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JAPAN DROPS NEW ROBOT ON ASTEROID

A computer graphic image shows the Mobile Asteroid Surface Scout on the asteroid Ryugu. | Photo Credit: JAXA/AP

A Japanese probe launched a new observation robot towards an asteroid on Wednesday as it pursues a mission to shed light on the origins of the solar system.

The Hayabusa2 probe launched the French-German Mobile Asteroid Surface Scout, or MASCOT, towards the Ryugu asteroid’s surface, the Japan Aerospace Exploration Agency (JAXA) said.

“We can confirm that the MASCOT separated from the spacecraft as planned,” the agency said in a tweet on its official account.

“I’m doing it! I’m descending to Ryugu! Can’t stop me now!” the lander’s official Twitter account @MASCOT2018 added. The robot has safely landed, officials later confirmed.

“It is hugely significant to take data from the surface of an asteroid, we have high expectations for the scientific data,” Hayabusa2 mission manager Makoto Yoshikawa said. The 10-kg box-shaped MASCOT is loaded with sensors. It can take images at multiple wavelengths, investigate minerals with a microscope, gauge surface temperatures and measure magnetic fields.

MASCOT’s launch comes 10 days after the Hayabusa2 dropped a pair of MINERVA-II micro-rovers on the Ryugu asteroid. It was the first time that moving, robotic observation device have been successfully landed on an asteroid.

The rovers will take advantage of Ryugu’s low gravity to jump around on the surface — travelling as far as 15 metres while airborne and staying in the air for as long as 15 minutes — to survey the asteroid’s physical features with cameras and sensors. Unlike those machines, MASCOT will be largely immobile — it will “jump” just once on its mission, and it can turn on its sides. And while the rovers will spend several months on the asteroid, the MASCOT has a maximum battery life of just 16 hours, and will transmit the data it collects to the Hayabusa2 before running out of juice.

The Hayabusa2 is scheduled later this month to deploy an “impactor” that will explode above the asteroid, shooting a two-kilo copper object into it to blast a small crater on the surface.

The probe will then hover over the artificial crater and collect samples using an extended arm.

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Astronomers have pinpointed what appears to be the first moon detected outside our solar system, a large gaseous world the size of Neptune that is unlike any other known moon and orbits a gas planet much more massive than Jupiter.

The discovery, detailed by researchers on October 3, was a surprise, and not because it showed that moons exist elsewhere — they felt it was only a matter of time for one to be found in another star system. They were amazed instead by how different this moon was from the roughly 180 known in our solar system.

“It's big and weird by solar system standards,” Columbia University astronomy professor David Kipping said of the moon, known as an exomoon because it is outside our solar system.

Our solar system's moons all are rocky or icy objects. The newly discovered exomoon and the planet it orbits, estimated to be several times the mass of our solar system's largest planet Jupiter, are both gaseous, an unexpected pairing. They are located 8,000 light years from Earth.

Kipping and study co-author Alex Teachey, a Columbia graduate student, said their observations using NASA's Hubble Space Telescope and Kepler Space Telescope provided the first clear evidence of an exomoon, but further Hubble observations next May must be used to confirm the finding.

The exomoon is exponentially larger than our solar system's biggest moon. Jupiter's moon Ganymede has a diameter of about 5,260 km. The exomoon is estimated to be roughly the size of Neptune, the smallest of our solar system's four gas planets, with a diameter of about 49,000 km.

The exomoon and its planet orbit Kepler-1625, a star similar in temperature to our sun but about 70% larger. The exomoon orbits roughly 3 million km from its planet and its mass is about 1.5% that of its planet.

Kipping and Teachey relied on the “transit” method already used by researchers to discover nearly 4,000 planets outside our solar system, called exoplanets. They observed a dip in Kepler-1625’s brightness when the planet and then the exomoon passed in front of it. The size and gaseous composition of the exomoon challenge current moon formation theories.

“You could argue that because larger objects are easier to detect than smaller ones, this is really the lowest-hanging fruit, so it might not be wholly unexpected that the first exomoon detection would be among the largest possible,” Teachey said.

The findings were published in the journal Science Advances.
Fun facts or complex puzzles, science contains mysteries ranging from the minute to the magnificent. Taste science! Take this quiz!

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This handout photo released by NASA shows the United Launch Alliance Delta IV Heavy rocket with the Parker Solar Probe onboard shortly after the Mobile Service Tower was rolled back on August 10, 2018, Launch Complex 37 at Cape Canaveral Air Force Station in Florida.

NASA’s Parker Solar Probe – mankind’s first mission to ‘touch’ the Sun – successfully completed a flyby of Venus at a distance of about 2,415 kilometres during its first gravity assist from the planet, according to the US space agency.

These gravity assists will help the spacecraft tighten its orbit closer to the Sun over the course of the mission, NASA said in a statement.

Detailed data from the flyby will be assessed which allows the flight operations team to prepare for the remaining six Venus gravity assists which will occur over the course of the seven-year mission, it said.

Parker Solar Probe was successfully launched on August 12 on an unprecedented, seven-year long journey to unlock the mysteries of the Sun’s fiery outer atmosphere and its effects on space weather.

The mission’s findings will help researchers improve their forecasts of space weather events, which have the potential to damage satellites and harm astronauts on orbit, disrupt radio communications and, at their most severe, overwhelm power grids.

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Ministry of Commerce & Industry

GI Tag for Alphonso from Konkan

Posted On: 05 OCT 2018 4:48PM by PIB Delhi

Alphonso from Ratnagiri, Sindhudurg, Palghar, Thane and Raigad districts of Maharashtra, is registered as Geographical Indication (GI). A Geographical Indication or a GI is an indication used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin. Such a name conveys an assurance of quality and distinctiveness which is essentially attributable to its origin in that defined geographical locality. Darjeeling Tea, Mahabaleshwar Strawberry, Blue Pottery of Jaipur, Banarasi Sarees and TirupatiLaddus are some of the GIs.

GI products can benefit the rural economy in remote areas, by supplementing the incomes of artisans, farmers, weavers and craftsmen. Our rural artisans possess unique skills and knowledge of traditional practices and methods, passed down from generation to generation, which need to be protected and promoted.

Recently, Union Minister of Commerce and Industry, Suresh Prabhu, launched the logo and tagline for the Geographical Indications (GI) of India and said that the GI will give the rightful share in the intellectual property to the artisan and the place of origin of the product. He emphasised that it’s an area of strength and optimism for India, whereby GI tag has given protection to a large number of hand-made and manufactured products, especially in the informal sector.

The Department of Industrial Policy and Promotion has taken several initiatives in this regard and is actively involved in promotion and marketing of GIs with a vision to enhance the horizon both socially and economically for GI producers.

The king of mangoes, Alphonso, better known as ‘Hapus’ in Maharashtra, is in demand in domestic and international markets not only for its taste but also for pleasant fragrance and
vibrant colour. It has long been one of the world's most popular fruit and is exported to various
countries including Japan, Korea and Europe. New markets such as USA and Australia have
recently opened up.

The first product to get a GI tag in India was the Darjeeling tea in 2004. There are a total of
325 products from India that carry this indication.

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MM/ SB

(Release ID: 1548736) Visitor Counter : 757

Read this release in: Marathi
Scientists have determined a gene signature that is linked to the severity of spinal cord injury in animals and humans, according to a study. The discovery of key genes that are switched on or off in response to spinal cord injury could inform the development of biomarkers that predict recovery and possibly pinpoint new targets for treatment. The team first reviewed past experiments to find genes associated with the response to spinal cord injury, searching through more than 500 studies, and found 151 human genes were linked in more than one study. Further analysis showed that the genes are biologically and functionally related, coding for groups of protein molecules that physically interact with one another. The researchers’ team constructed a network of genes from healthy human spinal cords and integrated this data with those determined from the experimental studies. They found that two groups of genes (M3 and M7) included a high number of the genes that had been previously pinpointed in experiments as important in the response to spinal cord injury. The findings have been published in the open access journal *eLife*.

As the second most common cause of death in India, every conversation around cancer counts, especially when it comes to women’s cancer

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A team of researchers in Spain, Switzerland and the U.S. has homed in on a specific antibody, called the p95HER2-T cell bispecific antibody (TCB), that can successfully guide immune cells, known as lymphocytes, directly to cancerous ones for their targeted killing. Among the key hurdles in cancer immunotherapy — an emerging approach to cancer medicine — is to ensure that these therapeutics only target cancerous cells and not healthy tissue. This direct delivery is achieved thanks to the p95HER2 protein, which is only located in tumour cells. The study represents a new therapeutic avenue and fresh hope for patients who have ceased to respond to current therapies. This novel immune-based approach, say the researchers involved, can be used to tackle certain HER2+ breast cancers through its exclusive targeting of cancerous cells. Each antibody molecule has a bipartite structure containing two protein-binding sites. This means that they can simultaneously attach to immune cells and cancerous ones as well as take the lymphocytes hand-in-hand directly to the malignant cells for their subsequent destruction.

The findings have been published in *Science Translational Medicine*.

As the second most common cause of death in India, every conversation around cancer counts, especially when it comes to women’s cancer

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AI MAY PREDICT ALZHEIMER’S DISEASE 5 YEARS IN ADVANCE

The methodology could help lead people in the right direction, say scientists.

Scientists — including one of Indian origin — have created an artificial intelligence (AI) algorithm that can accurately predict whether a person’s cognitive decline will lead to Alzheimer’s disease in the next five years.

Researchers from the University of Toronto in Canada designed an algorithm that learns signatures from magnetic resonance imaging (MRI), genetics, and clinical data. According to the study published in *PLOS Computational Biology*, the algorithm can help predict whether an individual's cognitive faculties are likely to deteriorate towards Alzheimer’s in the next five years.

“At the moment, there are limited ways to treat Alzheimer’s and the best evidence we have is for prevention. Our methodology could have implications as a ‘doctor’s assistant’ that would help stream people onto the right pathway for treatment,” said Mallar Chakravarty, an assistant professor in McGill University.

