Important News in the field of

Space
Atomic Energy
Environment and Ecology
Health and Medicine
Bio-Technology
Computer and IT
Defence
Agriculture
Miscellaneous
Aspirant Forum is a Community for the UPSC Civil Services (IAS) Aspirants, to discuss and debate the various things related to the exam. We welcome an active participation from the fellow members to enrich the knowledge of all.

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Courtesy:
The Hindu
SpaceX rocket makes history

SpaceX successfully launched and then retrieved its first recycled rocket, a historic feat and the biggest leap yet in its bid to drive down costs and speed up flights. It was the first time SpaceX founder Elon Musk tried to fly a booster that soared before an orbital mission. He was at a loss for words after the Falcon 9 core landed on the bull’s-eye of the ocean platform following lift-off with a broadcasting satellite.

“Thi s is a huge day. My mind’s blown, frankly,” Mr. Musk said. He called it an “incredible milestone in the history of space” and predicted, “this is going to be a huge revolution in spaceflight.”

Mr. Musk foresees dozens, if not hundreds of repeat flights, for a booster and rocket turnarounds of as little as 24 hours, perhaps by next year. Land, refuel and then back up again, with everything leading to one day putting humanity “out there among the stars.”

This particular first stage landed on an ocean platform almost exactly a year ago after a space station launch for NASA. SpaceX refurbished and tested the 15-story booster, still sporting its nine original engines. It nailed another vertical landing at sea once it was finished boosting the satellite for the SES company of Luxembourg.

Loud cheers

SpaceX employees outside jammed Mission Control at the Hawthorne, California, company headquarters cheered loudly every step of the way and again when the satellite reached its proper orbit. Longtime customer SES got a discount for agreeing to use a salvaged rocket, but wouldn’t say how much. It’s not just about the savings, said chief technology officer Martin Halliwell. He called it “a big step for everybody something that’s never, ever been done before.”

Eclipses of binary star shed light on orbiting exo-planet

A team of scientists from Raman Research Institute, Bengaluru, and University of Delhi have seen for the first time indications of a massive planet orbiting a low mass X-ray binary star system. The technique that has been used, namely, X-ray observations, is a new way of detecting exoplanets. The results have been published in Monthly Notices of the Royal Astronomical Society. The system is nearly 30,000 light years away and the planet is expected to be nearly 8,000 times as massive as the earth.

Paired with neutron star

The star system in question, MXB 1658-298 is an X-ray binary and a part of the constellation Ophiuchus (serpent bearer). X-ray binaries consist of a pair of stars orbiting each other of which one is compact such as a black hole or a neutron star (in this case, a neutron star). The neutron star draws matter from its less-massive companion. The mass when drawn generates X-rays which are detected by detectors placed in satellites in space.

Discovered in 1976, this binary star system is so far and so faint that it may be observed only when it shows “outbursts” of X-rays. That is, an increase in X-ray intensity by a factor of 100 or more. Recently this system showed an outburst. “This provided us with an excellent opportunity to try to trace the orbital evolution of this system,” Chetana Jain, Assistant Professor, Hansraj College, Delhi, who is the first author of the paper, says in an email. As the two stars revolve around each other, the less-massive companion star hides the compact star every time it crosses the line of sight, in between the detector and the neutron star, giving rise to eclipses. In X-ray binaries, the time in-between eclipses of the source can increase, decrease and also shows abrupt changes. “The eclipse first [time] arrived about ten seconds earlier and after about a year, arrived about ten seconds later that what would be expected [if these was no other body disturbing the system]” says Biswajit Paul, Raman Research Institute, who led the research, in an email. The team was surprised by this unusual behaviour.

The massive third

This periodic variation implied that there was a third body orbiting the system. “The long-term evolution of the mid-eclipse times indicated that this orbit is shrinking. Over and above this, we found periodic variation on shorter timescale,” says Dr Jain, summarising the results.

“Till now, there are various indirect methods [of detecting exoplanets] such as transit photometry and microlensing,” says Dr Jain. This discovery is made with a new technique, by measuring periodic delays in X-ray eclipses.

X-ray observations are done from space observatories such as NASA’s Chandra X-ray Observatory. “In this particular work, we have used data from XMM-Newton and archival data from RXTE (NASA) and some earlier published values of mid-eclipse times,” says Dr Paul, who
has been studying this system for eight years.

Large asteroid to buzz past Earth on April 19: NASA

A relatively large near-Earth asteroid will fly safely past our planet on April 19 at a distance of about 1.8 million kilometres — over four times the distance from Earth to the Moon, NASA said today.

Although there is no possibility for the asteroid to collide with Earth, this will be a very close approach for an asteroid of this size.

The asteroid, known as 2014 JO25, was discovered in May 2014 by astronomers at the Catalina Sky Survey in Arizona, US.

Contemporary measurements by NASA’s NEOWISE mission indicate that the asteroid is roughly 650 meters in size, and that its surface is about twice as reflective as that of the Moon.

At this time very little else is known about the object’s physical properties, even though its trajectory is well known.

The asteroid will approach Earth from the direction of the Sun and will become visible in the night sky after April 19.

NASA balloon launch again delayed

The launch of NASA’s super pressure balloon — carrying a space observatory designed to detect high-energy cosmic rays — was postponed for the third time due to poor weather conditions.

Wind speeds were just slightly above those required for launch, and with the uncertainty for precipitation in the area, the team made the decision to postpone for the day.

No launch attempt is scheduled, NASA said in a blog post. This was the third scheduled launch attempt for NASA’s 2017 Wanaka Balloon Campaign from New Zealand.

The first attempt was cancelled due to unacceptable stratospheric wind conditions.

The second attempt was cancelled due to a mechanical issue with a crane used for launch operations, which has since been resolved.

Long duration flight

The purpose of the flight is to test and validate the super pressure balloon (SPB) technology with the goal of long duration flight of over 100 days at mid-latitudes.

In addition, the Extreme Universe Space Observatory on a Super Pressure Balloon (EUSO-SPB) will be on the test flight.

EUSO-SPB is designed to detect high-energy cosmic rays originating from outside our galaxy as they penetrate the Earth’s atmosphere.

It is predicted to brighten to about magnitude 11, when it could be visible in small optical telescopes for one or two nights before it fades as the distance from Earth rapidly increases, NASA said.

Small asteroids pass within this distance of Earth several times each week, but the upcoming close approach is the closest by any known asteroid of this size, or larger, since asteroid Toutatis, a five-kilometre asteroid, which approached within about four lunar distances in 2004.

The next known encounter of an asteroid of comparable size will occur in 2027 when the 800-metre-wide asteroid 1999 AN10 will fly by at one lunar distance, about 380,000 kilometres.

The April 19 encounter provides an outstanding opportunity to study this asteroid, and astronomers plan to observe it with telescopes around the world to learn as much about it as possible.

The encounter on April 19 is the closest this asteroid has come to Earth for at least the last 400 years and will be its closest approach for at least the next 500 years.

Also on April 19, the comet PanSTARRS (C/2015 ER61) will make its closest approach to Earth, at a very safe distance of 175 million kilometres, NASA said.

A faint fuzzball in the sky was discovered in 2015 by the Pan-STARRS NEO survey team using a telescope on the summit of Haleakala, Hawaii.

The comet has since brightened considerably due to a recent outburst and is now visible in the dawn sky with binoculars or a small telescope.

NASA releases global maps of ‘night light’ on Earth

NASA scientists have released new global maps of Earth at night, providing the clearest yet composite view of the patterns of human settlement across our planet.

Satellite images of Earth at night have been a source of curiosity for public and a tool for fundamental research for nearly 25 years.

Now, a research team led by scientist Miguel Roman of NASA’s Goddard Space Flight Centre in the U.S. plans to find out if “night lights” imagery could be updated yearly, monthly or even daily.

In the years since the 2011 launch of the NASA–NOAA Suomi National Polar-orbiting Partnership (NPP) satellite, researchers have been analysing night lights data and developing new software and algorithms to make night lights imagery clearer. They are now on the verge of
Third gravitational wave merger detected
The Laser Interferometer Gravitational-wave Observatory (LIGO) detectors in the U.S. have detected yet another merger of two black holes on January 4, 2017. Named GW170104, this signal marks the third confirmed detection of gravitational waves coming from a binary black hole merger. It is of great interest to the scientific community that the black holes, having masses nearly 31 times and 19 times the sun’s mass. Until the first detection of gravitational waves by LIGO in 2015 (GW150914) it was not known that such massive black holes could exist.

The gravitational wave detection was ‘The first time, a chance event; second time, a coincidence, and third, a pattern,” says Bangalore Sathyaprakash, a senior scientist with the LIGO collaboration in the U.S. and an editor of the paper describing these results which was published in Physical Review Letters.

The Indian space-based ASTROSAT mission did a related sensitive search for short duration x-ray flashes associated with the event and did not detect any. These results will be published soon by the scientists from ASTROSAT.

Meanwhile, at LIGO, this time around, the detection has revealed not merely a black-hole merger but also the alignment of the spins of the black holes. This can shed light on the way the black holes might have formed. In this event, the spins of the individual black holes making up the merger are probably not aligned along the same direction. This supports the theory which says that black holes form independently in a star cluster, then sink to the centre of the cluster and eventually merge. Simultaneously, the detection does not favour the competing theory according to which binary black holes form in pairs even at the start and eventually merge. The latter theory prefers that the pair of black holes will both necessarily have aligned spins.

Einstein proved right
The observation also supports Einstein’s General Theory of Relativity. According to this theory, gravitational waves, unlike light waves, will not disperse as they travel through space. This, too, has been confirmed by the analysis of the latest signal.

One drawback of having just the two detectors at Hanford and Livingston tuned to detect gravitational waves is that they cannot accurately figure out where in the sky the signal is coming from. Just as in the case of a GPS, they need at least three non-collinear detectors to do this.

After Mars, ISRO decides it’s time to probe Venus
It’s official. The Indian Space Research Organisation (ISRO) has invited scientists to suggest studies for a potential orbiter mission to Venus - somewhat similar to the one that landed in Mars in 2013.

ISRO plans to send a spacecraft that will initially go around Venus in an elliptical orbit before getting closer to the ‘Yellow Planet’. It will carry instruments weighing 175 kg and using 500W of power. The scientific community has been told to suggest space-based studies by May 19.

“The Announcement of Opportunity [AO] is just the beginning. The mission needs to be finalised, a project report would have to be presented and approved. A formal mission may not happen before 2020,” a senior ISRO official told The Hindu.

A mission must be approved by ISRO’s Advisory Committee on Space Sciences, then the Space Commission and later by the government.

Venus, the second planet from the Sun, comes closest to Earth roughly every 583 days, or about 19 months. Venus, our closest planetary neighbour, is similar to Earth in many aspects. However, it takes only 225 days to revolve around the Sun. Secondly; the surface is very hot due to nearness to the Sun.

India’s previous and second planetary outing, the record-setting Rs. 450-crore Mars Orbiter Mission (MOM) of 2013, continues to impress. The orbiter is going round the Red Planet even as you read this — well beyond its planned life of six months.

An orbiter sent to the Moon in 2008 was delivering data until about three months before its estimated life span. A second Moon landing mission is planned in early 2018.

China to launch its first cargo spacecraft for space lab
China is set to launch its first cargo spacecraft between April 20 and 24. The Tianzhou-1 has been transferred with a Long March – 7 Y2 carrier rocket from the testing centre to the launch zone in Wenchang, Hainan province, said the office of China’s manned space programme.

IANS

providing daily, high definition views of Earth at night, and are targeting the release of such data to the science community later this year. The new global composite map of night lights was observed in 2016. NASA is now automating the processing of images.
Of course, a network of detectors will improve the scope of “Gravitational Wave Astronomy,” the era of which has just been ushered in by the third detection of gravitational waves from a binary black hole merger. The Italy-based VIRGO detector is almost in place and will join in to collect data later this year, a spokesperson for VIRGO said, at a tele conference organized by LIGO collaboration. The study had a major Indian contribution and the LIGO-India facility which is making immense progress will join the club in 2024.

