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**DELHI AIR QUALITY IMPROVES A SHADE,
STILL 'VERY POOR'**

High volume of airborne particulates continues to keep Delhi's air quality 'very poor', a shade better than 'severe', continuing the trend observed since Dec 6.

The National Air Quality Index (NAQI) of Central Pollution Control Board (CPCB) puts the 24-hour-average AQI at 340-- anything beyond 400 is considered severe as per the categorisation.

Experts say although little differentiates the two categories, the general intensity of pollution in Delhi during winters is such that anything less than 'severe' is considered a relief. All but one monitoring station of Central agency SAFAR (System of Air Quality and Weather Forecasting and Research) recorded very poor air. Only the Lodhi Road Centre had PM 10 as 'moderate' and PM 2.5 as 'poor'.

CPCB parameters say that one may develop respiratory illness on prolonged exposure to very poor air quality while severe AQI affects healthy people and seriously impacts those with existing diseases.

SAFAR said the 24-hour-average (rolling) of PM 2.5 and PM 10 were 137 and 290 micrograms per cubic metre respectively. PM 2.5 and PM 10 are ultrafine particulates-- products of vehicular emissions, road and construction dust, and diesel generators among others-- which routinely violate the prescribed standards of 60 and 100 micrograms per cubic metre in Delhi daily.

The Delhi government held a review meeting where the average concentration of particulate matter from November 1 to December 11 was also discussed.

"In the meeting, Delhi Pollution Control Committee officials informed that there is no significant increase in levels of particulate matter. Environment Minister Imran Hussain said in view of dipping night temperature, controlling of garbage and biomass burning needs to be emphasised," a spokesperson said.

**INDIAN EXPERTS RECOMMEND 200-DAY
PLAN TO FIGHT TYPE 2 DIABETES**

Leading Indian experts in diabetes have issued a series of urgent recommendations, that included early detection of the condition, to be implemented during the

next 200 days to reduce the growing national burden of type 2 diabetes.

The recommendations, which include four pillars of Early Action - prevention, detection, control and access to the right interventions, were presented at the Global Diabetes Policy Forum, held on December 13 and 14 in Berlin, Germany.

"Type 2 diabetes is a ticking time bomb for our country. Every year, more and more people in India are diagnosed with this condition," said Dr Ashok K Das, Professor of Medicine and Professor and Head of Endocrinology, Pondicherry Institute of Medical Sciences, and Dr Sanjay Kalra, Bharti Research Institute of Diabetes and Endocrinology, Bharti Hospital.

"Our recommendations are aimed at encouraging government, fellow physicians and patients to take early action to prevent, diagnose and control type 2 diabetes," they said in a statement.

Type 2 diabetes affects more than 69.1 million people in India, said the statement, which said an estimated 1 million deaths per year in India are attributable to type 2 diabetes.

Poorly-controlled type 2 diabetes can increase the risk of cardiovascular disease, blindness and kidney failure.

In addition to presenting their 200-day plan, the Indian experts joined other international leaders in diabetes at the forum in signing 'The Berlin Declaration', a manifesto establishing foundational principles and recommendations to help countries formulate policies likely to improve health outcomes for people living with, or at risk of, diabetes. The 200-day plan has taken inspiration from this document.

"What sets 'Early Action' apart from other campaigns is its focus on real action on the ground, aimed at producing concrete benefits for people with diabetes in countries at all levels of income," said President, International Diabetes Federation, Dr Shaukat Sadikot.

"Every six seconds, someone in the world dies from diabetes. This sobering fact makes it absolutely critical that policymakers take action now, and that a broad range of stakeholders come together to encourage and support needed policy reform," Sadikot said.

The forum carried forward the work begun under the banner of 'Early Action in Diabetes' at the first Global Diabetes Policy Summit, held in Barcelona, Spain, in November 2015.

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Forum participants plan to reconvene in Rome, Italy, in October 2017 for the third Global Diabetes Policy Summit, where they will take stock of progress achieved in implementing the recommendations of the Berlin Declaration.

OVER 13K PATENTS BAGGED BY CSIR IN LAST 3 FIN YRS: MINISTER

The Council for Scientific and Industrial Research (CSIR) bagged 13,365 patents in the last three financial years and over 13 per cent of the body's total number of patents were put to commercial use as compared to the global average of 3 to 4 per cent.

In a written response to a question in Rajya Sabha, Y S Chowdary, Minister of State for Science and Technology said the CSIR has acquired 4,526 Indian patents while 8,839 have been acquired from abroad.

The scientific body acquired 1,592 Indian patents in 2013-14, followed by 1,508 and 2,818 in the subsequent two financial periods. Chowdary said the CSIR has achieved a commercialisation rate of 13.33 per cent of its patents in comparison to the global average of 3 to 4 per cent. He added that the CSIR has taken a series of steps to commercialise the patents, which includes encouraging start-ups and creation of an innovation fund to support the translation of patents into technologies.

The country's premier research body for science and technology has spent over Rs 50 crore on its maintenance over the last three years.

Institutes under the body that carry out research activities on a range of issues, spent around Rs 12.20 crore and Rs 38.65 crore for its annual maintenance.

PAR PANEL RECOMMENDS REPLACING PINE TREES WITH BROAD-LEAVED TREES

With nearly 55 per cent rise in forest fire spots in 2016 from last year, a parliamentary panel has recommended systematic replacement of chir pine trees in forests with broad-leaved trees, observing that its needles are highly inflammable due to high resin content.

The panel also flayed the Ministry of Environment, Forests and Climate Change over the declining trend of funds released by the government for protection of forests and controlling forest fires.

"Chir pine needles, which are highly inflammable due to its high resin content, are a prominent factor in occurring and spreading of forest fires.

"The Committee also recommends that broad tree leaves should be planted in forests, and after a period of five years, there should be a systematic replacement of chir pine trees in forests by broad leaves as it has been seen that the incident of fires in latter forest are minimal as compared to chir pine trees," the Committee said in its report.

The Parliamentary Standing Committee on Science & Technology, Environment & Forests tabled its report before the Rajya Sabha.

The Committee also suggested procuring sweeping machines to clear roadsides of chir pine needles and dry leaves in vulnerable areas and said steps should be taken to incentivise the clearing and collection of pine needles.

The report stated that 2016 witnessed 24,817 forest fires spots in comparison to 15,937 in 2015, a jump of nearly 55 per cent.

In 2016, Uttarkhand alone witnessed a nearly 700 per cent rise in forest fire spots. In 2015, the state recorded 207 fire spots, but the figure rose to 1501 in 2016.

Fires destroyed nearly 4000 hectares of forest covering over 13 districts in the hill state. It killed 9 people and injured 17.

The Committee also observed that there seems to be "huge disconnect" between the research done by Forest Research Institute, a body under the MoEF&CC and its usage by state forest departments and other agencies.

It also recommended that the government should approach countries like Canada, Australia and New Zealand, which witness a large number of forest fire cases, and the study the use of other systems used for fire fighting such as chemical fogging.

BOOST RESEARCH TO FIGHT TB, HIV, MALARIA: BRICS

BRICS nations today agreed to boost research to fight diseases like TB, HIV and Malaria and take steps to reduce premature mortality, while acknowledging the need for a greater use of information and technology in health services to promote cost-effective treatment.

During the sixth two-day BRICS Health Ministers' meet that concluded, they adopted the Delhi Communique as part of which member-nations agreed to a TB cooperation plan, a BRICS network on TB research and developing an R&D consortium on TB, HIV and Malaria.

The 25-point communique lays emphasis on research and development of medicines and diagnostic tools, reduction in premature mortality due to non-communicable diseases by one-third by 2030 as per Sustainable Development Goals (SDGs) Target and effective health surveillance.

The member nations - Brazil, Russia, India, China and South Africa - also agreed to take measures to reduce maternal mortality, infant mortality, neo-natal mortality, under-5 mortality and congenital disorders with the aim of achieving the unfinished agenda of the Millennium Development Goals (MDGs) and the relevant SDGs.

They also acknowledged the need for greater use of information and communications technology in health services to promote cost-effective treatment.

Addressing the BRICS countries, Minister of Health and Family Welfare JP Nadda appealed to the delegates to sign an MoU on the regulatory working group mooted during BRICS workshop on drugs and medical devices in Goa in November 2016.

"Let us move forward by agreeing to sign the MoU and constituting a regulatory working group, to work on mutual recognition, sharing of information and accelerated regulatory approvals in case of international and national health emergencies and promotion of innovation and R&D," Nadda said.

The communique reiterated the support for development of a fully functional WHO Global Observatory on Health R&D. Dmitry Kostennikov, Deputy Minister of Healthcare of the Russian Federation, told PTI, "In Russia, we have been able to tackle infectious diseases but we need to look more urgently at NCDs as there is rise in TB cases. So, it is important for us to establish co-operation among BRICS nations on that front so we can find some solutions."