For example, one could even initiate lifestyle changes that may delay the beginning stages of Alzheimer’s or even prevent it altogether,” said Chakravarty.

The researchers trained their algorithms using data from more than 800 people ranging from normal healthy seniors to those experiencing mild cognitive impairment, and Alzheimer’s disease patients.

“We are currently working on testing the accuracy of predictions using new data. It will help us to refine predictions and determine if we can predict even farther into the future,” said Chakravarty.

With more data, the scientists would be able to better identify those in the population at greatest risk for cognitive decline leading to Alzheimer’s.

Worldwide, around 50 million people have dementia and the total number is projected to reach 82 million in 2030 and 152 in 2050, according to the World Health Organization.

Alzheimer’s disease, the most common form of dementia, may contribute to 60-70 per cent of cases. Presently, there is no truly effective treatment for this disease.

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As the second most common cause of death in India, every conversation around cancer counts, especially when it comes to women’s cancer

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NASA PROBE TO FLY BY MOST DISTANT OBJECT EVER VISITED BY A SPACECRAFT

Artist conception of New Horizons Spacecraft. | Photo Credit: Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

NASA’s New Horizons probe is on course to flyby the Kuiper Belt object nicknamed Ultima Thule, which is at a distance of 6.6 billion kilometers from Earth this New Year. This event will set the record for the most distant object ever visited by a spacecraft, scientists say.

The spacecraft has successfully performed the three and half-minute manoeuvre on October 3 to home in on its location, NASA said in a statement. The manoeuvre slightly tweaked the spacecraft’s trajectory and bumped its speed by 2.1 metres per second keeping it on track to fly past Ultima — officially named 2014 MU69 — on January 1, 2019.

“Thanks to this manoeuvre, we’re right down the middle of the pike and on time for the farthest exploration of worlds in history — more than a billion miles beyond Pluto,” said Alan Stern, Principal Investigator of the Southwest Research Institute in the US.

New Horizons itself was about 6.35 billion kilometres from home when it carried out Wednesday’s trajectory correction maneuver (TCM), the farthest course-correction ever performed. This was the first Ultima targeting maneuver that used pictures taken by New Horizons itself to determine the spacecraft’s position relative to the Kuiper Belt object.

These “optical navigation” images — gathered by New Horizons’ Long Range Reconnaissance Imager (LORRI) — provide direct information of Ultima’s position relative to New Horizons, and help the team determine where the spacecraft is headed. The New Horizons team designed the TCM by determining the current trajectories of the spacecraft and its target, and then calculating the manoeuvering required to put the spacecraft at the desired “aim point” for the flyby — 3,500 kilometres — from Ultima at closest approach.

“The recent navigation images have helped us confirm that Ultima is within about 500 kilometres of its expected position, which is exceptionally good,” said Fred Pelletier, New Horizons navigation team chief, of KinetX Aerospace, Inc.

“Since we are flying very fast and close to the surface of Ultima, approximately four times closer than the Pluto flyby in July 2015, the timing of the flyby must be very accurate,” said Derek Nelson, New Horizons optical navigation lead, also from KinetX. “The images help to determine the position and timing of the flyby, but we must also trust the prior estimate of Ultima’s position and velocity to ensure a successful flyby. These first images give us confidence that Ultima is where we expected it to be, and the timing of the flyby will be accurate.”

The spacecraft is just 112 million kilometres from Ultima, closing in at 51,911 km/h. The team will eventually have to guide the spacecraft into an approximately 120 by 320-kilometre “box” and predict the flyby to within 140 seconds.

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The Royal Swedish Academy of Sciences awarded the Nobel Prize in Chemistry 2018 with one half to Frances H. Arnold and the other half jointly to

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END
IS IOT THE NEXT BIG THING AND ARE WE READY FOR IT?

We have become accustomed to digital technology, which has made our lives easier, more convenient and comfortable. Our smartphones, coffee machines, headphones, wearable devices, bluetooth trackers and smart door locks are already impacting and reshaping our daily lives, and we need to be prepared for various such innovations.

Consider, for instance, what connected devices can do. Our alarm clock that rings at 5am will alert our coffee machine to start brewing coffee. Or our office vending machine will know when it was running low and automatically restock itself. On a broader note, the Internet of Things (IoT) can help improve the efficiency of things, thus refining the way we work and live.

The emergence of IoT, artificial intelligence (AI) and machine learning (ML) has started to impact our lives and businesses across industries. Indian farming has gone through a technological evolution in the past decade, becoming more industrialized and technology-driven.

With smart agriculture gadgets and AI sensors, farmers have gained better control over crop and soil management, monitoring climate conditions, predictive agricultural analytics and supply chain efficacies, making it more predictable and efficient.

AI and IoT not only help in medication adherence, patient monitoring, quality control and biometric security, but also play an important part in making the city efficient.

There are connected vehicles and smart roadways providing real-time updates on traffic, transit and parking data to improve efficacy and reduce congestion. They also help implement waste management solutions.

IoT, AI and ML are ideas that are proving to be the pivot of a digital revolution. Even today, we still find the internet largely being a person-to-person connection and electronic devices merely playing the role of passive facilitators. A recent Gartner Inc. survey said by 2020 the relationship will be multi-directional and multi-dimensional—from people to people, people to devices, and devices to devices.

It is clear “The Next Big Thing” is IoT. Unfortunately, not all consumers can imagine its impact except those who are keen observers or technology experts. India’s supplier ecosystem is evolving at a rapid pace with original equipment manufacturers and service providers developing end-to-end solutions, including usage-based insurance, cold chain and those for infotainment.

Besides touching every aspect of life, IoT also brings people, processes and devices closer to each other. At the American Enterprise Institute, Bill Gates insisted that the mindset of the government and people has not adjusted to view the future so far, even though technology is exploding in this decade.

IoT has become a critical part of an enterprise’s digital strategy and every business is keen on leveraging it. The IoT universe churns data and numbers to provide optimal service and value. Security plays a key role not only to protect physical assets, but also to protect vital information. Security weaknesses are raising concerns as interconnection of physical assets with critical data on the internet raises risks of theft and frauds.
In India, the “Connect India” strategy aims to create a robust digital communication infrastructure to connect the entire nation. The government believes it will not be enough to just provide a robust communications network. The country should make greater strides to nurture technologies such as IoT, AI, ML, and also other new technologies. The National Digital Communications Policy 2018 is a good move to build the country’s information and communication infrastructure.

While India adapts to this evolving world, even in its current state, IoT can confer key benefits and provide an invaluable head start to organizations adopting this technology optimistically.

*Jürgen Hase is chief executive officer of Unlimit.*
ANTIBIOTICS TO GROW FARM ANIMALS RAISE SUPERBUG RISK

The world’s biggest animal drugs company has been accused of double standards and of exposing consumers in India to “higher levels of risk” by selling antibiotics for purposes now banned in Europe and the U.S.

Zoetis, the largest producer of veterinary medicines, is supplying Indian farmers with antibiotics to help their animals grow faster. The practice should be banned worldwide, according to the World Health Organisation (WHO), because it increases the prevalence of resistant bacteria that can infect humans and cause deadly and untreatable infections.

The company stopped advertising antibiotics as growth promoters to American farmers almost two years ago. Zoetis publicly supported new laws in the U.S. banning this abuse of antibiotics as part of its “continued commitment to antibiotic stewardship”. However, Zoetis continues to sell antibiotics directly to Indian farmers with claims on the company’s Indian website that they will make animals grow bigger and faster.

This is not currently against Indian law although the government has called for it to end and Maharastra banned the indiscriminate use of antibiotics in agriculture after a Hindu/Bureau of Investigative Journalism report earlier this year.

Abdul Ghafur, a professor in infectious diseases who brought together medical societies and the Indian government in 2012 to create a plan to tackle antibiotic resistance, known as the Chennai Declaration, said Zoetis is adopting “double standards”. “If an American company follows one policy in America, they should follow the same policy in India,” he added.

Double standards

Thomas Van Boeckel, a researcher at the Swiss Federal Institute of Technology (ETH Zurich) who has mapped antibiotic use in agriculture, said: “It is blatantly clear that Zoetis is using a double standard in the way it is willing to expose consumers in India to higher levels of risk than in the United States.” Zoetis says it complies with the law in each location where it operates.

The unnecessary use of antibiotics in human medicine and agriculture, such as their use to make animals grow faster rather than treat disease, are major contributors to growing levels of resistant bacteria. It is estimated 1,00,000 babies a year in the country die from infections from resistant bugs. Worldwide they’re believed to kill 7,00,000 people, according to a British government-commissioned review in 2016. WHO has called antibiotic resistance one of the greatest threats to public health.

Zoetis, a former subsidiary of pharmaceutical giant Pfizer, has previously said it is “a leader in providing ongoing education to veterinarians and livestock producers on the proper use of antimicrobial drugs”. But the multibillion dollar U.S. company still sells its antibiotics to farmers in India.

WHO, the World Organisation for Animal Health (OIE) and the Food and Agriculture Organisation (FAO) have called for a worldwide ban on the use of antibiotics to fatten farm animals — a practice already banned in the EU and U.S. — in an attempt to stem the rising
threat of resistance.

**Illegal sale**

Zoetis said that when used “properly and responsibly according to their approved indications” and “under the supervision of a veterinary professional” its products do not contribute to drug resistance and do not pose a threat to public health.

But unnecessarily giving healthy animals antibiotics — such as their use to help fatten livestock — is fuelling the rise of superbugs, according to WHO. And, despite Zoetis’ stance they should be used under the supervision of a vet, they can be bought without a prescription in India.

In veterinary drug stores in Hyderabad, the Bureau found a number of antibiotics manufactured by Zoetis, which are used to fatten animals, being sold over the counter without a prescription. A Bureau reporter, posing as a veterinary drug store owner, also spoke to a member of Zoetis’ Indian sales team who said it typically sold these antibiotics directly to farmers.