India’s polar ship still a long way off
India’s plans to acquire a Rs. 1,000-crore polar research vehicle (PRV) — a ship that can cut through ice sheets and glaciers — may see fresh delays. Though a Spanish ship-building company was roped in, in early 2015, the contract fell through, primarily due to escalated costs. The new ‘Make in India’ policy gives Indian companies an edge in bagging these contracts, which are open to international and local bidders. This concession allows an Indian company, which may have lost out to a foreign company in the final bidding stage on price, to match the latter’s lower, winning bid and bag the contract.

Multiple sources, privy to the PRV procurement process, told The Hindu that Indian ship companies are not experienced in building PRVs. “There are very few companies in the world with such expertise. Insisting on Indian companies for the sake of it may mean longer delays,” said a person familiar with the process.

New tender soon
A fresh, global tender incorporating these changes will likely be floated later this year. The government had authorised the Goa-based National Centre for Antarctic and Ocean Research (NCAOR), a facility that comes under the Earth Sciences Ministry, to acquire a Polar Research Vehicle (PRV) in 2014. According to a March 2015 press statement by the Cabinet approving Rs. 1,050 crore for the purpose, a PRV was necessary to meet “…the growing need of the scientific community to initiate studies in ocean sciences, (ii) the uncertainty in the charter-hire of polar vessels and the ever-escalating chartering costs, and (iii) the expansion of scientific activities into the Arctic and Southern Ocean (the seas surrounding Antarctica).”

“An Indian company can also partner with a foreign company for the bidding… once awarded, we expect the ship to be ready within three years,” said Madhavan Rajeevan, Secretary, Ministry of Earth Sciences.

Crucial to nation’s goals
The ‘ice-breaker,’ as these ships are colloquially called, can cut through a 1.5-metre thick wall of ice. With a lifespan of 30 years, the ship is expected to be central to India’s ambitions in the Arctic and Antarctica in coming years. India has announced plans to rebuild Maitri, its research station in Antarctica, and make it impervious to its harsh environment for at least 25 years.

Though the plans to procure a ship were laid out in 2011, there have since been design changes and disagreements with the Spain-based company, which had won the tender on the final costs. “These led to the delay at that time,” said Shailesh Nayak, former MoES Secretary.

ISRO abuzz with Monday’s heavy-lift rocket launch
An anxious space establishment is keeping its fingers crossed over the launch of its new and most powerful rocket on June 5.

On that evening, the indigenous GSLV-Mark III will make a bid to breach a heavy-lift rocket club that can put four-tonne satellites into space. The U.S., Russia, Europe, China and Japan are already there.

The first development vehicle, called GSLV-MkIII D-1, is slated to fly from the Satish Dhawan Space Centre at Sriharikota at 5.28 p.m., says the Indian Space Research Organisation.

The success of the first full flight of Mk III will mean that soon, Indian communication satellites can be lofted into space from within the country. It will also improve ISRO’s ability to reach heavier satellites to both — the higher geostationary transfer orbit or GTO of 36,000 km; and to low-Earth orbit or LEO of up to 800 km. ISRO Chairman and Secretary, Department of Space, A.S. Kiran Kumar, told The Hindu: “MKIII should enable us to launch communication satellites totally in India without going out. That is the primary aim.”

“We are improving our capacity to put higher payloads into GTO and LEO. What we now have with MkII is ca-
Citizen scientists find cold new world near solar system

A brown dwarf over 100 light years away from the Sun has been discovered using a new citizen science tool that helps astronomer's pinpoint new worlds lurking in the outer reaches of our solar system.

Just six days after the launch of the Backyard Worlds: Planet 9 website in February, four different users alerted the science team to the curious object, whose presence has since been confirmed via an infrared telescope.

"I was so proud of our volunteers as I saw the data on this new cold world coming in," said Jackie Faherty, a senior scientist at the American Museum of Natural History and one of Backyard World's researchers.

"It was a feel-good moment for science," said Ms. Faherty.

India successfully fires heaviest launch vehicle

India leapfrogged into a select group of nations having their own indigenous cryogenic engine technology, when the Indian Space Research Organisation (ISRO) successfully launched its heaviest launch vehicle, GSLV MkIII-D1, and placed the country's heaviest satellite till date, GSAT-19, into a precise orbit.

The rocket lifted off from the second launch pad into clear blue skies at 5.28 p.m., and soared above the moon which was rising in the evening, leaving a plume of smoke, a bright orange light shining below the rocket as the cryogenic engine fired up and took the rocket on its intended path.

The GSAT-19, a communication satellite, expected to enhance India's communication infrastructure, was placed into a Geosynchronous Transfer Orbit (GTO), 16 minutes after launch, with a perigee (closest point to Earth) 170 km and apogee (farthest point from Earth) 35,975 km. It will take about two to three weeks to be placed in its intended orbit.

The satellite weighs 3,136 kg. This successful launch will enable India to launch 4-tonne class satellites from India.
These were earlier launched from launch pads abroad. The cryogenic engine, which ignited roughly about 5 minutes after lift-off, and was firing for 640 seconds, “was a culmination of large amounts of work done over decades,” A.S. Kiran Kumar, Chairman, ISRO, told a press conference after the launch.

**Russian design**

ISRO has been trying to master development of an indigenous cryogenic for decades and has used indigenous cryogenic engines on earlier GSLV flights but modelled mainly on Russian design.

On this GSLV, no technological element was borrowed or adapted from any other space organisation, Somanath S., Director, Liquid Propulsion Systems Centre (LPSC), ISRO said.

“The cryo stage is a complex technology. We were making it for the first time; we faced no serious test failures or problems. That is a world record,” he said, adding that despite limited resources, “it is a marvel that we were able to achieve this.”

When the indigenous cryogenic engine started firing, the mood at Mission Control was “upbeat,” Mr. Kiran Kumar said. He said the engine was being tested and perfected since December 2014.

“More than 199 tests were done since December 2014. The entire team was confident,” the Chairman said, however adding that “there were some butterflies in the stomach.”

**Business opportunities**

The GSAT-19 carries a Ka/Ku-band high throughput communication transponders. It also carries a Geostationary Radiation Spectrometer (GRASP) payload to monitor and study the nature of charged particles and the influence of space radiation on satellites and their electronic components, according to ISRO. “The spacecraft will open up a lot of new vistas in the field of Internet connectivity, broadband connectivity,” P.K. Gupta, project director, said.

The successful launch of the GSLV MkIII- D1 also opens up business opportunities for ISRO. “Definitely the credibility of the system goes up and customers will have greater confidence,” Mr. Kiran Kumar said, adding that it would reduce insurance premiums. “As far as Mk III is concerned, we are planning two launches every year,” he said.

**More in the pipeline**

Two launches are coming up, which however, happen from Ariane in French Guiana. The first one scheduled for June 28, will be the GSAT 18, a 3.3 tonne satellite, and the second one will be a 5.8 tonne satellite.

Work is on to launch two approved missions — Aditya-L1 and Chandrayaan-II — in the next two years, Mr. Kiran Kumar said. “Chandrayaan will be [launched] in the first quarter of next year, and Aditya… around 2018-19.” The ‘Aditya-L1’ will be placed in the halo orbit around the ‘Lagrangian point of the Sun-Earth system, according to ISRO.

**GSLV MkIII has given us a big push:** ISRO Chairman

For space-faring nations, a launch vehicle — such as the all-Indian GSLV-MarkIII that was first flown on June 5 — is a vital tool for placing spacecraft in the sky. For India, the MkIII can lift four-tonne satellites with double the power of the older MkII rocket.

In a short exchange over the phone, A.S. Kiran Kumar, Chairman, Indian Space Research Organisation, explains what the new big rocket’s success means and what lies next. Edited excerpts:

**How important for you has been the maiden success of your new launcher, GSLV MkIII?**

Could you please explain it beyond its four-tonne-lifting power?

It is indeed a very significant development in the Indian space programme. It gives us a big push. We were short of this capacity for lifting our communication satellites. We had to go outside for our launches; and because of [the launch schedules of foreign space agencies] the pace at which we did our projects was getting affected. Cost was another deterrent for pushing things aggressively.

By achieving MkIII, we will be able to push confidently and launch many of our communication satellites faster and indigenously. We will do one more launch within a year and establish it systematically.

**The cost benefit?**

I cannot give you the exact figures as they keep changing. But just to give you the example of last year’s INSAT-3DR, we were able to do both the satellite and launch it here for the cost of an earlier foreign launch.

What would be next in your launcher-related activities? What is their status, schedule and the funds they need? First we need to consolidate the developments. Our immediate and main task remains how to streamline the realisation of our three launch vehicles PSLV, GSLV-MkII [two-tonne lifter] and the new GSLV-MkIII, sustain them and ensure the number of launchers we need to put the satellites in orbit. For MkII, our target is to do two launches a year. As it is, building its supply chain, managing it...
and ensuring the required supplies for it are all an effort. To that we will be adding the requirements for MkIII.

On the launch technology side, we will be looking at how to reduce the cost further — by adopting new mechanisms, materials and new capabilities. Including the reusable launch vehicle concept.

You mentioned reusable technology to save costs. Where are we in that?

Last year, we tried out the RLV-TD experiment [Reusable Launch Vehicle Technology Demonstrator]. We got a small, plane-like model to vertically land on water. Next we will look at landing it on the ground with a landing gear system. We are conceiving systems to work on the air breathing propulsion technology that will use atmospheric oxygen. For the present launch vehicles, we will look at recovering [and reusing] some parts.

What is essential today for ISRO?

To build capacities within the organisation and the country to meet the demands.

We have a significant shortage of satellites in space. If we have to roughly double the capacity of the spacecraft, we have to do as many launches and cost effectively. That is the prime driver.

Also, it is essential for a space agency to build new capabilities, constantly get new skills to do complex jobs and to do routine things better.

Scientists conjure up largest virtual universe

Scientists have created the largest-ever virtual universe that simulates the formation galaxies and may hold clues to the nature of the elusive dark matter that is believed to make up majority of the cosmos.

The gigantic catalogue of about 25 billion virtual galaxies generated from 2 trillion digital particles using a supercomputer is being used to calibrate the experiments on the board the Euclid satellite that will be launched in 2020.

The satellite will investigate the nature of dark matter and dark energy.

The computer code that took three years to complete was executed on the world-leading machine for only 80 hours, and generated a virtual universe of two trillion macro-particles representing the dark matter fluid, from which a catalogue of 25 billion virtual galaxies was extracted, researchers said.

About 95 per cent of the universe is dark. The cosmos consists of 23 per cent of dark matter and 72 per cent of dark energy, researchers said.

Harnessing the solar spectrum

Using different parts of sunlight’s spectrum to produce crops, generate electricity, collect heat and purify water could provide food, energy and water resources for the world’s growing population, a study has said.

“Increase in population, coupled with rising per capita income and associated change in consumption habits, will put unprecedented stress on food, energy and water resources,” said Rakesh Agrawal, professor at Purdue University in the U.S.

“The grand challenge before us is to sustainably meet the needs of a full Earth using scarcer resources, and the sun is the key energy source to achieve this goal,” said Prof. Agrawal.

He led a study that talks of a system that would use the entire solar spectrum to maximise resource production from a given land area.

The concept, described in the journal Scientific Reports, works by separating and harvesting the three specific segments of the solar spectrum that are best suited to facilitate the production of food, energy and clean water.

In current practices, much of this spectrum is wasted because all of the sunlight falling on a given spot is used for one purpose: agriculture, energy production or water purification.

The new approach would instead use the same land mass for all three purposes simultaneously through innovative technologies that split the spectrum into three segments and efficiently harvest sunlight.

A typical photovoltaic panel, when installed on farmland, casts a shadow and dramatically reduces plant growth and crop yield from the shadowed area.

The proposed photovoltaic designs transmit photons responsible for plant growth while reflecting remaining photons in the solar spectrum to specially designed solar cells that can help generate electricity and collect heat for energy recovery and water purification.

