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# Science Service

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### **CSIR-JOHNSON & JOHNSON TO CONDUCT R&D ON DRUG-RESISTANT TB**

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The CSIR and Johnson & Johnson teamed up for conducting joint research on drug-resistant tuberculosis (TB).

The Institute of Microbial Technology, under the Council of Scientific & Industrial Research, signed a memorandum of understanding (MoU) with Johnson & Johnson for the purpose.

Speaking on the occasion, Science and Technology Minister Harsh Vardhan said drug-resistant TB is a global threat and India has about one-fourth of the global burden. "A sustained effort is needed to tackle this problem," he said.

While he was the health minister, Vardhan had launched TB-Mission, with an aim to eradicate the disease by 2020.

Johnson & Johnson's chief scientific officer Paul Stoffels said, "While we have made great advances in recent years with approval of new TB medicines, much more needs to be done."

Over 17 lakh TB patients were recorded last year in the Centre's TB control programme, the annual report on the disease released by the government.

Released on March 24, 2017, the World TB Day, the report said that over 33,000 drug-resistant TB patients were also recorded in 2016.

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### **COME UP WITH SOP FOR DUST CONTROL AT CONSTRUCTION SITES: LG TO NDMC**

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Lt Governor Anil Baijal asked the New Delhi Municipal Council (NDMC) to prepare a standard operating procedure for dust control at construction sites here in consultation with the Centre for Science and Environment (CSE) within two weeks.

He also said that the operation of Badarpur Thermal Power plant, which was reopened in March this year, will be closed from mid-October, considering the rise in pollution during winters.

The decision was taken at a high-level meeting on air pollution review, chaired by LG Baijal, and attended by Environment Minister Imran Hussain and senior officers.

During the meeting, the LG was informed that the Delhi Pollution Control Committee (DPCC) will set up 20 more real-time monitoring stations by October 15.

"The NDMC has been tasked to prepare an SOP for dust control at construction sites and other related parameters in consultation with Centre for Science and Environment (CSE) within two weeks," stated a press released issued by the LG office.

The CSE is a public interest research and advocacy organisation based in New Delhi.

The LG also said that once the SOP is prepared, it could be uniformly adopted by all municipal corporations and other construction agencies.

The LG stressed that the SOP should be "feasible" and "enforceable".

Also, the transport department was instructed to intensify inspections of the centres certifying pollution under control (PUC).

The department informed Baijal that it has done physical inspection of 957 PUC centres, issued 134 show cause notices, suspended 20 and cancelled eight PUC centres.

Further, the department said it will strictly implement the Supreme Court directions regarding linking of vehicle insurance with PUC Certificate.

The PWD and the traffic police were directed to review traffic engineering arrangements in order to prevent entry of non-designated vehicles, that are a major source of air pollution, in the city.

For augmentation of public transport, the Delhi Metro Rail Corporation (DMRC) informed the LG that a proposal for establishing a subsidiary is being considered to effectively resolve the problem of last-mile connectivity in the city.

Baijal also directed that an intensive anti-firecrackers campaign should be undertaken particularly targeting school-children who are the "best ambassadors of change" to bring down pollution level.

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### **DEFICIT RAINS IN ONE-FOURTH OF COUNTRY; IMD HOPES RECOVERY**

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More than one-fourth of the country has received deficient rainfall this monsoon, which is halfway through, but the IMD is hopeful of the situation improving in the remaining period.

According to the India Meteorological Department (IMD), there is five per cent overall shortfall in rains across the country, but the deficiency is more in 26 per cent of the country's land mass.

The rainfall deficiency is more in parts of Madhya Pradesh, Kerala, Maharashtra, Karnataka and western Uttar Pradesh, it said.

IMD has projected "normal" southwest monsoon in 2017, which is from June to September.

"The coastal, north and south interior Karnataka have been receiving good rainfall since the last two days. Rainfall has also begun in Marathwada and Madhya Pradesh. We are hoping the situation will improve," IMD Director General K J Ramesh said.

Last week, the Met Department had said the second half of the monsoon season is likely to be 100 per cent of the Long Period Average. The rainfall during August is likely to be 99

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per cent.

Noting that monsoon is reviving, Secretary in the Ministry of Earth Sciences Madhavan Rajiveevan tweeted, "Good rains over central India including Maharashtra, Madhya Pradesh, Gujarat in the next 2 weeks."

He also noted that "rain deficit regions (are) likely to recover" but cautioned about "chance of floods" in some parts.

Sowing of kharif (summer) crops has been affected in states with deficit rains, though overall sowing area across the country remains higher at 976.34 lakh hectare till last week of the season as against 984.57 lakh hectare in the year-ago period, as per the Agriculture Ministry's data.

Among the states with deficit rains, IMD said that north and south interior Karnataka have both recorded rainfall deficiency in range of 20-25 per cent so far.

There has been 32 per cent rainfall deficit so far recorded in Marathwada and Vidarbha regions of Maharashtra, which had reported farmer suicides over the last few years.

Even east and west Madhya Pradesh have recorded a deficiency of 23 per cent. Parts of Kerala recorded deficient rainfall for a second consecutive year.

However, some states especially east Uttar Pradesh, Bihar, Assam and Gujarat have witnessed floods.

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### 'GM CROPS ONLY AFTER BIOSAFETY, SOCIO-ECONOMIC EVALUATION'

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No genetically modified (GM) crop should be introduced in India unless the biosafety and socio-economic desirability is evaluated in a "transparent" process and an accountability regime is put in place, a parliamentary panel has said.

The committee has also recommended that the environment ministry should examine the impact of GM crops on environment thoroughly, in consultation with all stakeholders so that the nation is very clear about all its probable effects before taking a call on the matter.

The remarks come after India's GM crop regulator Genetic Engineering Appraisal Committee (GEAC) recently recommended the commercial use of genetically modified mustard in a submission to the environment ministry.

The department-related parliamentary standing committee on science and technology and environment and forest made its recommendations in its 301st report on 'GM crop and its impact on environment'.

It said GM mustard being a herbicide-tolerant GM organism (GMO), there is clear evidence on the adverse impacts of such GMOs elsewhere in the world.

"The committee strongly believes that unless the biosafety and socio-economic desirability, taking into consideration long run effects, is evaluated by a participatory,

independent and transparent process and a retrieval and accountability regime is put in place, no GM crop should be introduced in the country," it said.

The report of the committee, chaired by Congress leader Renuka Chowdhury was presented to the Rajya Sabha chairman.

The committee noted that the GEAC has given its approval for commercialisation of GM mustard "inspite of the fact that the matter is pending for decision in the Supreme Court".

"In the case of GM mustard, from what one can gather from different quarters, there are serious unanswered questions.

"The committee has also come to know that many state governments in the country are opposed to its entry even in the form of field trials, leave alone commercial cultivation," it said.

"The committee recommends that the environment ministry should examine the impact of GM crops on environment thoroughly, in consultation with the concerned government agencies, experts, environmentalists, civil society, and other stakeholders so that the nation is very clear about all its probable impacts before taking a call in the matter," it said.

The Centre for Genetic Manipulation of Crop Plants (CGMCP), Delhi University, had submitted an application to the GEAC for the environmental release of GM mustard (Brassica juncea) hybrid DMH-11 and the use of parental events (varuna bn 3.6 and EH2 mod bs 2.99) for the development of a new generation of hybrids.

The environment ministry had received over 700 comments from various stakeholders, including farmers and researchers, on the Assessment of Food and Environmental Safety (AFES) report on GM Mustard, which it had earlier posted on the ministry website.

The application was submitted in 2015 after which several rounds of meeting were held by the GEAC. The sub-committee also convened meetings with experts.

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### ASTHMA, COPD LED TO 3 MILLION DEATHS WORLDWIDE IN 2015: STUDY

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Two common chronic respiratory conditions -- asthma and chronic obstructive pulmonary disease (COPD) -- led to over three million deaths worldwide in 2015, a report in a reputed medical journal has said, highlighting that India, along with other three countries, recorded the highest disease burden due to COPD.

According to a Global Burden of Disease study published in the Lancet Respiratory Medicine journal, 3.2 million deaths took place due to COPD while 0.4 million people died of asthma in 2015.

"The disease burden due to COPD in 2015 was highest in Papua New Guinea, India, Lesotho and Nepal, and burden for asthma was highest in Afghanistan, Central African Republic, Fiji, Kiribati, Lesotho, Papua New Guinea and Swaziland," it said.

India recorded 2774.64 prevalent cases of COPD per 100,000 people (2533-3027.38) and 4021.72 prevalent cases of asthma per 100,000 (3637.41-4,424.58) in 2015, the report said.

The study estimated the number of cases and deaths caused by the two conditions between 1990 and 2015 worldwide.

COPD is a group of lung conditions (including emphysema and chronic bronchitis) that cause breathing difficulties. The condition is largely caused by smoking and air pollution.

While overall prevalence and death rates had reduced since 1990, population growth and the ageing population meant that the numbers had increased, it said.

