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# Science Service

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### **Worsening air quality in 2 decades main reason behind high pre-mature deaths: Study**

Worsening air quality in the last two decades is the principle reason behind high number of pre-mature deaths in the country, according to a study conducted by IIT-Delhi.

The study titled 'Know what you breathe', conducted with the support of the Centre for Environment and Energy Development (CEED), has found that the annual mortality is in the range of 150-300 persons per year for every 1 lakh population in the urban areas of Uttar Pradesh, Bihar and Jharkhand.

Whereas the level of PM2.5, is more than two times of its National Annual Standard and eight times of the WHO's annual permissible limits in all the studied cities with the exception of Ranchi, capital of Jharkhand.

The researchers studied the annual mean PM2.5 concentration for 11 north Indian cities using the satellite data of the last 17 years.

Out of these 11 cities, eight are also listed in the global air quality assessment report of the World Health Organisation (WHO) titled 'Global Ambient Air Quality Database (2018)'.

"We are witnessing a public health emergency in our cities as polluting air is choking our lungs. State and Union governments need to take note of this alarming situation and create national clean air action plan which is ambitious, effective and focuses on time-bound implementation," Abhishek Pratap, Programme Director of the CEED said.

The study found that level of PM2.5 exposure was moving downward from west to east of the Indo-Gangetic plain with the highest proliferation in Varanasi, while the slowest was in Ranchi. The report has indicated an increase of 28.5 microgram/m<sup>3</sup> in PM 2.5 in the last 17 years in Varanasi.

### **Prez asks scientists to find solutions for challenges like climate change, water scarcity**

President Ram Nath Kovind today exhorted scientists and students to work towards finding solutions to challenges such as climate change and water scarcity, while underscoring that science and technology must continue to play a role in nation building.

Kovind, who was addressing the 7th convocation of the Indian Institute of Science Education and Research (IISER) here, also encouraged students, who graduated today, to become entrepreneurs and asked them to give back to society, especially to the less privileged.

"The purpose of scientific research is threefold. First, science and technology must continue to play a role in nation building. As our nation evolves and our society changes, are needs too are transformed. Yet, science and technology will always be required to find answers to developmental questions," he said.

"Today, the questions before us range from battling climate change to providing low-cost, but effective, healthcare solutions. And, from helping our farmers overcome productivity and water-scarcity challenges to building sustainable cities and houses that are socially inclusive and provide a life of dignity to the last family in the last mohalla. The IISER network must immerse itself in these tasks," the president said.

Noting that science and technology have a symbiotic relationship with business and industry, Kovind said science and commerce can do a lot together.

### **India working on unmanned tanks, vessels, robotic weaponry for future wars**

In an ambitious defence project, the government has started work on incorporating artificial intelligence (AI) to enhance the operational preparedness of the armed forces in a significant way

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that would include equipping them with unmanned tanks, vessels, aerial vehicles and robotic weaponry.

The move is part of a broader policy initiative to prepare the Army, Navy and the Air Force for next generation warfare and comes amid rising Chinese investments in developing critical applications of AI for its military.

Secretary Defence Production Ajay Kumar said the government had decided to introduce AI in all the three forces as it would be a “big area” considering the requirements of future warfare.

He said a high-powered task force headed by Tata Sons Chairman N Chandrasekaran was finalising the specifics and framework of the project, which would be implemented in a “partnership model” between the armed forces and the private sector.

“It is India’s preparation for next generation warfare. This (AI) is where the future is going to be. We need to prepare ourselves for the next generation warfare which will be more and more technology driven, more and more automated and robotised,” he told PTI.

Like many other world powers, India had also started work on the application of AI to boost the capabilities of its armed forces, Kumar said, adding that unmanned aerial vehicles, unmanned naval vessels, unmanned tanks and automatic robotic rifles as weapon systems will have an extensive use in future wars.

### **Need for cities to enhance waste management system: CSE on Swachh Survekshan 2018**

A leading environment advocacy group today lauded the just-released ‘Swachh Survekshan’ 2018 for using improved methodology but stressed the need for cities to enhance solid waste management system for better results.

The Centre for Science and Environment (CSE) noted that there was a clear improvement in the methodology adopted in the survey with more focus

on innovation and on adoption of sustainable waste management practices.

Housing and Urban Affairs Minister Hardeep Singh Puri had released the ‘Swachh Survekshan 2018’ yesterday. Jharkhand has emerged as the best-performing state in terms of cleanliness, while Indore in Madhya Pradesh was adjudged the cleanest city in the country.

“There is a clear improvement in the methodology adopted by the survey – we see more focus on innovation, and on adoption of sustainable waste management practices.

“However, some of the cities that have been selected for the awards are merely visibly clean and cannot claim to have adopted sustainable practices,” said Chandra Bhushan, deputy director general, CSE.

He said the CSE had advocated categorisation of cities by population and pointed out that it is incorrect and misleading to place cities with different populations in the same category of ranking.

“This year’s survey has definitely made significant improvements. However, cities must shift their focus towards creating end-to-end systems to support segregation with effective processing and disposal mechanisms.

“Only then will such ranking systems work in changing the solid waste management scenario in the country,” he added.

The ‘Swachh Survekshan 2018’ has followed the broad population-based categories, several sub-categories have been introduced — such as the cleanest city or the fastest moving city, and cities with best solid waste management practices, highest citizen feedback, best innovation and practices, etc, CSE said.

