactions between the moon's rocky core and warm water from its subsurface ocean are linked to these complex molecules.

"We are, yet again, blown away by Enceladus. Previously we'd only identified the simplest organic molecules containing a few carbon atoms, but even that was very intriguing," said Christopher Glein, a space scientist from Southwest Research Institute in the US.

"Now we've found organic molecules with masses above 200 atomic mass units. That's over ten times heavier than methane," said Glein.

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“With complex organic molecules emanating from its liquid water ocean, this moon is the only body besides Earth known to simultaneously satisfy all of the basic requirements for life as we know it,” he said.

Prior to its deorbit in September of 2017, Cassini sampled the plume of material emerging from the subsurface of Enceladus.

The Cosmic Dust Analyser (CDA) and the SwRI-led Ion and Neutral Mass Spectrometer (INMS) made measurements both within the plume and Saturn’s E-ring, which is formed by plume ice grains escaping Enceladus’ gravity.

“Even after its end, the Cassini spacecraft continues to teach us about the potential of Enceladus to advance the field of astrobiology in an ocean world,” Glein said.

### **Sweden, Finland developing technology to curb India’s pollution woes**

Sweden is exploring ways to come up with innovative technology to address the issue of stubble-burning in parts of north India that leads to pollution in Delhi-NCR, a Swedish diplomat said today.

“Delhi has seen this problem of air pollution and smog and the air quality gets worse around November. And, stubble-burning has been a major issue. So, we are looking into ways to bring an innovative technology to address this issue,” Gautam Bhattacharyya, Deputy Head of Mission at Swedish Embassy here, said.

Stubble-burning refers to a practice adopted by many farmers in northwest India, who typically burn abundant crop residue on the fields after harvest season in order to prepare their fields for subsequent planting.

Bhattacharyya was speaking at a panel discussion here on ‘India-Nordic Partnership: An Idea Whose Time Has Come’. Envoys of Finland, Iceland and

Denmark, and the deputy mission of Norway were also present at the discussion.

The Swedish diplomat said his country was in talks with the Department of Science and Technology of India to work on the innovation.

“The idea essentially seeks to transform those burning fields (stubble) into bio coal. We want to see if this idea can be scalable,” he said.

Ambassador of Finland to India, Nina Vaskunlahti said her country also had innovative solutions to offer in the matter like converting rice paddy to fibre that can later be used for making clothes.

### **Scientists develop “deep learning” robots to empower autistic children**

MIT scientists have developed a new type of “deep learning” network that can aid robots gauge the quality of their interactions with children having autism spectrum conditions by using data unique to each child.

Autism spectrum disorder is a condition related to brain development that impacts how a person perceives and socializes with others, causing problems in social interaction and communication. The term “spectrum” in autism spectrum disorder refers to the wide range of symptoms and severity.

Armed with personalised “deep learning”, the child-friendly robot NAO can smoothly estimate the engagement and interest of each autistic child, using data unique to that particular individual, based on a study performed on 35 autistic children.

The new development can make their lives easier.

“The long-term goal is not to create robots that will replace human therapists, but to augment them with key information that the therapists can use to personalise the therapy content and also make more engaging and naturalistic interactions between the robots and children with autism,” said Oggi Rudovic, the first author of the study.

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The robot's perception of the children's responses agreed with assessments by human experts, with a correlation of 60 per cent, according to the scientists.

"The challenge of creating machine learning and AI [artificial intelligence] that works in autism is particularly vexing, because the usual AI methods require a lot of data that are similar for each category that is learned. In autism where heterogeneity reigns, the normal AI approaches fail," said Rosalind Picard, co-author of the study.

The robot-assisted therapy involves a human therapist showing flash-cards of different faces expressing different emotions, like happiness, sadness, fear and a programmed robot or NAO, which shows the same emotions to the child.

The therapist observes how the child engages with the robot and gets feedback on how the lesson is to be taken further.

NAO is a two feet tall robot resembling an armoured superhero or a droid, which conveys different emotions by changing its eye colour, limb-motion and the tone of its voice.

"Therapists say that engaging the child for even a few seconds can be a big challenge for them, and robots attract the attention of the child," said Rudovic.

"Also, humans change their expressions in many different ways, but the robots always do it in the same way, and this is less frustrating for the child because the child learns in a very structured way how the expressions will be shown," he said.