The number of deaths due to COPD increased by 11.6 per cent between 1990 and 2015 (from 2.8 to 3.2 million), and the number of cases increased by 44.2 per cent (from 121 to 174.5 million), the report said.

Comparatively, deaths from asthma reduced by 26.2 per cent (from 0.55 to 0.4 million), but prevalence increased by 12.6 per cent (from 318.2 to 358.2 million) over the same time period, it said.

As a result of the larger number of cases, there were more people living with disability — with the countries with the highest burden of disability from COPD and asthma typically residing in developing regions, the study said.

The study found that asthma was the most common chronic respiratory disease worldwide, with twice the number of cases of COPD in 2015, but that deaths from COPD were eight times more common than deaths from asthma.

Many cases of asthma and COPD can be treated or prevented with affordable interventions, but people are often left undiagnosed, misdiagnosed or undertreated.

The main risk factors for COPD were smoking and air pollution, followed by household air pollution, occupational risk (such as asbestos, diesel fumes, arsenic and benzene), ozone and second-hand smoke, leading the authors to call for public health interventions to bring down air pollution and further reduce global smoking rates.

"Conversely, the causes of asthma are less clear, but include smoking and asthma-causing allergens experienced in the workplace," the report said.

The authors highlighted the need for more research into causes of COPD and asthma to create better prevention measures and reduce the burden of the diseases, and also to help better define and diagnose the diseases.

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### ISRO LOOKING AT CO-OPN WITH ISRAEL IN SPACE TECH: ISRO CHIEF

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India is looking at cooperation from Israel in the field of optical communication technique and electric propulsion system of space technology, ISRO chief A S Kiran Kumar said.

The Indian Space Research Organisation (ISRO) and the Israel Space Agency (ISA) had signed a cooperation agreement during the visit of Prime Minister Narendra Modi to the Jewish state last month.

"We are looking for cooperation in the field of optical communication technique and electric propulsion system of space technology," the ISRO chairman said.

The electric propulsion system is important for sending heavy-weight satellites in the orbit while the optical communication technology transmits data, using light, from satellite to the earth station.

Kiran Kumar, who is also the secretary of the Department of Space, said ISRO is also working with international agencies for a collaborative work and share resources.

He cited the example of cooperation of ISRO and NASA for the NISAR (NASA-ISRO Synthetic Aperture Radar) satellite that can help in providing crucial information on the biomass estimation and agriculture production estimation.

The NISAR will also help in studying earth surface deformation, something that can provide valuable inputs for future earthquake precursors.

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### ICMR, MIN OF HEALTH SIGN PACT WITH S KOREA'S IVI FOR VACCINE R&D

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The Indian Council of Medical Research (ICMR) and the Union Ministry of Health today inked a pact with the International Vaccine Institute (IVI), South Korea to collaborate on vaccine research and development.

The Memorandum of Understanding (MoU) was signed between Dr Soumya Swaminathan, Director General of ICMR and Secretary, Department of Health Research, Manoj Jhalani, Additional Secretary, Ministry of Health and Dr Jerome H Kim, Director General of IVI.

The ICMR in Delhi is the apex body in the country for the formulation, coordination and promotion of biomedical research. With a long history of scientific collaboration with IVI, India officially became a signatory to the treaty of the Seoul-based organisation in 2012. The IVI has 35 signatory countries.

With this partnership, India is committing an annual contribution of USD 5,00,000 to IVI and joins Sweden and South Korea as financially contributing signatories to IVI, an official statement said.

The IVI has been partnering with Indian vaccine manufacturers, research institutes, government and public health agencies on vaccine development, research and training.

One of the most successful collaborations was with Shantha Biotech on the development of Shanchol, the world's first low-cost oral cholera vaccine. The vaccine was licensed in India in 2009 and WHO-prequalified in 2011.

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The IVI successfully collaborated with health authorities in Odisha to introduce the oral cholera vaccine for the first time in India in 2011, the statement said.

In addition, IVI has collaborated with the National Institute of Cholera and Enteric Diseases (NICED), Kolkata on research and training projects, including the establishment of a vaccine evaluation lab at NICED.

"India is a vaccine industry powerhouse that supplies 60 per cent of the world's vaccines for vaccine preventable diseases and 60-80 per cent of annual UN vaccine purchases (2012)," Dr Kim, Director General of IVI, said.

"The signing of the MoU is a continuation of our partnership with India to provide safe, effective and affordable vaccines for people around the world. We look forward to having India's representation on the IVI Board of Trustees which will increase engagement with Indian academia and industry even further," the DG said.

ICMR's Dr. Swaminathan said, "We have been working closely with IVI in India for more than a decade now. We are confident that this collaboration will elevate the vaccine research and development capacity at IVI as well as Indian labs and further benefit India's vaccine industry."

Jhalani said the partnership will help better address vaccine needs of children in the country and ultimately contribute to protecting people from infectious diseases.

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### AIR POLLUTION AT CRISIS LEVELS IN NORTH INDIA, SAYS NITI AAYOG; SPELLS OUT THREE-YEAR PLAN

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Noting that air pollution has reached crisis level in Northern India, government think-tank Niti Aayog has recommended a slew of measures like imposing higher taxes on petrol in and around the more polluted cities to encourage commuters to share cars and take public transportation.

The Aayog, in its 'Three Year Action Agenda to be implemented till 2019-20' and released by Finance Minister Arun Jaitley, also suggested making public transportation faster and more comfortable to discourage the use of private vehicles.

It has identified coal power plants, brick kilns, vehicles, cooking and heating fires which burn biomass, rubbish burning and burning of crop residue and dust from construction as the "major" source of air pollution.

It noted that air pollution has reached crisis levels in Northern India and though it is much publicised in Delhi, it is also widespread in many other cities and as many as ten of the top 20 most polluted cities in the world are in India.

It recommended actions like finding alternatives to crop residue burning, reducing pollution from cooking fires and installing flu gas de-sulphurizers on all coal power plants in or

close to densely populated areas except those less than 5MW capacity and those older than 25 years by 2020.

It also suggested switching to cleaner technologies to reduce pollution from brick kilns considerably within three years.

"A number of complementary steps can be taken (to reduce in-city-vehicle pollution). First making public transportation faster and more comfortable will discourage the use of private vehicles.

"Metro or bus based rapid transit systems connecting suburbs and city centre and a dense in-city transport system will go some distance towards achieving the objective," it proposed.

It also talked about replacement of vehicles from petrol and diesel to CNG, infrastructure improvements which allow vehicles travelling long distances to bypass the cities without entering, higher taxes on petrol to encourage commuters to share cars and other measures to cut emissions.

"Higher taxes on petrol in and around more polluted cities would encourage commuters to share cars and take public transportation.

"Higher parking fees and park and ride facilities will have similar effects," it recommended.

As far finding alternatives to crop residue burning was concerned, the document noted that 'Happy Seeder', a machine developed by Commonwealth Scientific and Industrial Research Organisation (CSIRO Australia) and Punjab Agricultural University, allows planting of wheat through the residue.

It said that the machine was introduced about five years ago and has been shown to reduce field preparation costs marginally and maintain yields and profits of wheat, which has led some farmers to adopt it.

"In view of the urgency of the problem and the large benefit from putting an end to crop residue burning, a larger subsidy on the machine for limited time complemented by extension and information campaigns may eliminate the problem within the next three years," it said.

It also suggested installation of Flue-gas De-sulphurizers on all coal power plants in or close to densely populated areas except those less than 5 MW capacity and those older than 25 years by 2020.

The older power plants should be shut down and retired in a phased manner, it said while adding that this will cut emissions of Sulphur Dioxide (SO<sub>2</sub>) gas that becomes sulphate particles in the atmosphere.

"It will also reduce particulate (smoke) emissions directly.

"The average cost of doing this along with improvements in fly ash removal and control of Nitrogen Oxides (NO<sub>x</sub>) emissions has been estimated to be 35-40 paise/KWh, and could reduce the PM<sub>2.5</sub> concentrations by 30-40 per cent," it recommended.

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### GRID-CONNECTED ROOFTOP SOLAR PROJECT INAUGURATED

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Chief Minister Naveen Patnaik launched the grid-connected rooftop solar project through net-metering system.

"I hope establishing rooftop solar systems through net-metering will be well accepted by the people. I wish the initiative all success," Patnaik said.

Patnaik also launched the web portal of the rooftop solar programme— [www.rtsodisha.gov.in](http://www.rtsodisha.gov.in).

Under the programme, consumers can install solar plants on their rooftops and consume the generated solar power during the day time. Excess power can be sold to the grid through service cables, said the secretary to science and technology department Vir Vikaram Yadav.

The additional solar power generated could be exported through net-meter, a special type of meter which will be provided by the respective distribution companies. The difference between buying from the grid and selling to it will be billed to the consumer.

Consumers can reduce their consumption of electricity by using solar power and simultaneously get a reduced bill on account of selling solar power to the grid, he said.