Elaborating on the green body’s forum of cities that segregate scores points, Swati Singh Sambyal, programme manager, waste management, CSE, said cities which are members of the forum that segregate have bagged several awards.

### **Develop drugs to cure diabetes: VP to scientists at IIIM**

Applauding the Indian Institute of Integrative Medicine (IIIM) for playing a major role in supporting the drug regulatory system of the country, Vice President M Venkaiah Naidu today asked scientists here to develop drugs to cure diabetes and prevent diseases like malaria, chikungunya and dengue.

“Pay more attention on diabetes and other diseases such as malaria, chikungunya and dengue so that a large number of people get benefited from your (IIIM) research,” he said.

The vice president said he was glad to know that the institute has started a Technology Business Incubator with the objective of creating jobs for the youngsters of the state.

“I am happy to note that a number of startups within the IIIM campus are currently incubating under this initiative, which is being supported by the department of science & technology”, Naidu said.

He said it was heartening to know that institute has a very robust drug pipeline in the areas of Oncology, Arthritis, Tuberculosis, Alzheimer’s and Peptic ulcer.

Naidu said as we all know, science has played a major role in the growth of our great nation and the remarkable achievements in the areas of affordable medicine, food security, milk production, space, atomic energy and information technology, among others, are a testimony to this fact.

### **IIIT-Delhi develops apparatus that can predict bowel movements**

A team of Delhi’s Indraprastha Institute of Information Technology has developed an apparatus that can predict bowel movements to help people with lower body paralysis make arrangements in advance.

The apparatus consisting of a stethoscope and a microphone has to be wrapped around the abdomen.

The stethoscope will listen to the intestinal sounds while the microphone will amplify it and send it to a smartphone, which will record these sounds.

“Using a pre-trained machine learning classifier, the sounds will be classified as either a bowel sound or a non-bowel sound in the smartphone. In case if the sound is a bowel sound, the person will be notified that s/he is about to experience a bowel movement,” assistant professor at the institute’s Computer Science department and team member Juhi Ranjan said.

“Due to the muscle function loss, people with lower body paralysis find it difficult to sense their bowel timings which may sometime result in bowel accidents making it a situation of embarrassment for them. To avoid such awkward situations, they tend to follow a very restricted lifestyle which includes strictly monitoring the food they should eat, the timings of food intake, using an enema, etc.”

The project is a creative blend of internet of things and machine learning techniques and aims to help such patients live a healthy and less-restricted life in terms of the food they take, she added.

### **AIIMS gets green nod for developing Rs 2,163 cr super-speciality blocks**

All India Institute of Medical Sciences (AIIMS) has received green nod for developing super-speciality blocks at Jai Prakash Narayan Apex Trauma Centre (JPNATC) in the national capital at a cost of Rs 2,163 crore.

State-owned NBCC will be implementing the proposed project that will come up in an area of 60,500 square metre in the JPNATC campus-II at Safdarjung Enclave. The construction work is expected to be completed in four years.

In a letter to NBCC, Union Environment Ministry said that it has given the environment clearance to the AIIMS’ proposed project with certain riders.

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The clearance has been given after taking into account the recommendations of an internal expert committee.

The land acquisition has been done for the proposed site. The cost of the project is estimated to be Rs 2,163 crore.

As per the proposal, the project will comprise of constructing five blocks with 184 beds. Maximum height of the building will be 38 metre.

### **Apollo Hospitals to adopt Watson platform for oncology, genomics**

Healthcare major Apollo Hospitals today said it will adopt IBM cognitive computing platform Watson for oncology and genomics.

Watson for oncology will be available at the Apollo Chennai and Delhi hospitals from April 2018, followed by Hyderabad, Mumbai, Kolkata, Ahmedabad, Bhubaneshwar and Madurai over the next few months, Apollo Hospitals said in a statement.

Watson for genomics will become available across the same locations in the following months, it added.

Apollo Hospitals Group Vice Chairperson Preetha Reddy said, "IBM Watson for oncology and genomics will help the clinicians and oncologists at Apollo Hospitals augment their own expertise to deliver an unparalleled and personalised patient care across our hospitals."

This collaboration with Apollo Hospitals reflects IBM's ongoing commitment to partner with leading healthcare providers across the world to leverage the power of artificial intelligence to support cancer care, IBM Watson Health Oncology, Genomics and Life Sciences GM Lisa Rometty said.

### **Jubilant Life gets USFDA nod for Niacin extended release tablets**

Jubilant Life Sciences Ltd today said it has received the final approval from USFDA for its

generic Niacin extended-release tablets used for controlling cholesterol levels.

The approval granted by the US Food and Drug Administration (USFDA) to the company's wholly-owned arm Jubilant Pharma Ltd, is for multiple strengths of Niacin extended-release tablets of 500 mg, 750 mg, and 1,000 mg, the company said in a statement.

These are the generic equivalent of AbbVie's Niaspan, which is indicated to reduce elevated high-density lipoprotein (known as bad cholesterol), among others while increasing HDL-C (good cholesterol) in patients with primary hyperlipidemia and mixed dyslipidemia.

The drug helps reduce the risk of recurrent nonfatal myocardial infarction (heart attack) in patients with a history heart disease and hyperlipidemia, the statement added.

"This is the first approval that we have received from the USFDA during the current financial year," it said.