LIBERAL PERMIT REGIME FOR TAXIS WILL HELP CURB POLLUTION: CSE

Leading environment advocacy group CSE has welcomed the Centre's guidelines for a liberal permit

regime for taxis, saying they would encourage shared mobility, reduce vehicular congestion and help in curbing pollution.

The Centre for Science and Environment said the new proposals will also improve access to public transport systems and reduce pressure on parking space in major cities.

"Regulating these high-frequency services (taxis) for accountability and compliance is necessary for safe, reliable and affordable services," said Anumita Roychowdhury, Executive Director-Research and Advocacy at the leading advocacy group.

It has also urged state governments to adopt and implement the suggestions to control pollution and vehicular congestion.

"The state governments should quickly build on these and notify the rules for efficient and organised deployment of taxi services and shared mobility. This can help to move people from cars to public transport," Roychowdhury said. She said these recommendations will discourage people from owning private vehicles.

"Shared assets - using cars as taxis instead of personal vehicles - help in disincentivising private car ownership. These systems are becoming attractive globally as these help to reduce search and waiting time; bring more certainty and reliability in waiting time; and improve last mile connectivity."

The Committee on Taxi Policy Guidelines, set up by the Ministry of Road Transport and Highways, submitted its proposals last week. These suggestions push for liberal permit regime both for city taxis as well as All India Permit Tourist taxis thereby encouraging more taxis on the roads.

As per the proposals, "dynamic or surge pricing" will be allowed to match demand and supply.

The new proposals permit maximum tariff of up to four times the minimum rate. They also moot reserving free parking for taxis and charging higher fee for personal vehicles.

The panel has identified growth in number of cars due to a lack of public transport as one of the main reasons for pollution. It comprised representatives from Transport Commissioners from four states and Central Pollution Control Board, Delhi Police, Ministry of Women and Child Development, NITI Aayog and Ministry of Electronics and Information Technology.

SUBSONIC CRUISE MISSILE NIRBHAY FLIGHT TESTED IN CHANDIPUR

India conducted the flight test of indigenously-designed and developed long range subsonic cruise missile 'Nirbhay' from the Integrated Test Range (ITR) at Chandipur in Odisha but there was no official word on reports that it had failed.

The sophisticated missile with a strike range of 1,000 km was test launched from a specially-designed launcher around noon from the launch complex-3 of the ITR near here, defence sources said.

Shortly after the launch, there were reports that the test had failed like most of the earlier launches.

Neither the Defence Ministry nor the DRDO, which is the agency involved in the launch, were ready to comment on the development.

They also refused to react to reports that the launch was a failure.

Powered by a solid rocket motor booster, 'Nirbhay' missile with a turbo-fan engine is guided by a highly advanced inertial navigation system.

After the missile achieves designated altitude and velocity the booster motor is separated and the turbofan engine automatically switches on taking over further propulsion, a Defence Research and Development Organisation (DRDO) scientist associated with this project said.

He said that mid-way in its flight, missile's wing opens up by the commands generated by the sophisticated on board computer for stabilising the flight path.

The missile was tracked with the help of ground based radars and its health parameters were monitored by indigenous telemetry stations by team of professionals from DRDO's ITR and LRDE (Electronics & Radar Development Establishment).

The maiden test flight of Nirbhay held on March 12, 2013 had to be terminated mid way for safety reasons due to malfunction of a component, sources said.

However, the second launch on October 17, 2014 was successful.

The next trial conducted on October 16, 2015, had to be aborted after 700 seconds of its launch. All these trials were conducted from same defence base.

2016: INDIA'S YEAR OF DANCING TADPOLES AND SORTING HAT SPIDERS

Dancing tadpoles, rabbits which look like tailless rats, and a spider which looks like a wizard's hat straight out of a Harry Potter novel were discovered in India in 2016, offering glimpses of the faunal diversity potential of Indian ecosystems.

A new bird species was also found in Arunachal Pradesh besides three new species of butterflies in Uttarakhand, much to the delight of scientists.

The year started on a promising note with a new bird species found in northeast India and named after noted ornithologist Salim Ali. The bird was discovered by a team of scientists from India, Sweden, China, the US, and Russia.

The bird, Himalayan Forest Thrush, has been distinguished as a separate species by researchers and the discovery has been published in the international Avian Research journal.

This is only the fourth new bird species described from India by modern ornithologists since Independence.

Himalayan Forest Thrush is common in eastern Himalayas and so far, believed to be a sub-species of Plain-backed Thrush.

In April this year, researchers discovered a new tadpole that burrows through sand and live in complete darkness in streambeds in the Western Ghats.

The tadpole, belonging to the Indian Dancing Frog family Micrixalidae, was documented in a joint expedition by a group of scientists from University of Delhi, University of Peradeniya, Sri Lanka and Gettysburg College, USA.

PLOS ONE, an open-access journal, published the study.

According to the study, these tadpoles were discovered in the deep recesses of streambeds where they live in total darkness until they fully develop into froglets.

With muscular eel-like bodies and skin-covered eyes which facilitate burrowing through gravel beds, the tadpole has well-serrated jaw sheaths which may help prevent large sand grains from entering its mouth while feeding and moving through sand.

The Indian Dancing frogs typically wave their legs as a territorial and sexual display while sitting on boulders

in streams. Though these displays are well known, the tadpoles of these frogs were completely unknown. This was, in fact, the only family of frogs and toads whose tadpoles remained a mystery.

Uttarakhand, which is home to a large number of flora and fauna, added more to its name with three new varieties of butterflies discovered.

With the new discoveries, the total number of butterflies found in the hill state rose to 453.

"Out of the 1300 varieties of butterflies found in India, Uttarakhand was home to 450 until recently when three more names were added to the list," said Statistical Officer, Forest Department, Shankar Kumar who is also a biodiversity enthusiast.

The three new varieties found are 'No War Three Ring', botanical name, *Ypthima Newara*, belonging to the Nymphalidae family, 'Western Five Ring', botanical name *Ypthima Indecora*, of the Nymphalidae family and 'Ciliate Blue', botanical name *Anthene Emolus* of the Lycaenidae family, Kumar said.

Of the three new varieties, the first two were discovered and photographed in Nainital whereas the third was found in Haldwani, he said.

In Sikkim, a new species of a small mammal in the rabbit family was discovered in the higher altitudes of the Himalayas.

Identified as '*Ochotona sikimaria*' — the new pika species was discovered by the study based on genetic data and skull measurements. The study has been published in the journal 'Molecular Phylogenetics and Evolution'.

These members of the rabbit family look like tailless rats and have been in the news in North America for their sensitivity to impacts of climate change, like increasing temperature, which has caused several of the populations in pika series go extinct.

Nishma Dahal, the first author of the paper, started by collecting pika pellets to get its DNA and identify the species. On comparing the DNA sequences from the pellets with that of all known pika species in the world, she saw that these were quite different.

To prove that this is indeed a new species, she had to compare the Sikkim pika to its close relatives. It took two years for collaborations with researchers from the Chinese Academy of Sciences, Zoological Museum of Moscow and Stanford University to get detailed data on these possible sister species.

A new roundworm species from India is a link between two genera. The unique features and blending characters of a new roundworm species, discovered in India, make the nematode an intermediary between two supposedly distant genera. The new worm is a hermaphrodite that primarily feeds on bacteria.

The study, conducted by a research team from the Aligarh Muslim University led by Qudsia Tahseen, is published in the open access Biodiversity Data Journal.

On the lighter side, a new species of spiders discovered in the forests of Karnataka has been named after Godric Gryffindor – a character from the wizarding world of Harry Potter. The spider is uniquely shaped like the magical artifact, the Sorting Hat, which features in J K Rowling's 'Harry Potter' series.

The famous talking hat was owned by the medieval wizard Godric Gryffindor, one of the four founders of Hogwarts School of Witchcraft and Wizardry.

The name '*Eriovixia gryffindori*' is an ode to the "magic lost and found" – in an effort to draw attention to the fascinating, but often overlooked world of invertebrates, and their secret lives.

IIT-B WORKING WITH US SCIENTISTS TO PREDICT STORM SURGE

Researchers in climate science at the IIT, Bhubaneswar, are studying coastal inundation for developing a Land-Ocean-Atmospheric Modelling System to make prediction in case of extreme weather events, Prof U C Mohanty, Professor of Earth, Ocean and Climate Sciences at IIT, Bhubaneswar said.

With climate change and global warming triggering erratic and extreme weather events, the coastal states in India were vulnerable, he said on the sidelines of the four-day National Symposium on Tropical Meteorology (TROPMET-2016) which concluded at SOA University yesterday.

"The IIT-Bhubaneswar has been working with a group of US-based scientists to develop such a model. This modelling will help improve the prediction on coastal inundation which is a major cause of loss of life and property in the coastal states," Prof. Mohanty, an acknowledged expert in climate science, said.

