Rs. 275/-
ISSN 0970-6488

Science Service

www.ptinews.com
Vol 36 No. 17 (23 pages including cover)

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A DIESEL-RUN SUV MAY BE EMITTING 25-65 TIMES MORE NOX: CSE

A diesel-run SUV may be emitting between 25 to 65 times more NOx, a harmful gaseous pollutant, than a small petrol car, says a global study shared by Centre for Science and Environment (CSE).

The not-for-profit organisation said the findings assume significance as the country's existing Pollution Under Control (PUC) certification system does not measure gaseous and particulate emissions from diesel vehicles on road.

"Adding one diesel SUV to the city fleet in Delhi-NCR is equal to adding 25 to 65 small petrol cars in terms of nitrogen oxide, a very harmful gas that also forms deadly ozone," CSE said in a statement.

The study was undertaken by International Centre for Automotive Technology (ICAT) and US-based International Council on Clean Transportation (ICCT), it said.

"India must adopt tighter test procedures for vehicle certification as well as implement direct monitoring of actual emissions while vehicles are driven on road. Europe has already implemented this system," Anumita Roychowdhury of CSE's Right To Clean Air Campaign said.

Concerned over rising vehicular pollution, the Supreme Court had on August 10 issued a slew of directions, including non-renewal of insurance policy of vehicles unless the owner provides pollution under control (PUC) certificate to the insurance firms.

SCIENTISTS MARCH ACROSS INDIA AGAINST 'OBSCURANTISM'

Scientists across the country marched on the streets today, urging the government to stop the "propagation of unscientific and obscurantist ideas".

The "March for Science", held in 27 cities, also urged the government to allocate at least 3 per cent of the country's GDP to scientific and technological research.

The RSS-linked science organisation Vijnana Bharati dubbed the march "politically motivated, left-oriented and "anti-government".

In Delhi, some 400-500 scientists, researchers, students and others took part in the rally from Mandi House to Jantar Mantar.

Vinay Kumar, a mathematics professor at the Zakir Hussain College here and a part of the Delhi Organising Committee, said a memorandum with a set of demands had been submitted to the Prime Minister's Office.

"Allocate at least 3 per cent of GDP to scientific and technological research and 10 per cent towards education. Stop the propagation of unscientific, obscurantist ideas and religious intolerance, and develop scientific temper, human values and spirit of enquiry," the memorandum said.

It urged the government to "ensure that the education system imparts only ideas that are supported by scientific evidence and enact policies based on evidence-based science".

In Mumbai, some 250 scientists, educationists and others participated in the march from Wilson College to Azad Maidan.

Aniket Sule, an astrophysicist by training and educationist with the Mumbai-based Homi Bhabha Centre for Science, denounced the "propagation of pseudo-science under the pretext of research" and expressed concern at the government's emphasis on Panchgavya, a concoction of cow dung,= cow urine, milk, curd and ghee.

The Ministry of Science and Technology has formed a 19- member panel to study the benefits of Panchgayva. The panel will shortlist projects for research.

"We have demanded that this pseduo-science be stopped under the name of research on Panchgavya and cow urine. Science should be evidence-based," Sule told PTI.

Vijnana Bharati secretary general A Jaykumar described the protest march as "shocking" and said "renowned intellectuals" were not only "diminishing the reputation of the government, but that of the scientific fraternity".

He said the budgetary allocations for the Ministry of Science and Technology and Earth Science had not been reduced.

"It was Rs 6275 crore in 2013-14 and in 2016-2017, it was increased to Rs 8100 crore. We urged the scientific community not to fall prey to a false campaign devoid of facts and against science and scientists in India," he said.

India spent about 0.88 per cent of its GDP on research and development in 2011-12, compared to US's 2.79 per cent and South Korea's 3.36 per cent.

The march — held in Bengaluru, Mysore, Pune, Lucknow and other cities — was initiated by breakthrough-india.org, a science portal, Sule said. But the cities had their separate chapters which organised the protests, he said.

The Institute of Genomics and Integrative Biology (IGIB), under CSIR, Ministry of Science and Technology, had sent out an email asking its scientists not to attend the march.

When contacted, IGIB Director Sanjay Kumar said this was done because of security concerns.

"Some scientists wrote to me asking for my permission to participate in the march. How will I allow them to participate when there is a mob? It was done due to security concern," Kumar said.

On April 22, 2017, more than one million people in over 600 cities around the world participated in a similar protest.

SCIENTISTS TAKE OUT MARCH; WARN AGAINST "PSEUDO-SCIENCE"

On a day when a mammoth rally of Maratha community hogged all media attention in the city, a small group of scientists and rationalists also marched, seeking deepening of scientific spirit among people as well as policy-makers.

Over 200 scientists and rationalists took out 'March for Science' from the historical August Kranti Maidan to Bharatiya Vidya Bhawan in south Mumbai as a part of a national campaign.

Participants appealed the government to encourage scientific temper and uphold the spirit of enquiry, address lack of appreciation of science in the society, and boost funding for education and scientific research.

"In the last year or so, we are seeing repeated assaults on reason. We think a basic perception of science is needed in everyone," said Arnab Bhattacharya, professor of physics at the Tata Institute of Fundamental Research (TIFR).

People as well top policy-makers sometimes confuse mythology with science, he said.

"This is very dangerous. We welcome all kinds of inquiry, but we should understand that science is global and our country should not become a laughing stock for the world," he said, pointing out claims such as ancient Indian 'advances' in plastic surgery or aviation.

Another scientist, associated with a premier educational body, said the funding for tuberculosis research had decreased, while that for cowsheds ("gow-shalas") had increased.

Similar marches were held in over 20 cities today, modelled on the ones held in the US against President Donald Trump's policies.

While in the US it is about Trump administration's stand against the science of climate change, in India the problem is "stress on pseudo-science and cow urine," said another scientist who participated in the march.

Apart from scientists from TIFR and IIT Bombay, people from Mumbai University, Institute of Chemical Technology, St Xavier's College, Maharashtra Andhashraddha Nirmulan Samiti (Maharashtra anti-superstition committee) and the Tata Institute of Social Sciences took part in the march.

AVOID EARLY INTRODUCTION TO BOVINE MILK, MOTHER'S MILK BEST FOR NEWBORNS: EXPERTS

Early introduction to cow or buffalo milk may lead to several health complications in newborns, say experts who maintain there is no substitute to breastfeeding as mother's milk is the best source of nutrition for a baby.

In several households, especially in urban areas, mother's are unable to breastfeed their child due to various reasons including lack of motivation, ignorance, work pressure and work places being not equipped with facilities, they said.

In India, a positive trend has been observed in breastfeeding practices over the last decade. According to the National Family Health Survey-IV, 55 per cent of the infants are exclusively breastfed for the first six months.

According to Dr Bernd Stahl, R&D Director of Human Milk Research at Nutricia Research in Utrecht, the Netherlands, the mother's milk is an orchestra of benefits having all nutrients that are required by the infant to achieve optimal growth, brain and cognitive development.

It also helps fight infections and illnesses like diarrhoea, allergies and asthma, among others.

"Breastfeeding also has a positive impact on mothers. Women who breastfeed have a reduced risk of ovarian and breast cancers and metabolic and cardiovascular diseases. It also helps in postpartum weight loss," Dr Stahl said.

According to Dr Raghuram Mallaiah, director of neonatology at Fortis La Femme, which also runs the not-for-profit Breastmilk Foundation here, cow or buffalo milk for newborns should be avoided.

"People generally think that cow or buffalo milk can be a substitute for mother's milk, which is not true. Bovine milk has a high protein content called Casein which is a much more heavier molecule for the baby to digest, causing an extra pressure on kidneys.

"Also, once pasteurised, cow milk loses all the micro-nutrients like iron, zinc and iodine," he said, adding that it should be introduced only after first year.

AIIMS head of paediatrics Dr V K Paul said some families wrongly believe that mother's milk alone is not enough to provide required nutrition to the newborn and choose to supplement it with bovine milk.

"Mother's milk is such a fortified diet that it is enough to provide required nutrition for a baby. The infant intestine is not properly equipped to digest non-human milk, and this may result in diarrhoea, allergies, intestinal bleeding, malnutrition and obesity among babies," Paul said.

Cow's milk allergy is the most common food allergy in young children, Dr Nandan Joshi, head of nutrition science and medical affairs at Danone India said.

The food allergy usually establishes in the first six months of life and a majority of the affected-children have one or more symptoms involving one or more organ systems, mainly the gastrointestinal tract and/or skin.

He said cow's milk allergy is generally outgrown during early childhood. Children at risk of not resolving the problem are those who have multiple food allergies, or concomitant asthma and allergic rhinitis.

"Avoidance of cow's milk protein in any form is the only available treatment," Joshi said.

Meanwhile, as the government is making all efforts to encourage breastfeeding among mothers, infant formula's available in market claim to be an alternative to breast milk.

Although cow's milk is the basis of almost all infant formula, to reduce the negative effect on the infant's digestive system it undergoes processing to be made into an infant formula, Dr Bernd said.

"This includes steps to make protein more easily digestible and alter the whey-to-casein protein balance to one closer to human milk, the addition of several essential ingredients like vitamins, minerals, nucleotides and the partial or total replacement of dairy fat with fats of vegetable or marine origin," Dr Bernd said.

According to WHO recommendations, infants should be exclusively breast fed for the first six months, followed by introduction of complementary feeding at six months along with continued breast feeding up to two years or longer.

The India Newborn Action Plan, developed by the Ministry of Health, is targeting a 75 per cent rate of initiation of breastfeeding within an hour of birth by 2017 and 90 per cent by 2025.

Nearly one lakh children die every year in India due to diseases that could have been prevented through breastfeeding, according to a UN report which said mortality and other losses attributed to inadequate breastfeeding could cost the country's economy USD 14 billion.

INDIA'S NAVIC SATELLITE NAVIGATION SYSTEM TO RIVAL US-MADE GPS

To ensure that strategic and crucial sectors are not dependent on US-made GPS, India today took a major step towards indigenisation as ISRO's regional positioning system 'NAVIC' will now rely on Indian atomic clocks.

ISRO's ISTRAC cell and the National Physical Laboratory have signed an MoU under which the latter will help authenticate precise timings for the space agency, crucial for its satellites, and also end its dependence on American GPS.

The NPL, an institute under the Council of Scientific and Industrial Research (CSIR), is one of oldest in the country, founded before India's independence, and provides high precision Indian Standard Time (IST), through its atomic clocks.