### **The Himalaya Drug Company**

The Himalaya Drug Company Promotes Menstrual Hygiene in Over 100 Schools in Mumbai (Disclaimer: The following press release comes to you under an arrangement with PRNewswire.

On the occasion of Menstrual Hygiene Day, The Himalaya Drug Company along with Rotary Club of Bombay has initiated a campaign, Jagriti, to install sanitary pad dispensers across schools and colleges. The main aim of this campaign is to make sanitary pads accessible to girls at an affordable price of Rs. 2. Menstrual hygiene is an integral part of personal sanitation and health. With this initiative, Himalaya aims at promoting menstrual hygiene among girls.

"A lot of young girls drop out of school due to a lack of affordable menstrual products. If we were to go by the statistics, 88% of women still don't use menstrual products, and about 4 million women face

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barriers to comfortable and accessible menstrual hygiene.

The need of the hour is to create an environment where these products are easily available at an affordable price. To provide young girls a comfortable and dignified experience, Himalaya is happy to partner with Rotary Club and various institutions for this initiative,” says Anil Jiandani, Business Director, Pharmaceuticals Division, The Himalaya Drug Company. As a part of this initiative, two sanitary pad dispensers were inaugurated at the M.K Sanghvi College of Commerce in April. Ms. Krushna Gandhi,

the Principal, volunteers from Rotary Club, team Himalaya, and the faculty and students from the college were present at the event.

Speaking about the initiative, Ms. Krushna Gandhi, Principal, M.K Sanghvi College of Commerce, said, “It is important to create awareness about menstrual hygiene. This initiative is a big boost for the students to improve personal hygiene. We truly appreciate Himalaya’s noble initiative in sharing our responsibility to help young girls maintain proper personal hygiene and health. This initiative will ensure an increase in the attendance of female students.”



### **‘Ingestible sensor to help diagnose stomach disease’**

MIT scientists have developed an ingestible sensor equipped with genetically engineered bacteria, that can diagnose bleeding in the stomach or other gastrointestinal problems.

This “bacteria-on-a-chip” approach combines sensors made from living cells with ultra-low-power electronics that convert the bacterial response into a wireless signal that can be read by a smartphone.

“By combining engineered biological sensors together with low-power wireless electronics, we can detect biological signals in the body in near real-time, enabling new diagnostic capabilities for human health applications,” said Timothy Lu, an associate professor at Massachusetts Institute of Technology (MIT) in the US.

In the study, published in the journal *Science*, the researchers created sensors that respond to heme, a component of blood, and showed that they work in pigs.

They also designed sensors that can respond to a molecule that is a marker of inflammation.

In the past decade, synthetic biologists have made great strides in engineering bacteria to respond to stimuli such as environmental pollutants or markers of disease.

To make these bacteria more useful for real-world applications, the MIT team decided to combine them with an electronic chip that could translate the bacterial response into a wireless signal.

### **Learning Physics activates new brain regions: Study**

Parts of the brain not traditionally associated with learning science become active when people are confronted with solving Physics problems, a study has found.

The finding, published in the journal *Frontiers in ICT*, shows that the brain’s activity can be modified by different forms of instruction.

Using fMRI (functional magnetic resonance imaging) to measure blood flow in the brain, the researchers looked to map what areas become active when completing a Physics reasoning task, both before a course on the concepts and after.

“The neurobiological processes that underpin learning are complex and not always directly connected to what we think it means to learn,” said Eric Brewster, an associate professor at Drexel University in the US.

More than 50 volunteer students took part in the study in which they were taught a Physics course that utilised “Modeling Instruction,” a style of teaching which encourages students to be active participants in their learning.

Before they participated in the class, the students answered questions from an abridged version of the Force Concept Inventory while undergoing fMRI.

The Force Concept Inventory is a test that assesses knowledge of Physics concepts commonly taught in early college Physics classes.

After the volunteer students completed their Physics course, they again took the Force Concept Inventory, once more monitored by fMRI.

### **‘NASA’s InSight lander on path to Mars’**

NASA’s InSight lander - the first mission dedicated to exploring the deep interior of Mars - has made its first course correction towards the red planet, the US space agency said today.

InSight, short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport, is currently encapsulated in a protective aeroshell, which launched on top of an Atlas V 401 rocket on May 5 from California, US.

Yesterday, the spacecraft fired its thrusters for the first time to change its flight path, NASA said in a statement.

This activity, called a trajectory correction maneuver, will happen a maximum of six times to guide the lander to Mars.

“This first maneuver is the largest we’ll conduct,” said Fernando Abilleira of NASA’s Jet Propulsion Laboratory (JPL), InSight’s Deputy Mission Design and Navigation Manager.

“The thrusters will fire for about 40 seconds to impart a velocity change of 3.8 metres per second to the spacecraft. That will put us in the right ballpark as we aim for Mars,” Abilleira said.

Every launch starts with a rocket, which is necessary to get a spacecraft past the Earth’s gravity - but rockets don’t complete the journey to other planets.

Before launch, every piece of hardware headed to Mars is cleaned, limiting the number of Earth microbes that might travel on the spacecraft.

However, the rocket and its upper stage, called a Centaur, don’t get the same special treatment.

As a result, Mars launches involve aiming the rocket just off-target so that it flies off into space.

### **Earth may become 4 degrees warmer by 2084: Study**

The Earth’s average temperature may increase by four degrees Celsius, compared to pre-industrial levels, before the end of 21st century, a study claims.