Prof. Mohanty said the endeavour to develop the modelling system with the group of US-based scientists was crucial as climate change had altered the rainfall pattern.

"We now receive a huge amount of rainfall within a short window of time followed by long dry spells. Besides, the rainfall and storm surge during tropical cyclones seriously affects large shoreline populations causing destruction," he said.

Asked about future projections, he said though the number of tropical cyclones in a season could remain the same, their category or intensity would be higher.

With global warming leading to sea level rise, inundation in a state like Odisha had to be studied, Prof. Mohanty said, adding the storm surge on the southern coastline of the state from Ganjam district upto Visakhapatnam in Andhra Pradesh could be of 2-3 meters while a cyclone of the same intensity could whip up waves of 10-12 meters in the Balasore coast in the north.

"It is because, the sea is very shallow off the Balasore coast while it is deep along the southern coastline," he said.

'BAY OF BENGAL WITNESSED 500 CYCLONES IN 125 YRS'

The Bay of Bengal has witnessed around 500 cyclones in 125 years (since 1891) of which 107 had targeted Odisha causing immense devastation, a professor said today.

"However, compared to hurricanes in the west pacific, cyclones originating in the Bay of Bengal are less intense and much weaker but ironically cause more death and destruction," said Uma Charan Mohanty, Visiting Professor at the School of Earth, Ocean and Climate Science at IIT, Bhubaneswar.

Mohanty said, adding in fact, 18 out of 24 cases of cyclonic storms causing more than 5,000 deaths had occurred in the region surrounding the Bay of Bengal.

Prof Mohanty said this at a press conference on the eve of the four-day National Symposium on Tropical Meteorology (TROPMET-2016) beginning at the SOA University. The high casualty figure was because the coastal deltaic plains were densely populated as the land was fertile and preparedness for such an eventuality was less, he said, adding the shallowness of the sea also led to extreme surges.

The conference, being held in the state for the third time, has been organized by the Indian Meteorological Society (IMS) in collaboration with the SOA University and Odisha government and supported by the India Meteorological Department (IMD), Union government.

The theme of the symposium is "Climate Change and Coastal Vulnerability."

Prof. Mohanty said the world witnesses around 80 to 90 cyclones every year, seven per cent of which occur in the Bay of Bengal and the Arabian Sea but the change in the climate has been impacting such natural phenomena to a much greater extent than before.

INDIAN WOMEN SPEND MORE TIME ON SMARTPHONES THAN MEN: REPORT

Women in India spend twice more time than men on their smartphones watching YouTube or playing games, according to a new report released today which also found that an average person uses their cellphone for three hours daily.

Women also spend 80 per cent more time on Facebook than their male counterparts, the report said.

The report, released by the Mobile Marketing Association (MMA) and research agency Kantar IMRB, looks at the evolving nature of the Indian mobile consumers and provides insights and behaviours individually on smartphones and feature phones.

An average individual spends three hours per day on their smartphones (an increase of 55 per cent from 2015), which surpasses time spent on TV or any other media, according to the report.

Social media and messaging apps were the clear leaders accounting for almost 50 per cent of all time spent on smartphones.

The study also shows that women spend double the time on their smartphones compared to men – on YouTube and games.

Another finding showed the rise of online shopping category, which now has 15 per cent higher reach than the entertainment - making it the second most popular category in terms of reach.

"With over 85 per cent mobile penetration, we are today one of the largest mobile markets globally and insights on mobile usage in India are of critical importance

to the modern day marketer," said D Shivakumar, Chairman of the Mobile Marketing Association.

"Today, the mobile is undeniably the closest we can get to our consumers, and it is this that will help marketers seek to understand – and leverage – a consumer's path to purchase," he said.

"With the advent of 4G, reduced data costs and free voice and SMS, we expect to see even more rapid changes in the mobile landscape," said Hemant Mehta, Senior Vice President of media and retail at Kantar IMRB.

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HUMAN-INDUCED CLIMATE CHANGE WORSENERD 2015 HEATWAVE IN INDIA

The deadly heat waves that killed nearly 2,500 people in India and 2,000 people in Pakistan last year were exacerbated by human-induced climate change, scientists including those from IIT-Delhi have found.

Researchers examined observational and simulated temperature and heat indexes and found that the heat waves in the two countries "were exacerbated by anthropogenic climate change."

While the two countries typically experience severe heat in the summer, the 2015 heat waves - which occurred in late May/early June in India and in late June/early July in Pakistan - have been linked to the deaths of nearly 2,500 people in India and 2,000 in Pakistan.

Researchers used "factual" simulations of the world and compared them to "counterfactual" simulations of the world that might have been had humans not changed the composition of the atmosphere by emitting large amounts of carbon dioxide, said Daithi Stone from the Lawrence Berkeley National Laboratory (Berkeley Lab) in US.

"It is relatively common to run one or a few simulations of a climate model within a certain set of conditions, with each simulation differing just in the precise weather on the first day of the simulation; this difference in the first day propagates through time, providing different realisations of what the weather 'could have been,'" said Stone.

"The special thing about the simulations used here is that we ran a rather large number of them. This was important for studying a rare event; if it is rare, then you need a large amount of data in order to have it occurring frequently enough that you can understand it," Stone added.

Researchers, including those from Indian Institute of Technology (IIT) Delhi, examined both observational and simulated temperature alone as well as the heat index, a measure incorporating both temperature and humidity effects.

From a quality-controlled weather station observational dataset, they found the potential for a very large, human-induced increase in the likelihood of the magnitudes of the two heat waves.

"Observations suggested the human influence; simulations confirmed it," said Michael Wehner, climate researcher at Berkeley Lab.

The heat waves in Pakistan in late June/early July of 2015 were also similar killing around 2,000 people.

The research team also found that, despite being close in location and time, the two heat waves were "meteorologically independent."

HANDFUL OF WALNUTS DAILY MAY FIGHT ALZHEIMER'S: PIO LED STUDY

Eating a handful of walnuts per day may help reduce the risk, delay the onset, slow the progression of, or prevent Alzheimer's disease due to the anti-inflammatory and anti-oxidative properties of the dry fruit, a study led by an Indian-American scientist has claimed.

These yet to be published findings are very promising and help lay the groundwork for future human studies on walnuts and Alzheimer's - a disease for which there is no known cure, researchers said.

"One in 10 people over the age of 65 suffer from Alzheimer's. However, the awareness about the disease is very less. It takes 10 years to show the symptoms. It is not diagnosed properly; people think it is just an old age symptom and they have started forgetting things," Dr Abha Chauhan from New York State Institute for Basic Research in Developmental Disabilities (IBR) in the US told reporters..

"Oxidative damage and inflammation are two prominent features in the pathology of Alzheimer's disease and many other neurodegenerative diseases. Walnuts are very rich in anti-inflammatory components and antioxidants," said Chauhan, lead researcher of the study and head of the Developmental Neuroscience Laboratory at IBR.

Demographic ageing is a global phenomenon. India's population is undergoing a rapid demographic transition now. With demographic ageing comes the problem of dementia, researchers said.

According to the Dementia India Report 2010, India is home to more than 70 million people older than 60 years as per the 2001 census.

The number of persons with dementia double every five years of age and so India will have one of the largest numbers of elders with this problem.

In 2010, there were 3.7 million Indians with dementia and it is expected to double by 2030. The number of persons with dementia double every 5 years of age and so India will have one of the largest numbers of elders with this problem, the report said.

Amyloid beta-protein (A beta) is the major protein of amyloid deposits in the brain of patients with Alzheimer's disease (AD).

Extensive evidence suggests neurotoxic effects of soluble oligomers of A beta, and the role of oxidative stress and inflammation in AD.

According to the new study, walnuts are rich in antioxidant and anti-inflammatory components.

NEUTRON STARS MAY BE EMITTING GRAVITATIONAL WAVES CONTINUOUSLY

Many fast spinning dense neutron stars generate gravitational waves continuously, according to Indian scientists who suggest that careful observations should be made to detect such waves.

Neutron stars are the densest observable objects in the universe, with a fistful of stellar material outweighing a mountain on Earth.

While such stars are not bigger than a city, in size, they have more material than in the Sun crammed inside them.

Sudip Bhattacharyya from the Tata Institute of Fundamental Research (TIFR) in Mumbai and Deepto Chakrabarty from Massachusetts Institute of Technology (MIT) in the US have shown that a population of neutron stars should spin around their axes much faster than the highest observed spin rate of any neutron star.

They pointed out that the observed lower spin rates are possible if these neutron stars emit gravitational waves continuously, and hence spin down.

A population of neutron stars can increase their spin rate by the transfer of matter from a normal companion star.

Infact, some of them have been observed to spin several hundred times in a second around their own axes.

In the 1970s, it was theoretically worked out how fast these neutron stars could spin, and since then this has formed the basis of studies of these stars.

However, the new study has shown that for episodic mass transfer, which happens for many neutron stars, the stellar spin rate should be much higher, and the star could easily attain a spin rate more than a thousand times per second.