Global resilience

Solar spectrum splitting to maximise electric power generation and heat recovery is well-known, said Muhammad Ashraf Alal, a professor at Purdue University.

The proposed system could create solar-powered, self-sufficient communities, said Peter Bermel, an assistant professor at Purdue University. “Implementing this approach across agricultural land areas could supply extra electricity to the power grid, as well as freshwater supplies to other areas in need, thus improving global resilience,” he added.
What ails the Navigation Indian Constellation

What is NavIC?

Navigation Indian Constellation (NavIC) is an independent Indian satellite-based positioning system for critical national applications. The purpose is to provide “reliable position, navigation and timing services over India and its neighbourhood.” NavIC consists of a constellation of seven satellites and was named so by Prime Minister Narendra Modi.

Three of the satellites are in a geostationary orbit and four in a geosynchronous one. This means they will be visible at all times in the Indian region.

All the seven satellites of NavIC, namely, IRNSS-1A, 1B, 1C, ID,1E, 1F and 1G were successfully launched on July 2, 2013, April 4, 2014, October 16, 2014, March 28, 2015, January 20, 2016, March 10, 2016 and April 28, 2016 respectively.

What's the problem?

Because navigation requires the most accurate clocks, the Rs. 1,420-crore NavIC relies on rubidium clocks.

Each of the seven satellites has three of them on-board. However, this January, the ISRO confirmed that the clocks on the first satellite, IRNSS-1A had failed in June 2016. According to ISRO, the applications of IRNSS are:

- terrestrial, aerial and marine navigation, vehicle tracking and fleet management,
- terrestrial navigation for hikers and travellers, disaster management, integration with mobile phones, mapping and geodetic data capture and visual and voice navigation for drivers.

Though six of the satellites are working fine, the one faulty one means the “GPS” isn’t working as accurately as it ought to be.

How's it being fixed?

ISRO Chairman A.S. Kiran Kumar told the Hindu that without its clocks, the IRNSS-1A “will give a coarse value. It will not be used for computation. Messages from it will still be used.”

ISRO was trying to revive the clocks on 1A and reading one of the two back-up navigation satellites to replace it in space in the second half of this year. Rubidium clocks were the previous standard in accurate clocks and most organisations, that need precise time estimates, need cesium clocks. It is learnt that future clocks on such satellites, each with a lifespan of 10 years, will host such clocks.

What’s up with Bosphorus?

A sudden change in the colour of the Bosphorus Strait that divides the continents of Europe and Asia in Turkey’s largest city Istanbul has surprised residents, with scientists putting it down to a surge in a species of plankton across the Black Sea.

Residents alarmed

The sudden transformation of the usually blue waters of the Bosphorus to a milky turquoise since the weekend had alarmed some residents.

Some took to social media to express fears that there had been a pollution spill while others even suggested it could be linked to an earthquake that rocked the Aegean region afternoon. But scientists said there was no mystery behind the colour change, which was accompanied by a sharper smell.

Ahmet Cemal Saydam, professor of environmental science at Hacettepe University, told the Dogan news agency that the cause was a surge in numbers of the micro-organism Emiliania huxleyi, also known as Ehux. “This has nothing to do with pollution,” he said, adding it was particularly good for the numbers of anchovies, a popular supper in Istanbul. Anchovies feed on phytoplanktons and tiny fish.

Ehux explosion

“Across the Black Sea there is an explosion of Emiliania huxleyi. This is a blessing for the Black Sea,” he said. One of the most successful life-forms on the planet, Emiliania huxleyi is a single-celled organism visible only under a microscope.

Its astonishing adaptability enables it to thrive in waters from the equator to the sub-Arctic. The changing colour across the Black Sea was also captured in an image taken from NASA’s Terra satellite.

NASA said the milky colouration is “likely due to the growth of a particular phytoplankton called a coccolithophore”. Emiliania huxleyi is a species of coccolithophore. “This particular organism is plated with white calcium carbonate and, when present in large numbers, tend to turn the water a milky sheen,” NASA said.

ISRO set to launch back-up satellite

In an attempt to keep India’s regional navigation satellite system fully operational, the Indian Space Research Organisation (ISRO) is preparing to launch a back-up for IRNSS-1A, one of the seven satellites in the constellation, which has been hobbled by the failure of the atomic clocks on board.

The PSLV C39 mission, scheduled for late July or early August, will carry the new satellite named IRNSS-1H into orbit, K. Sivan, Director of Vikram Sarabhai Space Cen-
Mindful of the fact that the standard size of satellites is van, Director, Vikram Sarabhai Space Centre, said.

First of seven

IRNSS-1A is the first of the seven satellites comprising the Navigation Indian Constellation (NaVIc), a multi-purpose satellite-based positioning system, envisaged as India’s alternative to the American GPS. NaVIc has been designed to support vehicle tracking, fleet management, disaster management and mapping services besides terrestrial, marine and aerial navigation for India and its neighbourhood.

The system became operational in 2016 after the seventh satellite in the series was placed in orbit.

ISRO may use semi-cryogenic engine for heavy lift rockets

The Indian Space Research Organisation (ISRO) has progressed to the testing of subsystems in the development of a semi-cryogenic engine for rockets with heavier payload capacity.

The testing facilities at the ISRO Propulsion Complex, Mahendragiri, are being augmented for the engine being developed by the Liquid Propulsion Systems Centre here under a project codenamed SCE 200. Three of the four turbo pumps of the new engine have been tested and the pre-burner and thrust chambers are being readied for testing, LPSC Director S. Somanath told The Hindu.

The semi-cryogenic engine uses a combination of liquid oxygen (LOX) and refined kerosene (Isrosene) as propellants.

ISRO scientists have simultaneously begun work on the stage configuration. “We hope to complete the development of the engine by 2019. The stage test is expected to take place by 2020, followed by the first flight test in 2021,” he said.

One of the options before ISRO is to replace the liquid core (L110) engine of the GSLV Mark 3 with the SCE-200 to boost the payload capacity of the rocket from four to six tonnes. “That could be one of the immediate applications of the new engine, though the objective is to power the future heavy lift launch vehicles and reusable launch vehicles as well as human spaceflight missions,” K. Sivan, Director, Vikram Sarabhai Space Centre, said.

Mindful of the fact that the standard size of satellites is expected to go up in the near future, ISRO is already looking much ahead. On the cards is a proposal to develop a bigger semi cryogenic engine with a cluster of four or five engines that could generate a lift of eight to 10 tonnes.

More work ahead

A clustered semi cryogenic booster with a more powerful cryogenic upper stage is another possibility. “Once we have mastered the technology, we could possibly go on to modular development of rockets with different configurations,” Mr. Somanath said.

But before that, ISRO needs to ensure that critical technologies such as special materials and coatings, brazing process, kerosene refinement, combustion instability and control components are mastered and key infrastructure is in place.

AstroSat rules out afterglow in black hole merger

Recently US-based LIGO group announced having detected gravitational waves emanating from the merger of two massive black holes located nearly 3 billion light years away. Simultaneously, Hawaii-based ATLAS group identified a fading glow from the part of the sky where these black holes were roughly estimated to lie. The group surmised that this was an electromagnetic (light based) afterglow emanating from the merger. ISRO’s space observatory, AstroSat, however, has, with extremely sensitive measurements, ruled out the possibility that this has any connection with the black hole merger.

In collaboration with the GROWTH (Global Relay of Observatories Watching Transients Happen) network of observatories, AstroSat team has concluded that this event is due to a gamma ray burst. A gamma ray burst is light emanating from a bursting star, for example, an exploding supernova, that may lead to the formation of a black hole. This places the afterglow among a class of phenomena detected routinely by the space observatory. The discovery was made with the help of the Cadmium Zinc Telluride Imager (CZTI), an x-ray telescope aboard AstroSat.

Imposter revealed

The burst of light, dubbed ATLAS17aeu appeared to Varun Bhalerao of IIT Bombay, who leads the searches for transients and explosive sources, to have come from a burst that took place on January 5 and not January 4, the date on which the signal from the black hole merger was picked up by the LIGO detectors. “I shot off a mail to my student Sujay, asking him to search for a burst in CZTI data in the calculated time window. And then I no-
The telescope detects the presence of planets by registering minuscule drops in a star’s brightness.

**NASA finds 10 Earth-sized exoplanets**

NASA revealed 10 new rocky, Earth-sized planets that could potentially have liquid water and support life.

The Kepler mission team released a survey of 219 potential exoplanets — planets outside of our solar system — that had been detected by the space observatory launched in 2009 to scan the Milky Way galaxy.

Ten of the new discoveries were orbiting their suns at a distance similar to the Earth’s orbit around the sun, the so-called habitable zone that could potentially have liquid water and sustain life.

Kepler has already discovered 4,034 potential exoplanets, 2,335 of which have been confirmed by other telescopes as actual planets. The 10 new Earth-size planets bring the total to 50 that exist in habitable zones around the galaxy.

The latest findings were released at the Fourth Kepler and K2 science conference being held this week at NASA’s Ames research centre in California.

**NASA to test flexible solar panel on ISS**

NASA will test a flexible solar panel on the International Space Station.

The panel rolls up to form a compact cylinder and may offer substantial cost savings as well as an increase in power for satellites in the future.

Traditional solar panels used to power satellites can be bulky with heavy panels. Smaller and lighter than traditional solar panels, the Roll-Out Solar Array consists of a centre wing made of a flexible material containing photovoltaic cells to convert light into electricity.

On either side of the wing is a narrow arm that extends the length of the wing to provide support. The arm can be flattened and rolled up.

**PSLV will lock heavy weight Cartosat-2 into orbit today**

The Indian Space Research Organisation (ISRO) is all set for the launch of the Polar Satellite Launch Vehicle carrying the Cartosat-2 series satellite, along with 30 co-passenger satellites morning.

The 28-hour countdown for the PSLV- C38 mission began at 5.29 a.m. at the Satish Dhawan Space Centre, Sriharikota.

It will be the 17th flight of the four-stage PSLV in the XL (extended) version with strap-on motors.

The rocket weighing 320 tonnes at lift-off uses solid propellant for the first and third stage and the strap-ons, while the second and fourth stage use liquid propellant.

**30 other satellites**

The 31 satellites, together weighing 955 kg, will be lifted into a 505-km polar sun synchronous orbit.

“This will be the second highest number of satellites to be launched by ISRO using a single rocket”, says PSLV project director B. Jayakumar. In February this year, the PSLV-C37 mission launched 104 satellites into orbit, in a milestone achievement.

The Cartosat-2 earth observation satellite, weighing 712 kg, is the primary payload aboard PSLV-C38 and will be the first to be injected into orbit, 16 minutes from lift-off. The imagery provided by the satellite will be used for cartographic applications, coastal land use and regulation, road network monitoring, water distribution, land use mapping and geographical information system applications.

Cartosat-2 is designed for a lifespan of five years, according to ISRO.

**14 countries**
The PSLV-C38 payload includes a nano satellite designed and developed by the Noorul Islam University in Kanyakumari district. The rest of the payload comprises 29 nano satellites from 14 countries — Austria, Belgium, Chile, the Czech Republic, Finland, France, Germany, Italy, Japan, Latvia, Lithuania, Slovakia, United Kingdom and the U.S. They are being launched as part of the commercial pact between the Antrix Corporation, the commercial arm of ISRO, and the international customers.

ISRO plans complex manoeuvres
As the countdown for the PSLV-C38 mission began morning, engineers at ISRO were preparing to execute a series of complex manoeuvres for the shutdown and reignition of the rocket engines in space.

The engines in the fourth stage will be reignited three times, in a bid to master the technique that will enable ISRO to inject satellites into different orbits in a single launch. "It will be a validation of the technique that was tested in the PSLV-C34 mission and deployed in the subsequent C35 mission", says B. Jayakumar, PSLV project director. The exercise will be conducted after all 31 satellites on PSLV-C38 have been injected into orbit. "Once the last satellite has been separated from the rocket at a height of 520 km, the fourth stage of the rocket (PS4) comprising two liquid propellant engines will be shut down and reignited three times," Mr. Jayakumar told The Hindu. While the first two firings are expected to last about six seconds each, the third restart is likely to fire up to 40 seconds.