In addition to being personalised, the system created by these researchers involves deep learning powered by AI.

Deep learning has been used in automatic speech and object-recognition programmes, making it well-suited for a problem such as making sense of the

multiple features of the face, body and voice that go into understanding a more abstract concept such as a child's engagement.

### **SpaceX launches AI robot, strong coffee for station crew**

A SpaceX rocket that flew just two months ago with a NASA satellite roared back into action today, launching the first orbiting robot with artificial intelligence and other station supplies.

The used Falcon rocket blasted off before dawn, hauling nearly 6,000 pounds (2,700 kilograms) of cargo including the spherical AI bot named Cimon, genetically identical mice and super-caffeinated coffee for the crew of the International Space Station.

The shipment — packed into a Dragon capsule that's also recycled — should reach the station Monday.

It was an especially gorgeous launch, delighting spectators as the rocket plume expanded in the clear night sky like a giant halo beneath a nearly full moon and a gleaming Mars.

SpaceX's Jessica Jensen described the high-altitude plume, illuminated against the dark sky, as "the space jellyfish that's coming down after us." "I was going to say breathtaking, but maybe awakening might be a better word," said NASA's space station program manager, Kirk Shireman.

This marked SpaceX's fastest reflight of a booster. The same first-stage booster launched the planet-hunting Tess satellite in April. The capsule, meanwhile, flew in 2016.

Aiming to lower launch costs by reusing rockets, SpaceX did not retrieve the booster for another flight and ditched it in the Atlantic instead. The company is switching to a new and improved line of boosters.



### **World's most powerful supercomputer unveiled**

US scientists have unveiled the world's most powerful and smartest scientific supercomputer that can complete over 200,000 trillion calculations per second - providing unprecedented computing power for research in energy, advanced materials and artificial intelligence (AI).

The US Department of Energy's Oak Ridge National Laboratory (ORNL) supercomputer called Summit will be eight times more powerful than its previous top-ranked system, Titan.

For certain scientific applications, Summit will also be capable of more than three billion billion mixed precision calculations per second, or 3.3 exaops.

"Summit will empower scientists to address a wide range of new challenges, accelerate discovery, spur innovation and above all, benefit the American people," said Rick Perry, Secretary of Energy.

The IBM AC922 system consists of 4,608 compute servers, each containing two 22-core IBM Power9 processors and six NVIDIA Tesla V100 graphics processing unit accelerators, interconnected with dual-rail Mellanox EDR 100 Gb/s InfiniBand.

Summit also possesses more than 10 petabytes of memory paired with fast, high-bandwidth pathways for efficient data movement.

The combination of cutting-edge hardware and robust data subsystems marks an evolution of the hybrid CPU-GPU architecture successfully pioneered by the 27-petaflops Titan in 2012.

### **Astronomers spot supermassive blackhole destroying star**

For the first time, astronomers have directly imaged the formation and expansion of a fast-moving jet of material ejected when a supermassive black hole ripped apart a star that wandered too close to the cosmic monster.

The scientists tracked the event with radio and infrared telescopes, including the National Science Foundation's Very Long Baseline Array (VLBA), in a pair of colliding galaxies called Arp 299, nearly 150 million light-years from Earth.

At the core of one of the galaxies, a black hole 20 million times more massive than the Sun shredded a star more than twice the Sun's mass, setting off a chain of events that revealed important details of the violent encounter.

Only a small number of such stellar deaths, called tidal disruption events, or TDEs, have been detected, although scientists have hypothesised that they may be a more common occurrence.

Theorists suggested that material pulled from the doomed star forms a rotating disk around the black hole, emitting intense X-rays and visible light, and also launches jets of material outward from the poles of the disk at nearly the speed of light.

"Never before have we been able to directly observe the formation and evolution of a jet from one of these events," said Miguel Perez-Torres, of the Astrophysical Institute of Andalusia in Spain.

### **Living in mountains limits bone growth: Study**

Living in high altitude regions can limit bone growth, causing people have shorter limbs, say scientists who conducted a study in Himalayan populations.

High altitude is a particularly challenging environment - the terrain is physically challenging and the land has a relatively poor crop yield, so food can be sparse.