Since no neutron star has been observed with such a high spin rate, the team has pointed out that many of these stars are likely to be slowed down by continuously emitting gravitational waves.

Gravitational waves emitted by massive objects is a prediction of Einstein's general theory of relativity, which has recently been discovered during transient phenomena of black hole mergers.

However, the detection of continuous gravitational waves, which could provide an opportunity to study these waves almost permanently, is still elusive.

The research provides a strong indication that many fast spinning neutron stars generate gravitational waves continuously, and careful observations should be made to detect such waves.

The study appears in *The Astrophysical Journal*.

NAGALAND VILLAGES SHOW WAY TOWARDS GRASSROOTS INNOVATIONS

While it is common for people to visit a doctor or apply antiseptic creams on wounds to stop bleeding and avoid infections, many Nagaland villagers simply pluck a "doctor leaf" from a tree to stall the blood flow.

According to the villagers, extract from the leaves of Sayanglaza tree (*Eupatorium Odoratum*) when applied on the wounds stops the external flow of blood within no time.

Living in tough terrains and faced with the scarcity of resources, villagers in Nagaland have not only preserved their traditional knowledge but have also adopted many new scientific approaches to make their lives better.

Their tradition of "no wastage" and "optimum usage of available resources" brings relief to their otherwise difficult life.

This and many other traditional and new scientific approaches were evident during the 38th Shodhyatra in Nagaland which took place from November 26 to December 2, where 60 'shodhyatris' from India and foreign countries participated.

"These Shodhyatras are organised by SRISTI twice a year to unearth the traditional knowledge and grassroots innovations in remote villages of a particular state and give them the knowledge acquired from the other states of country," Professor Anil K Gupta, President, Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) told media.

During the recent Shodhyatra, biodiversity and food recipe competitions were organised in villages to unveil the traditional knowledge of villagers. To encourage the curiosity and creativity among school children, competitions on innovative ideas were also held.

In addition to these competitions, people aged 90 years and above were honoured in their villages.

"In my lifetime, I have seen this first of its own kind of Shodhyatra. These baby steps will be helpful to our younger generation and they will get inspiration from it," said Nyitsangpa, from village Phirahi, who claims to be 112 years old.

"These Shodhyatras are management of knowledge for 200 years. By these journeys, we document 100 years old traditional knowledge of our elders, which is going to serve our younger generation for next 100 years," Gupta added.

During this journey, machines invented by grassroots innovators were demonstrated before villagers. Bamboo incense stick making machine by L Ralte and L Sailo of Mizoram, hand operated water lifting device by N Saktimainthan of Tamilnadu and multipurpose food processing machine by Dharamveer Kamboj of Haryana were some of them.

Grassroots innovator and farmer Amrut Agrawat (71), who has been President Pranab Mukherjee's guest for over two weeks in Rashtrapati Bhavan, also participated in the Shodhyatra. With the conclusion of the Shodhyatra in Nagaland, one cycle of covering each state in country has been completed and second cycle will begin with Odisha in summer.

SEAFLOOR ROBOT SETS WORLD RECORD WHILE COLLECTING CLIMATE DATA

An autonomous robotic seafloor crawler has set a new world record for the longest distance travelled and duration sustained under the sea, while collecting climate data for an entire year.

Benthic Rover, developed by the Monterey Bay Aquarium Research Institute (MBARI) in the US, is the only untethered, entirely autonomous seafloor crawler in existence.

The Rover operates at Station M - an area of flat, muddy, abyssal seafloor 4,000 meters deep and about 220 kilometres from the California coastline.

MBARI marine ecologist Ken Smith and his colleagues have been studying Station M since 1989.

Some of their instruments measure sinking particulate organic carbon (POC) in the form of marine snow - bits of phytoplankton and zooplankton detritus, as well as faecal matter - that drifts down to the seafloor.

One of the most significant findings from the last few years of the Rover's deployments involved several large pulses of marine snow that rapidly sank to the seafloor.

These pulses may be related to stronger along-shore winds that drive the upwelling of nutrients in coastal waters.

The nutrients spur the growth of phytoplankton and zooplankton, which increases the amount of marine snow that rains down to the seafloor.

Organisms in this abyssal realm rely upon marine snow as their primary source of food. The Benthic Rover records how much of the marine snow is consumed by the seafloor community.

The Rover detected several brief, two- to four-week events when nearly an entire year's worth of chlorophyll-rich detritus landed on the seafloor.

These events would have gone undetected without the long-term presence of the Benthic Rover.

In documenting such events, the Rover helped solve an important piece of Earth's carbon-cycle puzzle - showing that a much larger percentage of carbon than previously expected can sink rapidly from the surface into deeper water.

These periodic events can now be factored into global climate change models.

When marine snow arrives on the seafloor, some is eaten and respired as carbon dioxide while some is buried in seafloor sediment.

Information about how much carbon is respired and how much is sequestered is important data for climate science.

In November 2016, the Rover was retrieved after its record run - operating for one year and two days, and travelling a distance of 1.6 kilometres.

The Rover has been operating autonomously since 2009 and has been steadily increasing its duration of deployment and distance travelled before needing to be brought onboard a research vessel for maintenance.

5,000-YEAR-OLD NATIVITY SCENE DISCOVERED IN EGYPT

Researchers have found what may be the oldest nativity scene ever found - 5,000-year-old rock art depicting a newborn between parents, two animals and a star in the east - in the Egyptian Sahara desert.

The scene, painted in reddish-brown ochre, was found on the ceiling of a small cavity, during an expedition to sites between the Nile valley and the Gifl Kebir Plateau.

"It's a very evocative scene which indeed resembles the Christmas nativity. But it predates it by some 3,000 years," said geologist Marco Morelli, director of the Museum of Planetary Sciences in Prato, Italy.

Morelli discovered the cave drawing in 2005, however his team has decided to unveil the finding now.

"The discovery has several implications as it raises new questions on the iconography of one of the more powerful Christian symbols," Morelli said.

The scene features a man, a woman missing the head because of a painting detachment and a baby, 'Seeker' reported.

"It could have been interpreted as a normal depiction of a family, with the baby between the parents, but other details make this drawing unique," Morelli said.

The newborn is drawn slightly above, as if raising to the sky. Such position, with the baby not yet between the parents, would have meant a birth or a pregnancy, he said.

"As death was associated to Earth in contemporary rock art from the same area, it is likely that birth was linked to the sky," Morelli said.

MEETING GLOBAL CLIMATE TARGET MAY UP FISH CATCH BY 6 MLN TONS

Potential fish catches could increase by six million metric tonnes per year, if countries abide by the Paris Agreement global warming target of 1.5 degrees Celsius, a new study has found.

The researchers also found that some oceans are more sensitive to changes in temperature and will have substantially larger gains from achieving the Paris Agreement.

"The benefits for vulnerable tropical areas is a strong reason why 1.5 degrees Celsius is an important target to meet," said William Cheung, associate professor at University of British Columbia's Institute for the Oceans and Fisheries in Canada.

"Countries in these sensitive regions are highly dependent on fisheries for food and livelihood, but all countries will be impacted as the seafood supply chain is now highly globalized. Everyone would benefit from meeting the Paris Agreement," Cheung said.

The researchers compared the Paris Agreement 1.5 degrees Celsius warming scenario to the currently pledged 3.5 degrees Celsius by using computer models to simulate changes in global fisheries and quantify losses or gains.

They found that for every degree Celsius decrease in global warming, potential fish catches could increase by more than three metric million tons per year.

Previous research had shown that today's global fish catch is roughly 109 million metric tonnes.

"Changes in ocean conditions that affect fish stocks, such as temperature and oxygen concentration, are strongly related to atmospheric warming and carbon emissions," said Thomas Frolicher, senior scientist at ETH Zurich.

"For every metric tonne of carbon dioxide emitted into the atmosphere, the maximum catch potential decreases by a significant amount," said Frolicher.

Climate change is expected to force fish to migrate towards cooler waters. The amount and species

of fish caught in different parts of the world will impact local fishers and make fisheries management more difficult.

The findings suggest that the Indo-Pacific area would see a 40 per cent increase in fisheries catches at 1.5 degrees Celsius warming versus 3.5 degrees Celsius.

Meanwhile the Arctic region would have a greater influx of fish under the 3.5 degrees Celsius scenario but would also lose more sea ice and face pressure to expand fisheries.

The findings may provide further incentives for countries and the private sector to substantially increase their commitments and actions to reduce greenhouse gas emissions, researchers said.

The study was published in the journal *Science*.

NEW CONCUSSION BIOMARKER MAY LEAD TO BETTER DIAGNOSIS

The secret to reliably diagnosing concussions lies in the brain's ability to process sound, according to a "groundbreaking" research which has found a biological marker for the traumatic brain injury.