The investment on a rooftop solar system is about Rs 70,000 per kw. The state government will provide 30 percent subsidy to the consumers.

Officials said Odisha envisages renewable energy capacity addition of 2750 mega watt by 2022 and a major part of this capacity addition target has been assigned to solar power with a share of 2200 MW.

Roof top potential in Odisha has been estimated at 5000 MW. For the current year, a target of 8 MW has been fixed of which 4 MW has been exclusively assigned to Bhubaneswar, they said.

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### CM URGES VARDHAN TO EXPEDITE INSTALLATION OF DOPPLER RADARS

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Odisha government today sought the intervention of Union Minister Harsh Vardhan for immediate installation of two more doppler radars to avail real time forecast of weather in the state.

"I would once again request you to kindly intervene in the matter and issue appropriate instructions for procurement and installation of the radars at Balasore and Sambalpur at the earliest," Chief Minister Naveen Patnaik wrote to the Union Earth Sciences, Science and Technology minister.

Though it was decided to install four doppler weather radars in the disaster prone state of Odisha for tracking and monitoring of real time weather forecasting, only two such

facilities had been made available at Paradip and Gopalpur, Patnaik pointed out.

He stated that the decision for such installation was taken by the Government of India way back in 2006. While two such radars have been made operational, two other could not be installed so far, Patnaik said in the letter.

Patnaik said he in 2015 had sought the Union Minister's personal intervention for taking expeditious steps for procurement and installation of radars at Balasore and Sambalpur.

"But, the radars at these locations are yet to be installed," Patnaik said.

Doppler radar stations at Balasore and Sambalpur would help tracking local storms/thunderstorms in the northern and western parts of the state and provide real time forecast to save many lives, Patnaik said.

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### NEW PAPER-BASED SENSOR CAN QUICKLY DETECT DRUG OVERDOSE

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Scientists have developed a new paper-based sensor that can quickly detect excess dose of a drug often misused in sexual assaults, robberies and for recreational purposes, an advance that may help solve such crimes faster.

Diazepam - used to treat depression and anxiety - is extensively used in cases of homicide or suicides, drug overdoses or drug-facilitated sexual assault, crime and robbery, said researchers who published their findings in the journal *Analytica Chimica Acta*.

"Analysis of the exposure of drug is very costly and resource intensive because of the use of sophisticated instrumental techniques," a professor at Amity University said.

"Hence, the idea popped up to develop a sensor which, if miniaturised, can help these laboratories solve the mystery behind related deaths," Narang said.

"Driven by the necessity to detect diazepam, we report a novel, simple, portable, disposable, rapid inexpensive microfluidic paper-based analytical device to detect diazepam," she said.

Researchers, including those from Jamia Millia Islamia in New Delhi and Maharshi Dayanand University in Rohtak, Haryana, fabricated the sensor by depositing silica-coated gold nanorods on paper. They then tested its efficiency to detect the drug in urine samples.

"The paper chip is connected to an instrument which shows current signals. Reading these signals can tell us the extent of the drug intake," said Narang.

"Conventionally the drug is detected using gas chromatography-mass spectrophotometer. These techniques are time consuming and expensive," she said.

"Our approach was to use paper electrodes which not only reduces the time but also makes the sensor cheaper," she added.



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### **ULTRA-THIN CARBON NANOTUBES CAN SEPARATE SALT FROM SEAWATER**

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Scientists have developed carbon nanotubes over 50,000 times thinner than a human hair which can separate salt from seawater, an advance that may help solve the global water crisis.

Increasing demands for fresh water pose a global threat to sustainable development, resulting in water scarcity for four billion people, researchers said.

Current water purification technologies can benefit from the development of membranes with specialised pores that mimichighly efficient and water selective biological proteins.

Scientists, including those from Northeastern University in the US, developed carbon nanotube pores that can exclude salt from seawater.

The team found that water permeability in carbon nanotubes (CNTs) with diameters of 0.8 nanometre significantly exceeds that of wider carbon nanotubes.

The nanotubes, hollow structures made of carbon atoms in a unique arrangement, are more than 50,000 times thinner than a human hair.

The super smooth inner surface of the nanotube is responsible for their remarkably high water permeability, while the tiny pore size blocks larger salt ions.

"We found that carbon nanotubes with diameters smaller than a nanometre bear a key structural feature that enables enhanced transport," said Ramya Tunuguntla, a postdoctoral researcher at Lawrence Livermore National Laboratory (LLNL) in the US.

"The narrow hydrophobic channel forces water to translocate in a single-file arrangement, a phenomenon similar to that found in the most efficient biological water transporters," said Tunuguntla.

Computer simulations and experimental studies of water transport through CNTs with diameters larger than one nanometre showed enhanced water flow, but did not match the transport efficiency of biological proteins and did not separate salt efficiently, especially at higher salinities.

The key breakthrough achieved by the LLNL team was to use smaller-diameter nanotubes that delivered the required boost in performance.

"Carbon nanotubes are a unique platform for studying molecular transport and nanofluidics," said Alex Noy principal investigator at LLNL.

"Their sub-nanometre size, atomically smooth surfaces and similarity to cellular water transport channels make them exceptionally suited for this purpose, and it is very exciting to make a synthetic water channel that performs better than nature's own," said Noy.

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### **TAKING PHOTOS REALLY HELPS YOU REMEMBER EXPERIENCES: STUDY**

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Taking photos may actually help you remember the visual details of your encounters, whether it is lying on the beach, touring a museum, or just waiting in line at the grocery store, a study suggests.

"Our research is novel because it shows that photo-taking itself improves memory for visual aspects of an experience but can hurt memory for non-visual aspects, like auditory details," researchers said.

Previous research has suggested that being able to take photographs or consult the internet may allow us to outsource our memory, freeing up cognitive resources but potentially impairing our ability to remember.

Researchers, including those from New York University in the US, hypothesised that this offloading effect may hold for factual information, but might not apply when it comes to the experiences we deliberately choose to photograph.

"People take photos specifically to remember these experiences, whether it is a fun dinner with friends, a sightseeing tour, or something else," they said.

In one experiment, the researchers had 294 participants tour a real-life museum exhibit of Etruscan artifacts. The participants stashed their belongings before starting the tour but some were allowed to keep a camera on them.

Those with a camera could photograph anything they wanted in the exhibit and were told to take at least 10 photos. As the participants toured the exhibit, they listened to an accompanying audio guide.

At the end of the tour, they answered multiple-choice questions asking them to identify objects they had seen or complete factual statements from the audio guide.

The results, published in the journal *Psychological Science*, showed that those who took photos visually recognised more of the objects compared with those who did not have a camera.

However, they also remembered less auditory information than their camera-less peers.

These findings provided evidence that taking pictures can enhance visual memory.

To test their hypotheses in a more controlled environment, the researchers designed a virtual art-gallery tour.

Participants navigated through the gallery on screen as they would in real life and some were able to take pictures of what they saw on screen by clicking an on-screen button.

Those who were able to take pictures were better at recognising what they saw and worse at remembering what they heard, compared to those who could not take pictures.



When the researchers examined visual memory for specific objects, they found that participants who were able to take pictures performed better on visual memory tasks regardless of whether the objects in question were the most or least photographed.

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### **ONLINE USER REVIEWS CAN MAKE YOU CHOOSE WRONG PRODUCTS**

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Do you often check user ratings before buying products online? You may be misled into making the wrong choice, a study suggests.

When buying products online, people often rely on the ratings and reviews of others to choose.

However, scientists suggest that people tend to use this information in ways that can work to their disadvantage.

The findings, published in the journal *Psychological Science*, indicate that people tend to favor a product that has more reviews, even when it has the same low rating as an alternative product.

"It's extremely common for websites and apps to display the average score of a product along with the number of reviews," said Derek Powell of Stanford University.

"We found that people were biased toward choosing to purchase more popular products and that this sometimes led them to make very poor decisions," Powell said.

As opportunities to buy products and services online multiply, we have greater access than ever before to huge amounts of first-hand information about users' experiences.

"We wanted to examine how people use this wealth of information when they make decisions and how they weigh information about other people's decisions with information about the outcomes of those decisions," said Powell.

Looking at actual products available on Amazon.com, researchers found no relationship between the number of reviews a product had and its average rating.

In other words, real-world data show that a large number of reviews is not a reliable indicator of a product's quality.

Researchers wanted to see how people would actually use review and rating information when choosing a product.

In one online experiment, 132 adult participants looked at a series of phone cases, presented in pairs.

The participants saw an average user rating and total number of reviews for each phone case and indicated which case in each pair they would buy.

Across various combinations of average rating and number of reviews, participants routinely chose the option with more reviews.

This bias was so strong that they often favored the more-reviewed phone case even when both of the options had

low ratings, effectively choosing the product that was, in statistical terms, more likely to be low quality.

A second online experiment that followed the same design and procedure produced similar results.

"By examining a large dataset of reviews from Amazon.com, we were able to build a statistical model of how people should choose products," said Powell.