This increase translates to more annual and seasonal warming over land than over the ocean, with significant warming in the Arctic, researchers said.

“A great many record-breaking heat events, heavy floods, and extreme droughts would occur if global warming crosses the four degrees celsius level, with respect to the preindustrial period,” said Dabang Jiang, a senior researcher at the Chinese Academy of Sciences.

“The temperature increase would cause severe threats to ecosystems, human systems, and associated societies and economies,” Jiang said.

In the study published in the journal *Advances in Atmospheric Sciences*, researchers used the parameters of scenario in which there was no mitigation of rising greenhouse gas emissions.

They compared 39 coordinated climate model experiments from the fifth phase of the Coupled Model Intercomparison Project, which develops and reviews climate models to ensure the most accurate climate simulations possible.

The study found that most of the models projected an increase of four degrees Celsius as early as 2064 and as late as 2095 in the 21st century, with 2084 appearing as the median year.

The variability of temperature throughout one year would be lower in the tropics and higher in polar regions, while precipitation would most likely increase in the Arctic and in the Pacific.

These are the same effects that would occur under 1.5 degrees Celsius or two degrees Celsius increases, but more severe, researchers said.

### **Twin satellites to track Earth’s water launched: NASA**

A twin spacecraft to monitor the changes in sea level rise, ice melt and drought on Earth was today successfully launched aboard a SpaceX rocket, along with five communication satellites, NASA said.

The Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) is a joint mission by NASA and the German Research Centre for Geosciences (GFZ).

It lifted off on a SpaceX Falcon 9 rocket from the Vandenberg Air Force Base in California, US, sharing their ride into space with five Iridium NEXT communications satellites.

Ground stations have acquired signals from both GRACE-FO spacecraft. Initial telemetry shows the satellites are performing as expected.

The GRACE-FO satellites are at an altitude of about 490 kilometers, travelling about 7.5 kilometers

per second. They are in a near-polar orbit, circling Earth once every 90 minutes.

“GRACE-FO will provide unique insights into how our complex planet operates,” said Thomas Zurbuchen, associate administrator of NASA’s Science Mission Directorate at NASA Headquarters in Washington.

“Just as important, because the mission monitors many key aspects of the Earth’s water cycle, GRACE-FO data will be used throughout the world to improve people’s lives - from better predictions of drought impacts to higher-quality information on use and management of water from underground aquifers,” said Zurbuchen.

GRACE-FO is continuing GRACE’s legacy of tracking Earth’s water movement across the planet.

### **First probe to ‘touch’ the Sun will carry 1.1 million names: NASA**

NASA’s Parker Solar Probe - humanity’s first mission to ‘touch’ a star - will carry over 1.1 million people’s names to the Sun this July, the US space agency said.

Throughout its seven-year mission, the probe will swoop through the Sun’s atmosphere 24 times, getting closer to our star than any spacecraft has gone before.

“Parker Solar Probe is going to revolutionise our understanding of the Sun, the only star we can study up close,” said Nicola Fox, project scientist for Parker Solar Probe at the Johns Hopkins Applied Physics Lab in the US.

“It is fitting that as the mission undertakes one of the most extreme journeys of exploration ever tackled by a human-made object, the spacecraft will also carry along the names of so many people who are cheering it on its way,” said Fox.

In March, the public were invited to send their names to the Sun aboard humanity’s first mission to ‘touch’ a star. A total of 1,137,202 names were submitted and confirmed over the seven-and-a-half-

week period, and a memory card containing the names was installed on the spacecraft on May 18 - three months before the scheduled launch on July 31.

The card was mounted on a plaque bearing a dedication to and a quote from the missions namesake Eugene Parker, who first theorised the existence of the solar wind. This is the first NASA mission to be named for a living individual.

This memory card also carries photos of Parker, professor at the University of Chicago, and a copy of his ground-breaking 1958 scientific paper.

Parker proposed a number of concepts about how stars - including our Sun - give off material.

### **New 3D printer can create complex tissues**

Scientists have developed a 3D printer that can build therapeutic biomaterials, paving the way for on-demand printing of complex artificial tissues needed in transplants and surgeries.

The technique, developed by researchers at the University of California, Los Angeles (UCLA) in the US, uses a light-based process called stereolithography, and it takes advantage of a customised 3D printer that has two key components.

The first is a custom-built microfluidic chip - a small, flat platform similar in size to a computer chip - with multiple inlets that each “prints” a different material.

The other component is a digital micromirror, an array of more than a million tiny mirrors that each moves independently.

“Tissues are wonderfully complex structures, so to engineer artificial versions of them that function properly, we have to recreate their complexity,” said Ali Khademhosseini, a professor at UCLA.

“Our new approach offers a way to build complex biocompatible structures made from different materials,” said Khademhosseini, who led the study published in the journal *Advanced Materials*.

The researchers used different types of hydrogels - materials that, after passing through the printer, form scaffolds for tissue to grow into.

The micromirrors direct light onto the printing surface, and the illuminated areas indicate the outline of the 3D object that is being printed.

The light also triggers molecular bonds to form in the materials, which causes the gels to firm into solid material. As the 3D object is printed, the mirror array changes the light pattern to indicate the shape of each new layer.

### **Solar system's first interstellar immigrant discovered**

Scientists have discovered the first known permanent immigrant to the solar system - an asteroid, currently nestling in Jupiter's orbit, that migrated from another star system.