Widely considered a crisis in professional sports and youth athletic programmes, sports-related concussions have had devastating neurological, physical, social and emotional consequences for millions of athletes, researchers said.

Still, no single test has been developed to reliably and objectively diagnose concussions.

The groundbreaking research by Northwestern University in the US has found a biological marker in the auditory system that could take the ambiguity and controversy out of diagnosing concussions and tracking recovery.

"This biomarker could take the guesswork out of concussion diagnosis and management," said Nina Kraus, Professor at Northwestern University's Auditory Neuroscience Laboratory.

"Our hope is this discovery will enable clinicians, parents and coaches to better manage athlete health, because playing sports is one of the best things you can do," said Kraus.

Concussions, a type of mild traumatic brain injury, are the result of a direct or indirect blow to the head that causes the brain to be jostled within the skull.

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However, there is little relation between the force of an impact and the potential for injury - two athletes can suffer similar hits but experience vastly different outcomes.

By observing research subjects' brain activity as they were exposed to auditory stimuli, Kraus and her team discovered a distinct pattern in the auditory response of children who suffered concussions compared to children who had not.

They placed three simple sensors on children's heads to measure the frequency following response, which is the brain's automatic electric reaction to sound.

With this measure, researchers successfully identified 90 per cent of children with concussions and 95 per cent of children in the control group who did not have concussions.

Children who sustained concussions had on average a 35 per cent smaller neural response to pitch, allowing the scientists to devise a reliable signature neural profile.

As the children recovered from their head injuries, their ability to process pitch returned to normal.

"Making sense of sound requires the brain to perform some of the most computationally complex jobs it is capable of, which is why it is not surprising that a blow to the head would disrupt this delicate machinery," Kraus said.

What was surprising, Kraus said, was the specificity of the findings.

"This isn't a global disruption to sound processing. It is more like turning down a single knob on a mixing board," she added.

The research was published in the journal *Nature Scientific Reports*.

NEW ULTRASOUND TECHNIQUE CAN 'SEE' INSIDE LIVE CELLS

Researchers have developed a new technique that uses sound rather than light to see inside live cells, an advance that may have potential applications in stem-cell transplants and cancer diagnosis.

The technique uses shorter-than-optical wavelengths of sound and could even rival the optical super-resolution techniques which won the 2014 Nobel Prize for Chemistry, researchers said.

This new kind of sub-optical phonon (sound) imaging provides invaluable information about the structure, mechanical properties and behaviour of individual living cells at a scale not achieved before.

"People are most familiar with ultrasound as a way of looking inside the body - in the simplest terms we have engineered it to the point where it can look inside an individual cell," said Professor Matt Clark from the University of Nottingham in the UK.

In optical microscopy, the size of the smallest object you can see is limited by the wavelength of light.

For biological specimens, the wavelength cannot go smaller than that of blue light because the energy carried on photons of light in the ultraviolet (and shorter wavelengths) is so high it can destroy the bonds that hold biological molecules together damaging the cells.

Optical super-resolution imaging also has distinct limitations in biological studies.

This is because the fluorescent dyes it uses are often toxic and it requires huge amounts of light and time to observe and reconstruct an image which is damaging to cells.

Unlike light, sound does not have a high-energy payload. This has enabled the researchers to use smaller wavelengths and see smaller things and get to higher resolutions without damaging the cell biology.

"A great thing is that, like ultrasound on the body, ultrasound in the cells causes no damage and requires no toxic chemicals to work. Because of this we can see inside cells that one day might be put back into the body, for instance as stem-cell transplants," said Clark.

The study was published in the journal *Scientific Reports*.

BACTERIA-POWERED BATTERY BUILT ON SINGLE SHEET OF PAPER

Scientists have developed a bacteria-powered battery on a single sheet of paper that can power disposable electronics such as diagnostic sensors.

The manufacturing technique reduces fabrication time and cost, and the design could revolutionise the use of bio-batteries as a power source in remote, dangerous and resource-limited areas, researchers said.

"Papertronics have recently emerged as a simple and low-cost way to power disposable point-of-care

diagnostic sensors," said Seokheun Choi, Assistant Professor at Binghamton University in the US.

"Stand-alone and self-sustained, paper-based, point-of-care devices are essential to providing effective and life-saving treatments in resource-limited settings," said Choi.

On one half of a piece of chromatography paper, Choi and PhD candidate Yang Gao, placed a ribbon of silver nitrate underneath a thin layer of wax to create a cathode.

They then made a reservoir out of a conductive polymer on the other half of the paper, which acted as the anode.

Once properly folded and a few drops of bacteria-filled liquid are added, the microbes' cellular respiration powers the battery.

"The device requires layers to include components, such as the anode, cathode and PEM (proton exchange membrane)," said Choi.

"(The final battery) demands manual assembly, and there are potential issues such as misalignment of paper layers and vertical discontinuity between layers, which ultimately decrease power generation," Choi said.

Different folding and stacking methods can significantly improve power and current outputs. Scientists were able to generate 31.51 microwatts at 125.53 microamps with six batteries in three parallel series and 44.85 microwatts at 105.89 microamps in a 6x6 configuration.

It would take millions of paper batteries to power a common 40-watt light bulb, but on the battlefield or in a disaster situation, usability and portability is paramount.

There is enough power to run biosensors that monitor glucose levels in diabetes patients, detect pathogens in a body or perform other life-saving functions.

"Among many flexible and integrative paper-based batteries with a large upside, paper-based microbial fuel cell technology is arguably the most underdeveloped," said Choi.

"We are excited about this because microorganisms can harvest electrical power from any type of biodegradable source, like wastewater, that is readily available. I believe this type of paper biobattery can be a future power source for papertronics," Choi added.

SMARTPHONES CAN BE USED TO IMAGE LIVE CELL

Smartphones can be used to make high-resolution movies of living cells, without the need for expensive equipment, a new study has found.

Live imaging is a very powerful tool for the study of cells, to learn about how cells respond to different treatments such as drugs or toxins. However, microscopes and equipment for live imaging are often very expensive.

The new study by researchers at Uppsala University in Sweden makes it possible for laboratories around the world to do the same thing

In the study, old standard inverted microscopes that are very abundant at universities and hospitals were upgraded to high quality live imaging stations using a few 3D-printed parts, off-the-shelf electronics, and a smartphone.

It was shown that the resultant upgraded systems provided excellent cell culture conditions and enabled high-resolution imaging of living cells.

"What we have done in this project is not rocket science, but it shows you how 3D-printing will transform the way scientists work around the world," said Johan Kreuger, senior lecturer at the Department of Medical Cell Biology at Uppsala University.

"3D-printing has the potential to give researchers with limited funding access to research methods that were previously too expensive," Kreuger said.

"The technology presented here can readily be adapted and modified according to the specific need of researchers, at a low cost.

"Indeed, in the future, it will be much more common that scientists create and modify their own research equipment, and this should greatly propel technology development," he added.

DRONES USED TO DELIVER HOT FOOD, MEDICINES IN US

A US-based drone delivery service has completed its first month in operation, successfully sending over-the-counter medicines, hot food items and cold beverages to customers' homes using GPS-enabled autonomous flying vehicles.

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The company conducted regular weekend deliveries last month from a convenience store to a dozen select customers who used a smartphone app to place orders.

Along with listing all items available for delivery, the app also notified customers when their drone was loaded, when it departed from the store and when it was arriving at their doorstep.

Once an order was placed, the merchandise – including items such as hot and cold food and over-the-counter medicines – were loaded into a drone delivery container and flown autonomously using precision GPS to a local customer's house.

At the customer's home, the drone hovered in place and lowered the package.

On average, customers receive their packages in less than 10 minutes from the time of order. The company completed 77 autonomous drone deliveries to customer homes.

Customers who participated stated they will continue to use the drone delivery service, the company said.

"This is a giant leap towards a future where everyone can experience the convenience of instant store-to-door drone delivery," said Matthew Sweeny, CEO of the drone delivery service Flirtey.

Customers of all ages participated in the deliveries – including elderly couples, working parents and busy college students – and feedback from customers cited the speed and convenience as the most appealing aspects of the deliveries.

Popular items included hot food items, cold beverages and over-the-counter medicines such as aspirin, the company said.

SUPERCLUSTER OF GALAXIES NEAR MILKY WAY FOUND

An international team of astronomers has found one of the universe's biggest superclusters of galaxies near the Milky Way.

Researchers, including those from Australian National University (ANU), said the Vela supercluster, which had previously gone undetected as it was hidden by stars and dust in the Milky Way, was a huge mass that influenced the motion of our galaxy.

"This is one of the biggest concentrations of galaxies in the universe - possibly the biggest in the neighbourhood of our galaxy, but that will need to be confirmed by further study," said Professor Matthew Colless from the ANU Research School of Astronomy and Astrophysics.

"The gravity of the Vela supercluster may explain the difference between the measured motion of the Milky Way through space and the motion predicted from the distribution of previously mapped galaxies," said Colless.