"We found that, faced with a choice between two low-scoring products, one with many reviews and one with few, the statistics say we should actually go for the product with few reviews, since there's more of a chance it's not really so bad," he said.

"But participants in our studies did just the opposite: They went for the more popular product, despite the fact that they should've been even more certain it was of low quality," he added.

The researchers found that this pattern of results fit closely with a statistical model based on social inference.

That is, people seem to use the number of reviews as shorthand for a product's popularity, independent of the product's average rating.

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### **NEW PAPER-BASED SENSOR CAN QUICKLY DETECT DRUG OVERDOSE**

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Scientists have developed a new paper-based sensor that can quickly detect excess dose of a drug often misused in sexual assaults, robberies and for recreational purposes, an advance that may help solve such crimes faster.

Diazepam - used to treat depression and anxiety - is extensively used in cases of homicide or suicides, drug overdoses or drug-facilitated sexual assault, crime and robbery, said researchers who published their findings in the journal *Analytica Chimica Acta*.

"Analysis of the exposure of drug is very costly and resource intensive because of the use of sophisticated instrumental techniques," Jagriti Narang, assistant professor at Amity University in Noida told PTI.

"Hence, the idea popped up to develop a sensor which, if miniaturised, can help these laboratories solve the mystery behind related deaths," Narang said.

"Driven by the necessity to detect diazepam, we report a novel, simple, portable, disposable, rapid inexpensive microfluidic paper-based analytical device to detect diazepam," she said.

Researchers, including those from Jamia Millia Islamia in New Delhi and Maharshi Dayanand University in Rohtak, Haryana, fabricated the sensor by depositing silica-coated gold nanorods on paper.

They then tested its efficiency to detect the drug in urine samples.

"The paper chip is connected to an instrument which shows current signals. Reading these signals can tell us the extent

of the drug intake," said Narang.

"Conventionally the drug is detected using gas chromatography-mass spectrophotometer. These techniques are time consuming and expensive," she said.

"Our approach was to use paper electrodes which not only reduces the time but also makes the sensor cheaper," she added.

This will be a great platform for forensic laboratories, researchers said.

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### **NEW AI SYSTEM CAN SPOT HOSPITAL STAFF WHO DON'T WASH HANDS**

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Scientists have developed a new artificial intelligence system that can track medical staff through cameras and detect whether they maintain proper hand hygiene, an advance that could reduce the risk of hospital-acquired infections.

Researchers at the Swiss Federal Institute of Technology (EPFL) conducted a study using a combination of depth cameras and computer-vision algorithms.

They tracked people around two hospital wards and automatically identified when they used gel dispensers.

"We're trying to shed light on the dark spaces of healthcare. Understanding the problem is just the first step," said Alexandre Alahi from EPFL.

In the initial study, researchers collected images from cameras installed overlooking corridors, patient rooms and alcohol-based gel dispensers, among other places.

Of the 170 people they recorded entering a patient's room, only 30 people correctly used the gel dispensers.

The team then used 80 per cent of the images to train their algorithms to detect healthcare staff, track them as they move from one spot to another across different cameras, and monitor their hand hygiene behaviour.

Once trained, they tested the system on the remaining 20 per cent, and achieved an accuracy of 75 per cent in telling whether people had used the dispensers.

Although there are privacy concerns related to cameras constantly monitoring hospitals, researchers said that the cameras used capture more information about the position of a person than about how they look.

The resulting images consist of unidentifiable human blobs, 'New Scientist' reported.

Cameras dotted around hospitals could help with other things too. Artificial intelligence has already demonstrated the ability to detect falls and monitor vital signs. It could do this throughout a hospital.

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### **ORIGAMI TECHNIQUE USED TO BUILD LOW-COST CRAWLING ROBOT**

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Scientists have used origami - a Japanese paper folding technique - to create a low-cost, crawling robot that uses very little energy to move around.

Researchers were inspired by a common theme in the rapid movement of soft plants like the Venus Flytrap and the swimming of uni-flagellated bacteria, both of which use the flexibility of their bodies to quickly snap, allowing fast motion and saving energy.

"The robot uses origami building blocks to mimic the gait and metameric properties of earthworms and directional material design to mimic the function of the setae on earthworms that prevents backward slipping," said Sameh Tawfik, from University of Illinois in the US.

The researchers investigated the concept of using the Kresling crease pattern of origami, which is a chiral tower with a polygonal base.

This origami tower couples its expansion and contraction to longitudinal and rotational motion, similar to a screw, and they used buckling instabilities to accomplish a large-stroke snapping motion from small inputs.

Their design utilises a skeleton made from the buckling origami tower as mechanisms to transform motor rotation to fast expansion and contraction of the worm robot, enabling a crawling gait. It can go forward and turn left and right using repeated expansion and contraction.

"The ability to produce a functional and geometrically complex 3D mechanical system from a flat sheet introduces exciting opportunities in the field of robotics for remote, autonomously deployable systems or low cost integrated locomotion," researchers said.

Their mathematical analysis is thought to be the first of its kind to use the idea of virtual folds to analyse panel bending in snapping Kresling-like origami towers.

This configuration presents an advantage in energy consumption and makes the open loop locomotion control straight-forward.

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### **2,000-YEAR-OLD ROMAN TOMBS UNCOVERED IN EGYPT**

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Archaeologists have discovered five tombs dating back to about 2,000 years ago when the Romans were ruling Egypt.

The tombs made of mudbricks were excavated at Bir esh-Shaghala in the Dakhla Oasis of Egypt.

Some of the tombs are quite large containing multiple burial chambers, while some have vaulted roofs and one tomb has a roof built in the shape of a pyramid, researchers said.

Archaeologists from Ministry of Antiquities in Egypt also discovered several artefacts inside the tomb including mummy masks and pieces of inscribed pottery known as ostraca.

Giant containers that may have held olive oil or wine were also found. However, chemical tests will need to be done to confirm the contents.

Eight tombs were uncovered within the past six excavation seasons while five were recently discovered, 'Live Science' reported.

Located in the Western Desert, about 350 kilometres west of Luxor, the Dakhla Oasis contains a vast amount of archaeological remains that date from prehistoric to modern times. A number of settlements from the Roman era flourished in the Dakhla Oasis.

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### **NEW 'TWISTRON' YARNS CAN GENERATE ELECTRICITY WHEN STRETCHED**

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Scientists have developed high-tech "twistron" yarns that generate electricity when stretched or twisted, an advance that may lead to self-powered wearable health monitors as well as smart clothes in future.

The yarns have various possible applications such as harvesting energy from the motion of ocean waves or from temperature fluctuations, researchers said.

When sewn into a shirt, these yarns served as a self-powered breathing monitor, they said.

"The easiest way to think of twistron harvesters is, you have a piece of yarn, you stretch it, and out comes electricity," said Carter Haines, associate research professor at University of Texas at Dallas in the US.

The yarns are constructed from carbon nanotubes, which are hollow cylinders of carbon 10,000 times smaller in diameter than a human hair.

The researchers first twist-spun the nanotubes into high-strength, lightweight yarns. To make the yarns highly elastic, they introduced so much twist that the yarns coiled like an over-twisted rubber band.

In order to generate electricity, the yarns must be either submerged in or coated with an ionically conducting material, or electrolyte, which can be as simple as a mixture of ordinary table salt and water.

"Fundamentally, these yarns are supercapacitors," said Na Li, a research scientist at UT Dallas and co-lead author of the study published in the journal *Science*.

"In a normal capacitor, you use energy - like from a battery - to add charges to the capacitor. But in our case, when you insert the carbon nanotube yarn into an electrolyte bath, the yarns are charged by the electrolyte itself. No external battery, or voltage, is needed," said Li.

When a harvester yarn is twisted or stretched, the volume of the carbon nanotube yarn decreases, bringing the electric charges on the yarn closer together and increasing their energy, Haines said.

This increases the voltage associated with the charge stored in the yarn, enabling the harvesting of electricity.

Stretching the coiled twistron yarns 30 times a second generated 250 watts per kilogram of peak electrical power when normalised to the harvester's weight, said Ray Baughman, from UT Dallas.

Researchers showed that a twistron yarn weighing less than a housefly could power a small LED, which lit up each time the yarn was stretched.

To show that twistrons can harvest waste thermal energy from the environment, Li connected a twistron yarn to a polymer artificial muscle that contracts and expands when heated and cooled.

The twistron harvester converted the mechanical energy generated by the polymer muscle to electrical energy.

"There is a lot of interest in using waste energy to power the Internet of Things, such as arrays of distributed sensors," Li said.

"Twistron technology might be exploited for such applications where changing batteries is impractical," said Li.

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### **STAR TREK INSPIRED VIRTUAL REALITY ARENA BUILT FOR ANIMALS**

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Scientists have developed a 'holodeck' - a virtual reality arena inspired from the sci-fi series *Star Trek* - that can replicate any environment to study behaviours in animals.