Ahead of new laws introduced last year in the U.S. banning the use of antibiotics as growth promoters, Zoetis voluntarily began to remove such claims from its products there. In 2013, Zoetis said it “supports the FDA’s efforts to voluntarily phase out growth promotion indications for medically important antibiotics”. Meanwhile, in India Zoetis is selling Neftin-T, which contains the antibiotic tylosin. Zoetis recommends feeding Neftin-T to chickens to “improve weight gain and FCR [feed conversion rate]”. Tylosin is not only critically important to animal health, it has been banned for use as a growth promoter in the EU since 1998 because of fears it fuels resistance to erythromycin, which is used to treat chest infections and other human diseases. WHO classes erythromycin as critically important to human health.

The practice of using antibiotics to make animals grow faster was banned completely in the EU in 2006.

Pharmaceutical companies earn about $5 billion a year from worldwide sales of antibiotics for livestock, according to Animal Pharm. As one of the world’s leading producers of medicated feed additives — many of which contain antibiotics — Zoetis takes a significant slice of this.

**Banned abroad**

Zoetis faces a dwindling market in U.S. since the ban last year for these products but expects that increased sales elsewhere will more than compensate in the future. Speaking to investment analysts in February, Zoetis CFO Glenn David said, despite the downturn in the U.S., he still expects to see sales of medicated feed additives rise “as the emerging markets become more industrialised”.

Animals reared for meat in the major emerging economies of Brazil, Russia, India, China and South Africa are expected to consume double the amount of antibiotics in 2030 than they did in 2010.

Responding to the Bureau’s findings, Zoetis said: “Each country enacts regulations appropriate for their market needs and standards, and we work with the national regulatory authorities in various countries, including India, to understand, respect and comply with local regulatory interpretation and oversight.”
Experts are particularly concerned about the widespread use of a ‘last hope’ antibiotic on Indian poultry farms. Colistin is often used to treat seriously ill people with infections that have become resistant to almost all other drugs and is deemed one of the “highest priority, critically important” antibiotics by WHO as it is so crucial to human medicine.

Although none of Zoetis’ growth promoters contain colistin, a number of major Indian poultry companies have been found to use the drug, spreading fears about how much longer one of our last lines of defence against highly resistant infections will be effective.

Fears about growing resistance to a drug crucially important to human health has led some to call for an outright ban of colistin use on farms. The discovery of a colistin-resistant gene that can pass between bacteria, conferring resistance to bugs never exposed to the drug, sent shockwaves through the medical community in 2015. This transfer will likely accelerate the spread of resistance to colistin, further boosted by the rampant use of the antibiotic on farms in many countries.

Timothy Walsh, a professor at Cardiff University who made the discovery in 2015, called for a worldwide ban on colistin use in agriculture.

“I’ll be OK, but my children and my children’s children are seriously going to grow up in a world where we have no viable antibiotics because of unrivalled stupidity” he said.

But growth promoting antibiotics, including colistin, remain widely available to Indian farmers through a number of international and domestic pharmaceutical companies.

Mr. Walsh said: “I predict that colistin as a drug will be dead in 10 years time. And given what is in the pipeline, which is next to nothing, and given the plasticity of bacteria and their ability to evolve and adapt and survive and prosper, I see no good end to this story at all.”

*If an American company follows one policy in America, they should follow the same policy in India*

Abdul Ghafur

*Professor in Infectious Diseases*

*We work with the national regulatory authorities in various countries, including India*

Zoetis

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MISSION TO SEQUENCE GENES OF A ‘LARGE GROUP’ OF INDIANS

India is planning a major mission to sequence the genes of a “large” group of Indians — akin to projects in the U.K., China, Japan and Australia — and use this to improve health and buck a global trend of designing “personalised medicine”.

This was among the key decisions taken by the Prime Minister’s Science, Technology and Innovation Advisory Council (STIAC) at its first meeting on Tuesday.

The Health and Family Welfare Ministry and the Biotechnology Department will be closely associated with the project.

Ever since the Council of Scientific and Industrial Research in 2009 announced that it had sequenced the genome of an Indian, then making India one of six countries to achieve such a feat, several research labs have analysed genes from Indians for disease susceptibility. However, no compendium of genes that differentiate Indian populations from, say, Caucasian or African genomes exist.

A group of Indian scientists and companies are involved with a 100k GenomeAsia project, led by the National Technological University (NTU), Singapore, to sequence the whole genomes of 100,000 Asians, including 50,000 Indians.

“Our lifestyle, our environment and the genes we inherit all combine to make us what we are. The diversity of Indians and of our environment requires a large-scale study of human genomes, of our lifestyle in health and disease and the use of healthy — and disease — samples to understand the impact on health,” said a press statement from the STIAC.

K. Vijay Raghavan, Principal Scientific Adviser and Chair of the council, said the genome initiative would have to move at two different levels.

“Sequencing genomes and linking to human health and disease as a research initiative, and doing this on a much larger scale, so it has a direct impact on public health. As the first level starts, the second will be put in place, speedily.”

The Council acts as a coordinator between several Ministries to work on projects and missions and is scheduled to meet once a month, he said.

Key programmes, such as a deep ocean mission, to facilitate ocean science and technologies to help with India’s strategic interests and an Artificial Intelligence and quantum computing mission were also discussed.

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CENTRAL UNIVERSITY OF JAMMU SIGNS MOU WITH ISRO TO SET UP SPACE APPLICATIONS CENTER

Relevant for: Science & Technology | Topic: Space Technology & related matters

Department of Space

Central University of Jammu signs MoU with ISRO to set up Space Applications Center

“Landmark achievement,” says MoS Dr. Jitendra Singh

Posted On: 11 OCT 2018 7:16PM by PIB Delhi

The Indian Space Research Organisation (ISRO) signed an MoU with the Central University of Jammu (CUJ) in Jammu today for setting up of the Satish Dhawan Center for Space Science in the University in the presence of the Union Minister of State for Development of North Eastern Region (I/C), PMO, Personnel, Public Grievances and Pensions, Department of Atomic Energy and Department of Space, Dr Jitendra Singh. Secretary, Department of Space and ISRO Chairman, Dr. K. Sivan, Prof. Ashok Aima, Vice Chancellor, CUJ and former ISRO Chairman Dr. K. Radhakrishnan were also present on the occasion.

Another MoU was signed between CUJ and the Central Scientific Instruments Organization (CSIR-CSIO). To create awareness about space research and to motivate young minds to take up research related to space, astronomy, geology, atmospheric sciences and related fields, a two day workshop was also inaugurated at the CUJ campus.

Speaking on the occasion, Dr. Jitendra Singh that the collaboration between ISRO and CUJ for establishing an ISRO Center at Jammu is a landmark achievement for the State. He urged the youth and the faculty of the Institute to develop scientific temper and generate interest in space research. He said that space technology has become an important part of our day-to-day lives from communication and weather forecasting to better rail-traffic management, better border surveillance and even searching for nearest toilets through mobile app etc.

While taking about the establishment of the Satish Dhawan Center for Space Science at Central University of Jammu, Dr. K Sivan said that the Center will help in tapping potential of Space Applications for the region of J&K in various fields like disaster management, health, education, communication, weather forecasting, land use planning, etc. He said that this would provide opportunity to the youth of the region to contribute to the field of space science as well as to the nation. He further said ISRO is dedicated to the mission of utilizing space sciences for the benefit of mankind as envisaged by Dr. Vikram Sarabhai and Prof Satish Dhawan, the founding fathers of ISRO.

The area of space applications is of particular interest to J&K and the larger Himalayan region as its economy and habitations are affected by vegetation cover, forest area, snow, landslides, avalanches, ground water, cloud cover, atmospheric conditions etc. which can be easily monitored from space through remote sensing. Considering the recurring natural calamities in the region, requirement of strengthening ground-based observational capabilities of this region for weather and atmospheric research is also of utmost important. The setting up of this Center will take care of the emerging Geospatial and Space Technology requirements for the
development of the region.

The Satish Dhawan Centre for Space Science at CUJ will have facilities for Geospatial Data analysis that will help in sustainable use of natural resources and planning land-use pattern. It will have ground-based observations for Atmospheric Studies, research lab for astrophysics, Atmospheric Sensing and Glacier studies Lab for better use of large quantity of water stored in the form of seasonal snow, ice and glaciers in the rivers of North India. Apart from this, Disaster Management Center will also be set up here that would be able to take up research in the area of different disasters like flood, Landslides, forest fires, drought and climate change.

The establishment of Materials Sciences Lab for space applications as a part of the Satish Dhawan Center for Space Science at CUJ will be another outstanding feature of the Center where special focus will be to synthesize and design new sensors and materials for space applications.

This is the first of its kind institute coming up in Jammu and Kashmir and the building is proposed in an area of about 1,150 sq. m.

As part of outreach, Research and Development, awareness creation, training and skill development, ISRO has also started many other activities like setting up of Regional Academic Centers (RAC), Space Technology Incubation Centers (S-TIC), setting up of ISRO Chairs and Space Technology Cells in various parts of the country.

Space Sciences is a multidisciplinary subject which involves basic sciences such as physics, chemistry, biology, astronomy, geology, planetary science, mathematics, atmospheric sciences, geography, space engineering and even space law.

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(Release ID: 1549475) Visitor Counter : 693

Read this release in: Urdu
PUNE’S NATIONAL CENTRE FOR CELL SCIENCE TO COLLECT, STUDY MULTIDRUG-RESISTANT BUGS

The bio-repository will receive, store, preserve and characterise these microbes.

The Pune-based National Centre for Cell Science (NCCS) is set to become a repository of multidrug-resistant bacteria and fungi from across the country.

On September 25, the Department of Biotechnology (DBT) authorised the National Centre for Microbial Resource (NCMR) at NCCS to function as a bio-repository for multidrug-resistant microbes/infective agents. The bio-repository will receive, store, maintain, preserve and characterise these microbes.