All of the planets in our solar system, and the vast majority of other objects as well, travel around the Sun in the same direction. However the immigrant asteroid named (514107) 2015 BZ509 is different - it moves in the opposite direction in what is known as a 'retrograde' orbit.

"How the asteroid came to move in this way while sharing Jupiter's orbit has until now been a mystery," said Fathi Namouni, from National Scientific Research Centre (CNRS) in France.

"If 2015 BZ509 were a native of our system, it should have had the same original direction as all of the other planets and asteroids, inherited from the cloud of gas and dust that formed them," said Namouni, lead author of the study published in the journal *Monthly Notices of the Royal Astronomical Society: Letters*.

An object known as 'Oumuamua was the last interstellar interloper to hit the headlines in last year. However it was just a tourist passing through, whereas this former exo-asteroid is a long-term resident.

The team ran simulations to trace the location of 2015 BZ509 right back to the birth of our solar system, 4.5 billion years ago when the era of planet formation ended.

These show that 2015 BZ509 has always moved in this way, and so could not have been there originally and must have been captured from another system.

"Asteroid immigration from other star systems occurs because the Sun initially formed in a tightly-packed star cluster, where every star had its own system of planets and asteroids," said Helena Morais, from Universidade Estadual Paulista (UNESP) in Brazil.

### **New battery can be charged within seconds**

Scientists have developed a novel self-assembling battery device that can be recharged within seconds and could power mobile devices of the future.

Researchers from Cornell University in the US created a new battery architecture to address the demands for energy storage devices that can be charged faster.

Instead of having the batteries' anode and cathode on either side of a nonconducting separator, they intertwined the components in a self-assembling, 3D gyroidal structure, with thousands of nanoscale pores filled with the elements necessary for energy storage and delivery.

"This three-dimensional architecture basically eliminates all losses from dead volume in your device," said Ulrich Wiesner, a professor at Cornell.

"More importantly, shrinking the dimensions of these interpenetrated domains down to the nanoscale, as we did, gives you orders of magnitude higher power density. In other words, you can access the energy in much shorter times than what's usually done with conventional battery architectures," said Wiesner.

Due to the dimensions of the battery's elements being shrunk down to the nanoscale, "by the time you put your cable into the socket, in seconds, perhaps even faster, the battery would be charged," he said.

The architecture for this concept is based on block copolymer self-assembly, which the Wiesner group has employed for years in other devices, including a gyroidal solar cell and a gyroidal superconductor.

### **Jupiter-like exoplanet discovered by amateur astronomer**

An amateur astronomer have discovered a new 'hot Jupiter' - an exoplanet that orbits a star similar to our Sun with a period of 40 hours.

The planet was first spotted by the Kourouka Planet Search (KPS) project in Russia. The mass and size of the exoplanet known as KPS-1b are close to the characteristics of Jupiter, but it is located very close to its parent star.

Due to such proximity to the star, the temperature of the atmosphere KPS-1b is much higher than that of Jupiter.

Software for analysing data and searching exoplanet candidates was developed at Ural Federal University in Russia.

Subsequent observations of exoplanets candidates were conducted in a number of observatories around the world including the Special Astrophysical Observatory of the Russian Academy of Sciences.

Spectral observations, which allowed calculating the mass of the exoplanet, were conducted at Haute-Provence Observatory (France).

According to the researchers, the current discovery is unique due to the fact that signs of exoplanet existence were found in the data gathered by an amateur astronomer using readily available and relatively affordable equipment.

The discovery was made in collaboration with astronomers from Belgium, the US, England, France, the Netherlands, Turkey, Portugal, Lithuania, Italy and Canada.

### **NASA's planet hunting probe completes lunar flyby**

NASA's latest planet hunting satellite has successfully completed a lunar flyby - passing about 8,000 kilometres from the Moon - and beamed back a test image revealing more than 200,000 stars.

The flyby provided a gravity assist that helped the Transiting Exoplanet Survey Satellite (TESS) sail toward its final working orbit.

As part of camera commissioning, the science team snapped a two-second test exposure using one of the four TESS cameras. The image, centred on the southern constellation Centaurus, reveals more than 200,000 stars.

The edge of the Coalsack Nebula is in the right upper corner and the bright star Beta Centauri is visible at the lower left edge.

TESS is expected to cover more than 400 times as much sky as shown in this image with its four cameras during its initial two-year search for exoplanets.

A science-quality image, also referred to as a "first light" image, is expected to be released in June.

TESS will undergo one final thruster burn on May 30 to enter its science orbit around Earth. This highly elliptical orbit will maximise the amount of sky the spacecraft can image, allowing it to continuously monitor large swaths of the sky.

TESS is expected to begin science operations in mid-June after reaching this orbit and completing camera calibrations.

Launched from Cape Canaveral Air Force Station in Florida on April 18, TESS is the next step in NASA's search for planets outside our solar system, known as exoplanets.

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The mission will observe nearly the entire sky to monitor nearby, bright stars in search of transits - periodic dips in a star's brightness caused by a planet passing in front of the star.

### **'NASA satellites reveal freshwater decline in India'**

India is among the hotspots where overuse of water resources has caused a serious decline in the availability of freshwater, according to a first-of-its-kind study using an array of NASA satellite observations of Earth.

Scientists led by NASA's Goddard Space Flight Center in the US used data on human activities to map locations where freshwater is changing around the globe and why.

The study, published in the journal *Nature*, found that Earth's wet land areas are getting wetter and dry areas are getting drier due to a variety of factors, including human water management, climate change and natural cycles.