Dubbed *FreemoVR*, the arena is a cylindrical space in which the floor and wraparound wall are made from flexible computer displays.

Animals placed into the environment can be monitored by overhead cameras and sensors that track their movement and behaviour around the 3D space.

In the *Star Trek* series, the holodeck was used as a training platform, *Enterprise* or as a recreational space, where officers immersed themselves in nature.

However, the new arena at University of Freiburg in Germany will be used as a controlled setting for examining animal perceptions and behaviour.

The principal benefit of the *FreemoVR* system is that the device allows animals to move about freely within the environment.

Using specially developed software, the researchers can adjust the visual imagery on the fly, as it were, and project elements based on the animals' behaviour and movements in real time.

"The most important thing is that the animal is actually moving and gets all the appropriate mechanosensory feedback,"

Andrew Straw, of the University of Freiburg in Germany, was quoted as saying by the 'Live Science'.

"This is really important for studies of navigation and spatial cognition, because if the animal doesn't believe it is moving, it will be difficult to study how the animal updates its 'mental map' as it moves," said Straw.

The study was published in the journal Nature Methods.

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### **TINY DIAMONDS MAY PREVENT FIRES IN SMARTPHONE BATTERIES**

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Nanodiamonds - tiny particles 10,000 times smaller than the width of a hair - can prevent lithium batteries from bursting into flames, making your smartphones, laptops and other mobile devices safer to use, scientists say.

Researchers, including those at Drexel University in the US, developed a recipe that can turn electrolyte solution - a key component of most batteries - into a safeguard against the chemical process that leads to battery-related disasters.

The team focused their work on making lithium anodes more stable and lithium plating more uniform by adding nanodiamonds to the electrolyte solution in a battery.

Nanodiamonds have been used in the electroplating industry for some time as a way of making metal coatings more uniform.

While they are much smaller and cheaper than the diamonds used in jewellery, nanodiamonds still retain the regular structure and shape of their pricey progenitors.

When they are deposited, they naturally slide together to form a smooth surface.

Researchers found that lithium ions can easily attach to nanodiamonds, so when they are plating the electrode, it is in the same orderly manner as the nanodiamond particles to which they are linked.

Mixing nanodiamonds into the electrolyte solution of a lithium ion battery slows dendrite formation to nil through 100 charge-discharge cycles, researchers said.

This discovery is just the beginning of a process that could eventually see electrolyte additives, like nanodiamonds, widely used to produce safe lithium batteries with a high energy density, researchers said.

Initial results already show stable charge-discharge cycling for as long as 200 hours, which is long enough for use in some industrial or military applications, but not nearly adequate for batteries used in laptops or cell phones, they added.

"It is potentially game-changing, but it is difficult to be 100 percent certain that dendrites will never grow," said Yuri Gogotsi, professor at Drexel University.

"To ensure safety, additives to electrolytes, such as nanodiamonds, need to be combined with other precautions,

such as using non-flammable electrolytes, safer electrode materials and stronger separators," Gogotsi added.

The study was published in the journal Nature Communications.

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### **'NEW AUGMENTED REALITY SYSTEM TO GUIDE PLASTIC SURGERY'**

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Scientists have developed an augmented reality system that could be a useful guide to planning, performing and evaluating the results of facial reconstruction and other procedures.

The system enables researchers to create three dimensional (3D) simulations of the desired results of facial reconstructive procedures and project them over the patient's face during surgery.

Researchers at Osaka Medical College in Japan reported the development and initial experience with the augmented reality (AR) system for evaluation of improvements of the body surface, a key consideration in plastic surgery.

Initial experience in eight cases suggests that augmented reality could be a useful guide to planning, performing and evaluating the results of facial reconstruction and other procedures, they said.

Augmented reality is a technology that combines computer-generated images on a screen with a real object or scene.

"We sought to develop a sophisticated yet simple and modifiable AR technique for use during plastic and reconstructive surgery," said Koichi Ueda and Daisuke Mitsuno from Osaka Medical College.

Researchers used a high-definition digital camera to capture 3D image of the facial surface and computed tomography scans to obtain digital information on the underlying facial bones for each patient.

These digital data were then manipulated to create 3D simulations of the ideal final results.

For example, in a patient with a fractured cheekbone, the reconstruction was simulated by obtaining and reversing an image of the opposite, uninjured bone.

Using a pair of commercially available smart glasses, the surgeon was able to superimpose the 3D digital simulation image of the desired appearance over the patient's face during surgery.

The group used free, open source software products to solve various technical problems, including manipulating and displaying the 3D simulations and lining them up with the surgical field.

In the study published in the journal Plastic and Reconstructive Surgery - Global Open, the team described their preliminary experience with AR system in eight patients undergoing reconstructive facial surgery.

The AR system helped in planning and confirming reconstruction of the underlying facial bones, for example, in a patient with a congenital bone development disorder and another patient with a complex facial fracture.

In all cases, the 3D simulation of the body surface provided a visual reference of the final facial appearance, researchers said.

"Our findings are not only useful for body surface evaluation but also for effective evaluation of AR technology in the field of plastic surgery," said Ueda.

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### **NEW SPECIES OF GIGANTIC, LONG NECKED DINOSAURS FOUND**

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Scientists have discovered a new species of long-necked titanosaurian dinosaur in Tanzania that lived about 70 to 100 million years ago.

The new species named *Shingopana songwensis* is a member of the gigantic, long-necked sauropods. Its fossil was discovered in the Songwe region of the Great Rift Valley in southwestern Tanzania.

"There are anatomical features present only in *Shingopana* and in several South American titanosaurs, but not in other African titanosaurs," said Eric Gorscak, a paleontologist at the Field Museum of Natural History in Chicago, US.

"*Shingopana* had siblings in South America, whereas other African titanosaurs were only distant cousins," Gorscak added.

The team conducted phylogenetic analyses to understand the evolutionary relationships of these and other titanosaurs.

They found that *Shingopana* was more closely related to titanosaurs of South America than to any of the other species currently known from Africa or elsewhere.

"This discovery suggests that the fauna of northern and southern Africa were very different in the Cretaceous Period," said Judy Skog, a programme director in National Science Foundation in the US.

"At that time, southern Africa dinosaurs were more closely related to those in South America, and were more widespread than we knew," Skog added.

*Shingopana* roamed the Cretaceous landscape alongside *Rukwatitan bisepultus*, another titanosaur identified in 2014, researchers said.

Part of the *Shingopana* skeleton was excavated in 2002 by scientists affiliated with the Rukwa Rift Basin Project, an international effort led by Ohio University Heritage College of Osteopathic Medicine researchers Patrick O'Connor and Nancy Stevens.

The findings were published in the *Journal of Vertebrate Paleontology*.

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### **DANCING MAY REVERSE SIGNS OF AGEING IN BRAIN: STUDY**

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Dancing may reverse the signs of ageing in the brains of older people who routinely partake in physical exercise, a study has claimed.

"Exercise has the beneficial effect of slowing down or even counteracting age-related decline in mental and physical capacity," said Kathrin Rehfeld from the German Center for Neurodegenerative Diseases in Germany.

"We show that two different types of physical exercise (dancing and endurance training) both increase the area of the brain that declines with age. In comparison, it was only dancing that led to noticeable behavioural changes in terms of improved balance," said Rehfeld.

Elderly volunteers, with an average age of 68, were recruited to the study and assigned either an eighteen-month weekly course of learning dance routines, or endurance and flexibility training.

Both groups showed an increase in the hippocampus region of the brain. This is important because this area can be prone to age-related decline and is affected by diseases like Alzheimer's. It also plays a key role in memory and learning, as well as keeping one's balance, researchers said.

While previous research has shown that physical exercise can combat age-related brain decline, it is not known if one type of exercise can be better than another.

To assess this, the exercise routines given to the volunteers differed.

The traditional fitness training programme conducted mainly repetitive exercises, such as cycling or Nordic walking, but the dance group were challenged with something new each week.

"We tried to provide our seniors in the dance group with constantly changing dance routines of different genres (Jazz, Square, Latin-American and Line Dance)," said Rehfeld, lead author of the study published in the journal *Frontiers in Human Neuroscience*.

"Steps, arm-patterns, formations, speed and rhythms were changed every second week to keep them in a constant learning process. The most challenging aspect for them was to recall the routines under the pressure of time and without any cues from the instructor," she said.

These extra challenges are thought to account for the noticeable difference in balance displayed by those participants in dancing group.

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### OVER 99 PER CENT OF MICROBES INSIDE US UNKNOWN TO SCIENCE

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Over 99 per cent of the microbes in our body have never been seen or identified, say Stanford scientists who conducted a survey of DNA fragments circulating in human blood.

The study suggests that our bodies contain vastly more diverse microbes than anyone previously understood.

"We found things that are related to things people have seen before, we found things that are divergent, and we found things that are completely novel," said Stephen Quake, a professor at Stanford University.

Researchers collected samples from 156 heart, lung and bone marrow transplant recipients, along with 32 pregnant women.