The notification said that the NCMR would take necessary steps to facilitate clinicians, scientists and others to handle multidrug-resistant microbe samples.

Currently, the National Centre for Disease Control and the Indian Council of Medical Research carry out anti-microbial resistance surveillance in various geographical regions and settings. But these two bodies only collect data and not microbe samples.

In 2007, in collaboration with nine institutes, the DBT collected 1,50,000 microbes from the natural environment, and these are housed at NCCS.

“While none of the microbes collected in 2007 is drug-resistant or disease-causing, it has now been decided to extend our mandate to include multidrug-resistant microbes,” Dr. Yogesh Shouche of NCCS and in-charge of the bio-repository said. Accordingly, the DBT has informed all medical colleges, hospitals and research institutions to deposit samples of drug-resistant microbes with the repository.

“So far we have not received any samples. On October 12, we will frame the guidelines for deposition and distribution of drug-resistant microbes. While we are clear that we will be accepting only multidrug-resistant microbes, we will decide microbes resistance to which antibiotics should be accepted. Once the guidelines are approved by the DBT, we will start accepting samples,” Dr Shouche said.

Multidrug-resistant microbes received from different settings in the same city and from other across the country will help shed light on the spread and resistance pattern of these microbes.

“After a few years of collecting samples from across the country we will know how multidrug-resistant microbes spread and how they evolve with time,” he said.

Since antibiotics are widely used in livestock and poultry as growth promoters, particularly in poultry, the NCMR hopes veterinary hospitals will also share samples from livestock where antibiotics are used as a growth promoter. Besides livestock, Antibiotics are also widely used in aquaculture.

“Sharing of samples is voluntary and it depends on the willingness of institutions to do so. We will be taking steps to encourage and support sample collection and sharing. Slowly, we may start collecting samples ourselves,” Dr Shouche said. He does not rule out the possibility of the
DBT making all researchers who receive funding, compulsorily share samples with the NCMR.

There is currently no large-scale research undertaken to study the presence and spread of different multidrug-resistant microbes. A few small studies have found these bacteria resistant to multiple antibiotics and even the last-resort antibiotics in fish, meat and vegetable samples collected from farms, shops, environment and households.

NCCS plans to study the samples collected at the repository to develop new antibiotics and anti-fungals and test the effectiveness of new drugs.

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It’s adorable to see an 11-month-old who’s just learning to walk, glide across the room in his walker, all smiles, hands flapping in glee. But that

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GLITCH PUTS NASA’S CHANDRA TELESCOPE IN ‘SAFE’ MODE

The Chandra X-ray Observatory: NASA said that the telescope automatically went into so-called safe mode on Wednesday, possibly because of a gyroscope problem. | Photo Credit: NASA/AP

Barely a week after NASA’s Hubble Space Telescope entered safe mode, the Chandra mission has also suffered a glitch possibly due to the failure of the gyroscope, the US space agency said.

The Chandra X-Ray Observatory, observing the universe in high-energy light since 1999, has entered a protective ‘safe mode’, which interrupts scientific observations and puts the spacecraft into a stable configuration.

“At approximately 9:55 a.m. EDT on Oct 10, NASA’s Chandra X-ray Observatory entered safe mode.

“The cause of the safe mode transition (possibly involving a gyroscope) is under investigation,” NASA said in a statement late on Friday.

During the safe mode, the observatory is put into a safe configuration, critical hardware is swapped to back-up units, the spacecraft points so that the solar panels get maximum sunlight, and the mirrors point away from the Sun.

“Analysis of available data indicates the transition to safe mode was normal behaviour for such an event. All systems functioned as expected and the scientific instruments are safe,” it added.

Chandra, launched in 1999, is well beyond the original design lifetime of 5 years. In 2001, NASA extended its lifetime to 10 years. It is now well into its extended mission and is expected to continue carrying out forefront science for many years to come.

Meanwhile, the U.S. space agency said that it continues to work towards resuming science operations of the Hubble Space Telescope.

On October 5, Hubble entered safe mode after one of the three gyroscopes (gyros) being used to point and steady the telescope failed. Gyroscopes help spacecraft maintain proper orientation.

Scientists are currently performing analyses and tests to determine what options are available to recover the gyro to operational performance.

Till then, science operations with Hubble have been suspended.

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The Royal Swedish Academy of Sciences awarded the Nobel Prize in Chemistry 2018 with one half to Frances H. Arnold and the other half jointly to
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The Navy has inducted its first deep submergence rescue vehicle to rescue downed or disaster-struck submarines on the high seas. India has now joined a select group of countries that have the capability to locate “distressed submarines”. At present, the U.S., China, Russia and a few others have the capability. PTI

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October 16 is observed as the World Food Day to mark the creation of the United Nation’s Food and Agriculture Organisation (FAO) in 1945. The world body envisions a “zero hunger world” by 2030. Perhaps, the occasion is incomplete without remembering Nobel Peace laureate Norman E Borlaug, whose “miracle seeds” of wheat saved over a billion people from starvation. Borlaug also instituted the World Food Prize in 1986, which is sometimes described as the Nobel Prize in agriculture. It’s important to understand the role of science and technology in ushering the Green Revolution, which ensured food security in India. Today, similar innovations in biotechnology hold the promise to provide nutrition security.

In 1943, the Bengal Famine claimed 1.5 to 3 million lives. After independence, India faced the challenge of feeding 330 million people. The situation became grim when the country was hit by back-to-back droughts in the mid-1960s. Grain production plummeted from 89.4 million metric tonnes (MMT) in 1964-65 to 72.4 MMT in 1965-66. India became heavily dependent on the PL 480 food aid from the US. Self-sufficiency in foodgrains became the country’s top policy priority.

In the early 1960s, India imported 18,000 tonnes of the semi-dwarf high yielding (HY) wheat variety, Lerma Rojo and Sonora 64. Developed by Borlaug and his team at the International Maize and Wheat Improvement Center (CIMMYT), Mexico, these wheat varieties proved to be the harbinger of the Green Revolution. Indian scientists adapted the imported germplasm to create indigenous varieties: Kalyan developed by D S Athwal and Sona created by M S Swaminathan. Around the same time, the HY miracle rice, IR8 — developed by Peter Jennings and Henry M Beachell of the International Rice Research Institute (IRRI) — was imported. About a decade later, an improved variety, IR36 — developed by IRRI’s Gurdev Khush — made its presence felt in the country’s fields. The breeding programme under the All India Coordinated Research Project (AICRP) produced Padma and Jaya, the first indigenous HY rice varieties. These became the centrepiece of India’s rice revolution.

Breakthroughs in Basmati rice came with the development of Pusa Basmati 1121 and 1509 from 2005 to 2013. These rice varieties were developed by teams led by V P Singh, A K Singh and K V Prabhu at the Indian Agriculture Research Institute. Pusa Basmati gave Indian rice more value with less water and 50 per cent higher yields compared to the traditional basmati. V Singh et al estimate that the cumulative earnings through exports of Pusa Basmati 1121 between 2008 and 2016 and the sale of the rice variety in the domestic market in the same period to be about $20.8 billion.

Where does India stand today in terms of wheat and rice? While the country’s population has grown by more than four times, from 330 million in 1947 to 1.35 billion in 2018, India’s wheat production has increased by over 15 times in roughly the same period — from about 6.5 MMT in 1950-51 to 99.7 MMT in 2017-18. India contributes about 13 per cent of the world wheat production, next only to China whose share is about 17 per cent. Rice production has shot up by about 5.5 times — from 20.6 MMT in 1950-51 to 112.9 MMT in 2017-18. India has a 23 per cent share in world rice production, next only to China whose share is about 29 per cent. India is also the largest exporter of rice in the world with about 12.7 MMT, valued at $7.7 billion (Basmati at $4.17 billion and Non-Basmati at $3.56 billion) during 2017-18.

Notwithstanding its foodgrain surpluses, the country faces a complex challenge of nutritional
security. FAO’s recent publication, The State of Food Security and Nutrition in the World, 2018 estimates that about 15 per cent of the Indian population is undernourished. More than 38 per cent of Indian children aged below five years are stunted and 21 per cent suffer from wasting. Several factors ranging from poor diet, unsafe drinking water, poor hygiene and sanitation, low levels of immunisation and education, especially that of women, contribute to this dismal situation. But latest innovations in biotechnology that fortify major staples with micro nutrients like vitamin A, zinc and iron can be game changers.

Globally, the HarvestPlus programme of the Consultative Group on International Agricultural Research (CGIAR) is doing lot of work in this direction. In India, the group has released the iron-rich pearl millet. The Indian Council of Agricultural Research has independently released zinc and iron rich wheat (WB 02 and HPWB 01), rice (DRR Dhan 45), and pearl millet (HHB 299 and AHB 1200) in 2016-17. This could possibly lead to the next breakthrough in staples, making them more nutritious. A research team led by Monika Garg at the National Agri-Food Biotechnology Institute in Mohali has innovated biofortified coloured wheat (black, blue, purple) through crosses between HY Indian cultivars (PBW550, PBW621, HD2967) and coloured wheat from Japan and America. These are rich in anthocyanins (antioxidants such those found in blueberries) and zinc (40 ppm compared to 5 ppm in white wheat). Farmers of the Borlaug Farmers Association from Punjab and Haryana have been roped in to multiply production of this wheat variety. This seems to be the beginning of a new journey, from food security to nutritional security. The best is yet to come. But innovations in biofortified food can alleviate malnutrition only when they are scaled up with supporting policies. This would require increasing expenditure on agri-R&D and incentivising farmers by linking their produce to lucrative markets. Can the Modi government do it? Only time can tell.
CHINA TESTS WORLD’S LARGEST UNMANNED DRONE

Relevant for: Science & Technology | Topic: Defence related developments

China has successfully tested the world’s largest unmanned transport drone which can carry a payload of 1.5 tonnes, official media reported on Wednesday.