Areas in northern and eastern India, the Middle East, California and Australia are among the hotspots where overuse of water resources has caused a serious decline in the availability of freshwater that is already causing problems, 'The Guardian' reported.

In northern India, groundwater extraction for irrigation of crops such as wheat and rice have caused a rapid decline in available water, despite rainfall being normal throughout the period studied, the report said.

"The fact that extractions already exceed recharge during normal precipitation does not bode well for the availability of groundwater during future droughts," researchers said.

The team used 14 years of observations from the US/German-led Gravity Recovery and Climate Experiment (GRACE) spacecraft mission to track global trends in freshwater in 34 regions around the world.

"This is the first time that we have used observations from multiple satellites in a thorough assessment of how freshwater availability is changing everywhere on Earth," said Matt Rodell of NASA's Goddard Space Flight Center.

### **Chinese researchers use waste cartons to remove heavy metals from water**

Chinese researchers have developed a nano material using waste cartons that can remove a toxic heavy metal from water, official media here reported today.

The breakthrough has provided a new means to control heavy metal contamination and recycling of waste cartons.

Incidents of heavy metal contamination of water have occurred frequently in China in recent years, and hexavalent chromium, a chemical compound of metal chromium and major cause of heavy metal pollution, can lead to significant risks to human health.

There is an urgent need for low cost and high efficiency technology to deal with heavy metal water contamination in China, state-run Xinhua news agency reported.

Researchers used high temperatures and pressure to create the nano material from waste cartons. The material can be coated with nano-scale iron which can effectively remove hexavalent chromium from water, control the migration of the compound in water sources, and prevent it from being absorbed by plants.

The research, led by Wu Zhengyan at Hefei Institute of Physical Science under Chinese Academy of Sciences, was recently published in the American Chemistry Society academic journal *ACS Langmuir*.

### **'AI detects stroke, dementia from brain scans'**

London, May 17 (PTI) Scientists have used artificial intelligence (AI) to accurately detect one of the most common causes of dementia and stroke from brain scans.

## ***International Science Briefs***

A software, created by scientists at Imperial College London and the University of Edinburgh in the UK, has been able to identify and measure the severity of small vessel disease.

The technology, described in the journal *Radiology*, can help clinicians to administer the best treatment to patients more quickly in emergency settings - and predict a person's likelihood of developing dementia.

The development may also pave the way for more personalised medicine, researchers said.

"This is the first time that machine learning methods have been able to accurately measure a marker of small vessel disease in patients presenting with stroke or memory impairment who undergo CT scanning," said Paul Bentley from Imperial College London.

"Our technique is consistent and achieves high accuracy relative to an MRI scan - the current gold standard technique for diagnosis. This could lead to better treatments and care for patients in everyday practice," said Bentley.

"This is a first step in making a scan reading tool that could be useful in mining large routine scan datasets and, after more testing, might aid patient assessment at hospital admission with stroke," said Joanna Wardlaw, a professor at the University of Edinburgh.

Small vessel disease (SVD) is a very common neurological disease in older people that reduces blood flow to the deep white matter connections of the brain, damaging and eventually killing the brain cells.

### **Chinese scientists complete first gene expression profiles of human digestive tract**

Scientists in China have completed the first systematic genetic study of the human fetal digestive tract that will assist diagnose and treat digestive-tract complaints such as gastrointestinal (GI) cancer, state media reported today.

The study was carried out by the Beijing Advanced Innovation Centre for Genomics (ICG), the Biodynamic Optical Imaging Centre and the Third Hospital of Peking University, supported by the China National Natural Science Foundation, Xinhua news agency reported.

The study was published in the latest issue of *Nature Cell Biology*. from human embryos, as well as the large intestine of adults.

"It was the first time that scientists had systematically studied the development paths and gene expressions of the oesophagus, stomach, small intestine and large intestine in both embryonic and adult stages," said Tang Fuchou, deputy director of ICG and member of the research team.

## **Great Barrier Reef on sixth life in 30,000 years: study**

Australia's Great Barrier Reef, under severe stress in a warmer, more acidic ocean, has returned from near-extinction five times in the past 30,000 years, researchers said today.

And while this suggests the reef may be more resilient than once thought, it has likely never faced an onslaught quite as severe as today, they added.

"I have grave concerns about the ability of the reef in its current form to survive the pace of change caused by the many current stresses and those projected into the near future," said Jody Webster of the University of Sydney, who co-authored a paper in the journal *Nature Geoscience*.

In the past, the reef shifted along the sea floor to deal with changes in its environment — either seaward or landward depending on whether the level of the ocean was rising or falling, the research team found. Based on fossil data from cores drilled into the ocean floor at 16 sites, they determined the Great Barrier Reef, or GBR for short, was able to migrate between 20 centimetres (7.9 inches) and 1.5 metres per year.

This rate may not be enough to withstand the current barrage of environmental challenges.

The reef "probably has not faced changes in SST (sea surface temperature) and acidification at such a rate," Webster told AFP. Rates of change "are likely much faster now — and in future projections." The World Heritage-listed site, which attracts millions of tourists, is reeling from successive bouts of coral bleaching due to warming sea temperatures linked to climate change.

## **Faulty gene can accelerate heart failure due to drinking**

Scientists have identified a gene mutation that can interact with alcohol to accelerate heart failure in some patients.