These atomic clocks are synchronised with the atomic clock of the International Bureau of Weights and Measures (BIPM), France, which provides the Universal Time Coordinated (UTC) to the world.

There are some 400 atomic clocks in the world and India has 4-5 of them. These clocks are so precise that the margin of error in their functioning is just of a second in 100 million years.

Such high precision timings, where nanoseconds also matter, are very crucial for ISRO's satellites.

The space agency is working to build its own Indian version of GPS - the NAVIC - and has launched its own Indian Regional Navigation Satellite System (IRNSS).

"The accuracy of satellite navigation system depends on the proper synchronisation of on-board clocks and at least four satellites are needed to know someone's position accurately," said V V Srinivasan, the Director of ISRO Telemetry and Command Network (ISTRAC).

ISRO also maintains its own atomic clocks, but the traceability for this was being provided by the GPS, which is linked to the BIPM in France.

Elucidating the significance of the development, ISRO scientists cited an instance during the Gulf War when the US deactivated the GPS system over the Middle East.

"The long-term plan is to emphasis on using NAVIC in India. For that, we cannot rely on the GPS. The MoU will put an end to our dependence on the GPS and rely on our indigenous services," an ISRO scientist said on condition of anonymity as he was not authorised to talk to the media.

373 INDIAN SCIENTISTS FROM FOREIGN INSTITUTES RETURNED HOME BETWEEN 2014-16: GOVT

Over 350 Indian scientists gave up jobs in reputed foreign institutions between 2014 and 2016 to return to work for domestic establishments, the government today informed the Lok Sabha.

Of 373 scientists who have returned to India under different programmes, 125 have been absorbed in different institutions.

The information was shared in a written response to a question in the Lok Sabha by Y S Chowdary, Minister of State in the Science and Technology Ministry.

Under the Ramanujan Fellowship scheme, 123 scientists returned to India between 2014 and 2016, of whom 52 have been absorbed.

The fellowship is meant for "brilliant scientists and engineers" from all over the world to take up scientific research positions in India.

Under the Ramalingaswami re-entry fellowship, 109 scientists have returned home and 55 have been absorbed while under the Inspire Programme, 141 scientists have chosen to come back home with 18 being absorbed.

The Ramalingaswami Re-entry Fellowship, under the ageis of the Department of Biotechnology, seeks Indian scientists to work in the field of biotechnology.

The Inspire fellowship scheme is applicable to basic and applied sciences as well as medicine and agriculture.

Apart from this, the Department of Science and Technology (DST) has also launched the VAJRA (Visiting Advanced Joint Research) Faculty scheme in June this year.

This scheme is exclusively for overseas scientists and academicians with emphasis on Non-Resident Indians (NRIs) and Persons of Indian Origion (PIO) and Overseas Citizens of India (OCI).

Under this scheme, scientists can work for a specific period of time in Indian public-funded academic and research institutions.

DST secretary Ashutosh Sharma said these schemes are aimed to address the "brain drain" and attract Indian talent back to their homeland.

PM1 SILENTLY LURKS IN LUTYENS' SEEMINGLY CRISP AIR: STUDY

It would perhaps be wise to junk the perception that Delhi's Lutyens zone with its wide tree- lined boulevards is less polluted than the city's peripheral areas which are visibly dusty.

A study has found a substantial presence of PM1 ultrafine particulates in the Lodhi Road area. These particulates are finer and potentially more harmful than the PM2.5 and PM10 particles which have a larger presence in the capital's air in terms of volume.

The monitoring station of the System of Air Quality and Weather Forecasting And Research (SAFAR) has recorded that the average volume of PM1 during summer, winter and the monsoon remain around 46, 49 and 20 micrograms per cubic metre respectively.

However, it has not attracted much attention till now as the safe standards of PM1 have not been defined yet, in the absence of which its potentially harmful effects have not been documented, scientist Gufran Beig, the project director of SAFAR, told PTI.

Presently, only SAFAR, which comes under the Ministry of Earth Sciences, monitors PM1 in the national capital.

"Globally you may not have a standard but PM1 is considered the most dangerous among all particulate matter, particularly because of its size. It measures around 1 micron or less in diameter. So it can enter deep into lungs and bloodstream," chief of CSE's air lab, Anumita Roychowdhury, said.

World over, scientists are yet to define standards using which one will be able to say in clear terms that PM1 above a certain limit can cause harm to the respiratory system as in the case of PM2.5 and the more coarser PM10.

The prescribed 24-hour-average of PM2.5 is 60 micrograms per cubic metre while the same is 100 in case of PM10 in India and anything beyond that sets the alarm bells ringing.

But in the absence of any major source of pollution, why is the air in the Central Delhi area, with its lush greenery and manicured landscape, teeming with these particulates?

The answer may lie in the fact that PM1 is a major product of vehicular combustion. And the roads in and around the Lodhi Road area like other parts of Lutyens see a huge flow of vehicles.

"The tinier the particle, the greater its share would be from combustion sources. If you profile the particulate matter emitted by diesel vehicles, more than 90 per cent would measure less than 1 micron," Roychowdhury said.

She said globally, governments are focusing on control measures at the source level of these particulates to eliminate them as far as possible, which will get a boost in India following the introduction of BS VI compliant vehicles in 2020.

"Under the BS IV emission standards, level of particulates are measured as gram per kilometre per vehicle. In case of BS VI, apart from the current mechanism, particulate matter coming out from a vehicle will also be measured. That is needed to ensure that diesel vehicles are equipped with particulate traps," she said.

RENOWNED SCIENTIST P M BHARGAVA PASSES AWAY

Renowned scientist Pushpa Mitra Bhargava, the founder director of CSIR-Centre for Cellular Molecular Biology (CCMB) here, who returned his Padma Bhushan award two years ago in protest against the NDA government's stance towards liberal ethos in the country, died. He was 88, CCMB sources said.

The scientist, popularly known as P M Bhargava, had been suffering from multiple health problems for some time now. He passed away around 6 PM, they said.

Bhargava, a reputed molecular biologist, is survived by a son and a daughter, they said.

Expressing deep sadness over Bhargava's demise, a release issued by the staff of the CCMB said it was his vision and pioneering efforts that led to the establishment of the CCMB in 1977 as an institution for research in basic biology.

Bhargava is a pioneer in the field of biotechnology in the country and he was instrumental in setting up a separate department for biotechnology (DBT) in the Union Ministry of Science and Technology in the 1970s, according to his portal linked to CCMB's website.

Bhargava held various positions, including the vice-chairman of the national knowledge commission during 2005-07. He is recipient of over 100 national and international honours and awards, including the Padma Bhushan in 1986 and the Legion d'Honneur in 1998 from then President of France, it said.

Born in Rajasthan's Ajmer, Bhargava studied at Theosophical College, Lucknow and Queen's College, Varanasi and completed his BSc in 1944 in Physics, Chemistry and Mathematics.

He obtained his MSc in organic chemistry in 1946. He received his PhD in synthetic organic chemistry from the Lucknow University at the age of 21, it said.

Bhargava went to the USA in 1953 and worked as a project associate at a laboratory for cancer research. He played an active part in the discovery of 5-fluorouracil, an anticancer drug, it said. He worked at different research institutions in United Kingdom and France.

He was instrumental in pioneering research in the field of Biology and published numerous papers.

In 2005, he initiated and played a major role in drafting the Indian Council for Medical Research's (ICMR) national guidelines for accreditation, supervision and regulation of Assisted Reproductive Technology (ART) clinics in India, according to the portal.

Bhargava had been a critic of the government policies. He served as a member in the National Security Advisory Board and was a nominee of the Supreme Court of India on the Genetic Engineering Appraisal Committee (GEAC) of the Union government.

He had opposed the approval of GM in India and called for a moratorium of at least 15 years on genetically modified crops in the country, it said.

Bhargava had returned his Padma Bhushan award in 2015 in protest against the alleged intolerance in the country thus facing flak from various quarters.

"I have decided to return the award. The reason is that the present government is moving away from the path of democracy, moving towards the path of making the country Hindu religious autocracy just like Pakistan. This is not acceptable... something I find unacceptable," he had said then.

Last month, two other eminent scientists - Yash Pal and U R Rao - have passed away.

REPLENISHMENT OF GROUNDWATER STORAGE AT REGIONAL SCALE

Amid concern over dwindling groundwater resources in India, a research team from IIT Kharagpur in collaboration with NASA scientists have reported regional-scale groundwater storage (GWS) replenishment through long-term observations.

The long-term (1996-2014) observations by the researchers used more than 19,000 groundwater observation locations, ground-based measurements and decadal-scale (2003-2014) satellite-based groundwater storage measurements all over the country.

IIT Kharagpur has issued this information quoting the research as reported by Nature Scientific Report this month.

The dwindling groundwater resource of India has been of great concern in recent years with almost 60 per cent of the country being regarded as water stressed.

Both the Centre and state governments over the years has undertaken several projects to replenish ground water through efficient ground water management and utilisation policies.

However, the effects were not known until now. For the first time, researchers from India and abroad have given positive confirmation on the replenishment of groundwater storage at regional scale.

Lead author Dr Soumendra Bhanja noted that in recent times, large parts of the country reels through severe water crisis during every summer.

It has been said that India, has been the largest consumer of global groundwater, is going through a 'groundwater drought', with every possibility that the drought may continue and aggravate in impending future.

This pervasive, unregulated abstraction for enhanced irrigation of water-intensive cultivation is resulting to one of the most rapid and drastic groundwater depletion in human history.

"Our study shows that recent paradigm shift in the Indian groundwater withdrawal and management policies for sustainable water utilisation, probably have started replenishing the aquifers by increasing storage in western and southern parts of India," said research lead Prof. Abhijit Mukherjee from IIT Kharagpur.

The team used numerical analysis and simulation results of groundwater management policy change effect on groundwater storage changes in western and southern India for this study.

Dr Matthew Rodell, NASA Chief of Hydrological Sciences Laboratory helped in interpreting the NASA satellite (GRACE) data (2003-2014) of groundwater storage changes in India for this study.

Prof Mukherjee pointed out at the recent changes in Indian policies (both by the Centre and state governments) on groundwater withdrawal and stress on management strategies, such as restriction of subsidised electricity for irrigation, separate electricity distribution for agricultural purpose etc.

"We have been able to demonstrate the initial scenarios of rejuvenating groundwater in parts of the India that optimistically has the potential to eventually become the largest groundwater replenishment occurrence in the human history," added Prof Mukherjee.