A large commercial drone Feihong-98 (FH-98) developed and modified by the China Academy of Aerospace Electronics Technology made a test flight at Baotou site in north China’s Inner Mongolia autonomous region on Tuesday, state-run China Daily reported.

Feihong-98 (FH-98) is now the world’s largest unmanned transport aircraft, with a maximum payload of up to 1.5 tonnes, it said.

It was adapted from the prototype of the Shifei Y5B, a China-developed transport plane.

As China’s first fully domestically-built transport aircraft, the Shifei Y5B has a history of over 60 years since its first flight in 1957 and has been widely used.

According to Liu Meixuan, president of the China Academy of Aerospace Electronics Technology, the FH-98 features simple take-off and landing, simple operation, advanced technology, at an affordable cost.

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A bug in Facebook’s WhatsApp messaging service allowed hackers to take over users’ applications when they answered an incoming video call, technology.

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CHINA TO LAUNCH ‘MAN-MADE MOONS’ TO LOWER ELECTRICITY COSTS

A perigee moon also known as a supermoon rises behind figurines on a Chinese pavilion in Beijing, China, Saturday, July 12, 2014. | Photo Credit: AP

China is planning to launch its own ‘artificial moon’ by 2020 to replace streetlamps and lower electricity costs in urban areas, state media reported Friday.

Chengdu, a city in southwestern Sichuan province, is developing “illumination satellites” which will shine in tandem with the real moon, but are eight times brighter, according to China Daily.

The first man-made moon will launch from Xichang Satellite Launch Center in Sichuan, with three more to follow in 2022 if the first test goes well, said Wu Chunfeng, head of Tian Fu New Area Science Society, the organization responsible for the project.

Though the first launch will be experimental, the 2022 satellites “will be the real deal with great civic and commercial potential,” he said in an interview with China Daily.

By reflecting light from the sun, the satellites could replace streetlamps in urban areas, saving an estimated 1.2 billion yuan (USD 170 million) a year in electricity costs for Chengdu, if the man-made moons illuminate an area of 50 square kilometers.

The extraterrestrial source of light could also help rescue efforts in disaster zones during blackouts, he added.

AFP was not able to contact Wu nor the Tian Fu New Area Science Society to confirm the reports.

As China’s space programme races to catch up with that of the United States and Russia, a number of ambitious projects are in the pipeline, including the Chang’e-4 lunar probe — named after the moon goddess in Chinese mythology — which aims to launch later this year.

If it succeeds, it will be the first rover to explore the “dark side” of the moon.

China is not the first country to try beaming sunlight back to Earth. In the 1990s, Russian scientists reportedly used giant mirrors to reflect light from space in an experimental project called Znamya or Banner.

Chengdu’s artificial moon project was announced by Wu at an innovation and entrepreneurship conference in Chengdu on October 10.

In addition to Tian Fu New Area Science Society, other universities and institutes, including the Harbin Institute of Technology and China Aerospace Science and Industry Corp, are involved in developing Chengdu’s illumination satellites.

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The social network said these accounts spread “sensational political content” designed to drive people to ad-laden websites outside Facebook.

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SUPERFLARES FROM YOUNG STARS MAY IMPERIL PLANETS: NASA

The planet Proxima b orbiting the red dwarf star Proxima Centauri, the closest star to our Solar System, is seen in an undated artist's impression released by the European Southern Observatory August 24, 2016. | Photo Credit: Reuters

Violent flares from the host star may make planets orbiting it uninhabitable by affecting their atmospheres, scientists using NASA's Hubble Space Telescope have found.

Hubble is observing such stars through a large programme called HAZMAT — Habitable Zones and M dwarf Activity across Time, NASA said in a statement.

“M dwarf” is the astronomical term for a red dwarf star — the smallest, most abundant and longest-lived type of star in our galaxy, according to the study published in The Astrophysical Journal.

The HAZMAT programme is an ultraviolet survey of red dwarfs at three different ages: young, intermediate, and old.

Stellar flares from red dwarfs are particularly bright in ultraviolet wavelengths, compared with Sun-like stars, according to NASA.

Hubble’s ultraviolet sensitivity makes the telescope very valuable for observing these flares.

The flares are believed to be powered by intense magnetic fields that get tangled by the roiling motions of the stellar atmosphere.

When the tangling gets too intense, the fields break and reconnect, unleashing tremendous amounts of energy.

The team has found that the flares from the youngest red dwarfs they surveyed — just about 40 million years old — are 100 to 1,000 times more energetic than when the stars are older.

This younger age is when terrestrial planets are forming around their stars, NASA said.

About three-quarters of the stars in our galaxy are red dwarfs.

Most of the galaxy’s “habitable-zone” planets — planets orbiting their stars at a distance where temperatures are moderate enough for liquid water to exist on their surface — likely orbit red dwarfs.

In fact, the nearest star to our Sun, a red dwarf named Proxima Centauri, has an Earth-size planet in its habitable zone.

However, young red dwarfs are active stars, producing ultraviolet flares that blast out so much energy that they could influence atmospheric chemistry and possibly strip off the atmospheres of these fledgling planets.
The study examined the flare frequency of 12 young red dwarfs. The observing programme detected one of the most intense stellar flares ever observed in ultraviolet light.

Dubbed the “Hazflare,” this event was more energetic than the most powerful flare from our Sun ever recorded.

“Flares like we observed have the capacity to strip away the atmosphere from a planet. But that doesn’t necessarily mean doom and gloom for life on the planet,” said Parke Loyd from Arizona State University in the US.

“It just might be different life than we imagine. Or there might be other processes that could replenish the atmosphere of the planet. It is certainly a harsh environment, but I would hesitate to say that it is a sterile environment,” Loyd said.

“The goal of the HAZMAT programme is to help understand the habitability of planets around low-mass stars,” said Arizona State University’s Evgenya Shkolnik, the programme’s principal investigator.

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Did Sai Baba appear on the Moon? What does Alice in wonderland syndrome mean? For answers, and more interesting questions on tricky appearances, take this quiz.

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A BID TO UNLOCK THE MYSTERIES OF SOLAR SYSTEM

As we go about our daily routines on Earth, Japanese robots are literally hopping about on the surface of a primitive asteroid called Ryugu, some 280 million km away. The data they are collecting might unlock some of the most fundamental mysteries of our solar system.

The asteroid-exploring spacecraft, Hayabusa 2, was launched by the Japan Aerospace Exploration Agency (JAXA) in December 2014 and took three and a half years to reach its destination. In late September this year, it made history by releasing two moving rovers onto the asteroid’s surface.

The rovers are designed to bounce, because the lack of gravity on Ryugu makes it impossible for them to roll.

Together with another, largely stationary, lander that joined them on October 3, the probes are not only providing images of what until now had been just a dot at the end of even our most powerful telescopes, but measuring temperatures and magnetic fields, as well as investigating mineral composition with microscopes.

The most ambitious part of the project, a surface landing by the mother ship itself, has however had to be delayed by several months, after initial explorations revealed Ryugu’s surface to be far rockier than anticipated. Boulders, some as big as 130 m, are strewn all across the surface.

This final part of the mission will now take place in January next year at the earliest. It will be preceded by the creation of an artificial crater to expose material that lies below the surface of the asteroid.

The plan is for the spacecraft to head back by late 2020 to Earth, carrying soil and other material samples, where they can be studied using the most sophisticated scientific instruments available.

“We might be able to get information about the origins of life that is still preserved in the body of the asteroid,” said Yuichi Tsuda, project manager of the Hayabusa 2 mission, when asked about the most optimistic, yet realistic, outcome of the mission.

Fast-moving time capsule

Because asteroids are thought to have formed from the same material that made up the planets, they are a kind of fast-moving time capsule that can take us back 4.6 billion years ago, to the infancy of our solar system.

Asteroids like Ryugu have not been exposed to the same geological processes that caused erosion on Earth’s rocks. Consequently, their surfaces are preserved and studying their composition could provide clues about the origin of life. “For example, we may discover molecules of carbon or water,” explained Mr. Tsuda.

Although the data that has been collected so far has not revealed any water molecules on Ryugu, Mr. Tsuda said that sub-surface exploration might yet reveal hydrated minerals (minerals...
that contain water in their crystalline structure).

Scientists have been studying asteroids for years, but where Hayabusa 2 has scored a first is in having deployed moving rovers. Moreover, Ryugu is what is called a C-type or carbonaceous asteroid which, according to Mr. Tsuda, is more likely to yield clues about the origins of life than the S-type or silicaceous asteroids that have been more commonly explored.

C-type asteroids exist furthest from the Sun, and have consequently been least altered by heat and are, therefore, most likely to contain water.

If all goes according to plan, Hayabusa 2 will become the world’s first asteroid sample-collecting mission to return to Earth from a C-type asteroid.

_The plan for the Japanese spacecraft exploring the asteroid Ryugu is to head back by late 2020 to Earth, carrying soil and other material samples, where they can be studied_

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EUROPE, JAPAN SEND SPACECRAFT ON 7-YEAR JOURNEY TO MERCURY

Relevant for: Science & Technology | Topic: Space Technology & related matters

In this photo released by European Space Agency (ESA), the Ariane 5 rocket carrying BepiColombo lifts off from its launch pad at Kourou in French Guiana, for the mission to Mercury on Saturday, Oct. 20, 2018. Photo: JM Guillon/2018 ESA-CNES-Arianespace via AP | Photo Credit: AP

European and Japanese space agencies said an Ariane 5 rocket successfully lifted a spacecraft carrying two probes into orbit on Saturday for a joint mission to Mercury, the closest planet to the sun.

The European Space Agency and the Japan Aerospace Exploration Agency said the unmanned BepiColombo spacecraft successfully separated and was sent into orbit from French Guiana as planned to begin a seven-year journey to Mercury.