The researchers from Imperial College London, Royal Brompton Hospital, and MRC London Institute of Medical Sciences in the UK investigated faulty versions of a gene called titin which are carried by one in 100 people or 600,000 people in the UK.

Titin is crucial for maintaining the elasticity of the heart muscle, and faulty versions are linked to a type of heart failure called dilated cardiomyopathy.

The study, published in the *Journal of the American College of Cardiology*, showed that the faulty gene may interact with alcohol to accelerate heart failure in some patients with the gene, even if they only drink moderate amounts of alcohol.

The team analysed 141 patients with a type of heart failure called alcoholic cardiomyopathy (ACM). This condition is triggered by drinking more than 70 units a week (roughly seven bottles of wine) for five years or more.

In severe cases the condition can be fatal, or leave patients requiring a heart transplant.

The team found that the faulty titin gene may also play a role in the condition. In the study 13.5 per cent of patients were found to carry the mutation - much higher than the proportion of people who carry them in the general population.

## **New element with magnetic properties discovered**

Scientists have discovered that the chemical element ruthenium (Ru) is the fourth element to have unique magnetic properties at room temperature.

The discovery, led by researchers at the University of Minnesota in the US, could be used to improve sensors, devices in the computer memory and logic industry, or other devices using magnetic materials.

The use of ferromagnetism, or the basic mechanism by which certain materials (such as iron) form permanent magnets or are attracted to magnets, reaches back as far as ancient times when lodestone was used for navigation.

Since then only three elements on the periodic table have been found to be ferromagnetic at room temperature - iron (Fe), cobalt (Co), and nickel (Ni). The rare earth element gadolinium (Gd) nearly misses by only 8 degrees Celsius.

The study, published in the journal *Nature Communications*, opens the door to fundamental studies of this new ferromagnetic Ru.

Magnetic materials are very important in industry and modern technology and have been used for fundamental studies and in many everyday applications such as sensors, electric motors, generators, hard disk media, and most recently spintronic memories.

As thin film growth has improved over the past few decades, so has the ability to control the structure of crystal lattices - or even force structures that are impossible in nature.

Researchers showed that Ru can be the fourth single element ferromagnetic material by using ultra-thin films to force the ferromagnetic phase.

### **Scientists transfer memory between animals**

Scientists have successfully transferred a memory from one marine snail to another, an advance that could lead to new treatments for trauma due to painful events and diseases like Alzheimer's.

RNA, or ribonucleic acid, has been widely known as a cellular messenger that makes proteins and carries out DNA's instructions to other parts of the cell. It is now understood to have other important functions besides protein coding, including regulation of a variety of cellular processes involved in development and disease.

The researchers from University of California, Los Angeles in the US gave mild electric shocks to the tails of a species of marine snail called *Aplysia*. The snails received five tail shocks, one every 20 minutes, and then five more 24 hours later.

The shocks enhance the snail's defensive withdrawal reflex, a response it displays for protection from potential harm.

When the researchers subsequently tapped the snails, they found those that had been given the shocks displayed a defensive contraction that lasted an average of 50 seconds, a simple type of learning known as "sensitisation."

Those that had not been given the shocks contracted for only about one second, according to the study published in the journal of the Society for Neuroscience.

### **AI robot can help people dress up**

Scientists have developed a robot with artificial intelligence that taught itself to help humans wear clothes, and could assist people with injuries or disabilities.

The machine, a PR2, taught itself in one day, by analysing nearly 11,000 simulated examples of a robot putting a gown onto a human arm.

Some of those attempts were flawless, while others were spectacular failures - the simulated robot applied dangerous forces to the arm when the cloth would catch on the person's hand or elbow.

From these examples, the PR2's neural network learned to estimate the forces applied to the human. In a sense, the simulations allowed the robot to learn what it feels like to be the human receiving assistance.

"People learn new skills using trial and error. We gave the PR2 the same opportunity," said Zackory Erickson, PhD student at Georgia Institute of Technology in the US.

"Doing thousands of trials on a human would have been dangerous, let alone impossibly tedious. But in just one day, using simulations, the robot learned what a person may physically feel while getting dressed," said Erickson.

The robot also learned to predict the consequences of moving the gown in different ways. Some motions made the gown taut, pulling hard

against the person's body. Other movements slid the gown smoothly along the person's arm.

The robot uses these predictions to select motions that comfortably dress the arm.

### **Limiting global warming may prevent millions of dengue cases**

Limiting global warming to 1.5 degree Celsius could prevent around 3.3 million cases of dengue fever ever year in Latin America and the Caribbean alone, a study has found.

The study published in the journal Proceedings of the National Academy of Sciences shows that limiting warming to the goal of the UN Paris Agreement would also stop dengue spreading to areas where incidence is currently low.

A global warming trajectory of 3.7 degree Celsius could lead to an increase of up to 7.5 million additional cases per year by the middle of this century.

Dengue fever is a tropical disease caused by a virus that is spread by mosquitoes, with symptoms including fever, headache, muscle and joint pain.

It is endemic to over 100 countries, and infects around 390 million people worldwide each year, with an estimated 54 million cases in Latin America and the Caribbean.

Since the mosquitoes that carry and transmit the virus thrive in warm and humid conditions, it is more commonly found in areas with these weather conditions. There is no specific treatment or vaccine for dengue and in rare cases it can be lethal.