"INDIA MARCH FOR SCIENCE" RALLY IN CITY

Researchers, scientists and students of premier institutions today marched in the city today demanding better

allocation of funds for science education and research. The rallyists joined their counterparts in other cities of the country where similar 'India March for Science' rally was taken during the day.

"We demand allocation of 3 per cent GDP for S&T and 10 per cent of GDP for overall education on an immediate basis," Dr Nilesh Maity, Convenor Kolkata Organising Committee 'India March for Science' told reporters as the rally began from Rajabazar Science College.

The rallyists, who included scientists and students of Calcutta University, Jadavpur University and various other institutions, also advocated for drafting of an education system that moulds scientific ideas among students.

The rally culminated at Esplanade at the heart of the city. On April 22, people had taken part in 'March for Science' rally in around 600 cities in the world.

"Today's rally was in continuation of that global campaign," JU professor Goutam Maity said.

ISC SCIENCE STUDENTS WILL HAVE TO STUDY ENTIRE SYLLABUS

ISC candidates will have to study the entire syllabus of a particular science paper with the Council for Indian School Certificate Examinations (CISCE) changing the question-paper pattern for all science subjects from 2018.

Nabarun De, General Secretary, Association of Heads of ICSE Schools in West Bengal, told PTI here today, "To our knowledge the CISCE will make changes in the science papers from 2018 so that a student will have to study the entire syllabus and not be selective."

"This will help them in making better preparations for engineering and medical entrance tests where they have to study extensively and not selectively. This is important for their future," De said.

When contactedv Gerry Arathoon, chief executive and secretary of CISCE said, "We had always sought to ensure comprehensive learning by the students. We always want the students study the entire syllabus."

IVORY SKELETON FOR TRAVANCORE KING TO STUDY ANATOMY

At a time when western treatment methods were not popular here, a ruler of the erstwhile princely state of Travancore got a human skeleton carved out of ivory to study anatomy and osteology over a century ago.

As social customs barred him from "touching" corpses and bones, Uthram Thirunal Marthanda Varma, the then King, who had a great affinity for English medicines and treatment system, got the replica of human skeleton made from ivory in 1853.

Created by a craftsman from Travancore, the skeleton, having astonishing similarity with original human skeleton and impeccable perfection in its measures, is now kept on display at the Natural History Museum on the zoo campus here.

Museum authorities say that a research is underway to ascertain the identity of the skilled craftsman who carved the ivory skeleton with "so much precision and still remains an unsung hero in the annals of history".

The museum's records showed that the model was "executed in 1853 by local workmen under commands of His Highness Uthram Thirunal Marthanda Varma Maharaja for scientific study".

The younger brother of visionary King Swathy Thirunal, Uthram Thirunal, who had ruled Travancore during AD 1846-60, had a great fancy for the European style, fashion, dress, occupation, furniture, amusements, medicines and treatment system since infancy.

According to historian Malayinkeezhu Gopalakrishnan, the ivory skeleton can be viewed as a monument of the evolution and spread of the English treatment system and medicines in the tiny princely state.

It can also be viewed as a fine example of Travancore's exemplary legacy in ivory craftsmanship which had even amused the British, he said.

"Uthram Thirunal is considered as the person who had popularised the English treatment system in Travancore ... He had devoted great time in studying the medical science and imported medicines and latest medical devices from England and other parts," Gopalakrishnan told PTI.

"However, the prevailing social customs had created hurdles for him to pursue his interest to study human anatomy and osteology ... To overcome the obstacle and continue his study, he had got made this ivory skeleton," he said.

It is believed that the skeleton was sculpted based on an actual skeleton, brought from Madras, he said.

Natural History Museum Superintendent S Abu said the ivory skeleton has always kindled a special interest among doctors and medical experts who visit the museum.

"The ivory skeleton was made in such a meticulous way.. experts see it as an excellent mix of science and craftsmanship ... We are now on a mission to figure out the unidentified craftsman who created this," he told PTI.

It is expected to be highly helpful for the posterity in studying the history and legacy of Travancore, the official said.

Besides the ivory skeleton, the historical records also showed several other examples of Uthram Thirunal's interest and knowledge in the Western treatment system and its practice.

Travancore Diwan Peishcar, P Shungoonny Menon recorded that Uthram Thirunal had even run a private dispensary, where he treated people, carried out minor surgical operations,

vaccinated his palace attendants with his own hands and distributed English medicines when he was the 'elaya raja' (prince).

He also set up a laboratory which had various apparatus and chemicals purchased from other parts of the globe, the records said.

In his book "A History of Travancore," Menon noted that his friendship with the then residency surgeon, Dr Brown, had helped 'elaya raja' study medical science.

"His Highness was inclined towards studying the doctor's profession and seeing the intelligence and aptitude of the prince, that gentleman (Dr Brown) most willingly undertook to teach the science of medicine to this knowledge-seeking scion of royalty; and in the course of this study, the cognate branches of chemistry and anatomy was also taught," he said.

Even after Dr Brown left for England after some time, the prince indulged in self-study by procuring and reading the works of eminent authors. Records showed that he procured medicines from Durbar physician's dispensary and used for treating his own attendants and their families.

He also placed orders for medicines from the Madras and Bombay presidencies and brought it from even England.

"Every new medicine, discovered and advertised in the newspapers, was procured and in the course of a few years, a large room, which had been converted into a private dispensary being found insufficient, a separate building was constructed on an enlarged scale to provide the necessary accommodation," Menon said. The arrangements at the dispensary won the admiration of even Europeans.

With the prince spending a large amount of time at his dispensary, people, especially belonging to the Hindu community, preferred this institution to government charity hospital.

It is interesting to note that though upper class Namboothiri Brahmins would not even touch English medicines under the idea that most of the liquid substance contained spirits, they began to take them freely from the prince's dispensary.

Brahmins, who visited Travancore as part of various religious ceremonies, spread the news of the prince's medical knowledge and the virtues and effectiveness of European medicines in Malabar (north Kerala) and other neighbouring princely states.

The royal's dispensary was the only resort of outside state Brahmins for medical aid while coming for Murajapam, an auspicious ritual conducted in Sree Padmanabha Swamy Temple here every six years.

Records also showed that Utram Thirnal successfully treated his brother and the then king Swathy Thirunal, when he suffered from diarrhoea.

A three-month-long treatment under him also cured the chronic dyspepsia of a 'Gouda Brahmin Sastri', who came here for Murajapam from Benaras, it said.

The prince's laboratory had glass retorts, boilers, evaporating dishes, crucibles of different kinds, and many other things necessary for conducting chemical experiments.

There was also a powerful electric machine, a galvanic battery, an air pump, an ice-making machine besides several kinds of optical instrument, such as stereoscopes of various sorts, telescopes of sizes and opera glasses, it added.

INDIAN SCIENTISTS USE TINY BUBBLES TO DRAW PLASTIC CIRCUITS

In a first, Indian scientists have found a way to use micro-bubbles to draw complex plastic circuits with lasers, an advance that may lead to low-cost flexible electronic devices.

Solution-printed electronics is one of the fastest growing areas in the industry primarily due to its very low cost and flexibility, researchers from the Indian Institute of Science Education and Research (IISER) in Kolkata said.

It is mostly based on conducting plastics, that are doped to increase conductivity.

The process of synthesising, doping and designing circuits separately is often complex and time consuming.

For the first time, scientists led by Ayan Banerjee and Soumyajit Roy from IISER Kolkata, have developed a simple and inexpensive technique to simultaneously synthesise and pattern conductive polymers on a glass surface in a matter of minutes.

They exposed a solution of charged metal oxide, known as soft oxometalate (SOM) and organic molecules in a glass chamber to optical tweezers - a tightly focused laser.

Absorbing the beam, oxometalate stuck to the chamber surface to form a micro-bubble around which the metal oxide and organic molecules assembled themselves to form conductive polymers.

"This patterning technique was discovered somewhat serendipitously when one of my graduate students was working with SOMs in optical tweezers and noticed these bubbles grow unexpectedly," Banerjee, associate professor at IISER Kolkata, told PTI.

Bubbles in optical tweezers often occur when the tightly focused laser hits some accumulated material which partially absorbs the light, so that the local temperature increases very rapidly.

However, these also can be dispensed easily by just redirecting the laser or shutting it off.

"In the case with the SOMs, the student observed that when he tried to move the laser away, the bubble followed it, and in the process generated a pattern in its wake," Banerjee said.

"We then proceeded to unravel this mystery, and in the process understood the phenomenon, which took more than a year," he said.

"The research revealed fascinating explanations, which then led to us think of various applications," he added. This method can be used for complex electronic circuits which are useful for fabricating electronic devices such as micro-capacitors.

According to Roy, associate professor at IISER Kolkata, the method is cheaper and much easier than several existing technologies.

"The method can even be used to make biodegradable flexible plastic circuits," Roy said.

IIT SCIENTISTS DEVELOP SILK MATS THAT COULD TREAT ARTHRITIS

Scientists from IIT Guwahati have synthesised mats made of silk-proteins and bioactive glass fibres that they believe can assist the growth of bone cells and repair worn-out joints in arthritis patients.

The disease most commonly affects joints in the knees, hips, hands, feet, and spine and is marked by the breakdown of joint cartilage and underlying bones. Left untreated, it can cause severe pain, swelling, and eventually limited range of movement.

"Current clinical treatment methods are limited by lack of viable tissue substitutes to aid the repair process," Biman B Mandal from Indian Institute of Technology Guwahati (IITG) told PTI.

To develop a suitable tissue substitute, scientists, including those from the University College London in the UK, looked into the natural bone-cartilage interface and tried to mimic it synthetically in lab conditions. Knee osteoarthritis is the most common bone and joint disease in India. However, Mandal pointed out that the available clinical grafts were expensive.

"We used silk, a natural protein to fabricate electrospun mats to mimic the cartilage portion and bioactive glass to develop a composite material, similar to the natural tissue," said Mandal.

For the mat, scientists used a kind of silk easily available in North-east India.

"Muga (Assam) silk is endowed with properties that enhance the healing process," he said.

The researchers adopted a green fabrication approach for the developing the silk composite mats - electrospinning.

"It is similar to knitting, except that it utilises electric high voltage force to draw ultrafine fibres," Mandal said.

A layer by layer approach was followed, where the bone layer was first formed, on top of which the cartilage layer was developed. The resulting composite mat resembled the architecture of the bone-cartilage interface. To assist the regenerative process, the mats would be grafted in the defected joint with cells harvested from the patient.