Of all the non-human DNA fragments the team gathered, 99 per cent of them failed to match anything in existing genetic databases the researchers examined.

Researchers then set about characterising all of that mystery DNA.

The "vast majority" of it belonged to a phylum called proteobacteria, which includes, among many other species, pathogens such as E coli and Salmonella.

Previously unidentified viruses in the torque teno family, generally not associated with disease but often found in immunocompromised patients, made up the largest group of viruses.

"We've doubled the number of known viruses in that family through this work," Quake said.

Perhaps more important, researchers found an entirely new group of torque teno viruses. Among the known torque teno viruses, one group infects humans and another infects animals, but many of the ones the researchers found did not fit in either group.

"We've now found a whole new class of human-infecting ones that are closer to the animal class than to the previously known human ones, so quite divergent on the evolutionary scale," Quake said.

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### ENERGY-HARVESTING YARNS MAY LEAD TO SMART CLOTHES

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Scientists have developed high-tech yarns that generate electricity when stretched or twisted, an advance that may lead to self-powered wearable health monitors as well as smart clothes in future.

The "twistron" yarns have various possible applications such as harvesting energy from the motion of ocean waves or from temperature fluctuations, researchers said.

When sewn into a shirt, these yarns served as a self-powered breathing monitor, they said.

"The easiest way to think of twistron harvesters is, you have a piece of yarn, you stretch it, and out comes= electricity," said Carter Haines, associate research professor at University of Texas at Dallas in the US.

The yarns are constructed from carbon nanotubes, which are hollow cylinders of carbon 10,000 times smaller in diameter than a human hair.

The researchers first twist-spun the nanotubes into high-strength, lightweight yarns. To make the yarns highly= elastic, they introduced so much twist that the yarns coiled like an over-twisted rubber band.

In order to generate electricity, the yarns must be either submerged in or coated with an ionically conducting material, or electrolyte, which can be as simple as a mixture of ordinary table salt and water.

"Fundamentally, these yarns are supercapacitors," said Na Li, a research scientist at UT Dallas and co-lead author of the study published in the journal Science.

"In a normal capacitor, you use energy - like from a battery - to add charges to the capacitor. But in our case, when you insert the carbon nanotube yarn into an electrolyte bath, the yarns are charged by the electrolyte itself. No external battery, or voltage, is needed," said Li.

When a harvester yarn is twisted or stretched, the volume of the carbon nanotube yarn decreases, bringing the electric charges on the yarn closer together and increasing their energy, Haines said.

This increases the voltage associated with the charge stored in the yarn, enabling the harvesting of electricity.

Stretching the coiled twistron yarns 30 times a second generated 250 watts per kilogram of peak electrical power when normalised to the harvester's weight, said Ray Baughman, from UT Dallas.

Researchers showed that a twistron yarn weighing less than a housefly could power a small LED, which lit up each time the yarn was stretched.

To show that twistrons can harvest waste thermal energy from the environment, Li connected a twistron yarn to a polymer artificial muscle that contracts and expands when heated and cooled.

The twistron harvester converted the mechanical energy generated by the polymer muscle to electrical energy.

"There is a lot of interest in using waste energy to power the Internet of Things, such as arrays of distributed sensors," Li said.

"Twistron technology might be exploited for such applications where changing batteries is impractical," said Li.

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### **CAFFEINE TRIGGERS TEMPTATION FOR SWEETS: STUDY**

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Do you crave for a donut after having a cup of coffee? Blame the caffeine, suggests a study which found that the widely consumed stimulant tempers taste buds temporarily, making food seem less sweet.

Caffeine is a powerful antagonist of adenosine receptors, which promote relaxation and sleepiness.

Suppressing the receptors awakens people but decreases their ability to taste sweetness - which may make them desire it more, researchers said.

"When you drink caffeinated coffee, it will change how you perceive taste - for however long that effect lasts," said Robin Dando, assistant professor at Cornell University in the US.

"So if you eat food directly after drinking a caffeinated coffee or other caffeinated drinks, you will likely perceive food differently," said Dando.

In the study published in the Journal of Food Science, one group sampled decaffeinated coffee with 200 milligrammes of caffeine added in a laboratory setting, making a strong cup of coffee.

The stimulant was added to make that group's coffee consistent with real-life amounts of caffeine.

The other group drank just decaffeinated coffee. Both groups had sugar added. Panelists who drank the caffeinated brew rated it as less sweet.

In a secondary part of the study, participants disclosed their level of alertness and estimated the amount of caffeine in their coffee.

They reported the same increase in alertness after drinking either the caffeinated or decaffeinated samples, all the while panelists could not predict if they had consumed the decaffeinated or the caffeinated version.

"We think there might be a placebo or a conditioning effect to the simple action of drinking coffee," said Dando.

"The act of drinking coffee - with the aroma and taste - is usually followed by alertness. So the panelists felt alert even if the caffeine was not there," said Dando.

"What seems to be important is the action of drinking that coffee. Just the action of thinking that you have done the things that make you feel more awake, makes you feel more awake," he said.

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### **NASA UNVEILS STUNNING IMAGE OF SNOW-COVERED DUNES ON MARS**

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NASA's Mars orbiter has beamed back a stunning image of the red planet's snow-covered dunes creating beautiful patterns over the rust coloured background.

The image was taken on May 21 in the Northern hemisphere of Mars by the High Resolution Imaging Science Experiment (HiRISE) camera on US space agency's Mars Reconnaissance Orbiter.

Unlike on Earth, the snow and ice is carbon dioxide, better known to us as dry ice.

When the Sun starts shining on it in the spring, the ice on the smooth surface of the dune cracks and escaping gas carries dark sand out from the dune below, often creating beautiful patterns.

On the rough surface between the dunes, frost is trapped behind small sheltered ridges.

NASA's Jet Propulsion Laboratory manages the Mars Reconnaissance Orbiter, which was launched in 2005 and attained Martian orbit on March 10, 2006.

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### **'SUPER STEEL' WITH HIGH STRENGTH, DUCTILITY DEVELOPED**

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In a breakthrough, scientists have developed a steel with a high level of both strength and ductility that may have a wide range of industrial applications.

The material cost of the steel is just one-fifth of that used in the current aerospace and defence applications, researchers said.

The steel belongs to the group of medium manganese steel that contains 10 per cent manganese, 0.47 per cent carbon, 20 per cent aluminium and 0.7 per cent vanadium, they said.

Strength and ductility - when a solid material stretches under stress - are desirable properties of metallic materials for wide-ranging applications.

However, increasing strength often leads to the decrease in ductility, researchers said.

To address the problem, the team led by Huang Mingxin from the University of Hong Kong used a new manufacturing technique called deformed and partitioned (D&P).

In a study published in the journal Science, researchers noted that it is very difficult to further improve the ductility of metallic materials when their yield strength is beyond two Gigapascal (GPa), Xinhua news agency reported.

They made "a successful attempt in realising the dream" as the newly developed method yields a "breakthrough steel" that has the "unprecedented" yield strength of 2.2 GPa and uniform elongation of 16 per cent.

"The D&P steel demonstrated the best combination of yield strength and uniform elongation among all existing high-strength metallic materials," researchers, including those from University of Science and Technology Beijing, said.

The uniform elongation of the new steel is much higher than that of metallic materials with yield strength beyond 2.0 GPa, they said.



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### **NEW TYPE OF MRI SCAN TO ACCURATELY PREDICT STROKE RISK**

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Scientists have developed a new type of MRI scan that can accurately predict the risk of life-threatening strokes.

The non-invasive technique created by researchers at the University of Oxford in the UK produces a quantitative result that can accurately indicate whether plaques in the carotid arteries – those that supply the brain with blood – are rich in cholesterol, and therefore more likely to cause a stroke.

The rupture of fatty plaques can block the arteries and cause potentially debilitating and life-threatening strokes as the brain is starved of oxygen.

At present, the risk of stroke is measured by the size of the plaque in the carotid artery.

If the plaque is deemed to be too big, people are treated surgically to remove it.

However, this method can miss fatty plaques that are not big, but have a high risk of rupturing.

The new magnetic resonance imaging (MRI) technique was developed to differentiate between the risky plaques that contain a lot of cholesterol, and those that are more stable.

In the study published in the journal *JACC: Cardiovascular*, the researchers used the new MRI scan to measure the amount of cholesterol in the carotid plaques of 26 patients scheduled for surgery.

After the plaques were surgically removed, the team looked at the actual cholesterol content in each plaque and found that the new technique was accurate and the more cholesterol they detected within the plaque, the greater the risk.

"When someone goes to hospital having suffered a minor stroke, it is vital that doctors know whether the patient might be at risk of a further stroke, which could be fatal," said Luca Biasioli, from the University of Oxford.

"Being able to quantify cholesterol in carotid plaques is a really exciting prospect, as this new MRI technique could help doctors to identify patients at higher risk of stroke and make more informed decisions on their treatments," said Biasioli.