Most importantly, oxygen levels are lower meaning that conversion of food into energy in an individual's body is not very efficient and leads to relatively limited energy available for growth.

In a study published, in the journal Royal Society Open Science, scientists examine how high altitude

and the associated limited available energy affects the growth of long bones.

By measuring the limbs of people of similar ancestry from high altitude and low altitude regions, the team found that those living at high altitude had significantly shorter lower arm segments.

However, compared to people living at low altitude, the length of the upper arm and hand were relatively the same.

“Our findings are really interesting as they show that the human body prioritises which segments to grow when there is limited energy available for growth, such as at high altitude,” said Stephanie Payne, at University of Cambridge in the UK.

### **Robot bloodhound tracks odours on ground**

Scientists have developed a robot that can rapidly detect odors from sources on the ground, such as footprints – and could even read a message written on the ground using odours as a barcode.

Over the past two decades, researchers have tried to develop robots that rival the olfactory system of bloodhounds, which are famous for their ability to track scents over great distances.

However, most robots can only detect airborne odours, or they are painstakingly slow at performing analyses.

Researchers from Kyushu University in Japan wanted to develop a robot with a high-speed gas sensor that could rapidly track invisible odour sources on the ground.

They based their odour sensor on a technique called localized surface plasmon resonance (LSPR) that measured changes in light absorption by gold nanoparticles upon exposure to a gas.

As the robot travelled across a surface, a tube placed close to the ground suctioned odours into the LSPR sensor.

The researchers showed that the sensor could accurately detect the location of ethanol odour

sources placed at different positions along the robot’s path, at a travel speed of 10 centimeters/second (about 4 inches/second).

### **Four cups of coffee daily may help protect your heart**

Drinking about four cups of coffee everyday can protect you from heart diseases, say scientists who have found that caffeine promotes the movement of a regulatory protein into mitochondria, enhancing their function and protecting cardiovascular cells from damage.

Caffeine consumption has been associated with lower risks for multiple diseases, including type II diabetes, heart disease, and stroke, but the mechanism underlying these protective effects has been unclear.

The study, published in the journal PLOS Biology, a protein called p27, known mainly as an inhibitor of the cell cycle, was present in mitochondria in the major cell types of the heart.

In these cells, mitochondrial p27 promoted migration of endothelial cells, protected heart muscle cells from cell death, and triggered the conversion of fibroblasts into cells containing contractile fibers — all crucial for repair of heart muscle after myocardial infarction.

Researchers, including those from IUF-Leibniz Research Institute for Environmental Medicine in Germany, found that caffeine induced the movement of p27 into mitochondria, setting off this beneficial chain of events, and did so at a concentration that is reached in humans by drinking four cups of coffee.

Caffeine was protective against heart damage in pre-diabetic, obese mice, and in aged mice.

### **Diabetes may be an early indicator of pancreatic cancer**

Onset of type 2 diabetes may be an early indicator of pancreatic cancer - one of the most deadliest forms of cancer, scientists say.

Researchers from University of Southern California in the US found that diabetes was associated with a more than twofold higher risk of pancreatic cancer in African Americans and Latinos.

However, recent-onset diabetes was associated with a 2.3-fold greater increase in risk of pancreatic cancer than long-standing diabetes.

Pancreatic cancer is one of the most fatal cancers, with a five-year survival rate of only eight per cent.

This is because the vast majority of pancreatic cancer patients (some 80 per cent of them) are diagnosed at a late stage. Identification of high-risk people and ability to detect pancreatic cancer earlier would likely improve patient outcomes.

Diabetes has been consistently associated with pancreatic cancer in previous studies, with a twofold higher risk of developing pancreatic cancer among diabetes patients.

Diabetes has been proposed to be both a risk factor for and a consequence of pancreatic cancer. The prevalence of diabetes among pancreatic cancer patients is unusually high relative to other cancers.

### **Vitamin D may cut breast cancer risk**

Higher levels of vitamin D may lower the risk of developing breast cancer, a study has found.

Researchers from the University of California San Diego in the US pooled data from two clinical trials with 3,325 combined participants and a prospective study involving 1,713 participants to examine the association between risk of female breast cancer and a broad range of serum 25-hydroxyvitamin D (25(OH)D) concentrations, which was chosen as the

marker because it is the main form of vitamin D in blood.