"The mats bond with the native tissue and acts as an artificial tissue construct. Eventually the mats degrade with time and new tissue is formed in its place," Mandal said.

The mats were tested under laboratory conditions, where artificial tissue formed efficiently during the two weeks of the study, researchers said.

However, the mats need to be tested in suitable animal models like rabbits and pigs, and finally in human trials, before they become available to patients.

SMARTPHONE APP CAN PREDICT DISEASE RISK BASED ON HEALTH INPUTS

A new smartphone app, developed by a Gurgaon-based start-up, can provide 'smart reports' that may predict the user's risk of diseases and expose hidden disorders based on their symptoms and lifestyle inputs.

The app, called Healthians, allows users to log their basic body vitals like blood pressure, weight and sugar levels as well as maintain a depository of all their test reports for future reference. The app then analyses the data for abnormal parameters, and recommends the future course of required action, including suitable medical specialist to consult and additional tests,if needed.

"With pathology checkups, understanding a medical report and its implications on one's health has always been a challenge," said Deepak Sahni, CEO and Founder of Healthians.

"With the Healthians app, this difficulty is addressed and people can now at a click of a button get deep insights into their health," Sahni told PTI.

The smart report feature helps uncover latent diseases and predict risk of future ones and to expose any latent ones. It recommends lifestyle and dietary changes based on the user's investigations, symptoms and lifestyle inputs.

Patients will be able to review their medical conditions and reach their treatment goals much faster, dramatically lowering the risks of serious health complications.

"The smart report is meant to empower users with a fore- knowledge of possible health risks and to effectively manage chronic diseases," said Sahni.

"Any decision regarding our health is best taken in an informed manner. Healthians app is exactly that channel of reliable information," he added.

Diseases are predicted based on the patients' health check-up report values of different parameters along with their age, lifestyle habits, symptoms and family medical history, Sahni said.

Along with symptoms we take lifestyle habits, age, gender and patients medical history into account to eliminate the chances of making a wrong diagnosis, he said.

To ensure any such misinterpretations, free doctor and dietician consultation is provided. We give a clear disclaimer to the user that these are system generated recommendations only. For an accurate diagnosis, user is encouraged to visit a particular specialist.

NEW SYSTEM MAY IMPROVE DIAGNOSES OF CHRONIC DISEASES

Scientists, including one of Indian origin, have developed a new system that could make it easier and less expensive to diagnose chronic diseases, particularly in remote areas without expensive lab equipment.

The technology created by researchers at University of California, Los Angeles (UCLA) in the US uses simple optical hardware and a lens-free microscope, as well as sophisticated algorithms that help reconstruct the images of tissue samples.

It could make much-needed diagnostic testing available and affordable for people in developing countries and remote areas that lack the expensive lab equipment currently used to perform tissue biopsies, researchers said.

Tissue biopsy is widely considered the gold standard for detecting diseases like cancer and inflammatory conditions.

However, the test is relatively expensive and complex, and it requires the use of sophisticated facilities - a serious challenge in regions with limited resources.

"Although technological advances have allowed physicians to remotely access medical data to perform diagnoses, there is still an urgent need for a reliable, inexpensive means for disease imaging and identification - particularly in low- resource settings - for pathology, biomedical research and related applications," said Aydogan Ozcan, professor at UCLA.

The researchers, including Rajan Kulkarni, an assistant professor at UCLA, prepared tissue samples using a technique called Clarity, which makes tissue transparent, or "clears" it, using a chemical process that removes fat and leaves behind proteins and DNA.

The method typically requires fluorescent dyes, which can be costly, to stain the tissue samples, but one drawback of those dyes is that the staining tends to degrade over time, making it harder for scientists to gather information from it.

Instead, the researchers used coloured, light-absorbing dyes which can be used with regular microscopy tools without any noticeable signal loss over time, said Kulkarni.

The scientists developed a new device made of components that collectively cost just a few hundred dollars: a holographic lens-free microscope capable of producing 3D pictures with one-tenth the image data that conventional scanning optical microscopes need to do the same thing.

The method also allowed the scientists to use tissue samples that were 0.2 millimetres thick, more than 20 times thicker than a typical sample - a critical benefit of the new system because producing thinner tissue slices is difficult without sophisticated equipment, researchers said.

This also enables scientists to study a larger sample volume, which could help them to detect abnormalities earlier than they otherwise would.

The research was published in the journal Science Advances.

EMOJIS IN WORK E-MAILS MAY PORTRAY LOW COMPETENCE: STUDY

Using a smiley face emoji or similar emoticons in work-related e-mails may not create a positive impression and could actually portray low competence, a study suggests.

"Our findings provide first-time evidence that, contrary to actual smiles, smileys do not increase perceptions of warmth and actually decrease perceptions of competence. In formal business e-mails, a smiley is not a smile," said Ella Glikson, a post doctorate fellow at Ben-Gurion University of the Negev (BGU) in Israel.

Researchers conducted a series of experiments with a total of 549 participants from 29 different countries.

In one experiment, participants were asked to read a work-related e-mail from an unknown person and then evaluate both the competence and warmth of that person.

All the participants received similar messages. Some included smileys while others did not.

Researchers found that in contrast to face-to-face smiles, which increase both competence and warmth, the smileys in an e-mail had no effect on the perception of warmth, and in fact had a negative effect on the perception of competence.

"The study also found that when the participants were asked to respond to e-mails on formal matters, their answers were more detailed and they included more content-related information when the e-mail did not include a smiley," Glikson said.

"We found that the perceptions of low competence if a smiley is included in turn undermined information sharing," she said.

In another experiment, the use of a smiley was compared to a smiling or neutral photograph. The findings show that in case of a photograph, a smiling sender was perceived as more competent and friendly than a neutral one.

However, when an e-mail on formal work-related matters included a smiley, the sender was perceived as less competent. The smiley did not influence the evaluation of the sender's friendliness, researchers said.

The team also found that when the gender of the e-mail writer was unknown, recipients were more likely to assume that the e-mail was sent by a woman if it included a smiley.

However, this attribution did not influence the evaluation of competence or friendliness.

"People tend to assume that a smiley is a virtual smile, but the findings show that in the case of the workplace, at least as far as initial 'encounters' are concerned, this is incorrect," Glikson said.

"For now, at least, a smiley can only replace a smile when you already know the other person. In initial interactions, it is better to avoid using smileys, regardless of age or gender," she added.

The study was published in the journal Social Psychological and Personality Science.

HIGHLY SENSITIVE BLOOD TEST FOR CANCER DETECTION DEVELOPED

Stanford scientists have developed alow-cost and highly sensitive blood test that may quickly detect cancer growth and spread.

The test called single colour digital PCR can detect genetic mutations in minute amounts of DNA released from cancer cells into the blood.

The highly sensitive test requires only a fraction of a tube of blood and can detect as few as three mutation-bearing molecules in a single reaction, researchers said.

It has the potential to be personalised to recognise mutations unique to any individual cancer, they said.

"For monitoring patient tumours, only a handful of blood tests are available which are limited to only several types of cancers," said Hanlee P Ji, associate professor at Stanford University in the US.

"Nearly all cancer patients require monitoring by whole body imaging, which can be costly, complex, and time- consuming.

"In contrast, molecular tests like the one we have developed will enable patients to be monitored at every visit, and thus have the potential for quickly tracking cancer growth and spread," said Hanlee.

The test's rapid turnaround and relatively low cost, especially compared to next-generation DNA sequencing, provide a potential opportunity for universal monitoring of more patients than is currently done, said Hanlee.

Researchers used the test to analyse samples from six patients. Five patients were previously diagnosed with colorectal cancer and one with cholangiocarcinoma or bile duct cancer.

After generation of customised mutation detection assays, the researchers were able to identify tumour-derived circulating DNA from three out of six patients.

In one patient, the assay was able to show the presence of three different mutations.

The three patients, whose samples did not show elevated cancer DNA, were undergoing active treatment at the time of collection.

The single-colour digital PCR test offers several advantages over other methods of circulating tumour DNA analysis, compared to next-generation targeted sequencing and fluorescent probe-based digital PCR assays.

The main advantage is that the new technique does not rely on pre-amplification, which can introduce errors and biases.

"This test is simple enough to set up and analyse without extensive training, and therefore, it can be implemented by anyone, making it highly accessible to any laboratory," said Christina Wood Bouwens from Stanford University.

"It has been truly motivating to work with a technology that will help transform the way that we monitor and treat individuals with cancer. I am excited to share our findings with the cancer research community," said Bouwens, lead author of the research published in The Journal of Molecular Diagnostics.

DEEP SLEEP MAY REINFORCE NEW MOTOR SKILLS: STUDY

Deep sleep can help the brain reinforce newly learnt motor skills that involve handling objects, Indian-origin scientists have found.

Researchers at University of California San Francisco in the US found that during non-rapid eye movement (REM) sleep, slow brain waves bolster neural touch points that are directly related to a task that was newly learned while awake, while weakening neural links that are not.

"This phenomenon may be related to the notion of 'extracting the gist' of how to perform a novel task. Sleep appears to reduce neural activity that is not related to a task we are in the process of learning," said Karunesh Ganguly, associate professor at UC San Francisco.

Researchers used a system known as a brain-machine interface (BMI) to better understand how the brain picks up new skills during sleep.

They implanted electrodes in the motor region of rats' brains to send electrical signals to a computer, which then drove movement of a detached mechanical device.

Since neural circuits are dynamic, the rats' brains rewired themselves to control this device just as swiftly as they would have if the rats were practising new ways to control their own limbs.

"A particular neuron may normally be devoted to controlling a limb, but we can create a new relationship of that neuron with an external disembodied device," said Tanuj Gulati, a postdoctoral scholar at UC San Francisco.

"A particular neuron may normally be devoted to controlling a limb, but we can create a new relationship of that neuron with an external disembodied device," said Gulati, lead author of the study published in the journal Nature Neuroscience.

Researchers connected neurons in rat brains to implanted electrodes, which controlled a mechanical waterspout. The source of water was behind a tiny door facing away from the mice.

Since the spout faced away, the rats had to learn to use a computer-driven mechanism to move it toward them. As the rats explored several strategies to control the spout, some of which included overt movements, they sometimes activated neurons adjacent to the electrodes.

When the proper neurons were activated, the computer moved the waterspout, researchers said.

"Eventually the rats learn to delink actual movements from the spout – they know they don't really need to flinch their arm or do anything to make it move," Gulati said.

"All they have to do is volitionally control the pipe and it will come to them," he added.