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### **COMMON DIABETES DRUG REDUCES BRAIN PRESSURE**

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A drug commonly used to treat patients with obesity or type 2 diabetes may also lower brain pressure, a study has found.

Raised brain pressure is common in emergency situations such as traumatic brain injury, hydrocephalus and stroke, and is also the cardinal feature of Idiopathic Intracranial Hypertension (IIH).

IIH causes disabling daily headaches and severely raised pressure around the nerves in the eye. It also causes permanent vision loss in 25 per cent of untreated people.

Over a three-year period, researchers at the University of Birmingham in the UK examined whether GLP-1 agonist drugs – existing drugs used in the treatment of diabetes and obesity – could reduce intracranial pressure in an animal model of raised brain pressure.

"Treatments to lower brain pressure are lacking and new treatments are desperately needed," Alexandra Sinclair, from the University of Birmingham's Institute of Metabolism and Systems Research.

"The current primary treatment in IIH is acetazolamide and this does not work well for many patients, while also having such severe side effects that our previous trials have shown that 48 per cent of patients stop taking it," Sinclair said.

"We have shown that the GLP-1 agonist *extendin-4* significantly reduces brain pressure rapidly and dramatically, by around 44 per cent with significant effects from just 10 minutes of dosing – the biggest reduction we have seen in anything we have previously tested.

The effects last at least 24 hours, according to the study published in the journal *Science translational Medicine*.

These findings are rapidly translatable into a novel treatment strategy for IIH as GLP-1 agonists are safe and widely-used drugs used to treat diabetes and obesity.

They are also potentially game-changing for other conditions featuring raised brain pressure, including stroke, hydrocephalus and traumatic brain injury.

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### **SCIENTISTS DECODE SECRET BEHIND HIT POP SONGS**

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Harmonic surprise – an unexpected change in music – as well as the use of relatively rare chords trigger pleasurable response in the listener's brain, say scientists who have decoded what makes certain songs top the charts.

Researchers from the Georgetown University in the US uncovered a simple, measurable explanation that can determine people's preference for one song over another.

The study, published in the journal *Frontiers in Human Neuroscience*, linked the harmonic structure of pop songs to their placement in the charts.

"The most popular songs tend to include relatively rare chords, that is, they typically have high harmonic surprise," said Norberto Grzywacz, a professor at Georgetown University.

"These songs also tend to have choruses with relatively low harmonic surprise preceded by sections with many rare chords," said Grzywacz.

Harmonic surprise can be described as where the music deviates from the listeners expectations. Scientists have predicted

that these changes in structure could elicit a pleasurable reward response in the brain.

In other words, harmonic surprise can increase the likelihood a song will be a hit.

"When listening to music, we enjoy some pieces and dislike others. Multiple reasons govern how much we like a piece of music, including compositional, emotional and cultural," said Grzywacz.

"We evaluated the role of a compositional element - the harmonic surprise. Surprise is important because it is a measure of new information; something that the reward centres of the brain recognise as being of value, leading to a positive emotional response," he said.

"Therefore, our finding that the most popular songs tend to include surprising chords reflects our brains in-built preference," Grzywacz said.

It is not just the surprise element of a song that the brain deems as pleasurable, but the return to normality too.

"The brain enjoys surprise only up to a point, because unexpected events indicate a failure of prediction," he said.

"Hence, the release of tension from surprising sections of a song to common choruses is also signalled positively by the reward centres," he said.

"Our research reveals that the brain has a deep-rooted preference, which can affect whether people enjoy a piece of music," he added.

The study analysed chord-by-chord transcriptions of the harmonies of 545 songs that entered the American Billboard Hot 100 charts between 1958 and 1991.

Researchers measured how far chords of a song deviated from what was expected. These measures of surprise were compared throughout the entire song and between song sections.

"We then used the peak position of the song in the weekly Billboard Hot 100 chart to determine its popularity," said Grzywacz.

It revealed that verses, not the choruses or bridges, accounted for much of the difference in harmonic surprise between the most and least popular songs in the Billboard Hot 100 chart.

Researchers suggest that high surprises in the harmony of a song, as well as high surprises followed by a lower-surprise section, can both contribute to the enjoyment of an unfamiliar piece of music.

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**MORE EFFECTIVE WAY TO TREAT HIV IDENTIFIED**

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Scientists have discovered a more effective way to treat people suffering from HIV whose bodies have built a resistance to drug 'cocktails' currently used to keep them healthy.

Researchers from University of South Carolina (USC) in the US identified a novel human protein variant that can be targeted to prevent the human immunodeficiency virus from harming HIV-positive individuals.

"Most HIV drugs target the virus but the virus is not stable, it always mutates - problematic because the virus can become resistant to effective drugs," said I-Chueh Huang, assistant professor at USC.

The new study focused on HIV-1, the most widespread version worldwide.

HIV can be classified into R5 and X4 viruses. R5 viruses are exclusively associated with primary infection, and X4 viruses emerge in later stages of HIV diseases in half of HIV carriers.

Detection of X4 is an indication that the patient's HIV infection has progressed to a very toxic state.

Researchers identified a novel variant within the previously identified family of proteins.

They nicknamed it "Delta 20," an immune system protein that suppresses the most damaging HIV strains, X4, by preventing the virus from infecting cells.

This method differs from the more traditional method of targeting viruses that may eventually become resistant to specific medical therapies, researchers said.

"Much more research needs to be done, but we may have identified a new approach to treating acute HIV infection," Huang said.

"Our finding will not help develop a vaccine because the focus is on innate immunity rather than the virus," Huang said.

"Perhaps one day scientists will create medicine that, like 'HIV cocktails,' have to be taken indefinitely. But the new treatment may be more effective because it is harder for viruses to escape the body's defences," Huang added.

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

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**BEST EVER IMAGE OF A STAR'S SURFACE, ATMOSPHERE TAKEN**

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Astronomers have captured the most detailed image ever of the surface and atmosphere of any star other than the Sun.

They have also made the first two-dimensional map of the velocities of material in the atmosphere of a star beyond the Sun, revealing unexpected turbulence in the red supergiant star Antares's huge extended atmosphere.

To the unaided eye the famous, bright star Antares shines with a strong red tint in the heart of the constellation of Scorpius (The Scorpion).

It is a huge and comparatively cool red supergiant star in the late stages of its life, on the way to becoming a supernova.

## *Globe Scan*

A team of astronomers, led by Keiichi Ohnaka, of the Universidad Catolica del Norte in Chile, has now used European Southern Observatory (ESO)'s Very Large Telescope Interferometer (VLTI) in Chile to map Antares's surface and to measure the motions of the surface material.

This is the best image of the surface and atmosphere of any star other than the Sun, researchers said.

"How stars like Antares lose mass so quickly in the final phase of their evolution has been a problem for over half a century," said Keiichi Ohnaka, the lead author of the research paper published in the journal Nature.

"The VLTI is the only facility that can directly measure the gas motions in the extended atmosphere of Antares - a crucial step towards clarifying this problem," said Ohnaka.

Using the new results the team has created the first two-dimensional velocity map of the atmosphere of a star other than the Sun.

They did this using the VLTI with three of the Auxiliary Telescopes and an instrument called AMBER to make separate images of the surface of Antares over a small range of infrared wavelengths.

The team then used these data to calculate the difference between the speed of the atmospheric gas at different positions on the star and the average speed over the entire star.

This resulted in a map of the relative speed of the atmospheric gas across the entire disc of Antares.

The astronomers found turbulent, low-density gas much further from the star than predicted, and concluded that the movement could not result from convection, that is, from large-scale movement of matter which transfers energy from the core to the outer atmosphere of many stars.

They said that a new, currently unknown, process may be needed to explain these movements in the extended atmospheres of red supergiants like Antares.

"In the future, this observing technique can be applied to different types of stars to study their surfaces and atmospheres in unprecedented detail. This has been limited to just the Sun up to now," Ohnaka said.

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### **YOUR SWEAT CAN POWER WEARABLE DEVICES**

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Scientists, including one of Indian origin, have developed stretchable fuel cells that extract energy from sweat, and could power a range of wearable devices such as LEDs and Bluetooth radios.

The biofuel cells generate 10 times more power per surface area than any existing wearable biofuel cells.

The epidermal biofuel cells are a major breakthrough in the field, which has been struggling with making the devices that are stretchable enough and powerful enough, they said.

Engineers from the University of California, San Diego in the US developed a stretchable electronic foundation by using lithography and screen-printing to make 3D carbon nanotube-based cathode and anode arrays.

The biofuel cells are equipped with an enzyme that oxidises the lactic acid present in human sweat to generate current.

"We needed to figure out the best combination of materials to use and in what ratio to use them," said Amay Bandothkar, first author of the research paper published in the journal Energy and Environmental Science.

Researchers led by Professor Joseph Wang from UC San Diego connected the biofuel cells to a custom-made circuit board and demonstrated the device was able to power an LED while a person wearing it exercised on a stationary bike.

To be compatible with wearable devices, the biofuel cell needs to be flexible and stretchable. So engineers decided to use what they call a "bridge and island".