They said the spacecraft, named after Italian scientist Giuseppe “Bepi” Colombo, was in the right orbit and has sent the first signal after the liftoff.

ESA says the 1.3 billion-euro (USD 1.5 billion) mission is one of the most challenging in its history.

Mercury’s extreme temperatures, the intense gravity pull of the sun and blistering solar radiation make for hellish conditions.

The BepiColombo spacecraft will have to follow an elliptical path that involves a fly-by of Earth, two of Venus and six of Mercury itself so it can slow down before arriving at its destination in December 2025.

When it arrives, BepiColombo will release two probes — Bepi and Mio — that will independently investigate the surface and magnetic field of Mercury.

The probes are designed to cope with temperatures varying from 430 degrees Celsius (806 F) on the side facing the sun, and -180 degrees Celsius (-292 F) in Mercury’s shadow.

The ESA-developed Bepi will operate in Mercury’s inner orbit, and JAXA’s Mio will be in the outer orbit to gather data that would reveal the internal structure of the planet, its surface and geological evolution.

Scientists hope to build on the insights gained by NASA’s Messenger probe, which ended its mission in 2015 after a four-year orbit of Mercury. The only other spacecraft to visit Mercury was NASA’s Mariner 10 that flew past the planet in the mid-1970s.

Mercury, which is only slightly larger than Earth’s moon, has a massive iron core about which little is known. Researchers are also hoping to learn more about the formation of the solar system from the data gathered by the BepiColombo mission.

“Beyond completing the challenging journey, this mission will return a huge bounty of science,” said Jan Wr, ESA Director General, in a statement.
JAXA President Hiroshi Yamakawa, who earlier managed the project, said, “We have high expectations that the ensuing detailed observations of Mercury will help us better understand the environment of the planet, and ultimately, the origin of the Solar System including that of Earth.”

It is the second recent cooperation between the Europeans and the Japan Aerospace Exploration Agency. JAXA’s Hayabusa2 probe dropped a German-French rover on the asteroid Ryugu earlier this month.

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Our Science Correspondent writes about scientists and pioneers whose achievements sowed the seeds of scientific temper in the country

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The title reflects the difficulty we face when trying to make a short list of achievements. There are many others who would fit into this list and it is not intended as a comprehensive or complete list in any way. Notable omissions include Narendra Karmakar's work in developing the first efficient algorithm for solving linear programming problems, Salim Ali's work in ornithology, C.V. Vishveshwara's calculations of black hole mergers and more recently Agarwal, Kayal Saxena's method of primality testing. In any case, here is presented a short account and a picture of some great work and some great people we need to feel good about in science.

Srinivasa Ramanujan’s untamed genius has made him today a byword among all who study mathematics. His brilliant work includes close to 3,900 results in the form of identities and equations. It is impossible to select one work that shines above all, but for ease of explanations, we can look at his derivation of the partition function in number theory. Take a number, e.g. 4. It can be written in the following ways (0+4), (1+3), (2+2), (1+ 2+ 1) and (1+1 +1+1). There are thus five partitions of the number 4. As the magnitude of a number increases the size of its partitions grows, and it becomes very difficult to count them. For many years people had tried to develop a formula for counting partitions. In one major work Ramanujan and Hardy brought out was an expression that gives the exact computation of partitions of an integer. Ramanujan was the first Indian scientist to be accepted as a Fellow of the Royal Society, London, a top honour given by the British scientific establishment.

Some people, when they enter the fray, bring in with them change, like a rush of air when you open the doors on a windy day – Meghnad Saha was one such. He was famous for his theory of stellar ionization, which explained the origin of stellar spectra. According to a biography posted in the Vigyan Prasar’s website, this was one of the most important contributions made by an Indian to science in the 20th century. Whether it was in teaching nuclear physics, setting up the country’s first cyclotron or building Institutions, Meghnad Saha was a master at it. He was elected as a member of parliament from south Calcutta constituency in 1952 as an independent candidate. He died in 1956 at the age of 63.

CV Raman won the Nobel prize in 1930 for his experiments in light scattering and the phenomenon which came to be known as Raman effect in his honour. When light is passed through a material, the photons in the beam excite the atoms of the sample. When these photons re-emerge, they can have higher or lower energies than the photons making up the original incident beam of light. This is because some of the energy is either absorbed or added to by the interaction with the material. As a result, the colour of the incident light can differ from the colour of the emergent light. This effect is used as a way of probing the properties of materials depending on the way they interact with light.

Norman Pogson was a much decorated British astronomer who worked in the Madras observatory, which was moved into Madras in 1792 and managed by the British East India Company. Pogson discovered many small asteroids and observed many comets, but the discovery he is famous for is that of the gas Helium. True to its name which is derived from Helios meaning the sun, helium was discovered not on earth but on the sun. Watching a solar eclipse from Machilipatnam on August 18, 1868, Pogson and his team spotted a bright yellow line in the solar spectrum and attributed it to a new element. Later, confirming this, Norman Lockyer gave the element its name as we now call it – helium.
Ronald Ross was born in Almora in India. He won the Nobel prize in 1902 for discovering how malaria is propagated by mosquitoes. In Secunderabad, in 1897 he used some 20 mosquitoes that he had cultured, and made them bite an infected patient. After the blood meal, when he dissected the mosquitoes he found the larvae in the guts of the mosquitoes. Further study confirmed that they were indeed the malarial parasite. Later, in Kolkata, he experimented with bird models and demonstrated how the parasite was transferred from an affected bird to a healthy one by mosquitoes. This established the lifecycle of the parasite and the mode of infection and forms the basis of many treatment procedures.

Satyendranath Bose (S.N. Bose) has made what is arguably one the most important contributions to theoretical physics from India. He derived Planck's law of black body radiation by applying Einstein's concept of photons to describe the radiation. His paper was initially not accepted for publication. So he sent the article, along with a letter, dated June 4, 1924, to Albert Einstein, requesting his help to get it published in the journal Zeitschrift fur Physik. Einstein not only said he would help Bose, but also translated the paper into German himself for the journal. Not just this, he further generalized the concept of Bose and derived the theory of a quantum theory of an ideal gas, giving rise to what is known today as the Bose-Einstein statistics.

Scottish pathologist and British Army medical officer William Boog Leishman served in India in the early 1900s. In 1901, when examining the spleen of a patient who had died of kala azar, he found some oval bodies, later identified as Leishmania donovani, the protozoan that causes kala azar or visceral leishmaniasis. It was Ronald Ross who ensured that the genus was named after William Leishman. World Health Organization estimates that between 700,000 and 1000,000 get affected by this disease annually, resulting in 20,000 to 30,000 deaths.

Jagadish Chandra Bose (1858 – 1937) is popularly known as India’s first modern scientist, though his contemporaries Prafulla Chandra Ray and mathematician Srinivasa Ramanujan also merit this distinction. J.C. Bose made significant contributions to chronobiology and concepts of circadian rhythms. He demonstrated that plants, in response to external stimuli can produce electric response similar to animals. According to a biography of JC Bose, published by Vigyan Prasar, three of his research papers were published in The Electrician, an important British periodical of those times, in 1895. These were perhaps the first articles published by an Indian in a western scientific periodical.

Envisioned as a low-cost alternative to handheld computers in India, the Simputer made a splash in the early 2000s. It was devised in order to bridge the digital divide, but it did not succeed in taking off. Yet, it remains an important homegrown development in computer manufacture. It was the brainchild of scientists from the Indian Institute of Science – Vijay Chandru, Ramesh Hariharan, Swami Manohar, Mark Mathias and V Vinay – and founding members Vinay Deshpande and Shashank Garg.

Subrahmanyam Chandrasekhar is best known for his definition of the Chandrasekhar Mass Limit, which is approximately 1.4 times the mass of the sun. A star having a mass lower than this limit would eventually evolve into a white dwarf. If it had a mass higher than this, it would not stop with becoming a white dwarf but would continue to collapse under its own gravity to perhaps becoming a neutron star or a black hole. He was awarded the Nobel prize in 1983 along with John Fowler.

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Our Science Correspondent writes about scientists and pioneers whose achievements sowed the seeds of scientific temper in the country

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Artificial intelligence (AI) is becoming ever more powerful. Consulting firm PwC estimates that AI could contribute up to $15.7 trillion to the global economy in 2030, more than the combined GDP of China and India today. The technology will soon be omnipresent—from household appliances to our financial, law and justice systems.

That is why we should be very worried about the dark side of AI. And this is not about devilishly powerful AIs making humans slaves, as depicted in science fiction. The danger is much subtler.

AI will help us make decisions, and in many cases, take decisions for us, but AI is only as good as the data that is fed into it. The data is worked on by deep-learning software, which absorbs the data, figures out patterns, creates rules to fit the patterns, and keeps tweaking those rules as more data is fed into it.

In many cases, the programmers themselves are unaware of how the AI reaches decisions. The workings are so complex that they become opaque.

These masses of data are fed into the system by humans. And as humans, we all carry prejudices, consciously or unconsciously. This may colour the data we give the AI to crunch. Also, all the data that is fed is current or historical. It will reflect societal biases.

For instance, if an AI is fed the resumes of candidates for a top corporate job, it is almost certain that the system will choose a man, because data shows that men have overwhelmingly outnumbered women as CEOs in the past.

Going by the data, the AI will decide that a man will make a better CEO than a woman.

This data may have nothing to do with the talents or competence of women managers but the fact that they were not promoted due to gender bias. But the AI will never know that. It does not and cannot have any concept of “fairness”. It only knows data. And the idea of what is fair differs from society to society.

The notions also change over time as societies evolve. But the AI will never know that.

Inherently biased data can affect credit ratings, insurance plans, one’s higher education and career. In fact, it can change one’s life.

In 2016, an investigation by American non-profit organisation ProPublica found that COMPAS, an AI-driven software that assesses the risk of a person committing a crime again, was biased against people of colour. But judges in some US states are still using the software.