Researchers noted that once rats got the hang of the task while awake, certain neural patterns kept 'replaying' during sleep.

"This shows that you can not ignore sleep. Whether you are trying to do it in patients trying to regain movement control after a neural injury, or healthy individuals trying to learn a new skill," Gulati said.

INFLATABLE SPEEDBOATS MAY PROVIDE SMOOTH RIDES IN ROUGH WATERS

Scientists are developing an inflatable speedboat that absorbs the energy of waves to provide a smooth ride when travelling through choppy waters.

Researchers at Utah State University (USU) in the US have for the first time demonstrated the unique differences in water impact behaviour of rigid and elastic bodies.

"Rigid and elastic materials interact with the water surface quite differently," said Randy Hurd, a PhD candidate at USU and lead author of the study published in the Journal of Fluid Mechanics.

"When an elastic body impacts the surface, the material deforms and oscillates significantly which changes the water-impact physics compared to a rigid body," Hurd said.

Researchers used high-speed cameras to record elastomeric spheres dropping into a tank of water.

At 2,000 frames per second, the footage revealed the unique splash curtains and air-filled cavities that form after impact.

The group used the images to track the position and deformation of the elastic spheres to understand how energy transfers from the water to the material.

By analysing the results, researchers said that they can accurately predict the water interaction behaviour based on the type of soft material and its speed.

"Being able to predict water interaction from a materials perspective is an important first step in understanding which material types would be best for developing an inflatable watercraft capable of providing a smoother ride over a choppy surface," said Hurd.

WHY 'SPICY FOOD CHALLENGE' LEFT MAN TEMPORARILY DEAF DECODED

Scientists have explained why eating extremely spicy food caused a video blogger to go temporarily deaf for two minutes after he participated in an online challenge to eat hot "death noddles" in Indonesia.

"The pain went all the way up to my ears to the extent where they were blocked," said the video blogger Ben Sumadiwiria.

The noodles Sumadiwiria ate were made with 100 bird's eye chilies or Thai chilies. These small, red chilies have between 100,000 and 225,000 heat units on the Scoville scale used to measure spiciness, making them 45 times hotter than a jalapeno

"I can not hear anything, man," he said in the video, shortly before dousing his head in cold running water.

"Consuming extremely high levels of capsaicin can even make the throat or mouth blister," Paul Bosland from New Mexico State University in the US told 'Live Science.'

Researchers said that the throat and ears are connected by conduits known as the Eustachian tubes, which help equalise pressure in the inner ear.

When the nose starts producing a lot of mucus it can block the Eustachian tubes, said Michael Goldrich, from Johnson University Hospital in the US.

"Then, as a response, people would feel that their hearing was down. It is the same phenomenon that makes the world sound wrapped in cotton batting when you have a bad cold," Goldrich said.

NEW BAT SPECIES RESEMBLES STAR WAR'S CHARACTER 'YODA'

An unusual breed of fruit bat - previously nicknamed 'Yoda' due to its resemblance to the Jedi Master in the popular Star Wars movies - has now officially been registered as a new species.

Discovered in a remote rainforest of Papua New Guinea, the bat's has been renamed the happy (Hamamas) tube-nosed fruit bat.

Its unusual features saw it affectionately referred to as the 'Yoda bat'.

However, after examining studies and some 3,000 specimens in 18 museums around the world, a researcher from the University of York in the UK has formally distinguished and registered the new species.

"The species is very difficult to tell apart from other tube-nosed bat species. Bat species often look similar to eachother, but differ significantly in behaviour, feeding and history, sais Nancy Irwin, research fellow in York's Department of Biology.

"Most of the morphological characteristics that separate this bat from other species are associated with a broader, rounder jaw which gives the appearance of a constant smile," said Irwin.

"Since most remote Papuans have never seen Star Wars, I thought it fitting to use a local name: the Hamamas - meaning happy - tube-nosed fruit bat," she said.

The happy tube-nosed fruit bat's formal name, Nyctimene wrightae, is after the conservationist Deb Wright, who devoted 20 years to building conservation programmes and long-term scientific capacity in Papua New Guinea.

Nyctimeninae were one of the first species of bat described in records dating back to 1769, and later in 1860 Alfred Russel Wallace - British naturalist and one of the fathers of evolution - collected two further species.

The bats' tube noses, bright colours, thick stripe on the back and spots have attracted attention for some 250 years, but researchers are still finding new hidden species in the group.

"There were no illustrations of the cyclotis group of bats which made identifying bats really difficult. So difficult was it that Papua New Guinea produced stamps illustrating the bats but could not allocate a species name," said Irwin.

"Now, with photographs, illustrations and a key of the other species in the group, it makes it possible to distinguish between three species of the group," she said.

"Taxonomy is often the forgotten science but until a species is recognised and has a name, it becomes difficult to recognise the riches of biodiversity and devise management," she said.

"Fruit bats are crucial to rainforest health, pollinating and dispersing many tree species, therefore it is essential we know what is there and how we can protect it, for our own benefit," she added.

NEW AI SMARTPHONE SYSTEM CAN IDENTIFY FAKE PRODUCTS

A new artificial intelligence (AI) algorithm that allows your smartphone to differentiate between genuine and counterfeit versions of the same product has been developed by a team of Indian-origin researchers in the US.

Researchers at New York University (NYU) in the US noted that fake goods represent a massive worldwide problem with nearly every high-valued physical object or product directly affected by this issue.

Some reports indicate counterfeit trafficking represents seven per cent of the world's trade today, researchers said.

While other counterfeit-detection methods exist, these are invasive and run the risk of damaging the products under examination, said researchers including Ashlesh Sharma.

The new method, by contrast, provides a non-intrusive solution to easily distinguish authentic versions of the product created by the original manufacturer and fake versions of the product made by counterfeiters.

It does so by deploying a dataset of three million images across various objects and materials such as fabrics, leather, pills, electronics, toys and shoes.

"The classification accuracy is more than 98 per cent, and we show how our system works with a cellphone to verify the authenticity of everyday objects," said Lakshminarayanan Subramanian, professor at NYU.

"The underlying principle of our system stems from the idea that microscopic characteristics in a genuine product or a class of products - corresponding to the same larger product line - exhibit inherent similarities that can be used to distinguish these products from their corresponding counterfeit versions," said Subramanian.

DRINKING TEA, RED WINE MAY PROTECT AGAINST FLU: STUDY

Drinking tea and wine may help prevent influenza, as a compound found in these beverages can boost the immune system, scientists say.

Researchers at Washington University in the US found that a particular gut microbe can prevent severe flu infections in mice, by breaking down naturally occurring compounds called flavonoids.

This strategy is effective in staving off severe damage from flu when the interaction occurs prior to infection with the influenza virus, researchers said.

Microbes that live in the gut do not just digest food. They also have far-reaching effects on the immune system, they said.

"For years, flavonoids have been thought to have protective properties that help regulate the immune system to fight infections," said Ashley Steed, from St Louis Children's Hospital in the US.

"Flavonoids are common in our diets, so an important implication of our study is that it is possible flavonoids work with gut microbes to protect us from flu and other viral infections," Steed said.

Flavonoids are commonly found in black tea, red wine and blueberries.

Previous studies found that the gut microbiome may be important in protecting against severe influenza infections, so in this study, researchers aimed to identify just what gut microbes might provide that protection.

It is not only having a diet rich in flavonoids, our results show you also need the right microbes in the intestine to use those flavonoids to control the immune response, researchers said.

"We were able to identify at least one type of bacteria that uses these dietary compounds to boost interferon, a signalling molecule that aids the immune response," said Thaddeus Stappenbeck, from University of Washington.

"This prevented influenza-related lung damage in the mice. It is this kind of damage that often causes significant complications such as pneumonia in people," Stappenbeck added.

The study was published in the journal Science.

ROBOTS BETTER THAN HUMANS AT HELPING WITH GUT SURGERIES: STUDY

Robot assisted esophageal surgeries are more effective and safe, according to the largest study of its kind.

Robotic technology gives surgeons a better view during surgery and lymph nodes can be removed without additional incisions on the patient, said researchers from Allina Health, a not-for-profit health care system, in the US.

"Very few centres have adopted robots for this procedure because of the technical difficulties and unique skills that are needed by the surgeons and the operating room staff," said Daniel Dunn, a retired surgeon at Allina, and the study's principle investigator.

"But the robotic arms can turn and twist and reach more places than human hands will ever be able to," Dunn added.

Researchers studied about 100 patients, most of whom had cancer, interpreted clinical and safety information and analysed survival data.

The study was published in the journal Diseases of the Esophagus.

HOW GOLDFISH MAKE ALCOHOL TO SURVIVE WITHOUT OXYGEN DECODED

Scientists have uncovered how the goldfish produce alcohol to survive harsh winters beneath frozen lakes, a remarkable ability that makes it one of the most resilient pets under human care.

Humans and most other vertebrate animals die within a few minutes without oxygen. Yet goldfish and their wild relatives, crucian carp, can survive for days, even months, in oxygen-free water at the bottom of ice-covered ponds.

During this time, the fish are able to convert anaerobically produced lactic acid into ethanol, which then diffuses across their gills into the surrounding water and avoids a dangerous build-up of lactic acid in the body.

Scientists at the University of Oslo in Norway and University of Liverpool in the UK found the molecular mechanism behind this highly unusual ability, which is unique among vertebrates and more commonly associated with brewer's yeast.

The team has shown that muscles of goldfish and crucian carp contain not just the usual one, but two sets of the proteins normally used to channel carbohydrates towards their breakdown within a cell's mitochondria - a key step for energy production.

While one set of these proteins appears very similar to that in other species, the second set is strongly activated by the absence of oxygen and shows a mutation that allows channelling of metabolic substrates to ethanol formation outside the mitochondria.

Further genetic analyses suggest that the two sets of proteins arose as part of a whole genome duplication event in a common ancestor of goldfish and crucian carp some eight million years ago.

"During their time in oxygen-free water in ice-covered ponds, which can last for several months in their northern European habitat, blood alcohol concentrations in crucian carp can reach more than 50 mg per 100 millilitres, which is above the drink drive limit in these countries," said Michael Berenbrink from the University of Liverpool.

"However, this is still a much better situation than filling up with lactic acid, which is the metabolic end product for other vertebrates, including humans, when devoid of oxygen," said Berenbrink.

"This research emphasises the role of whole genome duplications in the evolution of biological novelty and the adaptation of species to previously inhospitable environments," said Cathrine Elisabeth Fagernes, from the University of Oslo, lead author of the study published in the journal Scientific Reports.