Essentially, the cell is made up of rows of dots that are each connected by spring-shaped structures. Half of the dots make up the cell's anode or electrode through which conventional current flows; the other half are the cathode.

The spring-like structures can stretch and bend, making the cell flexible without deforming the anode and cathode.

The basis for the islands and bridges structure was manufactured via lithography and is made of gold.

Researchers used screen printing to deposit layers of biofuel materials on top of the anode and cathode dots.

To increase power density, engineers screen printed a 3D carbon nanotube structure on top the anodes and cathodes.

The structure allows engineers to load each anodic dot with more of the enzyme that reacts to lactic acid and silver oxide at the cathode dots.

In addition, the tubes allow easier electron transfer, which improves biofuel cell performance.

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### **'NASA ROCKETS TO CREATE GLOWING ARTIFICIAL CLOUDS'**

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A NASA rocket mission is set to form white artificial clouds that will glow in the night sky, to study disturbances in the upper atmosphere that interfere with communication and technology systems.

The artificial clouds will be visible to residents of the Republic of the Marshall Islands during two rocket flights to occur between August 29 and September 9, the US space agency said.

The Waves and Instabilities from a Neutral Dynamo (WINDY) mission will study a phenomenon that occurs in the ionosphere - a layer of charged particles in the upper atmosphere.

Known as equatorial spread F (ESF) these disturbances occur after sunset at latitudes near the equator in part of the

ionosphere known as the F region.

The disturbances interfere with radio communication, navigation and imaging systems and pose a hazard to technology and society that depends on it.

The WINDY mission consists of two NASA suborbital sounding rockets that will be launched nearly simultaneously in a window between 8 and 11 pm local time from August 29 through September 9 from the island of Roi-Namur .

The Kwajalein Atoll in the Marshall Islands is near the magnetic equator, where post-sunset ionosphere storms are more intense, making the site an ideal location for these studies.

One rocket will carry a substance called tri-methyl aluminium (TMA), which will form the white artificial clouds that glow in the night sky.

Scientists on the ground photograph the movement of these clouds to measure the winds and energetic particles that are in motion in the upper atmosphere. The clouds are expected to be visible for about 30 minutes.

The first rocket launched, a two-stage 47-foot long Black Brant IX rocket, will carry and release both TMA and lithium.

The release of the lithium vapours is not visible to the naked-eye but can be viewed with special cameras on the ground.

Both TMA and lithium, which are harmless to residents on the ground when released at these altitudes, move with the atmospheric winds and can therefore be used to determine the wind speeds and direction over the area where these ionosphere storms are occurring.

TMA reacts spontaneously on contact with oxygen to produce a pale white glow visible from the ground.

For the WINDY mission, sunlight reflected by the Moon, will illuminate lithium producing an emission that can be detected with cameras equipped with narrow-band filters.

Using moonlight allows the launches to occur later in the evening when the critical ESF conditions occur.

The second rocket, a two-stage 36-foot long Terrier-Malemute, will be launched five minutes after the first rocket.

It will carry instruments to measure ionosphere densities and electric and magnetic fields present in these storms.

The ionosphere is defined as the layer of Earth's atmosphere that is ionised by solar and cosmic radiation.

Ionisation occurs when incoming energetic radiation strips electrons from atoms and molecules, creating temporarily charged particles.

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### **ASTRONAUT URINE MAY BE RECYCLED INTO NUTRIENTS, PLASTIC**

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Scientists have found a way to recycle human urine into food supplements and plastics, an advance that may make long duration space trips more feasible.

Astronauts can not take a lot of spare parts into space because every extra ounce adds to the cost of fuel needed to escape the Earth's gravity.

"If astronauts are going to make journeys that span several years, we will need to find a way to reuse and recycle everything they bring with them. Atom economy will become really important," said Mark A Blenner, from the Clemson University in the US.

The solution lies in part with the astronauts themselves, who will constantly generate waste from breathing, eating and using materials.

Unlike people on Earth, Blenner said, spacefarers would not want to throw any waste molecules away.

Researchers are studying how to repurpose these molecules and convert them into products the astronauts need, such as polyesters and nutrients.

Some essential nutrients, such as omega-3 fatty acids, have a shelf life of just a couple of years, said Blenner.

They will need to be made en route, beginning a few years after launch, or at the destination.

"Having a biological system that astronauts can awaken from a dormant state to start producing what they need, when they need it, is the motivation for our project," Blenner said.

The biological system includes a variety of strains of the yeast *Yarrowia lipolytica*. These organisms require both nitrogen and carbon to grow.

Researchers discovered that the yeast can obtain their nitrogen from urea in untreated urine. Meanwhile, the yeast obtain their carbon from CO<sub>2</sub>, which could come from astronauts' exhaled breath, or from the Martian atmosphere.

However, to use CO<sub>2</sub>, the yeast require a middleman to 'fix' the carbon into a form they can ingest.

For this purpose, the yeast rely on photosynthetic cyanobacteria or algae provided by the researchers.

One of the yeast strains produces omega-3 fatty acids, which contribute to heart, eye and brain health. Another strain has been engineered to churn out monomers and link them to make polyester polymers. Those polymers could then be used in a 3D printer to generate new plastic parts.

Researchers are continuing to engineer this yeast strain to produce a variety of monomers that can be polymerised into different types of polyesters with a range of properties.

For now, the engineered yeast strains can produce only small amounts of polyesters or nutrients, but the scientists are working on boosting output.

They are also looking into applications here on Earth, in fish farming and human nutrition. For example, fish raised via aquaculture need to be given omega-3 fatty acid supplements, which could be produced by Blenner's yeast strains.

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### **AI SYSTEM TO HELP DETECT SKIN CANCER IN EARLY STAGES**

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Scientists are developing an artificial intelligence based system to help detect melanoma - a deadly form of skin cancer - in its early stages.

The system, built by researchers at University of Waterloo in Canada, analyses images of skin lesions and provides doctors with data on telltale biomarkers of melanoma, which is deadly if detected late, but highly treatable if caught early.

It deciphers levels of biomarker substances in lesions, adding consistent, quantitative information to assessments currently based on appearance alone, researchers said.

In particular, changes in the concentration and distribution of eumelanin, a chemical that gives skin its colour, and hemoglobin, a protein in red blood cells, are strong indicators of melanoma, they said.

The artificial intelligence (AI) system - trained using tens of thousands of skin images and their corresponding eumelanin and hemoglobin levels - could initially reduce the number of unnecessary biopsies, a significant health-care cost, researchers said.

It gives doctors objective information on lesion characteristics to help them rule out melanoma before taking more invasive action.

"This could be a very powerful tool for skin cancer clinical decision support. The more interpretable information there is, the better the decisions are," said Alexander Wong, a professor of systems design engineering at Waterloo.

"There can be a huge lag time before doctors even figure out what is going on with the patient. Our goal is to shorten that process" Wong added.

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### **NOW, YOU CAN CUSTOM DESIGN ROBOTS WITHIN MINUTES**

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Scientists have developed a system that lets you design a robot in minutes, and then 3D-print and assemble it in as little as four hours.

The process of creating robots is slow and costly: even one small change can mean days or weeks of rethinking and revising important hardware, researchers said.

One of the key features of the new system is that it allows designers to determine both the robot's movement ("gait") and shape ("geometry"), a capability that is often separated in design systems, they said.

"Designing robots usually requires expertise that only mechanical engineers and roboticists have," said Adriana Schulz, PhD student at Massachusetts Institute of Technology (MIT) in the US.

"What is exciting here is that we have created a tool that allows a casual user to design their own robot by giving them this expert knowledge," said Schulz, co-lead author of the paper published in the International Journal of Robotics Research. Interactive Robogami uses simulations and feedback with algorithms for design composition, allowing users to focus on high-level conceptual design.

Users can choose from a library of over 50 different bodies, wheels, legs and "peripherals," as well as a selection of different steps ("gaits").

The system is able to guarantee that a design is actually possible, analysing factors such as speed and stability to make suggestions and ensure that, for example, the user does not create a robot so top-heavy that it cannot move without tipping over.

Once designed, the robot is then fabricated. The team's origami-inspired "3D print and fold" technique involves printing the design as flat faces connected at joints, and then folding the design into the final shape, combining the most effective parts of 2D and 3D printing.

"3D printing lets you print complex, rigid structures, while 2D fabrication gives you lightweight but strong structures that can be produced quickly," said Cynthia Sung, PhD graduate from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL).

"By 3D-printing 2D patterns, we can leverage these advantages to develop strong, complex designs with lightweight materials," Sung said.

Researchers fabricated a total of six robots, each of which took 10 to 15 minutes to design, three to seven hours to print and 30 to 90 minutes to assemble.

They found that their 3D print-and-fold method reduced printing time by 73 per cent and the amount of material used by 70 per cent. The robots also demonstrated a wide range of movement, like using single legs to walk, using different step sequences, and using legs and wheels simultaneously.