The multiple reignition of the on board engines will validate the technique and provide ISRO with the mission flexibility to inject satellites into three different orbits in a single flight to reduce the launch cost and save time.

PSLV is capable of launching satellites into different types of orbits like Sun Synchronous Polar Orbit (SSPO), Low Earth Orbit (LEO) and Geosynchronous Transfer Orbit (GTO), as per the customer requirements. Even though ISRO has enough experience in long duration satellite missions employing multiple restart of the spacecraft's Liquid Apogee Motor (LAM) engine, it was during the PSLV-C34 mission that it first attempted a reignition of the rocket engine. Subsequently, the PSLV-C35 mission placed eight satellites into two different orbits.

ISRO puts 31 satellites in space
The Indian Space Research Organisation (ISRO) successfully launched 31 satellites — 29 of them belonging to foreign countries — on board the PSLV-C38 from the Satish Dhawan Space Centre here. The PSLV, in its 40th flight, carried the Cartosat-2 series satellite, the main payload, weighing 712 kg and another Indian satellite, NIUSAT, an Indian university/academic institute satellite from Noorul Islam University, Kanyakumari. Delegates from foreign agencies that were sending their satellites watched from Mission Control as the satellites were placed into orbit.

The PSLV-C38 took off from the first launchpad at 9.29 a.m. The Cartosat-2 series satellite was placed in orbit at 16 minutes after launch and the final satellite was injected into orbit at 23 minutes. The total payload weighed 955 kg at lift-off. The Cartosat satellite launch will provide remote sensing services for about five years. The other 29 nano satellites belonged to 14 nations — Austria, Belgium, Chile, Czech Republic, Finland, France, Germany, Italy, Japan, Latvia, Lithuania, Slovakia, the U.K., and the U.S.

Remote sensing satellite
The Cartosat-2 is a remote sensing satellite, and is the sixth in the series. It was placed in a 505 km polar Sun Synchronous orbit. It will be used for cartographic applications, coastal land use and regulation, road network monitoring, water distribution, creation of land use maps, Land Information Systems (LIS) and Geographical Information System (GIS) applications, ISRO said.

The Cartosat satellite separated 16.43 minutes after launch, as planned, following which the remaining satellites separated over the next seven minutes.

With the launch of the PSLV-C38, B. Jayakumar, Mission Director said, ISRO now had the confidence to put a number of satellites into different orbits, in a single mission. "Initially it [PSLV] was designed to put satellites in sun synchronous orbit... we could establish it could cater to any type of orbit – Geo Synchronous, Sun Synchronous orbit or low inclination orbit, carrying multiple satellites; Everything has been established. I’m sure this will be a major attraction for foreign customers," Mr. Jayakumar said.

‘Credible launch vehicle’
ISRO Chairman A.S. Kiran Kumar said the PSLV was emerging as a credible launch vehicle for anybody across the globe, “because of the frequency at which the launch is happening and also the access and timeline within which their satellites can be put into orbit.”
NASA’s CHESS to study interstellar clouds

NASA is launching a sounding rocket CHESS on June 27 to study vast interstellar clouds and know about the earliest stages of star formation. The Colorado High-resolution Echelle Stellar Spectrograph will measure light filtering through the interstellar medium, which provides crucial information for understanding the lifecycle of stars. In the space between distant stars there drift vast clouds of neutral atoms and molecules, as well as charged plasma particles that may, over millions of years, evolve into new stars and even planets. CHESS will train its eye at Beta Scorpii — a hot, brightly shining star in the Scorpius constellation well-positioned for the instrument to probe the material between the star and our own solar system. This is the third flight for the CHESS payload in the past three years, and the most detailed survey yet.

NASA-ISRO satellite at stake

Space scientists in India and America are on tenterhooks as Prime Minister Narendra Modi and U.S. President Donald Trump meet for the first bilateral in Washington. At stake is the world’s most expensive earth-imaging satellite till date being jointly made by the NASA and the ISRO. The satellite aims to study global environmental change and natural disasters. However, climate change seems to be a red rag for the current American administration. Mr. Trump calls climate change a hoax created by China by adhering to his views that “the concept of global warming was created by the Chinese in order to make U.S. manufacturing non-competitive”.

On the other hand, Mr. Modi has penned a pictorial book — Convenient Action: Continuity for Change — that compiles his actions and beliefs on climate change. Recently, the U.S. walked out of the Paris Climate Change Treaty while India continues to honour its commitments. Can a middle ground be found or can the jointly-made satellite escape President Trump’s anti-climate change gaze?

Uranus’ magnetic field flips on and off: study

Scientists have found that Uranus’ magnetic field gets flipped on and off like a light switch every day as the planet rotates. Researchers from Georgia Institute of Technology in the U.S. made the discovery based on data from NASA’s Voyager 2 spacecraft. “The magnetosphere is ‘open’ in one orientation, allowing solar wind to flow into the magnetosphere; it later closes, forming a shield against the solar wind and deflecting it away from the planet,” researchers said.

Uranus lies and rotates on its side, and its magnetic field is lopsided — tilted 60 degrees from its axis. Those features cause the magnetic field to tumble asymmetrically relative to the solar wind direction as the icy giant completes its 17.24-hour full rotation. ‘Geometric nightmare’

“Uranus is a geometric nightmare. The magnetic field tumbles very fast, like a child cartwheeling down a hill head over heels,” said Carol Paty, an associate professor at Georgia Institute of Technology. “When the magnetised solar wind meets this tumbling field in the right way, it can reconnect and Uranus’ magnetosphere goes from open to closed to open on a daily basis,” she added. Rather than the solar wind dictating a switch, Uranus’ rapid rotational change in field strength and orientation lead to a periodic open-close scenario as it tumbles through...
The solar wind. Reconnection of magnetic fields is a phenomenon throughout the solar system. It is one reason for Earth's auroras, scientists said.

‘Air pollutants on solar panels cut power generation by 17%’

Particulate matter — dust, black carbon and organic carbon from biomass burning and fossil fuel — deposited on solar panels and present in the ambient air is responsible for about 17% reduction in solar power generation in India. This translates to the reduction of about 2 Gigawatts (GW) in solar power production for about 12 GW installed solar power capacity. The Centre has set an ambitious renewable energy target of 175 GW by 2022.

Dust and non-dust particulate matter deposited on solar panels and present in the air prevent shortwave solar radiation from reaching the panels, thereby reducing energy production.

The field study was carried out between January and March 2016 and samples were collected from multiple solar panels located at Indian Institute of Technology (IIT), Gandhinagar. The results were published in the journal Environmental Science & Technology Letters.

Man-made particles

Analysis of samples collected from the solar panels revealed that dust accounted for 92% while the remaining fraction was composed of organic carbon, black carbon and ions produced from sources linked to human activity. However, dust has less influence in reducing solar energy production compared with man-made particles.

“Owing to their larger size, dust particles have less influence on solar panel transmittance, and scattering by dust particles is also relatively less compared with the combustion-related particulate matter,” says Prof. Chinmay Ghoroi, Department of Chemical Engineering, IIT Gandhinagar, and one of the authors of the paper. “The smaller man-made particles effectively block more light than natural dust.”

Risk of damage

“The man-made particles are also small and sticky, making them much more difficult to clean off,” said Mike H. Bergarten, Duke University, and the lead author of the paper. “You might think you could just clean the solar panels more often, but the more you clean them, the higher the risk of damaging them.”

The study found an average 50% jump in efficiency each time the panels were cleaned every 20-30 days. But if the cleaning was carried out once every two months, the efficiency decreased a lot. The study suggests that regular cleaning of the panels alone will not be of much help if particulate matter, particularly man-made particles, is present in the ambient air. “Thus efficient emission control measures are required to maximise solar energy generation,” added Prof. Ghoroi.

How your daily cuppa depletes ozone layer

Your love for decaffeinated tea or coffee may have led to ozone depletion, say scientists who found that a chemical commonly used in the food industry delayed recovery of the atmosphere’s protective layer by up to 30 years.

Researchers from Lancaster University in the U.K. found that a previously ignored chemical called dichloromethane may now be contributing to ozone depletion and should be looked at to improve future ozone predictions.

Man-made chemical

Dichloromethane is a man-made ozone-depleting chemical that is used in the food industry, to decaffeinate coffee and tea as well as to prepare extracts of hops and other flavourings.

The projections by researchers show that continued dichloromethane increases at the average trend observed from 2004-2014 would delay ozone recovery over Antarctica by 30 years.

Heaviest satellite of ISRO launched

GSAT-17 will join 17 communication satellites in orbit

A 39-minute dusk launch at the South American space port of Kourou placed GSAT-17 in space as the newest Indian communication satellite. The launch took place at 2.45 a.m. IST on Thursday.

The 3,477-kg spacecraft, the heaviest built by the Indian Space Research Organisation, will soon join the ring of 17
working national communication satellites that are already in orbit. It will add to the services they provide for broadcasting, telecommunications, VSAT services, meteorology, search and rescue, among others, ISRO said. Said to have over 40 transponders in different bands, “GSAT-17 is designed to provide continuity of services of operational satellites in C, extended C and S bands,” it said.

In Bengaluru, ISRO Chairman A.S. Kiran Kumar said, “We have been short of satellite capacity and need to continue adding it for some more time. However, the [transponders] scene is definitely improving” after recent launches of communication satellites.

The satellite and its foreign launch were approved in May 2015 with an outlay of Rs. 1,013 crore. It went to orbit on the Ariane-5 ECA rocket VA-238, operated by European launch services agency Arianespace.

When it sends the 5,700-kg GSAT-11 this year-end again on an Ariane booster, ISRO hopes it will be its last foreign launch, says Mr. Kiran Kumar.

“Right from its inception, the space scientists at ISRO have worked hard to bolster the scientific temper of this country. This latest addition to its long list of achievements has once again made every Indian proud

GSAT-17 to add teeth to ISRO satellite fleet

GSAT-17, the country’s newest communication satellite to be launched, will soon join the fleet of 17 working Indian communication satellites in space and augment their overall capacity to some extent. The 3,477-kg spacecraft was set to be launched at 2.29 a.m. IST on June 29 from the European space port of Kourou in French Guiana at the time of writing this report. GSAT-17 is the second passenger on the European booster, Ariane-5 ECA VA-238, according to ISRO and the European launch company Arianespace.

The 5,700-kg Hellas Sat 3-Inmarsat S EAN shared by two satellite operators was also put on the same booster as co-passenger. It was a pre-dusk launch in the South American space port.

“GSAT-17 is designed to provide continuity of services of operational satellites in C, extended C and S bands,” ISRO said. Its chairman A. S. Kiran Kumar has earlier said they need double the number of communication spacecraft to support various users across the country.

Rs. 1,013 crore outlay

The spacecraft was approved in May 2015 with an outlay of Rs. 1,013 crore, including its launch fee and insurance. GSAT-17, built mainly for broadcasting, telecommunication and VSAT services, carries over 40 transponders.

Designed and assembled at the ISRO Satellite Centre in Bengaluru, GSAT-17 has been at the Kourou space port since May 15, undergoing pre-launch checks and tests. Project Director Prakash Rao and a rotating team of over 20 ISRO engineers have been attending to it during the period.
India takes over control of Kudankulam Unit 1

India has taken over full operational control of Unit 1 of the Kudankulam Nuclear Power Plant (KKNPP).

India signed a joint statement with Russia on the final takeover of the unit, formally marking the full transition. The agreement was signed between representatives of Nuclear Power Corporation of India Ltd. and the ASE Group of Companies, a subsidiary of ROSATOM State Atomic Energy Corporation of Russia.

With the deal, the Russian and the Indian sides have confirmed fulfilment of all warranty terms and obligations of the contractor (ASE Group of Companies) for the construction of Unit 1, Rosatom said in a statement.

“The warranty period run showed reliable and safe operation of Unit 1. Thus, the Indian side confirms that ASE Group of Companies, which is a general contractor, has fulfilled all its tasks in full and accurately,” said Andrei Lebedev, vice-president of ASE for projects in South Asia.