"The ethanol production allows the crucian carp to be the only fish species surviving and exploiting these harsh environments, thereby avoiding competition and escaping predation by other fish species with which they normally interact in better oxygenated waters," said Fagernes.

"It's no wonder then that the crucian carp's cousin the goldfish is arguably one of the most resilient pets under human care," she said.

NOW, IDENTIFY FAKE PRODUCTS USING YOUR SMARTPHONE!

A new mechanism that uses algorithms and a smartphone to differentiate between genuine and counterfeit versions of the same product has been developed by a team of Indian-origin researchers in the US.

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with nearly every high-valued physical object or product directly affected by this issue.

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TRAPPIST-1 TWICE AS OLD AS OUR SOLAR SYSTEM: STUDY

The ultra-cool dwarf star of the intriguing TRAPPIST-1 planetary system is up to twice as old as our solar system, a study has found.

TRAPPIST-1 is a system of seven Earth-size planets orbiting an ultra-cool dwarf star about 40 light-years away.

In a new study, researchers found that the TRAPPIST-1 star is quite old: between 5.4 and 9.8 billion years.

This is up to twice as old as our own solar system, which formed some 4.5 billion years ago.

At the time of its discovery earlier this year, scientists believed the TRAPPIST-1 system had to be at least 500 million years old.

"Our results really help constrain the evolution of the TRAPPIST-1 system, because the system has to have persisted for billions of years," said Adam Burgasser, an astronomer at the University of California, San Diego in the US.

"This means the planets had to evolve together, otherwise the system would have fallen apart long ago," said Burgasser, first author of the research published in The Astrophysical Journal.

It is unclear what this older age means for the planets' habitability. On the one hand, older stars flare less than younger stars, and researchers confirmed that TRAPPIST-1 is relatively quiet compared to other ultra-cool dwarf stars.

On the other hand, since the planets are so close to the star, they have soaked up billions of years of high-energy radiation, which could have boiled off atmospheres and large amounts of water, researchers said.

The equivalent of an Earth ocean may have evaporated from each TRAPPIST-1 planet except for the two most distant from the host star: planets g and h, they said.

However, old age does not necessarily mean that a planet's atmosphere has been eroded, said Eric Mamajek, deputy programme scientist for NASA's Exoplanet Exploration Programme.

Given that the TRAPPIST-1 planets have lower densities than Earth, it is possible that large reservoirs of volatile molecules such as water could produce thick atmospheres that would shield the planetary surfaces from harmful radiation.

A thick atmosphere could also help redistribute heat to the dark sides of these tidally locked planets, increasing habitable real estate, researchers said.

"If there is life on these planets, I would speculate that it has to be hardy life, because it has to be able to survive some potentially dire scenarios for billions of years," Burgasser added.

DEVICES PRINTED ON CLOTH MAY LEAD TO SMART TEXTILES

Scientists have developed a technique to print batteries directly on cotton fabric using graphene, an advance that could power smart electronic textiles in the future.

The current hurdle with wearable technology is how to power devices without the need for cumbersome battery packs.

Devices known as supercapacitors are one way to achieve this. A supercapacitor acts similarly to a battery but allows for rapid charging which can fully charge devices in seconds.

Researchers from The University of Manchester in the UK developed a flexible supercapacitor device by using conductive graphene-oxide ink to print onto cotton fabric.

The printed electrodes exhibited excellent mechanical stability due to the strong interaction between the ink and textile substrate. Further development of graphene-oxide printed supercapacitors could turn the vast potential of wearable technology into the norm.

High-performance sportswear that monitors performance, embedded health-monitoring devices, lightweight military gear, new classes of mobile communication devices and even wearable computers are just some of the applications that could become available following further research and development.

To power these new wearable devices, the energy storage system must have reasonable mechanical flexibility in addition to high energy and power density, good operational safety, long cycling life and be low cost.

"The development of graphene-based flexible textile supercapacitor using a simple and scalable printing technique is a significant step towards realising multifunctional next generation wearable e-textiles," said Nazmul Karim, from the UK National Graphene Institute.

"It will open up possibilities of making an environmental friendly and cost-effective smart e-textile that can store energy and monitor human activity and physiological condition at the same time," said Karim.

Graphene-oxide is a form of graphene which can be produced relatively cheaply in an ink-like solution.

This solution can be applied to textiles to create supercapacitors which become part of the fabric itself.

"Textiles are some of the most flexible substrates, and for the first time, we printed a stable device that can store energy and be as flexible as cotton," said Amor Abdelkader, from University of Manchester.

"The device is also washable, which makes it practically possible to use it for the future smart clothes. We believe this work will open the door for printing other types of devices on textile using 2D-materials inks," said Abdelkader.

'WHATSAPP, FACEBOOK MESSENGER LEAVE USERS VULNERABLE TO FRAUD'

Popular messaging apps Facebook Messenger and WhatsApp leave people exposed to fraud or hacking because users do not know how to use important security options, scientists have warned.

"We wanted to understand how typical users are protecting their privacy," said Elham Vaziripour, PhD student at the Brigham Young University in the US.

Even though WhatsApp and Viber encrypt messages by default, all three messaging apps also require an authentication ceremony to ensure true security.

However, since most users are unaware of the ceremony and its importance, "it is possible that a malicious third party or man-in-the middle attacker can eavesdrop on their conversations," said Vaziripour.

The authentication ceremony allows users to confirm the identify of their intended conversation partner, and makes sure no other person - even the company providing the messaging application - can intercept messages. In the first phase of a two-phase experiment, the research team prompted study participants to share a credit card number with another participant.

Participants were warned about potential threats and encouraged to make sure their messages were confidential.

However, only 14 per cent of users in this phase managed to successfully authenticate their recipient.

Others opted for ad-hoc security measures like asking their partners for details about a shared experience.

In the second phase, participants were again asked to share a credit card number, but in this round researchers emphasized the importance of authentication ceremonies.

With that prompting, 79 per cent of users were able to successfully authenticate the other party.

Despite the drastic climb, however, researchers discovered another significant hurdle: participants averaged 11 minutes to authenticate their partners.

"Once we told people about the authentication ceremonies, most people could do it, but it was not simple, people were frustrated and it took them too long," said Daniel Zappala, professor at BYU.

Since most people don't experience significant security problems, it is hard to make a case for them investing the time and effort to understand and use security features that applications offer.

2016 WAS HOTTEST YEAR ON RECORD: NOAA

2016 was the hottest year on record for Earth, making it the third consecutive year to break global temperatures records of the last 137 years, US climate scientists have confirmed.

Last year's record heat resulted from the combined influence of long-term global warming and a strong El Nino early in the year, according to the State of the Climate in 2016 report by the US National Oceanic and Atmospheric Administration (NOAA).

The report found that the major indicators of climate change continued to reflect trends consistent with a warming planet. Several markers such as land and ocean temperatures, sea level, and greenhouse gas concentrations in the atmosphere broke records set just one year prior.

The report is based on contributions from nearly 500 scientists from more than 60 countries around the world and reflects tens of thousands of measurements from multiple independent datasets. Major greenhouse gas concentrations, including carbon dioxide (CO2), methane, and nitrous oxide, rose to new record high values during 2016.

The global annual average atmospheric CO2 concentration was 402.9 parts per million (ppm), which surpassed 400 ppm for the first time in the modern atmospheric measurement record and in ice core records dating back as far as 800,000 years.

This was 3.5 ppm more than 2015, and it was the largest annual increase observed in the 58-year record. Aided by the strong El Nino early in the year, the 2016 annual global surface temperature observed record warmth for a third consecutive year,

with the 2016 annual global surface temperature surpassing the previous record of 2015.

The globally averaged sea surface temperature was the highest on record. The more recent global sea surface temperature trend for the 21st century-to-date (2000–2016) of 1.62 degree Celsius per century is much higher than the longer term (1950–2016) warming trend of 1.0 degrees Celsius per century.

Global average sea level rose to a new record high in 2016 and was about 3.25 inches higher than the 1993 average, the year that marks the beginning of the satellite altimeter record.

This also marks the sixth consecutive year global sea level has increased compared to the previous year.

Over the past two decades, sea level has increased at an average rate of about 0.13 inch per year, with the highest rates of increase in the western Pacific and Indian Oceans.

During August and November, record low daily and monthly Antarctic sea ice extents were observed, with the November average sea ice extent significantly smaller than the 1981– 2010 average.

CURIOSITY SENDS 'MOST CLEARLY VISIBLE IMAGES' OF MARS CLOUDS

NASA's Mars Curiosity rover has captured its most clearly visible images of wispy, early- season clouds on the red planet which resemble the Earth's ice-crystal cirrus clouds.

Clouds moving in the martian sky have been observed previously by Curiosity and other missions on the surface of Mars, including NASA's Phoenix Mars Lander in the martian arctic nine years ago.

The clouds in the new images are the most clearly visible so far from Curiosity, which landed five years ago this month about five degrees south of Mars' equator, NASA said.

Researchers used Curiosity's Navigation Camera (Navcam) to take two sets of eight images of the sky on an early martian morning last month.

For one set, the camera pointed nearly straight up. For the other, it pointed just above the southern horizon.Cloud movement was recorded in both and was made easier to see by image enhancement. A midday look at the sky with the same camera the same day showed no clouds, NASA said.

"It is likely that the clouds are composed of crystals of water ice that condense out onto dust grains where it is cold in the atmosphere," said Curiosity science-team member John Moores of York University in Canada.

"The wisps are created as those crystals fall and evaporate in patterns known as 'fall streaks' or 'mare's tails.' While the rover does not have a way to ascertain the altitude of these clouds, on Earth such clouds form at high altitude," said Moores.

Mars' elliptical orbit makes that planet's distance from the Sun vary more than Earth's does. In previous martian years, a belt of clouds has appeared near the equator around the time Mars was at its farthest from the Sun, according to the US space agency.

The new images of clouds were taken about two months before that farthest point in the orbit, relatively early in the season for the appearance of this cloud belt.

NASA TO STUDY EARTH'S IONOSPHERE DURING TOTAL SOLAR ECLIPSE

NASA is set to study the Earth's ionosphere during the upcoming total solar eclipse in the US, to better understand the Sun's relationship to the region of the atmosphere where satellites orbit and radio signals are reflected towards our planet.