Colless used the Anglo-Australian Telescope to measure distances for many galaxies to confirm earlier predictions that Vela was a supercluster.

He also helped to estimate the supercluster's effect on the motion of the Milky Way.

The research involved astronomers based in South Africa, Australia and Europe. Two new Australian surveys starting in 2017 will confirm the size of the Vela supercluster.

"The Taipan optical survey will measure galaxy distances over a bigger area around Vela, while the WALLABY radio survey will be able to peer through the densest parts of the Milky Way into the supercluster's heart," Colless said.

The research was published in the journal *Monthly Notices of the Royal Astronomical Society*.

NASA'S SPACE-BASED SENSOR MAPS PLANKTON BEHAVIOUR ON EARTH

A NASA space-based sensor that can 'see' through fog, clouds and darkness has given scientists the first continuous look at the boom-bust cycles of polar phytoplanktons - microscopic marine plants that are the foundation of the ocean's food web.

The decade-long set of images shows that phytoplankton cycles are more tied to the push-pull relationship between them and their predators than was initially thought.

Phytoplankton are the foundation of the ocean's food web. Commercial fisheries, marine mammals and birds all depend on the blooms, said Michael Behrenfeld from the Oregon State University's College of Agricultural Sciences.

"It's really important for us to understand what controls these boom-bust cycles and how they might

change in the future, because the dynamics of plankton communities have implications for all the other organisms throughout the web," Behrenfeld said.

Phytoplankton also influence Earth's carbon cycle. Through photosynthesis, they absorb a great deal of the carbon dioxide near the ocean's surface. That, in turn, allows carbon dioxide from the atmosphere to go into the ocean.

The satellite-mounted LIDAR instrument, dubbed Cloud-Aerosol Lidar with Orthogonal Polarisation (CALIOP), uses a laser beam to map the ocean's surface and immediate subsurface.

CALIOP monitored plankton in the Arctic and Antarctic ocean waters from 2006 to 2015.

CALIOP'S measurements show that, as the phytoplankton growth accelerates, the blooms are able to outpace the organisms that prey on them.

As soon as that acceleration stops, however, the predatory organisms catch up and the bloom ends.

The finding goes against the commonly held belief that blooms begin when phytoplankton growth rates reach a threshold rate and then stop when growth rates crash, he said.

Instead, blooms start when growth rates are extremely slow, and then stop when phytoplankton growth is at its maximum but the acceleration of the bloom has hit its peak. It is only then that the predatory organisms catch up and the bloom terminates.

The study also shows that in Arctic waters the year-to-year changes in this constant push and pull between predator and prey has been the primary driver of change over the past 10 years.

The situation is different in the southern ocean around Antarctica, where changes in the ice cover held more sway.

"The take-home message is that if we want to understand the production of the polar systems as a whole, we have to focus both on changes in ice cover and changes in the ecosystems that regulate this delicate balance between predators and prey," said Behrenfeld.

ROBOT PROVIDES RARE GLIMPSE UNDER ANTARCTIC SEA ICE

An underwater robot has captured a rare glimpse beneath the Antarctic sea ice, revealing a thriving, colourful

world filled with coconut-shaped sponges, dandelion-like worms, pink encrusting algae and spidery starfish, scientists said today.

The footage was recorded on a camera attached to a Remotely Operated Vehicle (ROV) deployed by scientists under the sea ice at O'Brien Bay, near Casey research station in East Antarctica.

Australian Antarctic Division Biologist, Dr Glenn Johnstone, said the footage was captured while scientists retrieved a SeapHox pH data logger, which has been recording the acidity, oxygen, salinity and temperature of the seawater on an hourly basis since November last year.

"When you think of the Antarctic coastal marine environment, the iconic species such as penguins, seals and whales usually steal the show," Johnstone said.

"This footage reveals a habitat that is productive, colourful, dynamic and full of a wide variety of biodiversity, including sponges, sea spiders, urchins, sea cucumbers and sea stars.

These communities live in water that is minus 1.5 degrees Celsius year round and are covered in 1.5 metre thick sea ice for 10 months of the year.

"Occasionally an iceberg may move around and wipe out an unlucky community, but mostly the sea ice provides protection from the storms that rage above, making it a relatively stable environment in which biodiversity can flourish," said Johnstone.

Johnstone said scientists are only just beginning to understand the amazing biodiversity and complexity of the Antarctic near-shore ecosystem and the threats it is facing into the future.

The Australian Antarctic Programme project is the final field component of an experiment designed to determine the impacts of ocean acidification on Southern Ocean sea-floor communities under increasing carbon dioxide emissions.

Project leader, Dr Johnny Stark of the Australian Antarctic Division, said a quarter of the carbon dioxide emitted into the atmosphere is absorbed by the ocean, which increases its acidity.

"Carbon dioxide is more soluble in cold water. Polar waters are acidifying at twice the rate of tropical or temperate regions, so we expect these ecosystems to be among the first impacted from ocean acidification," Stark said.

"Research shows the pink encrusting algae, known as crustose coralline algae, may decrease in extent in a more acidic future ocean, as it incorporates calcium into its structure, and this becomes harder for organisms to obtain as the acidity of the seawater increases.

"Antarctica may be one of the first places we see detrimental effects of ocean acidification on these organisms," he said.

Australian Antarctic Division PhD student James Black said the ROV was deployed through a small hole drilled in these ice and also collected diatoms and sediment.

NASA PROBE SPOTS TROUGHS ON MARS GROWING INTO 'SPIDERS'

Scientists using data from NASA's Mars orbiter have, for the first time, imaged the growth of erosion-carved troughs that may be infant versions of Martian 'spiders' - radially patterned surface features found in the south polar region of the red planet.

Researchers using NASA's Mars Reconnaissance Orbiter (MRO) report the first detection of cumulative growth, from one Martian spring to another of channels resulting from the same thawing-carbon-dioxide process believed to form the spider-like features.

The spiders range in size from tens to hundreds of metres. Multiple channels typically converge at a central pit, resembling the legs and body of a spider.

"We have seen for the first time these smaller features that survive and extend from year to year, and this is how the larger spiders get started," said Ganna Portyankina of the University of Colorado, Boulder in the US.

"These are in sand-dune areas, so we don't know whether they will keep getting bigger or will disappear under moving sand," Ganna said.

Dunes appear to be a factor in how the baby spiders form, but they may also keep many from persisting through the centuries needed to become full-scale spiders.

The amount of erosion needed to sculpt a typical spider, at the rate determined from observing active growth of these smaller troughs, would require more than a thousand Martian years. One Martian year lasts about 1.9 Earth years.

Carbon-dioxide ice, better known as "dry ice," does not occur naturally on Earth.

On Mars, sheets of it cover the ground during winter in areas near both poles, including the south-polar regions with spidery terrain. Dark fans appear in these areas each spring.

Hugh Kieffer of the Space Science Institute in the US put those factors together in 2007 to deduce the process linking them: Spring sunshine penetrates the ice to warm the ground underneath, causing some carbon dioxide on the bottom of the sheet to thaw into gas.

The trapped gas builds pressure until a crack forms in the ice sheet. Gas erupts out, and gas beneath the ice rushes toward the vent, picking up particles of sand and dust.

This erodes the ground and also supplies the geyser with particles that fall back to the surface, downwind and appear as the dark spring fans.

This explanation has been well accepted, but actually seeing a ground-erosion process that could eventually yield the spider shapes proved elusive.

Six years ago, researchers using MRO's High Resolution Imaging Science Experiment (HiRISE) camera reported small furrows appearing on sand dunes near Mars' north pole at sites where eruptions through dry ice had deposited spring fans.

However, those furrows in the far north disappear within a year, apparently refilled with sand.

The newly reported troughs near the south pole are also at spring-fan sites. They have not only persisted and grown through three Martian years so far, but they also formed branches as they extended. The branching pattern resembles the spidery terrain.

AMMONIA DETECTED IN EARTH'S TROPOSPHERE FOR FIRST TIME

For the first time, researchers have discovered ammonia in the Earth's lowest atmospheric layer - with highest emissions of the gas encountered in North India and Southeast China.

Scientists of Karlsruhe Institute of Technology (KIT) in Germany together with researchers from US and Mexico analysed satellite measurements by the MIPAS infrared spectrometer and found increased amounts of

ammonia (NH₃) between 12 and 15 km height in the area of the Asian monsoon.

This suggests that the gas is responsible for the formation of aerosols, smallest particles that might contribute to cloud formation, researchers said.

Ammonia, a chemical compound of nitrogen and hydrogen, mainly originates from agricultural processes, in particular from life-stock farming and fertilisation.

Highest ammonia emissions are encountered in North India and Southeast China. Due to population growth and global warming, global ammonia emissions are expected to increase strongly in the future, researchers said.