"There is growing concern about the potential impacts of climate change on human health. While it is recognised that limiting warming to 1.5 degree Celsius would have benefits for human health, the magnitude of these benefits remains mostly unquantified," said Felipe Colon-Gonzalez, lead researcher from University of East Anglia (UEA) in UK.

### **Why heart function is reduced at high altitude decoded**

Scientists have found why high altitudes reduces the amount of blood the heart pumps around the body with each beat.

The research, published in The Journal of Physiology, will be important for people who live, travel and exercise at high altitudes, scientists said.

Over the years, several theories have been proposed to explain the reduction in the amount of blood the heart can pump; this was even of interest to the scientists involved in the first summit of Mount Everest in the 1950's.

Researchers including those from the Cardiff Metropolitan University in the UK and University of British Columbia in Canada showed that at high altitudes (over 3000 metres), the lower amount of oxygen in the air leads to a decrease in the volume of blood circulating around the body, and an increase in blood pressure in the lungs.

They found that both of these factors play a role in the reduction in the volume of blood the heart can pump with each beat, but importantly neither of these factors affects our ability to perform maximal exercise.

### **Stress in infancy alters body's organs: Study**

Suffering from emotional stress during infancy can cause significant and far-reaching effects on the organs of the body, leading to diseases later in life.

Psychological stress in infancy dramatically changes the amount of an important class of proteins, called GABAA receptors, which in turn may alter the workings of the heart, lungs, kidneys and bladder, researchers said.

It was already known that changes in the amounts of GABAA receptors causes some brain disorders, but researchers at the University of Portsmouth in the UK are the first to show that stress can also alter their expression in other organs.

Researchers studied the way GABAA receptors behave in secondary organs in mice which had first been exposed to stress.

The study, published in the journal *Frontiers in Molecular Neuroscience*, provides hope that drugs targeting these receptors can now be developed to treat a range of medical conditions, from hypertension to asthma, and from diabetes to inflammatory bowel diseases.

“GABAA receptors were known to control brain activity and served as important targets for many drugs used in modern medicine to treat brain disorders, such as epilepsy, anxiety as well as inducing surgical anaesthesia,” said Jerome Swinny, from University of Portsmouth.

### **Bacteria-coated broccoli sent to space**

Scientists have sent broccoli seeds coated with a healthy dose of good bacteria to space in a quest to find a viable way for astronauts at the International Space Station (ISS) to grow their own vegetables - and possibly one day on the Moon or Mars.

Six broccoli seeds were aboard the Orbital ATK Cygnus spacecraft that launched this week from Wallops Island, Virginia, as part of a space station cargo resupply mission.

Three of the seeds are travelling to space as is, while the other three were coated with two different species of bacteria, developed at the University of Washington, that can live inside crop plants and improve their growth.

These “beneficial” microbes, also called endophytes, may also help plants grow better in extreme low-gravity environments, and where nutrients or water could be lacking.

The goal of the experiment, conducted by students at Valley Christian High School in San Jose in California, is to learn how to grow vegetables in the challenging, microgravity conditions of the space station - and eventually on the Moon and Mars - as human space exploration expands.

Developed by a team of 11 students, the initial ground experiments proved successful, as the broccoli grew faster and significantly larger than the control study.

### **Rare, isolated neutron star discovered**

NASA scientists have discovered a special kind of neutron star for the first time outside of the Milky Way galaxy, and released a stunning image of the stellar body located 200,000 light years from Earth.

Neutron stars are the ultra dense cores of massive stars that collapse and undergo a supernova explosion.

The newly identified neutron star, discovered using data from NASA’s Chandra X-ray Observatory and the European Southern Observatory’s Very Large Telescope (VLT) in Chile, is a rare variety that has both a low magnetic field and no stellar companion.

The neutron star is located within the remains of a supernova - known as 1E 0102.2-7219 (E0102) - in the Small Magellanic Cloud, located 200,000 light years from Earth.

A new composite image of E0102 allows astronomers to learn new details about this object that was discovered more than three decades ago.

Oxygen-rich supernova remnants like E0102 are important for understanding how massive stars fuse lighter elements into heavier ones before they explode.

Seen up to a few thousand years after the original explosion, oxygen-rich remnants contain the debris ejected from the dead star’s interior. This debris is observed today hurtling through space after being expelled at millions of miles per hour.

Chandra observations of E0102 show that the supernova remnant is dominated by a large ring-shaped structure in X-rays, associated with the blast wave of the supernova.

### **Life-like 3D mini brains for drug testing developed**

Scientists have developed a life-like 3D mini-brain - containing all six major cell types found in normal organs including neurons and immune cells - that could help study diseases and tests new drugs.

In a study published in the journal *Scientific Reports*, researchers reported that their advanced 3D organoids promote the formation of a fully cell-based, natural and functional barrier - the blood brain barrier - that mimics normal human anatomy.

The blood brain barrier is a semipermeable membrane that separates the circulating blood from the brain, protecting it from foreign substances that could cause injury.

This development is important because the model can help to further understanding of disease mechanisms at the blood brain barrier, the passage of drugs through the barrier, and the effects of drugs once they cross the barrier.

“The shortage of effective therapies and low success rate of investigational drugs are due in part because we do not have a human-like tissue models for testing,” said Anthony Atala, director of Wake Forest Institute for Regenerative Medicine (WFIRM) in the US.

“The development of tissue engineered 3D brain tissue equivalents such as these can help advance the science toward better treatments and improve patients’ lives,” said Atala.