On August 21, the Moon will slide in front of the Sun and for a brief moment, day will melt into a dusky night in the US. The Moon's shadow will block the Sun's light, and weather permitting, those within the path of totality will be treated to a view of the Sun's outer atmosphere, called the corona.

However, the total solar eclipse will also have imperceptible effects, such as the sudden loss of extreme ultraviolet radiation from the Sun, which generates the ionised layer of Earth's atmosphere, called the ionosphere.

This ever-changing region grows and shrinks based on solar conditions, and researchers will use the eclipse as a ready-made experiment.

"The eclipse turns off the ionosphere's source of high-energy radiation," said Bob Marshall, a space scientist at University of Colorado Boulder in the US.

"Without ionizing radiation, the ionosphere will relax, going from daytime conditions to nighttime conditions and then back again after the eclipse," said Marshall.

Stretching from roughly 50 to 400 miles above Earth's surface, the tenuous ionosphere is an electrified layer of the atmosphere that reacts to changes from both Earth below and space above. Such changes in the lower atmosphere or space weather can manifest as disruptions in the ionosphere that can interfere with communication and navigation signals.

"In our lifetime, this is the best eclipse to see," said Greg Earle, engineer at Virginia Tech in the US.

"But we've also got a denser network of satellites, GPS and radio traffic than ever before. It's the first time we'll have such a wealth of information to study the effects of this eclipse; we'll be drowning in data," Earle said.

During the eclipse, scientists will know exactly how much solar radiation is blocked, the area of land it is blocked over and for how long. Combined with measurements of the ionosphere during the eclipse, they will have information on both the solar input and corresponding ionosphere response, enabling them to study the mechanisms underlying ionospheric changes better than ever before.

NEW HANDHELD DEVICE TURNS SMARTPHONE INTO DIAGNOSTIC TOOL

Scientists have developed a handheld device that enables a smartphone to perform lab- grade medical diagnostic tests which typically require large, expensive instruments.

The USD 550 spectral transmission-reflectance-intensity (TRI) Analyzer attaches to a smartphone and analyses patient blood, urine, or saliva samples as reliably as clinic-based instruments that cost thousands of dollars.

"Our TRI Analyzer is like the Swiss Army knife of biosensing," said Brian Cunningham, professor at the University of Illinois at Urbana-Champaign in the US.

"It is capable of performing the three most common types of tests in medical diagnostics, so in practice, thousands of already-developed tests could be adapted to it," Cunningham said.

Researchers used the TRI Analyzer to perform two commercially available assays - a test to detect a biomarker associated with pre-term birth in pregnant women and the phenylketonuria (PKU) test for newborns to indirectly detect an enzyme essential for normal growth and development.

Their test results were comparable to those acquired with clinic-grade spectrometer instrumentation.

"The TRI Analyzer is more of a portable laboratory than a specialised device," said Kenny Long, lead author of the research published in the journal Lab on a Chip.

Among the many diagnostic tests that can be adapted to their point-of-care smartphone format is an enzyme-linked immunosorbent assay (ELISA), which detects and measures a wide variety of proteins and antibodies in blood and is commonly used for a wide range of health diagnostics tests.

The system is capable of detecting the output of any test that uses a liquid that changes colour, or a liquid that generates light output (such as from fluorescent dyes).

The TRI Analyzer operates by converting the smartphone camera into a high-performance spectrometer.

Specifically, the analyzer illuminates a sample fluid with the phone's internal white light-emitting diode (LED) flash or with an inexpensive external green laser diode.

The light from the sample is collected in an optical fibre and guided through a diffraction grating into the phone's rear-facing internal camera.

These optical components are all arranged within a three-dimensional (3D) printed plastic cradle.

The TRI Analyzer can simultaneously measure multiple samples by using a microfluidic cartridge that slides through an opening in the back of the cradle.

This ability to analyse multiple samples quickly and reliably makes the Analyzer suitable for patients who lack convenient access to a clinic or hospital with diagnostic test facilities or for patients with urgent health situations requiring rapid results.

INTEREST IN SCIENCE MAY BE CONTAGIOUS: STUDY

You can catch the science bug from your peers, according to a study which found that sitting next to classmates inclined to the topic may help you develop an interest in the subject and boost grades.

Researchers at the Florida International University in the US found that when students see their science classmates as very interested in the class, they are more likely to develop an interest in science, technology, engineering and math (STEM) careers.

"People have been found to readily catch the emotions of others and we see this happening in science classroom environments," Zahra Hazari, professor at Florida International University.

"This really emphasises the importance of having engaging environments to hook students to science and motivate them towards learning," Hazari added.

How a student perceives the level of their peers' interests has a significant effect on their science career choices even after accounting for differences in their prior interest in STEM classes, their level of family support for science, academic achievement, gender and quality of teaching.

Researchers surveyed more than 2,000 students at 50 randomly selected colleges and universities across the US.

The positive effect was consistent across biology, chemistry and physics classes and was seen for both students' career interests and, in most cases, their grades, researchers said.

They found that even students who had little prior interest or support in science showed greater interest in science careers when they saw high levels of interest in their classmates.

The study was published in the journal Science Advances.

NEW 'SMART' WINDOWS GO FROM CLEAR TO DARK IN ONE MINUTE

Scientists have developed dynamic windows that can switch from transparent to opaque or back again in under a minute and do not degrade over time.

The prototypes created by researchers at Stanford University in the US are plates of conductive glass outlined with metal ions that spread out over the surface, blocking light, in response to electrical current.

Dynamic windows have the potential to transform our homes, businesses, cars, and more, reducing heating and cooling costs or the need for blinds, researchers said.

Smart windows already being sold, such as those used on airlines, are made of materials, such as tungsten oxide, that change colour when charged with electricity, they said.

However, these materials tend to be expensive, have a blue tint, can take over 20 minutes to dim, and become less opaque over time.

"We did not tweak what was out there, we came up with a completely different solution," said Michael McGehee, a professor at Stanford University.

"We have had a lot of moments where we have thought, 'how is it even possible that we have made something that works so well, so quickly,' and we are now running the technology by glass and other kinds of companies," said McGehee, senior author of the research published in the journal Joule.

The new prototypes block light through the movement of copper and another metal in a solution over a sheet of transparent indium tin oxide modified by platinum nanoparticles.

When transparent, the windows are clear and allow about 80 per cent of surrounding natural light through, and when dark, transmission drops to under five per cent.

The researchers switched the windows on and off at least 5,500 times and saw no change in the transmission of light, indicating that the design is durable.

NASA'S CASSINI PROBE TO BEGIN FINAL FIVE ORBITS AROUND SATURN

NASA's Cassini spacecraft is set to begin its final five ultra-close orbits around Saturn, before the probe plunges into the atmosphere of the ringed planet and ends its epic 20-year-long journey.

The spacecraft will enter new territory in its final mission phase, the Grand Finale, making the first of the five passes over Saturn on August 13.

The spacecraft's point of closest approach to Saturn during these passes will be between about 1,630 and 1,710 kilometres above Saturn's cloud tops.

The spacecraft is expected to encounter atmosphere dense enough to require the use of its small rocket thrusters to maintain stability - conditions similar to those encountered during many of Cassini's close flybys of Saturn's moon Titan, which has its own dense atmosphere.

"Cassini's Titan flybys prepared us for these rapid passes through Saturn's upper atmosphere," said Earl Maize, Cassini project manager at NASA's Jet Propulsion Laboratory (JPL) in the US.

The pass will be considered nominal if the thrusters operate between 10 and 60 per cent of their capability.

If the thrusters are forced to work harder - meaning the atmosphere is denser than models predict - engineers will increase the altitude of subsequent orbits.

Referred to as a "pop-up manoeuvre," thrusters will be used to raise the altitude of closest approach on the next passes, likely by about 200 kilometres.

If the pop-up manoeuvre is not needed, and the atmosphere is less dense than expected during the first three passes, engineers may alternately use the "pop-down" option to lower the closest approach altitude of the last two orbits, also likely by 200 kilometres.

Doing so would enable Cassini's science instruments, especially the ion and neutral mass spectrometer (INMS), to obtain data on the atmosphere even closer to the planet's cloud tops.

"As it makes these five dips into Saturn, followed by its final plunge, Cassini will become the first Saturn atmospheric probe," said Linda Spilker, Cassini project scientist at JPL.

Other Cassini instruments will make detailed, high-resolution observations of Saturn's auroras, temperature, and the vortexes at the planet's poles.

Its radar will peer deep into the atmosphere to reveal small-scale features as fine as 25 kilometres wide - nearly 100 times smaller than the spacecraft could observe prior to the Grand Finale.

On September 11, a distant encounter with Titan will serve as a gravitational version of a large pop-down manoeuvre, slowing Cassini's orbit around Saturn and bending its path slightly to send the spacecraft toward its plunge into the planet.

During the half-orbit plunge, the plan is to have seven Cassini science instruments turned on and reporting measurements in near real time.

The spacecraft is expected to reach an altitude where atmospheric density is about twice what it encountered during its final five passes.

Once Cassini reaches that point, its thrusters will no longer be able to work against the push of Saturn's atmosphere to keep the spacecraft's antenna pointed toward Earth, and contact will permanently be lost.

The spacecraft will break up like a meteor moments later, ending its long and rewarding journey.

NEW ULTRAFAST TEST TO DETERMINE ANTIBIOTIC RESISTANCE

In a first, scientists have developed a new test that can quickly determine whether infection- causing bacteria are resistant to antibiotics.

The test, developed by researchers at the Uppsala University in Sweden, can help doctors make an informed choice while prescribing antibiotics.

It is primarily intended for urinary tract infections - a condition that affects about 100 million women a year globally and accounts for 25 per cent of antibiotic use in Sweden.

Monitoring whether individual bacteria grow in the presence of antibiotics (ie are resistant) reveals their resistance or susceptibility within a few minutes, researchers said.

"We have developed a new method that allows determination of bacterial resistance patterns in urinary tract infections in 10 to 30 minutes," said Ozden Baltekin, from Uppsala University.

"By comparison, the resistance determination currently in use requires one to two days. The rapid test is based on a new plastic microfluidic chip where the bacteria are trapped and methods for analysing bacterial growth at single-cell level," Baltekin added.

It is great that the research methods we developed to address fundamental questions in molecular biology are useful for such a tremendously important medical application, researchers said.

"We believe the method is usable for other types of infection, such as blood infections where prompt, correct choice of antibiotic is critical to the patient," said Dan Andersson from Uppsala University.

Antibiotic resistance is a growing medical problem that threatens human health globally. One important contributory factor in the development of resistance is the incorrect use of antibiotics for treatment.