All women were age 55 or older. The average age was 63. Data were collected between 2002 and 2017. Participants were free of cancer at enrollment and were followed for a mean period of four years. Vitamin D levels in blood were measured during study visits.

Over the course of the combined studies, 77 new cases of breast cancer were diagnosed for an age-adjusted incidence rate of 512 cases per 100,000 person-years.

Researchers identified the minimum healthy level of 25(OH)D in blood plasma to be 60 nanograms per millilitre (ng/ml), substantially higher than the 20 ng/ml recommended in 2010 by the National Academy of Medicine, a US health advisory group.

“We found that participants with blood levels of 25(OH)D that were above 60 ng/ml had one-fifth the risk of breast cancer compared to those with less than 20 ng/ml,” said Cedric F Garland, a professor at the UC San Diego.

### **Plant-based diets may help diabetics manage health**

Vegan and vegetarian diets can help people suffering from diabetes lose weight and manage cholesterol, a study has found.

Researchers reviewed nine trials that assessed the effectiveness of vegan and vegetarian diets for diabetes patients.

The results, published in the journal *Clinical Nutrition*, show that those who ate a plant-based diet lowered their cholesterol, lost weight and improved other cardiometabolic risk factors when compared to those who ate a non vegetarian diet.

People with diabetes are two to four times more likely to die from cardiovascular disease than those who do not have diabetes.

“The link between diabetes and cardiovascular disease is strong. Sixty to seventy per cent of people

who have type 2 diabetes die of heart disease,” said Hana Kahleova, director of clinical research at US-based non-profit Physicians Committee for Responsible Medicine.

“The good news is that this study shows that the same simple prescription - eating a plant-based diet - can reduce our risk for heart problems and improve type 2 diabetes at the same time,” said Kahleova.

Researchers suggest that plant-based diets, which centre on fruits, vegetables, grains, and legumes, benefit both glycemic control and cardiovascular health, because they are low in saturated fat, rich in phytochemicals, high in fibre, and often rich in low-glycemic fruits and vegetables.

### **Biodegradable plastic alternative synthesised**

Scientists have successfully synthesised a polymer that is typically produced by bacteria, algae and other microorganisms, an advance that may lead to renewable and biodegradable plastics.

The compound called bacterial poly(3-hydroxybutyrate) - or P3HB - shows early promise as a substitute for petroleum plastics in major industrial uses.

P3HB is a biomaterial, typically produced by bacteria, algae and other microorganisms, and is used in some biomedical applications.

Its high production costs and limited volumes render the material impractical in more widespread commodity applications, however.

Researchers from Colorado State University in the US used a starting material called succinate, an ester form of succinic acid.

This acid is produced via fermentation of glucose and is first on the U.S. Department of Energy’s list of top 12 biomass-derived compounds best positioned to replace petroleum-derived chemicals.

The new chemical synthesis route produces P3HB that’s similar in performance to bacterial

P3HB, but their route is faster and offers potential for larger-scale, cost-effective production for commodity plastic applications.

### **Compound that stops viruses from replicating identified**

Scientists have identified how a naturally occurring enzyme in humans and other mammals prevents viruses from multiplying, an advance that may pave the way for new antiviral drugs.

The enzyme viperin, known to have antiviral effects on a wide variety of viruses, including West Nile, hepatitis C, rabies, and HIV, facilitates a reaction that produces the molecule ddhCTP, which prevents viruses from copying their genetic material and thus from multiplying.

The discovery could allow researchers to develop a drug that induces the human body to produce this molecule and could act as a broad-spectrum therapy for a range of viruses.

“We knew viperin had broad antiviral effects through some sort of enzymatic activity, but other antivirals use a different method to stop viruses,” said Craig Cameron, a professor at Pennsylvania State University in the US.

Researchers found that viperin catalyses an important reaction that results in the creation of a molecule called ddhCTP. They decoded the effects of ddhCTP on a virus’ ability to replicate its genetic material.

“The molecule acts in a similar manner to drugs that were developed to treat viruses like HIV and hepatitis C. With a better understanding of how viperin prevents viruses from replicating, we hope to be able to design better antivirals,” said Cameron.

A virus co-opts the host’s genetic building blocks to copy its own genetic material, incorporating molecules called nucleotides into new strands of RNA.