The commercial operation and the warranty period of Unit 1 started in December 2014. The warranty is typically for one year, which ended in December 2015. However, the final takeover agreement was delayed to ensure the reliability of the plant and equipment as this is the first of a series of six reactors.

Technical issues

Unit 1 had encountered technical issues and was shut down briefly after it commenced power generation. On March 30, 2017, the joint protocol on provisional acceptance of Unit 2 of the plant was signed, which marked the start of its commercial operation.

IIT Bombay uses mango leaves to make fluorescent graphene quantum dots

Using mango leaves to synthesise fluorescent graphene quantum dots (nanocrystals of semiconductor material), researchers from the Indian Institute of Technology (IIT) Bombay have been able to produce cheap probes for bioimaging and for intracellular temperature sensing. Unlike the currently used dyes, quantum dots synthesised from mango leaves are biocompatible, have excellent photostability and show no cellular toxicity. The results were published in the journal ACS Sustainable Chemistry & Engineering.

Green route

To synthesise quantum dots, the researchers cut mango leaves into tiny pieces and froze them using liquid nitrogen. The frozen leaves were crushed into powder and dipped in alcohol. The extract was centrifuged and the supernatant evaporated in an evaporator and then heated in a microwave for five minutes to get a fine powder. Using mice fibroblast cells, a team led by Rohit Srivastava from the Department of Biosciences and Bioengineering at IIT Bombay evaluated the potential of quantum dots for bioimaging and temperature-sensing applications. In mice cell in vitro studies, the graphene quantum dots were able to get into the cells easily without destroying the integrity, viability and multiplication of the cells. The quantum dots get into the cytoplasm of the cell.

The quantum dots, 2-8 nanometre in size, were found to emit red luminescence when excited by UV light. “Even when the excitation wavelength was 300-500 nanometre, the emission from the quantum dots was at 680 nanometre. The quantum dots exhibited excitation-independent emission,” says Mukeshchand Thakur from the Department of Biosciences and Bioengineering at IIT Bombay, one of the authors of the paper.

The quantum dots have smaller and larger fluorescent units. When the excitation is at lower wavelength, the smaller units transfer energy to the larger units and there is red emission. And when the excitation is at higher wavelength, the red emission comes directly from the larger units, thus remaining excitation-independent.

Nanothermometer

“Since the quantum dots get into the cytoplasm of the cell, the graphene quantum dots can be used for cell cytoplasm labelling applications,” says Mukesh Kumar.
Kumawat from the Department of Biosciences and Bio-engineering, IIT Bombay and the first author of the paper. The quantum dots found inside the cells showed intense fluorescence at 25 degree C. As the temperature rose to 45 degree C, the intensity of fluorescence tended to decrease.

As a result, the researchers found up to 95% reduction in fluorescence intensity when the temperature was increased by 20 degree C. “So quantum dots can be used for detecting temperature variation in the intracellular environment,” says Thakur.

“The graphene quantum dots can be used as a nanothermometer. Besides measuring intracellular temperature increase, they can be used for measuring temperature increase in cancer cells and when there is inflammation,” says Prof. Srivastava. “We are seeing interest by companies making imaging probes. There is also interest to use it as a temperature probe.”

“Since the quantum dots emit red light, they can be used for making organic light-emitting diodes as well,” says Kumawat.

IISc designs a novel graphene electrical conductor
Researchers from the Indian Institute of Science (IISc), Bengaluru have been able to experimentally produce a new type of electrical conductor that was theoretically predicted nearly 20 years ago.

A team led by Arindam Ghosh from the Department of Physics, IISc successful produced graphene that is single- or a few-layers thick to conduct current along one particular edge — the zigzag edge. The zigzag edge of graphene layer has a unique property: It allows flow of charge without any resistance at room temperature and above.

“This is the first we found the perfect edge structure in graphene and demonstrated electrical conductance along the edge,” says Prof. Ghosh. The results of the study were published in the journal Nature Nanotechnology.

A few-layers-thick graphene that conducts current along one edge does not experience any resistance and so can lead to realising power-efficient electronics and quantum information transfer, even at room temperature.

Getting an edge
Many groups over the world have been trying to access these edges since the emergence of graphene in 2004, but have been largely unsuccessful because when current flows through graphene, it flows through both the edge as well as the bulk. “We succeeded in this endeavour by creating the bulk part of graphene extremely narrow (less than 10 nanometre thick), and hence highly resistive, thus forcing the current to flow through the edge alone,” he says.

“While the bulk is totally insulating, the edge alone has the ability to conduct because of the unique quantum mechanics of the edge. Because of the zigzag orientation of carbon atoms [resulting from the hexagonal lattice], the electron wave on each carbon atom overlaps and forms a continuous train of wave along the edge. This makes the edge conducting,” explains Prof. Ghosh. The edge will remain conductive even if it is very long but has to be chemically and structurally pristine.

In the past, others researchers had tried making narrow graphene through chemical methods. But the use of chemicals destroys the edges. So the IISc team resorted to mechanical exfoliation to make graphene that are single- and few-layers thick. They used a small metal robot to peel the graphene from pyrolytic graphite. “If you take a metal tip and crash it on graphite and take it back, a part of the graphite will stick to the tip. The peeling was done slowly and gradually (in steps of 0.1 Å),” says Amogh Kinikar from the Department of Physics at IISc and the first author of the paper.

Effect of chemicals
The exfoliation was carried out at room temperature but under vacuum and the electrical conductance was measured at the time of exfoliation before the pristine nature of the edge was affected. The unsatisfied bonds of the carbon atoms make them highly reactive and they tend to react with hydrogen present in the air. “The edges conduct without any resistance as long as the edges don’t come in contact with any chemicals,” says Prof. Ghosh.

“It is very easy to passivate [make the surface unreactive by coating the surface with a thin inert layer] the edges to prevent contamination [when narrow graphene is used for commercial purposes].”

As the carbon atoms have a hexagonal structure, exfoliation is by default at 30 degree angle and one of the edges has a zigzag property. “The steplike changes observed for small values of conductance when other variables were changed were surprising. Through theoretical work we were able to link this to edge modes in graphene,” says Prof. H.R.Krishnamurthy from the Department of Physics, IISc and one of the authors of the paper.

There are currently several chemical methods to produce very narrow graphene nanoribbons. But these chemicals tend to destroy the edges. “So the challenge is to pro-
More aerosol in atmosphere results in heavier rainfall

Contrary to the general notion that pre-monsoon aerosol loading results in decrease in seasonal rainfall, a long-term (2002-2013) satellite observational study and model-based analysis by researchers from the Indian Institute of Technology (IIT) Kanpur has found that higher aerosol loading results in delayed but more rainfall over Central and Northern India. Higher aerosol loading changes cloud properties in terms of size (both height and width) and microphysics, which results in more rainfall. The results were published in the journal Atmospheric Chemistry and Physics.

Size matters

Fourteen microns is the agreed raindrop size, and until it reaches this size, the growth of droplets in the cloud is primarily driven by condensation. When aerosol particles are higher, the number of nucleation sites increases resulting in far too many numbers of droplets. Under such circumstances, it takes time for the droplets to grow in size through condensation. “There is an increase in the condensation of water vapour into cloud droplets as the number of aerosol particles increases. But there is a reduction in radius of the drops formed near the cloud base,” says Sachchida N. Tripathi, from the Department of Civil Engineering, IIT Kanpur and the corresponding author of the paper. This results in delay in the onset and efficiency of the condensation process.

“Although genesis of cloud systems is influenced by various meteorological parameters, aerosols are capable of strongly modifying the cloud structure, dynamics and composition during Indian summer monsoon,” says Chandan Sarangi from the Department of Civil Engineering, IIT Kanpur and the first author of the paper. Once cloud starts forming due to convection, the presence of more aerosol particles tend to modify the warm phase microphysics as well as ice phase microphysics. Two forces — gravity and updraft (vertical velocity) — tend to act on droplets. Under high aerosol loading, rather than falling down as raindrops, the smaller droplets tend to rise upwards in convective atmosphere due to updraft. As the droplets are lifted up they tend to cross the freezing level and turn into ice particles. The process of water droplets turning into ice particles releases more latent heat of freezing and further invigorates the cloud. “Ice turns into water by absorbing heat. Similarly, when water turns into ice it gives off heat. This release of heat further fuels the convection process and the clouds grow taller,” says Mr. Sarangi. “Satellite data showed that clouds are getting taller and wider under high aerosol loading,” says Prof. Tripathi. As the height of clouds increases, the ice particles generated at top of the cloud come in contact with numerous water and ice particles and become bigger in size. This results in more ice mass in the cloud and eventually more rainfall when the ice particles fall down due to gravity. “There is a delay in the onset of rainfall but once it starts raining it covers a wider area and may be heavier rainfall as well,” Prof. Tripathi says.

Suppression of convection

In the absence of cloud, aerosol particles tend to absorb solar radiation and this leads to warming or less decrease in temperature with height. As a result, there is suppression of convection leading to further suppression of cloud formation. Till now scientists have shown that presence of more aerosols in pre-monsoon season may lead to reduction in total monsoon rainfall due to aerosol-solar radiation interactions. “But in our study we looked at co-located measurement of aerosol, cloud and rainfall system. The aerosol-cloud microphysical feedback suggests that higher aerosol loading can enhance the strength of convective rainfall and increase the frequency and intensity of extreme rainfall during Indian summer monsoon,” says Mr. Sarangi.

IIT Bombay: Bird’s eye view and quantum biology

While there have been theories about the way migratory birds navigate across the earth, these have not been placed on a firm footing. Now, a group from IIT Bombay has tied this theory with observed features of the birds’ biological compass to get a clear picture of how it works. They affirm that it is due to the interplay of chemical reactions, electron spins and the magnetic fields present. Thus, understanding the avian compass is a lesson in quantum biology. This may be of use, one day, in engineering quantum computers.

Migratory birds have biological sensors that can sense the earth’s magnetic field, and guide them in their long journeys spanning continents. One might, mistakenly assume that these sensors would be located in the brain. Contrarily, they are located in the eyes, more specifically,
in the right eye, as studies on the European Robin reveal. The “compass” in question is generated by interplay of the electron and nuclear “spins.” The spins we talk about here are not to be understood in the conventional way, such as that of a rotating cricket ball. Spin is a name given to the quantum mechanical properties of these particles that can interact with magnetic fields.

Swaroop Ganguly, Department of Electrical Engineering, IIT Bombay, and collaborators have put the theory that the avian compass involves the interplay of electron spins and nuclear spins on a firm footing. They have shown that all observed characteristics of the avian compass can be explained thus. Their work is to be published in Physical Review E.

“If nature is indeed able to harness quantum spins in avian compass, understanding how [it works] might afford useful lessons to us in engineering quantum mechanical systems, such as sensing or computing hardware that is incomparably more powerful than what we have today,” says Dr Ganguly in an email to this correspondent.

Limiting window
A curious feature of the avian compass is that it has a sensitivity that peaks at values matching with the earth’s magnetic field. Just like humans have a “window” or range of frequencies limiting what they can hear, this leaves a window of magnetic field values the bird is sensitive to. The research has shown that it is the interaction between spins that naturally leads to this “functional window.” There are many directions to take this further: Vishvendra Poonia, the first author of the paper, says: “One is to study the physics of biological systems, especially, the quantum effects in these systems. Secondly, and more importantly, [to] translate the knowledge gained from these biological systems into technological application, [namely] bio-inspired quantum technologies.”

A safer alternative to lithium-ion batteries
Scientists have developed a safer alternative to fire-prone lithium-ion batteries, which are common in household devices such as smartphones and laptops.

Researchers at the U.S. Naval Research Laboratory (NRL) developed the nickel-zinc (Ni-Zn) batteries in which a three-dimensional Zn “sponge” replaces the powdered zinc anode, or positively charged electrode, traditionally used.

With 3D Zn, the battery provides an energy content and rechargeability those rival lithium-ion batteries while avoiding the safety issues that continue to plague lithium.