Gaseous ammonia reacts with acids, such as sulfuric acid or nitric acid, to the corresponding ammonium salts. However, ammonia does not only pollute the ecosystems. Particles of ammonium salts can attach to each other and form aerosol particles acting as condensation nuclei in cloud formation.

Such aerosols of anthropogenic origin have a cooling effect in the atmosphere and might compensate part of the anthropogenic greenhouse effect.

In this connection, it is important to determine vertical distribution of atmospheric ammonia. Concentrations of ammonia in the middle and upper troposphere, the bottom layer of the atmosphere, have hardly been studied so far.

Now, researchers of from KIT's Institute for Meteorology and Climate Research (IMK-ASF) and University of Colorado at Boulder and the Universidad Nacional Autonoma de Mexico for the first time detected ammonia in the upper troposphere.

They evaluated measurements made by the MIPAS infrared spectrometer on the European environmental satellite ENVISAT from 2002 to 2012.

MIPAS recorded highly resolved spectra in the middle infrared range, from which gases can be identified clearly. Every gas emits specific infrared radiation.

The scientists calculated the average of three-month measurements in areas of ten degrees longitude and ten degrees latitude each. At 12 to 15 km height, in the area of the Asian monsoon, they found an increased concentration of ammonia of up to 33 pptv (33 NH₃ molecules per trillion air molecules).

Similarly high concentrations were measured in no other season and no other region.

"Observations show that ammonia is not washed out completely when air ascends in monsoon circulation. Hence, it enters the upper troposphere from the boundary layer close to the ground, where the gas occurs at relatively high concentrations," said Michael Hopfner, Head of the Remote Sensing Using Aircraft and Balloons Group of IMK-ASF.

The research was published in the journal *Atmospheric Chemistry and Physics*.



SPEED OF PHOTOSYNTHESIS DETERMINED

Using ultrafast imaging to capture moving energy during photosynthesis, scientists have determined the speed of the crucial process for the first time.

The study by researchers at Imperial College London in the UK may help understand how nature has perfected the process of photosynthesis and how this might be copied to produce fuels by artificial photosynthesis.

During photosynthesis, plants harvest light and, through a chemical process involving water and carbon dioxide, convert this into fuel for life.

A vital part of this process is using the light energy to split water into oxygen and hydrogen. This is done by an enzyme called Photosystem II.

Light energy is harvested by 'antennae' and transferred to the reaction centre of Photosystem II, which strips electrons from water.

This conversion of excitation energy into chemical energy, known as 'charge separation', is the first step in splitting water.

It was previously thought that the process of charge separation in the reaction centre was a 'bottleneck' in photosynthesis - the slowest step in the process - rather than the transfer of energy along the antennae.

Since the structure of Photosystem II was first determined 2001, there was some suggestion that in fact it could be the energy transfer step that was slowest, but it was not yet possible to prove experimentally.

Using ultrafast imaging of electronic excitations that uses small crystals of Photosystem II, scientists have shown that the slowest step is in fact the process through which the plants harvest light and transfer its energy through the antennae to the reaction centre.

The new insights into the precise mechanics of photosynthesis should help researchers hoping to copy the efficiency of natural photosynthesis to produce green fuels.

"We can now see how nature has optimised the physics of converting light energy to fuel, and can probe this process using our new technique of ultrafast crystal measurements," said Jasper van Thor from Imperial College London.

Although researchers could determine which step is faster, both steps occur incredibly quickly - the whole process takes a matter of nanoseconds (billionths of a second), with individual steps of energy transfer and charge separation taking only picoseconds (trillionths of a second).

The team used a sophisticated system of lasers to cause reactions in crystals of Photosystem II and then to measure in space and time the movement of excitations of electrons - and hence the transfer of energy - across the antennae and reaction centre.

The resulting movie of the movement of excited electrons across minute sections of the system revealed where energy is held and when it is passed along. This proved that the initial step of separating charges for the water-splitting reaction takes place relatively quickly, but that the light harvesting and transfer process is slower.

NEW GENETIC IMMUNE DISORDER IDENTIFIED

Scientists have identified a new genetic immune disorder that is characterised by increased susceptibility to a virus associated to a type of cancer.

The researchers studied two unrelated sets of siblings with similar immune problems and determined their symptoms were likely caused by a lack of CD70, a protein found on the surface of several types of immune cells. Both sets of siblings had evidence of uncontrolled infection with Epstein-Barr virus (EBV), a common and usually mild virus, which resulted in the development of cancer called Hodgkin's lymphoma in three of these children.

Each child also had other immune symptoms, such as reduced activity of pathogen-fighting T cells, low production of antibodies and poor activation of antibody-producing B cells.

Researchers at the US National Institute of Allergy and Infectious Diseases (NIAID) analysed the genomes of all four children and found that each had two mutated copies of the CD70 gene, resulting in nonfunctioning or nonexistent CD70 proteins.

All four parents, who had healthy immune systems, had only one copy of the mutation - indicating that CD70 deficiency follows an autosomal recessive pattern of inheritance.

This means affected individuals receive a flawed gene from each parent in order to have symptoms.

While no specific treatment for CD70 deficiency currently exists, each of the four children has recovered from Hodgkin's lymphoma and is receiving antibody infusions to help bolster the immune system.

The research also offers insight into the normal role of CD70. Previous studies showed that CD70 interacts with another immune cell protein called CD27, an interaction that may be important for the proper function of lymphocytes.

This hypothesis is affirmed by these latest findings on CD70 deficiency.

The research also indicated that investigators testing experimental medications that decrease the activity of CD70 or CD27 - a possible strategy for combatting autoimmune disease - should be aware of a possible risk of EBV-related complications.

ANTARCTIC ICE SHEET IS AFFECTING CLIMATE CHANGE DECODED

The Antarctic Ice Sheet plays a major role in regional and global climate variability, a discovery that may help explain why sea ice in the southern hemisphere has been increasing despite the warming of the rest of the Earth, scientists say.

Global climate models that look at the last several thousand years have failed to account for the amount of climate variability captured in the paleoclimate record, said researchers from Oregon State University (OSU) in the US.

Their hypothesis was that climate modelers were overlooking one crucial element in the overall climate system - an aspect of the ocean, atmosphere, biosphere or ice sheets - that might affect all parts of the system.

"One thing we determined right off the bat was that virtually all of the climate models had the Antarctic Ice Sheet as a constant entity," said Pepijn Bakker, former post-doctoral researcher at OSU.

"What we discovered, however, is that the ice sheet has undergone numerous pulses of variability that have had a cascading effect on the entire climate system," said Bakker, who is now at the University of Bremen in Germany.

The Antarctic Ice Sheet has demonstrated dynamic behaviour over the past 8,000 years, according to Andreas Schmittner, a climate scientist in OSU.

"There is a natural variability in the deeper part of the ocean adjacent to the Antarctic Ice Sheet - similar to the Pacific Decadal Oscillation, or El Nino/La Nina but on a time scale of centuries - that causes small but significant changes in temperatures," Schmittner said.

"When the ocean temperatures warm, it causes more direct melting of the ice sheet below the surface, and it increases the number of icebergs that calve off the ice sheet," he said.

Those two factors combine to provide an influx of fresh water into the Southern Ocean during these warm regimes, according to Peter Clark, from OSU.

"The introduction of that cold, fresh water lessens the salinity and cools the surface temperatures, at the same time, stratifying the layers of water," Clark said.

"The cold, fresh water freezes more easily, creating additional sea ice despite warmer temperatures that are down hundreds of meters below the surface," he said.

The discovery may help explain why sea ice has expanded in the Southern Ocean despite global warming.

The same phenomenon does not occur in the Northern Hemisphere with the Greenland Ice Sheet because it is more landlocked and not subject to the same current shifts that affect the Antarctic Ice Sheet.

"One message that comes out of this study is that the Antarctic Ice Sheet is very sensitive to small changes in ocean temperatures, and humans are making the Earth a lot warmer than it has been," Bakker said.

The researchers analysed sediments from the last 8,000 years, which showed evidence that many more icebergs calved off the ice sheet in some centuries than in others.

FIRST BORON DETECTION ON MARS

NASA's Curiosity rover has detected boron for the first time on the surface of Mars, which indicates that the groundwater may have possibly been suitable for hosting microbial life in the ancient past.

"If the boron that we found in calcium sulfate mineral veins on Mars is similar to what we see on Earth, it would indicate that the groundwater of ancient Mars that formed these veins would have been 0-60 degrees

Celsius and neutral-to-alkaline pH," said Patrick Gasda, a postdoctoral researcher at Los Alamos National Laboratory in the US.

The temperature, pH, and dissolved mineral content of the groundwater could make it habitable.

The boron was identified by the rover's laser-shooting Chemistry and Camera (ChemCam) instrument

Boron is famously associated with arid sites where much water has evaporated away. However, environmental implications of the boron found by Curiosity are still open to debate.

Scientists are considering at least two possibilities for the source of boron that groundwater left in the veins: It could be that the drying out of part of Gale lake resulted in a boron-containing deposit in an overlying layer, not yet reached by Curiosity.