In 2015, Google had to apologize after its photo app tagged two black people as gorillas—perhaps because the algorithm’s training data set did not have pictures of enough black people.

In 2016, Russian scientists ran a global beauty contest to be judged by an AI. Of the 44 winners, only one had dark skin. The algorithm had been trained mostly with photos of white people, and it had equated “fair skin” with “beauty”.
A study of Google’s AI-driven advertising platform found that men were shown ads for high-paying jobs more often than women. Same with LinkedIn’s job ads.

AIs can also polarize society. On social media networks, deep-learning algorithms make sure that users are shown content that conforms to their preferences and biases. This creates a “filter bubble”.

I keep seeing opinions that resonate with mine, however loony they are, and over time, this makes me more isolated from and less tolerant towards opposing views. Social and political divides are deepened. This is how the Russian hackers cracked the 2016 US presidential elections.

And the more you use a biased AI, more biased data is created that the algorithms will use: a perfect feedback loop of insidious bias.

What if governments start using AI to take decisions on matters like resource allocation and national security? Politicians may lose power, or retire, but the AI (by now opaque in its complexity) will keep spewing out results, even though they may have calamitous consequences in the real world.

Mere technologists will never be able to solve the problem. More than technical, these are human, ethical and philosophical issues.

Some serious questions need to be answered before we jump, whistling and cheering, on the AI bandwagon.

**Sandipan Deb is an independent writer and editor.**
3D BIOPRINTING TO CREATE ARTIFICIAL BLOOD VESSELS, ORGAN TISSUE

A researcher prepares liquid droplets containing human cells before a bio- 3D printing with laser | Photo Credit: REUTERS

Scientists have developed a 3D printing technique that can recreate the complex geometry of blood vessels, and could one day be used to produce artificial arteries and organ tissues. A study, published in the journal *Nature Communications*, outlines a layer-by-layer printing method that features fine-grain, programmable control over rigidity.

“The idea was to add independent mechanical properties to 3D structures that can mimic the body’s natural tissue,” said Xiaobo Yin, an associate professor at University of Colorado (CU) Boulder in the US. “This technology allows us to create microstructures that can be customised for disease models.”

Hardened blood vessels are associated with cardiovascular disease, but engineering a solution for viable artery and tissue replacement has historically proven challenging. To overcome these hurdles, researchers found a unique way to take advantage of oxygen’s role in setting the final form of a 3D-printed structure.

“Oxygen is usually a bad thing in that it causes incomplete curing. Here, we utilise a layer that allows a fixed rate of oxygen permeation,” said Yonghui Ding, a postdoctoral researcher at CU Boulder. By keeping tight control over oxygen migration and its subsequent light exposure, researchers have the freedom to control which areas of an object are solidified to be harder or softer — all while keeping the overall geometry the same.

“This is a profound development and an encouraging first step toward our goal of creating structures that function like a healthy cell should function,” Ding said. As a demonstration, the researchers printed a small Chinese warrior figure, printing it so that the outer layers remained hard while the interior remained soft. The tabletop-sized printer is currently capable of working with biomaterials down to a size of 10 microns, or about one-tenth the width of a human hair.

The researchers are optimistic that future studies will help improve the capabilities even further. The findings could lead to better, more personalised treatments for those suffering from hypertension and other vascular diseases.

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According to the World Health Organization, India is the most depressed country in the world, followed by China and the U.S. The stigma and misconceptions associated with mental health add to the problem. Some views

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NASA NAMES GAMMA-RAY CONSTELLATIONS AFTER GODZILLA, HULK

The background shows the gamma-ray sky as mapped by Fermi. The prominent reddish band is the plane of our own galaxy, the Milky Way; brighter colors indicate brighter gamma-ray sources. | Photo Credit: NASA

NASA scientists have devised a new set of 21 modern gamma-ray constellations and named them after fictional characters such as the Hulk and Godzilla. The constellations, constructed with sources visible through its gamma-ray telescope, were devised to celebrate the completion of 10 years of operations of the Fermi Gamma-ray Space Telescope.

The new constellations include a few characters from modern myths. Among them are the Little Prince, the time-warping TARDIS from ‘Doctor Who,’ Godzilla and his heat ray, the antimatter-powered U.S.S. Enterprise from ‘Star Trek: The Original Series’ and the Hulk, the product of a gamma-ray experiment gone awry.

“Developing these unofficial constellations was a fun way to highlight a decade of Fermi’s accomplishments,” said Julie McEnery, the Fermi project scientist at NASA’s Goddard Space Flight Center in the US. “One way or another, all of the gamma-ray constellations have a tie-in to Fermi science.”

Gamma-rays in the sky, seen by our @NASAFermi telescope! To celebrate the mission’s 10-year anniversary, scientists used Fermi sources to create a set of unofficial gamma-ray constellations. Explore the interactive map and find them all: https://t.co/m3pF7WHOQT pic.twitter.com/pPtiPfHJY1

Since July 2008, Fermi’s Large Area Telescope (LAT) has been scanning the entire sky each day, mapping and measuring sources of gamma rays, the highest-energy light in the universe.

The emission may come from pulsars, nova outbursts, the debris of supernova explosions and giant gamma-ray bubbles located in our own galaxy, or supermassive black holes and gamma-ray bursts — the most powerful explosions in the cosmos — in others.

“By 2015, the number of different sources mapped by Fermi’s LAT had expanded to about 3,000 — 10 times the number known before the mission,” said Elizabeth Ferrara, who led the constellation project. “For the first time ever, the number of known gamma-ray sources was comparable to the number of bright stars, so we thought a new set of constellations was a great way to illustrate the point.”

The 21 gamma-ray constellations include famous landmarks — such as Sweden’s recovered warship, Vasa, the Washington Monument and Mount Fuji in Japan — in countries contributing to Fermi science.

Others represent scientific ideas or tools, from Schrodinger’s Cat, to Albert Einstein, Radio Telescope and Black Widow Spider, the namesake of a class of pulsars that evaporate their unfortunate companion stars.

Researchers also developed a web-based interactive to showcase the constellations, with
artwork from Aurore Simonnet, an illustrator at Sonoma State University in Rohnert Park, California, and a map of the whole gamma-ray sky from Fermi. Clicking on a constellation turns on its artwork and name, which includes a link to a page with more information. Other controls switch on the visible sky and selected traditional constellations.

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Our Science Correspondent writes about scientists and pioneers whose achievements sowed the seeds of scientific temper in the country

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One of NASA’s twin MarCO spacecraft took this image of Mars on October 2. | Photo Credit: NASA/JPL-Caltech

NASA’s first CubeSats to travel into deep space have beamed back an image of Mars — visible as a tiny red dot against the dark sky. The twin, low-cost MarCO CubeSats, called MarCO-A and MarCO-B, which are sharing a ride with InSight Mars lander, were designed to find out if they could survive the journey to deep space.

The image of Mars was taken on October 3 from a distance of roughly 12.8 million kilometres. A wide-angle camera on top of MarCO-B produced the image as a test of exposure settings. The MarCO mission, led by NASA’s Jet Propulsion Laboratory in Pasadena, California, hopes to produce more images as the CubeSats approach Mars. On November 26, they’ll demonstrate their communications capabilities while NASA’s InSight spacecraft attempts to land on the red planet.

The MarCOs are “chasing” Mars, which is a moving target as it orbits the Sun. In order to be in place for InSight’s landing, the CubeSats have to travel roughly 85 million kilometres. They have already travelled 399 million kilometres.

First-ever image of Mars from a CubeSat! On Oct. 2, one of our twin #MarCO satellites took this image. The pair has about 53 million miles left to reach Mars. They’ll demo communications during @NASAInSight’s Nov. 26 landing on the Red Planet. Look closer: https://t.co/6FfMBOnrDC pic.twitter.com/RajKnGaM1m

MarCO-B’s wide-angle camera looks straight out from the deck of the CubeSat. Parts related to the spacecraft’s high-gain antenna are visible on either side of the image. Mars appears as a small red dot in the image. To take the image, the MarCO team had to programme the CubeSat to rotate in space so that the deck of its boxy “body” was pointing at Mars. After several test images, they were excited to see that clear, red pinprick.

“We’ve been waiting six months to get to Mars,” said Cody Colley, MarCO’s mission manager at JPL. “The cruise phase of the mission is always difficult, so you take all the small wins when they come. Finally seeing the planet is definitely a big win for the team.”

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BepiColombo spacecraft’s two probes — Bepi will operate in Mercury’s inner orbit, and Mio will be in the outer orbit

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CELL-SIZED ROBOTS CAN BE USED TO DETECT DISEASES

The robots are called “syncells”, short for synthetic cells. | Photo Credit: Getty Images/iStockphoto

MIT scientists have developed a method to mass produce robots no bigger than a cell that could be used to monitor conditions inside an oil or gas pipeline, or to search out disease while floating through the bloodstream.

The key to making such tiny devices, which the team calls “syncells” (short for synthetic cells), in large quantities lies in controlling the natural fracturing process of atomically-thin, brittle materials.

The process, called “autoperforation”, directs the fracture lines so that they produce miniscule pockets of a predictable size and shape. Embedded inside these pockets are electronic circuits and materials that can collect data, according to a study published in the journal Nature Materials.

The system, developed by researchers at the Massachusetts Institute of Technology in the U.S., uses a two-dimensional form of carbon called graphene, which forms the outer structure of the tiny syncells.

These tiny objects “behave like a living biological cell”, said Michael Strano, a professor at MIT.

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Embedded inside these pockets are electronic circuits and materials that can collect, record, and output data, according to the study published in the journal *Nature Materials*.

The system, developed by researchers at the Massachusetts Institute of Technology in the US, uses a two-dimensional form of carbon called graphene, which forms the outer structure of the tiny syncells. Ranging in size from that of a human red blood cell, about 10 micrometers across, up to about 10 times that size, these tiny objects “start to look and behave like a living biological cell,” said Michael Strano, a professor at MIT. “In fact, under a microscope, you could probably convince most people that it is a cell.”