“The 3D sponge form factor allows us to reimagine zinc, a well-known battery material, for the 21st century,” said Debra Rolison from NRL’s Advanced Electrochemical Materials group.

Zinc-based batteries are the go-to global battery for single-use applications, but are not considered rechargeable in practice due to their tendency to grow conductive whiskers (dendrites) inside the battery, which can grow long enough to cause short circuits.

“The key to realising rechargeable zinc-based batteries lies in controlling the behaviour of the zinc during cycling,” said Joseph Parke, lead author of the research paper published in the journal Science.

Ready to be used
“Electric currents are more uniformly distributed within the sponge, making it physically difficult to form dendrites,” said Mr. Parke.

With the benefits of rechargeability, the 3D Zn sponge is ready to be deployed within the entire family of Zn-based alkaline batteries across the civilian and military sectors, researchers said.

“We can now offer an energy-relevant alternative, from drop-in replacements for lithium-ion to new opportunities in portable and wearable power, and manned and unmanned electric vehicles, while reducing safety hazards, easing transportation restrictions, and using earth-abundant materials,” said Jeffrey Long from NRL.

Indians use origami to get a closer look at beauty
The High Energy Accelerator Research Organisation (KEK) in Japan is getting ready to launch the Belle-II experiment, a massive collaboration of 700 scientists from across the globe. At Belle-II, highly intense electron-positron beams will be made to collide and a huge number of B-mesons (a boson containing the B, or beauty, quark) produced. Building a detector to observe the resultant decay products is a challenging task and that is one area where Indians have contributed significantly.

Indians have been involved in the preceding experiment, Belle, for decades now, however, with Belle-II, their engagement is deeper: “Initially we did not have the chance to build the detector, and this is the second step – to work with the inner part of the detector, where the resolution has to be high. We are happy we did it and are now among four important groups in the world that can build such detectors,” says Tariq Aziz of Tata Institute of Fundamental Research, Mumbai, who led the effort along with Gagan Mohanty.
Crucial folding

Indians built the fourth layer of the six-layer silicon vertex detector and developing the analysis and theory. The highly miniaturised sensor engineering and the “origami chip-on sensor” design of the readout chip, which improves the signal to noise ratio, are novel and highly complex aspects. The strip from one side of the silicon microstrip sensors are first connected to a flexible electrical circuit, which is turn, is connected to readout chips. “We fold over the flexible circuit such that the strips of the other side of the sensor can be connected to the readout chip. This ‘folding over’ enables us to place the readout chips as close as possible to the strips reducing the noise,” explains Prof. Mohanty in an email to this correspondent.

Belle-II is some fifty times more sensitive than its predecessor Belle. The SVD detector is meant to measure the charged particles passing through it to an accuracy of 15-20 microns. Compare this with the average thickness of human hair, which is 100 microns. Such a precise position measurement significantly enhances the physics potential of the Belle-II experiment.

Physicists’ goal

This experiment has the same aim as the LHCb experiment at CERN — to study the decay of the short-lived B-mesons, and unearth clues to “new physics”. If these experiments are successful in their endeavour, they will cause a massive rethink of particle physics as we know it today. The two setups are complementary. “But the idea in both cases is to search for new physics and discover it,” says Rahul Sinha of The Institute of Mathematical Sciences, Chennai, who is leading the theoretical studies. Both will seek evidence that can significantly enlarge the picture of particle physics painted by the Standard Model.

For nearly fifty years, the world of elementary particles has been best described by the Standard Model. This also provides a unified description of all the forces in the universe except gravitation. It accounts for various particles and how they get their masses with the help of the Higgs boson. However, now many questions remain which could be helped by Belle-II.

The group at IMSc focuses on decays in which the beauty quark within a meson changes to a different flavour of quark known as the strange quark. These processes are very rare according to the Standard model, but can possibly be detected at Belle-II and LHCb.

Global collaboration project Belle-II moves a step forward

The High Energy Accelerator Research Organisation (KEK) completed the much-awaited ‘rolling-in’ of the Belle-II experiment in Tsukuba, Japan. This experiment is designed to study violations of the Standard Model of particle physics. A grand collaboration of 700 scientists from 23 countries, Belle-II has a significant Indian participation both on experimental and theoretical sides.

The fourth layer of the six-layer, highly sensitive particle detector, which is at the heart of Belle-II, has been built by Indian scientists, led by Tariq Aziz and Gagan Mohanty, who are with the Tata Institute of Fundamental Research (TIFR), Mumbai.

“In 1998, when Indians [in this field] were working mostly with CERN (European Organisation for Nuclear Research), KEK first wanted us to participate in this experiment, which had a complementary approach,” says Prof Aziz. Scientists from the Indian Institutes of Technology in Bhubaneswar, Chennai, Guwahati and Hyderabad; the Institute of Mathematical Sciences, Chennai; Panjab University; Punjab Agricultural University; Malaviya National Institute of Technology, Jaipur; Indian Institute of Science Education and Research, Mohali; and Tata Institute of Fundamental Research, Mumbai, are participating in this research. “Building the silicon vertex detector has been a directing force that brought us together. It is a very young team, with an average age of 30 years, apart from some senior leaders,” says Professor Mohanty.

The lone person leading theoretical studies among this group of 35-40 experimentalists, IMSc’s Rahul Sinha says, “Some of the modes and techniques that will be possible for Belle-II to study were first proposed by the group at IMSc.”
Ken-Betwa: Forest body for lowering dam height
The Environment Ministry’s Forest Advisory Committee (FAC) has said the Ken-Betwa river-interlinking project should consider reducing the height of the proposed Dhaudan dam by at least 5 metres as well as re-aligning the main water-bearing canal to minimise the use of forest land. The FAC is a body that decides on whether forest land can be given up for industrial projects, “The height of the Dhaudan dam may be re-examined in the interest of conserving the park and the committee recommends that the height may be reduced by 10 meters if not at least 5 metre as a trade-off between conservation and development,” said a report by a sub-committee of the FAC.

The project involves building a 77-m tall and 2-km wide dam and a 230-km long canal to transfer water from the Ken river and irrigate 3.64 lakh hectares in the Bundelkhand region of U.P. and Madhya Pradesh. However, building them means encroaching into Madhya Pradesh’s Panna Tiger reserve and inundating 6,221 hectares — 4,141 of which is core forest — when the reservoir is filled to the brim.

Fungus that eats plastic may help clean environment
Scientists have identified a soil fungus, which uses enzymes to rapidly break down plastic materials, an advance that could help deal with waste problem that threatens our environment. Humans are producing ever greater amounts of plastic — much of which ends up as garbage. Since plastic does not break down in the same way as other organic materials, it can persist in the environment over long periods of time.

Now, researchers from the Chinese Academy of Sciences have found an unexpected solution to the growing plastic problem in the form of a soil fungus. Attempts to deal with plastic waste through burying, recycling, incineration or other methods are variously unsustainable, costly and can result in toxic by-products, which are hazardous to human health.

Researchers argue that we urgently need to find new, safer and more effective ways to degrade waste plastics. The team found the plastic-eating fungus living in a rubbish tip in Islamabad, Pakistan.

**Physical strength used**
The researchers took samples of soil and various pieces of rubbish in hopes of finding an organism that could feed on plastic waste in the same way that other fungi feed on dead plant or animal material. Aspergillus tubingensis is a fungus, which ordinarily lives in the soil. In laboratory trials, the researchers found that it also grows on the surface of plastics.

It secretes enzymes onto the surface of the plastic, and these break the chemical bonds between the plastic molecules, or polymers.

Using advanced microscopy and spectroscopy techniques, the team found that the fungus also uses the physical strength of its mycelia — the network of root—like filaments grown by fungi — to help break apart the polymers.

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‘Difficult to meet BS-VI deadline’
Automobile manufacturers conveyed to the Supreme Court their difficulty in starting the process of conversion of vehicles to BS-VI emission norm from 2019 to meet the April 1, 2020 deadline. The manufacturers told a Bench of Justices Madan B. Lokur and Deepak Gupta that as per the report of the Environment Pollution Control Authority (EPCA), they have to start the conversion of their vehicles into BS-VI from 2019 so that it could be sold from April 1, 2020, but said there were technological issues in it. “The BS-VI would come into effect from April 1, 2020. Effectively, we will have to start the process of conversion from 2019 which is difficult. There are issues of technology,” Society of Indian Automobile Manufacturers (SIAM) told the court.

‘Zero recovery’ for damaged corals
Coral bleached for two consecutive years at Australia’s Great Barrier Reef has “zero prospect” of recovery, scientists warned, as they confirmed the site has again been hit by warming sea temperatures. Researchers said last month they were detecting another round of mass bleaching this year after a severe event in 2016, and their fears were confirmed after aerial surveys of the entire 2,300-kilometre long bio-diverse reef. Last year, the northern areas of the World Heritage-listed area were hardest hit, with the middle-third now experiencing the worst effects. “Bleached corals are not necessarily dead corals, but in the severe central region we anticipate high levels of coral loss,” said James Kerry, a marine biologist at James Cook University who led the aerial surveys. “It takes at least a decade for a full recovery of even the fastest growing corals, so mass bleaching events 12 months apart offer zero prospect of recovery for reefs that were damaged in 2016,” Mr. Kerry said. It is the fourth time coral bleaching — where stressed corals expel the algae that live in their tissue and provide them with food — has hit the reef after previous events in 1998 and 2002, scientists said.

Antarctic penguin guano tells tale of rise and fall
Gentoo penguins first came to Ardley Island in the South Shetlands chain just off the Antarctic Peninsula about 7000 years ago. The island is not very long, almost small enough for a classic castaway cartoon, except that it is the Antarctic. And instead of a lone palm tree, there are now about 5,000 breeding pairs of gentoo penguins, one of the largest colonies in the Antarctic, and a lot of guano (penguin excrement), much of which is washed into the freshwater Ardley Lake, where it accumulates in the sediment. In that guano, scientists have found the record of a recurring natural historical drama. Three times since the gentoos arrived on Ardley, the colony was devastated.
by volcanic eruptions. The ash and smoke killed them or drove them away.
Penguins gather in colonies to breed, so there may well have been chicks caught in the ash fall even if the adults escaped. The landscape the eruptions left cannot have been hospitable, because each time it took 400 to 800 years for a colony of similar size to re-emerge.
That is the story, reported Tuesday in Nature Communications, that Stephen J. Roberts of the British Antarctic Survey, Patrick Monien of Bremen University in Germany and other scientists from Poland, Scotland and England teased out of lake sediments that show, in the rise and fall of guano concentration, the rise and fall of the penguin colony.
Mr. Roberts said the team of scientists did not set out to study guano. Rather, their interest was in evidence of historical changes in climate and sea level. But something about the sediment samples drilled from the bottom of Ardley Island prompted them to take a different approach this time. The samples were a bit ripe.
“When we opened them up they smell differently,” he said.

Digging up the dirt
The team could see the ash from volcanic deposits and penguin bones, and began to compile information on the ash layers, biochemical analysis of the guano and similar samples from a lake whose shores did not have a penguin colony nearby.
They estimated penguin population by the percentage of guano in a sediment sample, figuring 3 ounces of guano (85 grams) per day per penguin, and calculating how much of the colony’s output would flow into the lake.
Using a model to determine the amount of penguin guano flowing into the lake in a given period of time, they could calculate how big the colony was.
This showed wide fluctuations in the colony’s size, with the peaks similar to the current numbers. Overall, they did not find any consistent pattern related to climate or sea level. But three times the population crashed — indicating the near extinction of the colony — coinciding with eruptions from the Deception Island volcano, also in the South Shetlands chain.
The events do not have broad implications for climate studies, Roberts said. But they show one case where local events had a far greater effect on the population than global trends.
Deception Island is an Antarctic landmark and a destination for tourists. The island is the rim of the volcano’s caldera. It’s a circle in the ocean, with only one entrance to the protected waters inside.
Heat from the volcano makes some spots swimmable, and many passengers on Antarctic cruises bring back a picture of themselves in the waters of the island caldera. The scientists estimate that three large eruptions of the Deception Island volcano all but wiped out the penguins on Ardley Island — one 5,500 to 5,400 years ago, another 4,500 to 4,200 years ago, and the last 3,200 to 3,000 years ago.
In more recent times, there have been smaller eruptions. The last eruption was in 1970.