Researchers therefore seek reliable methods to quickly and easily identify bacterial resistance patterns, known as antibiotic susceptibility testing (AST), and provide early treatment, ie right from the doctor's appointment.

This has been inhibited by the current time-consuming antibiotic resistance tests.

The study was published in the journal Proceedings of the National Academy of Sciences.

NEW MINI SATELLITE CAN BE PROPELLED WITH WATER

Scientists have developed a new type of miniature satellite called CubeSat that can bemanoeuvred in space with tiny bursts of water vapour.

Low-cost microsatellites and nanosatellites - far smaller than conventional spacecraft - have become increasingly prevalent.

Thousands of these miniature satellites might be launched to perform a variety of tasks, from high-resolution imaging and internet services, to disaster response, environmental monitoring and military surveillance.

"They offer an opportunity for new missions, such as constellation flying and exploration that their larger counterparts cannot economically achieve," said Alina Alexeenko, a professor at Purdue University in the US.

However, to achieve their full potential, CubeSats require micropropulsion devices to deliver precise low-thrust "impulse bits" for scientific, commercial and military space applications.

The new micropropulsion system uses ultra-purified water, researchers said.

The new system, called a Film-Evaporation MEMS Tunable Array (FEMTA) thruster, uses capillaries small enough to harness the microscopic properties of water.

Since the capillaries are only about 10 micrometers in diameter, the surface tension of the fluid keeps it from flowing out, even in the vacuum of space.

Activating small heaters located near the ends of the capillaries creates water vapour and provides thrust.

In this way, the capillaries become valves that can be turned on and off by activating the heaters. The technology is similar to an inkjet printer, which uses heaters to push out droplets of ink.

"Water is thought to be abundant on the Martian moon Phobos, making it potentially a huge gas station in space," Alexeenko said.

"Water is also a very clean propellant, reducing risk of contamination of sensitive instruments by the backflow from thruster plumes," he said.

CubeSats are made up of several units, each measuring 10 cubic centimetres.

In the research, four FEMTA thrusters loaded with about a teaspoon of water were integrated into a one-unit CubeSat prototype and tested in a vacuum.

The prototype, which weighs 2.8 kilogrammes, contained electronics and an inertial measurement unit sensor to monitor the performance of the thruster system, which rotates the satellite using short-lived bursts of water vapour.

Typical satellites are about the size of a school bus, weigh thousands of pounds and sometimes cost hundreds of millions of dollars.

While conventional satellites require specialised electronics that can withstand the harsh conditions of space, CubeSats can be built with low-cost, off-the-shelf components.

Constellations of many inexpensive, disposable satellites might be launched, minimising the impact of losing individual satellites.

FOUR EARTH-SIZED PLANETS FOUND ORBITING SUN-LIKE STAR

Four Earth-sized planets have been discovered orbiting the nearest Sun-like star, which is about 12 light years away and visible to the naked eye, scientists said.

Two of the planets are super-Earths located in the habitable zone of the star, tau Ceti, meaning they could support liquid surface water, said researchers at University of California (UC), Santa Cruz in the US.

The planets have masses as low as 1.7 Earth mass, making them among the smallest planets ever detected around nearby Sun-like stars, they said.

They were detected by observing the wobbles in the movement of tau Ceti. This required techniques sensitive enough to detect variations in the movement of the star as small as 30 centimetres per second.

"Our detection of such weak wobbles is a milestone in the search for Earth analogs and the understanding of the Earth's habitability through comparison with these analogs," said Fabo Feng from the University of Hertfordshire in the UK.

"We have introduced new methods to remove the noise in the data in order to reveal the weak planetary signals," said Feng, lead author of the study published in the Astrophysical Journal.

The outer two planets around tau Ceti are likely to be candidate habitable worlds, although a massive debris disc around the star probably reduces their habitability due to intensive bombardment by asteroids and comets.

"We are slowly learning to tell the difference between wobbles caused by planets and those caused by stellar active surface. This enabled us to essentially verify the existence of the two outer, potentially habitable planets in the system," said Mikko Tuomi from the University of Hertfordshire.

Sun-like stars are thought to be the best targets in the search for habitable Earth-like planets due to their similarity to the Sun, researchers said.

Unlike more common smaller stars, such as the red dwarf stars Proxima Centauri and Trappist-1, they are not so faint that planets would be tidally locked, showing the same side to the star at all times.

Tau Ceti is very similar to the Sun in its size and brightness, and both stars host multi-planet systems.

MILKY WAY DOTTED WITH 100 MILLION BLACK HOLES: STUDY

There may be as many as 100 million black holes in the Milky Way galaxy, according to scientists, including one of Indian origin, who conducted a cosmic survey to calculate and categorise the enigmatic, dark objects.

The celestial census began more than a year and a half ago, shortly after the news that the Laser Interferometer Gravitational-Wave Observatory (LIGO) had detected ripples in the space-time continuum created by the distant collision of two black holes, each the size of 30 suns.

"Fundamentally, the detection of gravitational waves was a huge deal, as it was a confirmation of a key prediction of Einstein's general theory of relativity," said James Bullock, University of California, Irvine (UCI) in the US.

"But then we looked closer at the astrophysics of the actual result, a merger of two 30-solar-mass black holes. That was simply astounding and had us asking, 'How common are black holes of this size, and how often do they merge?'" Bullock said.

Scientists assume most stellar-remnant black holes - which result from the collapse of massive stars at the end of their lives - will be about the same mass as our Sun.

To see the evidence of two black holes of such epic proportions coming together in a cataclysmic collision left some astronomers puzzled.

The new research was an attempt to interpret the gravitational wave detections through the lens of what is known about galaxy formation and to form a framework for understanding future occurrences.

According to Manoj Kaplinghat, professor at UCI, the number of black holes of a given mass per galaxy will depend on the size of the galaxy.

The reason is that larger galaxies have many metal-rich stars, and smaller dwarf galaxies are dominated by big stars of low metallicity.

Stars that contain a lot of heavier elements, like our sun, shed a lot of that mass over their lives.

When it comes time for one to end it all in a supernova, there is not as much matter left to collapse in on itself, resulting in a lower-mass black hole.

Big stars with low metal content do not shed as much of their mass over time, so when one of them dies, almost all of its mass will wind up in the black hole.

"We have a pretty good understanding of the overall population of stars in the universe and their mass distribution as they're born, so we can tell how many black holes should have formed with 100 solar masses versus 10 solar masses," Bullock said.

"We were able to work out how many big black holes should exist, and it ended up being in the millions - way more than I anticipated," he said.

In addition, to shed light on subsequent phenomena,researchers sought to determine how often black holes occur in pairs, how often they merge, and how long it takes.

They wondered whether the 30-solar-mass black holes detected by LIGO were born billions of years ago and took a long time to merge or came into being more recently (within the past 100 million years) and merged soon after.

"We show that only 0.1 to one per cent of the black holes formed have to merge to explain what LIGO saw," Kaplinghat said.

"If the current ideas about stellar evolution are right, then our calculations indicate that mergers of even 50-solar- mass black holes will be detected in a few years," he said.

NOW, PAPER-BASED BATTERY POWERED BY YOUR SALIVA

Scientists have developed a new high-performance, paper-based battery powered by saliva that can be used in extreme conditions where normal batteries do not function.

Researchers from Binghamton University in the US created the battery by building microbial fuel cells with inactive, freeze-dried cells which generate power within minutes of adding saliva.

The battery generated reliable power from one drop of saliva, supplying on-board power that could be used by the next generation of disposable, paper-based Point of Care (POC) diagnostic platforms, researchers said.

The battery has competitive advantages over other conventional power solutions because the biological fluid for on-demand battery activation is readily available even in the most resource-constrained settings.

"The freeze-drying technology enables long-term storage of cells without degradation or denaturation. On-demand micro-power generation is required especially for POC diagnostic applications in developing countries," said Seokheun Choi, professor at Binghamton University.

"Typically, those applications require only several tens of microwatt-level power for several minutes, but commercial batteries or other energy harvesting technologies are too expensive and over-qualified. Also, they pose environmental pollution issues," Choi said.

Researchers are now focusing on improving the battery's power density so that more applications can be powered.

"Now, our power density is about a few microwatts per centimetre square," said Choi.

"Although 16 microbial fuel cells connected in a series on a single sheet of paper generated desired values of electrical current and voltage to power a light-emitting diode (LED), further power improvement is required for other electronic applications demanding hundreds of milliwatts of energy," he said.

FACEBOOK PHOTOS MAY HELP DIAGNOSE DEPRESSION: STUDY

Your Facebook or Instagram photos could tell if you are depressed, thanks to scientists who have developed a new computer programme that could diagnose depression from social media posts better than doctors.

The programme could identify depressed people correctly 70 per cent of the time.

In comparison, previous research has shown that doctors can make a correct unassisted diagnosis of depression 42 per cent of the time.

"Our analysis of user accounts from a popular social media app revealed that photos posted by people diagnosed with depression tended to be darker in colour, received more comments from the community, were more likely to contain faces and less likely to have a filter applied," said Christopher Danforth, from the University of Vermont in the US.

"When they did select a filter they were more likely to use the filter that converted colour images to black and white. People diagnosed with depression also posted at a higher frequency compared to non-depressed individuals," said Danforth.

"With an increasing share of our social interactions happening online, the potential for algorithmic identification of early-warning signs for a host of mental and physical illnesses is enormous," he said.

"Imagine an app you can install on your phone that pings your doctor for a check-up when your behaviour changes for the worse, potentially before you even realise there is a problem," he added.

The researchers used the computer programme to analyse 43,950 photos, following recruitment of 166 users of a popularsocial media app, including 71 people that had a clinical diagnosis of depression.

The programme scoured the photos for details that were associated with healthy and depressed individuals.

This information was then used to see if the programme could predict who would go on to be diagnosed with depression by only looking at photos that were posted before their diagnosis.

"Although we had a relatively small sample size, we were able to reliably observe differences in features of social media posts between depressed and non-depressed individuals," said Andrew Reece from Harvard University in the US.

"Importantly, we also demonstrate that the markers of depression can be observed in posts made prior to the person receiving a clinical diagnosis of depression," Reece said.

The research was published in the journal EPJ Data Science.

Edited, printed and published by M. R. MISHRA on behalf of the PRESS TRUST OF INDIA, at 4, Parliament Street, New Delhi -110001, Printed at AVION Printer, Aram Nagar, New Delh-110 005 Phone No.23619350 .