Some of the material from this layer could have later been carried by groundwater down into fractures in the rocks. The changes in the chemistry of clay-bearing deposits and groundwater may have affected how boron was picked up and dropped off within the local sediments.

The discovery of boron is only one of several recent findings related to the composition of Martian rocks.

Curiosity is climbing a layered Martian mountain and finding rock-composition evidence of how ancient lakes and wet underground environments changed, billions of years ago, in ways that affected their favourability for microbial life. As the rover has progressed uphill, compositions trend toward more clay and more boron.

These and other variations can tell us about conditions under which sediments were initially deposited and about how later groundwater moving through the accumulated layers altered and transported ingredients.

Groundwater and chemicals dissolved in it that appeared later on Mars left its effects most clearly in mineral veins that filled cracks in older layered rock.

However, it also affected the composition of that rock matrix surrounding the veins, and the fluid was in turn affected by the rock.

As the rover gets further uphill, researchers are impressed by the complexity of the lake environments when clay-bearing sediments were being deposited and also by the complexity of the groundwater interactions after the sediments were buried.

"We are seeing chemical complexity indicating a long, interactive history with the water. The more complicated the chemistry is, the better it is for habitability," said John Grotzinger, from California Institute of Technology in the US.

"The boron and clay underline the mobility of elements and electrons, and that is good for life," said Grotzinger.

'LAB-ON-A-CHIP TECH MAY SIMPLIFY CANCER DETECTION'

Scientists have developed a new lab-on-a-chip technique that may simplify the detection of cancer DNA biomarkers in blood and pave the way for new treatments for the deadly disease.

Genomic biomarkers offer great potential for diagnostics and new forms of treatment, such as immunotherapy.

Miniaturised lab-on-a-chip approaches are prime candidates for developing viable diagnostic tests and instruments because they are small, need only limited test volumes and can be cost-effective.

A team of scientists and engineers from the University of California, Santa Cruz and Brigham Young University in the US have developed just such an approach capable of processing biomolecular samples from blood.

Their method can analyse and identify multiple targets on a silicon-based molecular detection platform.

Laboratory-on-a-chip describes the miniaturisation of laboratory functions such as blood testing on a chip.

Instead of transferring relatively large (micro- to millilitres) samples between test tubes or using bulky analytical equipment, samples and reagents are handled on chip-scale devices with fluidic microchannels.

This requires much smaller test volumes, and multiple functions can be integrated on a single device, improving speed, reliability and portability of these lab processes.

"Our approach uses optofluidic chips where both fluid processing and optical sensing are done on a chip, allowing for further miniaturisation and performance enhancements of the chip system," said Holger Schmidt, professor at the University of California, Santa Cruz.

Each of the chips had to be developed and tested for multiple functions, from filtering of blood cells without

clogging the filter to reliably analysing optical data to create the right excitation patterns on the silicon chip.

The next step to realising the potential of this research is to move towards real clinical samples and to detect individual DNA biomarkers.

"We have shown single nucleic acid analysis in the context of on-chip Ebola detection and would like to transfer that to this application," said Schmidt.

Other goals for the team include increasing the speed of the analysis process, and integrating more optical elements on the chip.

They also want to expand their capabilities to analysing protein biomarkers in addition to nucleic acids and whole virus particles already demonstrated. This research is expected to have a wide range of applications because the underlying principle of this kind of on-chip optical analysis and manipulation is very general.

"In the near term, we hope to build new diagnostic instruments for molecular diagnostics with applications in oncology and infectious disease detection, both viruses and (drug-resistant) bacteria," Schmidt said.

SLEEP HELPS PROCESS TRAUMATIC EXPERIENCES: STUDY

Sleep during the first 24 hours after a trauma can have a positive impact on highly emotional distress and memories, according to a new study which may help develop new therapies to prevent post-traumatic stress disorder (PTSD). Researchers from the University of Zurich in Switzerland showed a traumatic video to the subjects. The recurring memories of the images in the film that haunted the test subjects for a few days were recorded in detail in a diary.

Virtually out of the blue, the test subjects would see a snapshot of what they had seen in their mind's eye, reawakening the unpleasant feelings and thoughts they had experienced during the film.

The quality of these memories resembles those of patients suffering from post-traumatic stress disorders. Other than after a traumatic event, however, they reliably disappear after a few days.

Participants were randomly assigned to two groups. One slept in the lab for a night after the video while their sleep was recorded via an electroencephalograph (EEG); the other group remained awake.

"Our results reveal that people who slept after the film had fewer and less distressing recurring emotional memories than those who were awake," said Birgit Kleim from the University of Zurich.

"This supports the assumption that sleep may have a protective effect in the aftermath of traumatic experiences," said Kleim.

On one hand, sleep can help weaken emotions connected to an existing memory, such as fear caused by traumatic experiences, for instance.

On the other hand, it also helps contextualise the recollections, process them informationally and store these memories. However, this process presumably takes several nights. According to the researchers, recommendations on early treatments and dealing with traumatised people in the early phase are few and far between.

"Our approach offers an important non-invasive alternative to the current attempts to erase traumatic memories or treat them with medication," said Kleim.

"The use of sleep might prove to be a suitable and natural early prevention strategy," he added.

'QUAKE-DETECTION APP DETECTED NEARLY 400 TEMBLORS WORLDWIDE'

A smartphone app developed by scientists has successfully detected nearly 400 earthquakes since its launch earlier this year, paving the way for a warning system that can alert users before a disaster strikes.

The MyShake app, developed at University of California, Berkeley, harnesses a smartphone's motion detectors to measure earthquake ground motion, then sends that data back to the seismological laboratory for analysis.

The eventual goal is to send early-warning alerts to users a bit farther from ground zero, giving them seconds to a minute of warning that the ground will start shaking. That is enough time to take cover or switch off equipment that might be damaged in a quake, researchers said.

To date, nearly 220,000 people have downloaded the app, and at any one time, between 8,000 and 10,000 phones are active - turned on, lying on a horizontal surface and connected to a wi-fi network - and thus primed to respond.

An updated version of the MyShake app is available, providing an option for push notifications of recent quakes within a distance determined by the user, and the option of turning the app off until the phone is plugged in, which could extend the life of a single charge in older phones.

"The notifications will not be fast initially - not fast enough for early warning - but it puts into place the technology to deliver the alerts and we can then work toward making them faster and faster as we improve our real-time detection system within MyShake," said project leader Richard Allen, a UC Berkeley professor.

Ten months of operation clearly shows that the sensitivity of the smartphone accelerometers and the density of phones in many places are sufficient to provide data quickly enough for early warning, researchers said.

The phones readily detect the first seismic waves to arrive - the less destructive P waves - and send the information to Berkeley in time to issue an alert that the stronger S wave will soon arrive.

"We already have the algorithm to detect the earthquakes running on our server, but we have to make sure it is accurate and stable before we can start issuing warnings, which we hope to do in the near future," Kong said.

The app can detect quakes as small as magnitude 2.5, with the best sensitivity in areas with a greater density of phones.

FIRST BIOLOGICAL PACEMAKER DEVELOPED

Scientists have developed the first functional pacemaker cells from human stem cells which can regulate heart beats with electrical impulses, paving the way for alternate, biological pacemaker therapy.

The findings from the McEwen Centre for Regenerative Medicine at University Health Network in Canada show how human pluripotent stem cells can be coaxed in 21 days to develop into pacemaker cells.

These human pacemaker cells were tested in rat hearts and were shown to function as a biological pacemaker, by activating the electrical impulses that trigger the contraction of the heart.

Pluripotent stem cells have the potential to differentiate into more than 200 different cell types that make up every tissue and organ in the body.

Sinoatrial node pacemaker cells are the heart's primary pacemaker, controlling the heartbeat throughout life.

Defects in the pacemaker can lead to heart rhythm disorders that are commonly treated by implantation of electronic pacemaker devices.

Learning how to generate pacemaker cells could help in understanding disorders in pacemaker cells, and provide a cell source for developing a biological pacemaker.

Biological pacemakers represent a promising alternative to electronic pacemakers, overcoming such drawbacks as a lack of hormonal responsiveness and the inability to adapt to changes in heart size in pediatric patients.

The researchers used a developmental-biology approach to establish a specific protocol for generating the pacemaker cells.

"What we are doing is human biology in a petri dish. We are replicating nature's way of making the pacemaker cell," said Dr Gordon Keller, Director of the McEwen Centre.

Based on previous findings in animal models, the researchers tested and mapped out the specific developmental pathway of how human pluripotent stem cells become pacemaker cells.

This was achieved by testing different signalling molecules at different times throughout the 21 days to guide the cells towards their goal.

"It's tricky. You have to determine the right signalling molecules, at the right concentration, at the right time to stimulate the stem cells," said Stephanie Protze, a post-doctoral fellow in the laboratory of Keller.