Three new balsams add to Nilgiris biodiversity colours
Three new species of plants belonging to the Balsamaceae family were identified in the Mukurthi National Park in the Nilgiris recently.
The three, named Impatiens kawttyana, Impatiens taihmushkulni and Impatiens nilgirica, found by Tarun Chhabra and Ramneek Singh a few years ago, were formally classified recently. Their discovery was published in the Nordic Journal of Botany in December 2016.

Endemic species
Dr. Chhabra, a practising dentist and cultural anthropologist who has worked closely with the Toda tribes, has published a book titled The Toda Landscape. Talking to The Hindu, he said several years have passed since new plant species were discovered in the Nilgiris, and the new species throw light on the continued importance and diversity of the Nilgiris.
“There are more than 135 endemic species of plants in the Nilgiri Biosphere Reserve, of which the Nilgiris in Tamil Nadu forms the core, with over 90 endemics,” Dr. Chhabra said.
Impatiens kawttyana, as described by Chhabra and Ramneek, is identifiable by its large, white flowers, glandular hairs followed by white hairs at the throat, and has been named after a Toda deity hill, ‘Kawtty’, commonly known as Pechakal bettu.
Similarly, the Impatiens taihmushkulni is named after the Toda deity hill, ‘Taihmushkul’. Like the halls of Valhalla in Norse mythology, the Todas believe that their god ‘Aihhn’ resides and rules the Toda afterworld from the hill. Impatiens nilgirica variant nawttyana, differs slightly from a previously identified species, with the newly found variety having “longer scape (part of a stalk bearing flowers) and petioles (the stalk that joins the leaf to the stem), with white flowers,” among other small variations. This variety was named based on what the Todas call the members

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of the Balsaminaceae family — ‘Nawitty.’

**Dedicated guardians**

The naming of the three species after Toda deities isn’t coincidental. Dr. Chhabra says the names reflect the Todas’ crucial role in maintaining pristine ecosystems, especially in the Mukurthi National Park.

“At least 14 of the sacred deity hills of the Todas are located inside the park and they have played a tremendous role in protecting the area,” said Mr. Chhabra.

The three new species were found in isolated pockets of the Mukurthi National Park and Porthimund reserve forests, and while I. taihmushkulii has been tentatively classified by researchers to be ‘endangered’, there was not enough data on the other two species, Dr. Chhabra explained.

**Myriad ways in which plants handle drought stress**

Year after year, we find several parts of India hit by drought, food-grain production affected and farmers suffering greatly. During the recent decades, this climate change-induced effect has affected not only India but many lands across the globe. How do plants react and adjust to drought mediated stress? This is an area of considerable interest and activity and we have come to understand same aspects of it.

Every school child knows that plants collect energy from sunlight, absorb carbon dioxide from the atmosphere, pick up water from the soil, and using theses, make food for us. This seemingly simple chemical reaction called photosynthesis generates not only carbohydrates but produces oxygen as well, letting us breathe and use it for us. This key needs for the plants are thus simple - sunlight, carbon dioxide (CO2) from the air and water. If there be a shortage of any of these three, plant productivity falls.

**Water crisis**

Fortunately, sunlight is regular and abundant during day time. Carbon dioxide is also available in plenty (indeed it happens to be in excess, and increasing every year, thanks to the burning of fossil fuels like coal, petrol and natural gas) but it is the water shortage that has reached famine proportions in many parts of the world. How do plants react to drought conditions, what built-in mechanisms do they have, and how do they cope with drought stress—this is an area of intense activity among plant biologists.

Two recent papers throw light on these aspects of how plants adapt to drought stress. The first one comes from the group of Dr Andy Pereira of the University of Arkansas, Fayetteville, Arkansas, in the US, who used rice as the crop plant to study (see their paper: Basu S, Ramegowda V, Kumar A, Pereira A. ‘Plant adaptation to drought stress’: F1000Res. 2016 Jun 30;5. pii: F1000 Faculty Rev-1554. doi: 10.12688/f1000research.7678.1. eCollection 2016., free on the web)

The paper describes the various strategies that plants adapt. Drought resistance (DR) is one aspect in which enables plants to escape, avoid and tolerate drought stress. Drought escape (DE) is where a plant attempts to complete its life cycle before the onset of drought; this would involve the plant capturing a signal for the onset of drought conditions and preparing ahead of time—‘smart’! Drought avoidance (DA) involves the ability of plants to maintain relatively higher tissue water content, despite the water the water scarcity in the soil (saving for a deficit day) and drought tolerance (DT) where in the plant endures low water content on its tissues through various adaptive traits.

How does a plant display all these traits under conditions of drought stress? The authors point out that there are at least five different ways used by plants. The first is to reduce the level of photosynthesis (recall it uses water) by decreasing the leaf area (close and expose less) and slowing down the rate of photosynthesis.

The second is by regulating the action of the hormones present in the plant, in particular, one called abscisic acid (or ABA). During drought stress, ABA moves from the roots to the leaves, helping them close the very small openings (called stomata) in them, which allow for the entry and exit of gases (CO2, oxygen, water vapour), and reduce plant growth. Other signalling molecules called cytokinins in the plant cells also act up, delaying premature leaf ageing and death. The third is to control transpiration (water release from the plant to the air) by closing the stomata, reducing water loss and reducing CO2 uptake. The fourth way is to change the growth, size, shape and branching out of the roots and the fifth is through what is termed osmotic adjustment. Here the pressure exerted by the contents of the cell against the cell wall or membrane is maintained sufficiently tense for stiffness (and no collapse or breakdown). Botanists call this turgor (from the Latin for swelling).

Clearly, these five processes must be controlled and triggered by genes that express proteins and other molecules that carry out the stress response. How this process is controlled has been the study of another group, led by Dr. Yanhai Yin of Iowa State University at Ames, Iowa,
USA. Their paper has appeared three weeks ago (Ye H et al., Nature Communications 2017 Feb 24;8:14573. doi: 10.1038/ncomms14573). They discuss the roles of two molecules called BES1 and RD26 which play key roles in regulating plant growth under drought conditions. These two belong to the class called transcription factors, which are molecules that regulate (allow or stop) the expression of chosen genes into making the relevant protein molecules.

**Frenemies**

These two molecules thus look like they are working at cross-purposes, yet the pathways that these two regulate are highly interconnected. Dr. Yin has described them as ‘frenemies’, when the science writer Rashmi Shivni interviewed him. (Frenemies are individuals who combine in them characteristics of friends as well as enemies).

“We found that these pathways are kind of like frenemies that stay together but ‘antagonise’ each other most of the time. They both bind to the same site on the DNA, but only one pathway is active, depending on the environmental conditions”. BES1 is involved in the process by which certain plant steroids regulate plant growth. RD26 is active only when the plant experiences drought stress. Greater understanding of the ‘frenemical’ action would thus lead us to help increase crop yields when drought strikes.

**New species of flying squirrel discovered**

Scientists have discovered a new species of flying squirrel in North America that had been hiding in plain sight for hundreds of years.

Known as Humboldt’s flying squirrel, or Glaucomys ornatus, the new flying squirrel species inhabits the Pacific Coast region of North America.

Until now, these coastal populations were simply thought to be the already-known northern flying squirrel, researchers said.

“For 200 years, we thought we had only had one species of flying squirrel in the Northwest — until we looked at the nuclear genome, in addition to mitochondrial DNA, for the first time,” said Jim Kenagy, professor at the University of Washington in the U.S.

“It was a surprising discovery,” said Mr. Kenagy, co-author of the study published in the Journal of Mammalogy. The Humboldt’s flying squirrel is known as a “cryptic” species — a species that was previously thought to be another, known species because the two look similar. This new discovery is the 45th known species of flying squirrel in the world, researchers said.

**World’s oldest fossil mushroom discovered**

The world’s oldest fossil mushroom — dating back to about 115 million years — has been discovered in Brazil, according to researchers who hailed the finding as a “scientific wonder”.

The mushroom has been named Gondwanagaricites magnificus and belongs to the Agaricales order, researchers said.

About five centimetres tall, the mushroom had gills under its cap, rather than pores or teeth, structures that release spores and that can aid in identifying species, they said.

“Most mushrooms grow and are gone within a few days,” said Sam Heads, from the University of Illinois at Urbana-Champaign in the US.

“The fact that this mushroom was preserved at all is just astonishing,” said Mr. Heads, who discovered the mushroom when digitising a collection of fossils from the Crato Formation of Brazil.

Around 115 million years ago, when the ancient supercontinent Gondwana was breaking apart, the mushroom fell into a river and began an improbable journey, researchers said.

Its ultimate fate as a mineralised fossil preserved in limestone in northeast Brazil makes it a scientific wonder, they said.

**Snow leopards kill livestock despite wild prey availability**

The reason why large carnivores such as tigers eat cattle or other livestock, in places where predators and people share space and resources, is thought to be due to wild prey scarcity. However, a study published a few days ago in Open Science shows that this is not necessarily true. Simulated scenarios of livestock predation based on ground data predict that snow leopards in Asia will still prey extensively on livestock even when wild prey is available in high numbers.

The snow leopard feeds on hoofed animals (ungulates) including the Siberian ibex, blue sheep, urial and argali in the Himalayas. But ungulates also include livestock such as cattle, yak and horses, and these are killed in hundreds, annually.

To find out whether snow leopards turn to livestock because wild prey populations are not sufficient, scientists from the Snow Leopard Trust (SLT), Nature Conservation Foundation (NCF), and National Centre for Biological Sciences (NCBS), Bengaluru, University of Aberdeen and
St. Andrews University obtained wild prey and livestock numbers from multiple sites in India and Mongolia. They used camera traps and genetic analyses of snow leopard faeces to identify individuals and arrive at snow leopard numbers at each site. The team also ascertained the preferred prey of snow leopards by examining prey fur (from the faeces). Using these data, the team finally modelled different ecological scenarios: whether livestock predation would increase or decrease with changing livestock and wild prey numbers.

**Prefer Wild prey**
The scientists found that snow leopards did indeed prefer wild prey over livestock. The number of snow leopards increased only with increasing wild prey and not livestock: only wild prey therefore, is crucial for snow leopards. Oddly, modelled results predict that when both wild prey and livestock numbers are high, snow leopards will kill more livestock. This is because while individual snow leopards may kill fewer livestock in this scenario, the cumulative effect of all snow leopards put together is increased livestock predation.

“Livestock have degenerated anti-predatory abilities as a result of artificial selection for other traits and living in a human-mediated environment,” says Charudutt Mishra, Science and Conservation Director of Snow Leopard Trust and scientist at Nature Conservation Foundation. “Their large herds and more predictable distribution also make them vulnerable to predation. Our data show that livestock will get killed, irrespective of the abundance of wild prey; that is an important lesson for livestock management.” These predictions will be tested in future work, he adds.

**Livestock predation**
“We should anticipate livestock predation regardless of high numbers of wild prey and have sufficient measures to tackle it,” says lead author Kulbhushansingh R. Suryawanshi, Director of the India chapter of the Snow Leopard Trust and NCF scientist.

Better livestock protection and offsetting carnivore-caused economic damage is a must, write the authors. Retaliating to enormous economic losses people kill snow leopards across most of its range in Asia, and this is one of the main threats that the endangered animal faces today.

According to Mr. Suryawanshi, though the study focused only on snow leopards, there are lessons in the study that would be worth considering for other carnivores and livestock predation scenarios, too.

**Marine reserves can mitigate climate change**
Evaluating 145 peer-reviewed studies, a research team has concluded that “highly protected” marine reserves can help mitigate the effects of climate change.