One layer of the material is laid down on a surface, then tiny dots of a polymer material, containing the electronics for the devices, are deposited by a sophisticated laboratory version of an inkjet printer. Then, a second layer of graphene is laid on top.

“People think of graphene, an ultrathin but extremely strong material, as being ‘floppy,’ but it is actually brittle,” said Strano. However, rather than considering that brittleness a problem, the team figured out that it could be used to their advantage.

The system controls the fracturing process so that rather than generating random shards of material, like the remains of a broken window, it produces pieces of uniform shape and size. There are a wide range of potential new applications for such cell-sized robotic devices, said Strano. As a demonstration, the team “wrote” the letters M, I, and T into a memory array within a syncell, which stores the information as varying levels of electrical conductivity. This information can then be “read” using an electrical probe, showing that the material can function as a form of electronic memory into which data can be written, read, and erased at will. It can also retain the data without the need for power, allowing information to be collected at a later time.

The researchers have demonstrated that the particles are stable over a period of months even when floating around in water, which is a harsh solvent for electronics, according to Strano.

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PM INTERACTS WITH IT AND ELECTRONIC MANUFACTURING PROFESSIONALS ON THE OCCASION OF THE LAUNCH OF “MAIN NAHIN HUM” PORTAL AND APP

Relevant for: Science & Technology | Topic: Science and Technology- developments and their applications and effects in everyday life

Prime Minister's Office

PM interacts with IT and electronic manufacturing professionals on the occasion of the launch of “Main Nahin Hum” Portal and App

Posted On: 24 OCT 2018 7:17PM by PIB Delhi

The Prime Minister, Shri Narendra Modi, today launched the “Main Nahin Hum” portal and app, in New Delhi.

The portal, which works on the theme “Self4Society”, will enable IT professionals and organizations to bring together their efforts towards social causes, and service to society, on one platform. In doing so, the portal is expected to help catalyse greater collaboration towards the service of the weaker sections of society, especially by leveraging the benefits of technology. It is also expected to generate wider participation of interested people who are motivated to work for the benefit of society.

Interacting with a wide cross-section of IT and electronic manufacturing professionals, captains of industry and technocrats on the occasion, the Prime Minister said he is sure that people want to work for others, serve society and make a positive difference.

Among those who interacted with the Prime Minister today were Shri Anand Mahindra, SmtSudhaMurthy, and a number of young professionals, from India’s top IT companies.

Every effort, however big or small, must be valued, the Prime Minister said, adding that Governments may have schemes and budgets but the success of any initiative lies in public involvement. Let us think about how we can use our strengths to bring a positive difference in the lives of others, the Prime Minister exhorted the gathering.

The Prime Minister noted that he observes India’s youngsters leveraging the power of technology very well. He said that they are using technology not only for themselves but also for the welfare of others. He described this as a wonderful sign. Noting that there are many start-ups in the social sector, the Prime Minister wished the young social entrepreneurs well.

Responding to questions in a townhall style interaction, the Prime Minister said that it is essential to step out of our comfort zone. There is so much to learn and discover, he added.

IT professionals explained their efforts towards social volunteering, especially in skilling and cleanliness. In response to an observation, the Prime Minister asserted that the symbol of the Swachh Bharat Mission is the spectacles of Bapu, the inspiration is Bapu and we are fulfilling...
Bapu's vision.

The Prime Minister said that on many occasions, what the “Sarkar” cannot do, “Sanskar” can do. Let us make cleanliness a part of our value systems, he added.

Speaking on the importance of conserving water, the Prime Minister said that in order to learn about water conservation, people should visit Porbandar in Gujarat, and see the home of Mahatma Gandhi. We need to conserve water and recycle water, he added. I appeal to my hardworking farmers to embrace drip irrigation, the Prime Minister said.

The Prime Minister said that through volunteering efforts, a lot can be done in the agriculture sector. Youngsters must venture out and work for the welfare of farmers, he added.

The Prime Minister asserted that more people are paying taxes because they have faith that their money is being used properly and for the welfare of people.

He said that India is making a mark in the start-up sector due to the talent of its youth.

Responding to a team that is working to create rural digital entrepreneurs, the Prime Minister said that it is important to create an India where everyone has equal opportunities.

The Prime Minister said doing social work should be a matter of great pride for everyone.

Expressing disagreement with the trend to criticize business and industry, the Prime Minister said that this townhall programme has illustrated how leading corporates are doing excellent social work, and urging their employees to venture out and serve the people.

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NCCS’ APPROACH MAKES BONE MARROW TRANSPLANTATION MORE SUCCESSFUL

Compared with controls, there was 30-40% increase in the engraftment of hematopoietic stem cells, say Vaijayanti Kale (right) and Sapana Jalnapurkar.

One of the reasons why the efficiency of bone marrow transplantation gets compromised is due to fewer hematopoietic stem cells available for transplantation. Researchers from the Pune-based National Centre for Cell Science (NCCS) have addressed this by using a novel way to multiply or expand the number of hematopoietic stem cells before transplantation. Importantly, the procedure also improves the body’s ability to accept the transplanted stem cells and begin producing new blood cells (engraftment potential). Increase in the engraftment potential improves the success rate of bone marrow transplantation.

A team led by Dr. Vaijayanti Kale from NCCS had earlier found that treating hematopoietic stem cells with nitric oxide improved the engraftment potential of juvenile cells. However, adult hematopoietic stem cells lost the engraftment potential when treated with a nitric oxide. “So in the latest study we treated the mesenchymal stem cells with a nitric oxide-producing compound (a nitric oxide donor),” says Dr. Kale.

The nitric oxide donor-treated mesenchymal stem cells (MSCs) secreted micro-vesicles that were enriched in certain factors have the ability to increase the engraftment potential of hematopoietic stem cells. “Micro-vesicles are normally secreted by all cells. But the micro-vesicles secreted by MSCs treated with the nitric oxide donor are rich in two mRNAs — Jagged-1 and VEGF-A,” says Sapana Jalnapurkar from NCCS and first author of a paper published in the journal Stem Cells. There was about 200-fold increase in Jagged-1-specific mRNA and about 7-fold increase in VEGF-A-specific mRNA in these micro-vesicles.

Micro-vesicles secreted by naïve mesenchymal stem cells do not show such high expression of Jagged-1 or VEGF-A-specific mRNAs.

The micro-vesicles enriched with these two mRNAs were cultured with hematopoietic stem cells for three days. There was an increase in the number (expansion) of hematopoietic stem cells at the end of three days of culture. Two signalling pathways involving Jagged-1 and VEGF-A were also induced when the micro-vesicles entered the hematopoietic stem cells. The pathway involving Jagged-1 plays an important role in self-renewal or multiplication of the stem cells whereas the pathway involving VEGF-A is required for HSCs to reach the bone marrow (homing) and be retained there.

After culturing with micro-vesicles, the hematopoietic stem cells were infused into mice that had undergone whole body irradiation to kill the stem cells in the bone marrow. “We found that the infused stem cells reached the bone marrow (homing) and produced new blood cells (engrafted). Compared with controls, there was 30-40% increase in the engraftment of hematopoietic stem cells. This is quite significant,” says Dr. Kale.

After four weeks, the peripheral blood contained 50-55% of blood cells that were derived from the donor stem cells; it was 40% after 16 weeks. In the case of bone marrow, the engraftment of HSCs was 30% after 16 weeks. “This is 5-6-fold more engraftment compared with control,” Dr. Kale says.
To test the engraftment efficiency, the researchers extracted the cells from the bone marrow of mice 16 weeks after receiving the donor stem cell infusion. The HSCs were separated and then infused into another set of mice that had undergone whole body irradiation. Blood cells in the peripheral blood after four and 16 weeks of infusion were 40% and 20-25% respectively. In the case of bone marrow, the stem cell engraftment was 7% after 16 weeks; the control mice had only about 1% engraftment. “There is 6-fold more engraftment in the bone marrow of the secondary mice, which is significant,” Dr. Kale says.

“Nitric oxide-donors are already being used as drugs for certain cardiac conditions. Similarly, mesenchymal stem cells are already in clinical use. So it will be relatively straightforward to use them in clinical settings to vastly improve engraftment and achieve greater bone marrow transplantation success. This finding has an important application in transplantation done with gene-edited hematopoietic stem cells,” says Dr. Kale.

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Fun facts or complex puzzles, science contains mysteries ranging from the minute to the magnificent. Taste science! Take this quiz!

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With the wide development of AI, questions of machine ethics arise in many contexts, for example in self-driving cars. A human driver might brake hard to save a pedestrian, while subjecting the passengers to a risk in a move that is decided by a moral value. A self-driving car will have to make such judgements based on encoded machine ethics. A machine ethics survey of 2.3 million people, published in *Nature*, indicates that deciding on a universal rule in such matters would be difficult. The survey presented 13 scenarios in which someone’s death was inevitable, and the people surveyed had to choose whom to spare. The data showed there were no universal rules, and therefore it is impossible to come up with a perfect set of rules for robots.

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DEMYSTIFYING SCIENCE: WHAT IS THE GHOST OF CASSIOPEIA?

About 550 light years away in the constellation of Cassiopeia lies IC 63, a stunning and slightly eerie nebula. Also known as the ghost of Cassiopeia, IC 63 is being shaped by radiation from a nearby unpredictably variable star, Gamma Cassiopeiae, which is slowly eroding away a cloud of dust and gas. The Gamma Cassiopeiae is a blue-white subgiant that is surrounded by a gaseous disc, which is 19 times more massive and 65,000 times brighter than our sun. It also rotates at the incredible speed of 1.6 million km per hour — more than 200 times faster than our parent star and releases radiation. The radiation of Gamma Cassiopeiae is so powerful that it even affects IC 63 and bestows an eerie appearance that gives it its ghostly aura. — *Science Daily*

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