“Marine reserves cannot halt or completely offset the growing impacts of climate change,” said Jane Lubchenco, a professor in the College of Science at Oregon State University (OSU) and co-author of the study published recently in Proceedings of the National Academy of Sciences. “But they can make marine ecosystems more resilient to changes and, in some cases, help slow down the rate of climate change.”

Around the world, coastal nations have committed to protecting 10% of their waters by 2020, but so far, only 3.5% of the ocean has been set aside for protection, and 1.6%, or less than half of that, is strongly protected from exploitation, Xinhua reported.

“Protecting a portion of our oceans and coastal wetlands will help sequester carbon, limit the consequences of poor management, protect habitats and biodiversity that are key to healthy oceans of the future, and buffer coastal populations from extreme events,” Lubchenco, who previously worked as National Oceanic and Atmospheric Administration (NOAA) Administrator, was quoted as saying in a news release.

The study also notes that ocean surface waters have become on average 26% more acidic since pre-industrial times. By the year 2100, under a “business-as-usual” scenario, they will be 150% more acidic, while coastal wetlands, including mangroves, seagrasses and salt marshes have demonstrated a capacity for reducing local carbon dioxide concentrations because many contain plants with high rates of photosynthesis.

**Increased probability of deaths from heat waves**
The mean temperature across India has risen by 0.5 degree C during the period 1960 and 2009, and this has led to a significant increase in heat waves in the country. Based on modelling studies, researchers from IIT Bombay, IIT Delhi and the University of California, Irvine have found that when the summer mean temperature during this period increased from 27 degrees C to 27.5 degrees C, the probability of a heat wave killing in excess of 100 people shot up from 13% to 32% — an increase of 146%. For instance, there were only 43 and 34 heat-related fatalities in 1975 and 1976, respectively, when the mean summer temperature was about 27.4 degrees C. But in 1998, at least 1,600 people died due to heat wave when...
the mean summer temperature was more than 28 degrees C.
Similarly, when the average number of heat-wave days in the country increased from six to eight, the probability of heat-wave-related deaths increased from 46% to 82% — a 78% increase. The average number of heat wave days between 1960 and 2009 was 7.3 per year.
“When there is a 0.5 degree C increase in mean temperature, the extreme temperature will increase at a much higher rate,” says Prof. Subimal Ghosh from the Department of Civil Engineering, IIT Bombay, one of the authors of the paper.

Worsening climate
As the Earth gets even warmer, there can be substantial increase in such deaths and heat waves will become more frequent in the country, and northern, central and western India will witness increased spatial warming, says a study published a few days ago in the journal Science Advances.
“The temperature in these regions is already high and so the chances of the mean temperature crossing the threshold are higher,” says Prof. Ghosh. Between 1960 and 2009, the intensity, number of heat-wave events taking place each year and the duration in days have increased across the country, particularly, in the northern, southern and western parts of India.
Between 1985 and 2009, southern and western India experienced 50% more heat-wave events compared with the period 1960 to 1984. But in most parts of the country, the number of heat-wave days and mean duration of heat waves have increased by 25%, the study says.
Heat waves killed more than 1,300 people in Ahmedabad in 2010 and in 2013 the number of people who died due to heat wave shot up to 1,500. It reached a new peak in 2015 when more than 2,500 people died. Last year witnessed the most intense heat wave sweeping the country in the month of May; the mercury touched 52.4 degree C in Jaisalmer.
“The IMD is doing extremely well in forecasting a heat wave. The only problem is that people are not aware of the adverse impact of heat waves,” says Prof. Ghosh.

Purveyor of plastic
Every year, the world’s rivers deposit between 1.15 and 2.41 million tonnes of plastic waste into the ocean: grocery bags and shampoo bottles, plastic straws and micropastics make their way into the sea via riverine systems, hugely impacting marine life.
Now, a new study finds that the Ganga is the world’s second biggest riverine contributor to plastic pollution in the oceans, discharging 1,20,000 tonnes annually. This quantity is exceeded only by Yangtze in China, which transports 3,30,000 tonnes, says a paper published in the latest edition of the journal Nature Communications. While the average Indian generates relatively little ‘mismanaged plastic’ (3.2 kg/year) compared with the rest of the world (17 kg/year per person), “with half a billion people living within the Ganges catchment, the overall pressure on the river is very large,” lead author Laurent Lebreton, Data Scientist at The Ocean Cleanup Foundation told The Hindu.
However, in rapidly developing economies like India, “a rise in the middle class population has meant a higher level of consumption — and plastic waste generation — but this is not matched by infrastructure to manage the waste,” he added.

Monsoon swell
The pollution swells during the southwest monsoon, peaking in August with 44,500 tonnes discharged by the Ganga.
Most of top 20 polluting rivers around the world are located in Asia, accounting for 86% of the global annual input of plastic debris. This “emphasises the need to focus monitoring and mitigation efforts in Asian countries with rapid economic development and poor waste management,” says the paper. Also among the top 20 polluters are Xi and Huangpu rivers in China, Cross river (Nigeria, Cameroon), Brantas river in Indonesia and the Amazon.
For the study, the researchers looked at indicators within the river catchment such as mismanaged plastic waste, population density, monthly catchment runoff and dams and weirs that act as particle sinks.

Damming river water impacts fish diversity
A new study has found that dams and other barriers across rivers in the Western Ghats do affect fish species and their recovery downstream. However, barrier-free tributaries that drain into these rivers can help fish recover even in dammed stretches; protecting such tributaries could be crucial to maintaining fish diversity in the Western Ghats.
The Western Ghats is home to 290 freshwater fish species, more than half of which are endemic. While other studies have shown that river barriers such as barrages and dams can affect fish diversity, there is no hard evidence to prove this in the Western Ghats.
To test if barriers across a 72-km stretch of Karnataka’s Malaprabha River in the central Western Ghats could affect fish diversity, scientists from the Asoka Trust for Research in Ecology and the Environment (ATREE) compared fish diversity both upstream and downstream of barriers.

**Endemic species**

Studies in the upstream, barrier-free stretches confirmed the presence of 28 fish species, including the Deccan mahseer, an endemic carp. However, this number dipped immediately downstream of barriers; fish recovery was low here. But it picked up further downstream, as distance from the barrier increased. The scientists also noticed that the more the number of barriers upstream, the more diminished was fish recovery downstream.

But there was a silver lining: as long as barrier-free tributaries merged with the Malaprabha River, fish — including endemics — recovered well, even in dammed stretches of the river. These tributaries, along with other environmental factors, increased dissolved oxygen content and reduced the hardness of water (alkalinity) in the Malaprabha, helping fish recover better. Fish diversity recovered to the highest level after a distance of 2 km downstream of barriers.

The finding that barrier-free tributaries are crucial to mitigate the impacts of already-existing barriers could be important to consider while implementing potentially high-impact river projects like Kerala’s Athirapilly hydroelectric project in the southern Western Ghats, an area that has the highest endemcity of freshwater species in the entire range.

“The study helps classify stretches of rivers or tributaries in an already developed basin that should be spared from future (hydrologic) barriers and regulation,” says co-author Jagdish Krishnaswamy from the Suri Sehgal Centre for Biodiversity and Conservation, ATREE.

It could also help policy makers and managers redesign hydrological barriers, and develop recovery plans for endemic species like the mahseer, says Vidyadhar Atkore, lead author of the study published in the Journal River Research and Applications.

“The efficacy of all existing hydrological barriers (small or large) needs proper evaluation to assess its impact on aquatic biodiversity,” he says, adding that they hope to test the effects of river barriers in another regulated river basin of the Western Ghats as well.

What does this mean in energy savings?

Take the example of ACs, which have the most impact. What is one-star now was four-star in 2010. And overall we have seen that comparing the one-star of 2010 and the one-star of 2016, there is almost an improvement of 35-40% in energy efficiency. That’s the effect of the change in technology.

Power Minister Piyush Goyal recently released the Energy Conservation Building Codes.

**How will these work in reducing power consumption in the country?**

We have buildings for different applications. This document comes out with a very clear understanding of the application [or the use] of a building. That’s why the (energy efficiency) criteria for every application of a building have been very clearly defined.

If it is an office building hosting a service sector office that is running 14 hours a day, then that should have an occupancy sensor in the rooms (to be able to tell if the room is empty or not), for example.

That is a clear requirement. On the other hand, if it is a school, which operates for only 6-8 hours, it doesn’t need an occupancy sensor. The children are there during school hours. An occupancy sensor in this case would [mean] an extra expenditure for very little benefit.

This is the approach: that for every application of a building, there is a specific criterion.

**Is the government considering making the codes mandatory?**

The benefit of the code is that it is a ready reckoner. Any designer, developer, and architect can go through it and implement it. So implementation can start now. The question of whether it has to be made mandatory or backed up by a regulation or law is an entirely different process. Since building laws are by the state governments, they can decide what they want to make mandatory for whatever application. They may like to make it mandatory for office buildings or for institutions like colleges. It is up to the state governments or even municipalities, depending on their jurisdiction, to decide what should be made mandatory.

**Was there a target for energy savings while designing the Codes?**

It was not a target; in fact, it was an analysis. We did a technical analysis, a material-based analysis, a simulation, etc. Based on the criteria that were developed, we are in a position to estimate that the base level itself (the lowest level of energy-efficient steps to be taken in the codes) will give a 20% saving over conventional levels. The higher levels will give about 35%. The highest level can give as much as 45-50%.
What benefit do the Codes have for buildings that are already constructed?
The Codes have come out in such a manner that it is directly beneficial to new buildings. If the building is already constructed, then a major portion of the benefit is compromised as the shell of the building is already made. There are other features like systems, lighting, and comfort controls that can be retrofitted. The cost will not be much. There are certain times when the inner design of a building is modified, the walls are broken down or shifted, for example, and this can be done according to the Code.

Is customer awareness of energy-efficient appliances present only in the main metros or is it taking place in the smaller cities and towns as well?
There is a good response even in these cities. We get the regular sales data from companies for each location. It is mandatory for them to provide the data. And we have regular dealer programmes, since dealers are the main contact for the consumers. They are getting trained and are facilitating the sale of higher energy-rated appliances.
UNICEF SEEKS HELP FROM ISLAMIC BODIES TO ACHIEVE VACCINATION GOAL

To quell the rumours around the measles-rubella vaccine, UNICEF has reached out to Islamic civil society organisations, religious leaders and academia to create trust and address myths around immunisation.

India has one of the largest immunisation programmes in the world, with nearly 26 million children targeted annually for immunisation. However, according to UNICEF, despite extensive coverage, only 65% of children in India received all vaccines during the first year of their life. India’s newest MR (measles rubella) vaccine also protects children from measles, a major cause of fatalities in small children, with 134,200 measles deaths globally in 2015, of which around 49,200 occurred in India — nearly 36%. This is the first time the rubella vaccine has been introduced in India’s childhood immunisation programme and misinformation about the vaccine in minority communities has caused concern in the government. “Immunisation is one of the most effective and cost-effective ways to protect children’s lives and futures. Through full immunisation coverage, we can make sure that the benefits of life-saving vaccines reach every child. The recently introduced measles rubella vaccine, which will be provided for free in schools in health facilities and at outreach session sites during the campaign, is another such step to achieving our goals,” says Dr. Pradeep Haldar, deputy commissioner, Immunisation, Health Ministry.

Serious consequences

Rubella, which is commonly referred to as German Measles, is a mild infection, but can have serious consequences if it occurs in pregnant women. The introduction of these new vaccines in the Universal Immunisation Programme aims to reduce childhood mortality and protect children from three major highly preventable and potentially fatal diseases — measles, pneumonia and diarrhoea. The first-time introduction of the rubella vaccine, in a combination MR shot, protects children against irreversible and devastating health issues.

UNICEF has engaged with Urdu media in efforts to create trust in vaccines and address myths around immunisation, Shamina Shafiq, executive founder director, Power Foundation, said.

IISC MAKES TWO POTENT MOLECULES TO FIGHT TB

Scientists at the Indian Institute of Science (IISc) Bengaluru have developed two new, potent molecules that can severely impact the survival of mycobacteria, including Mycobacterium tuberculosis that causes TB. The results were published in the journal Antimicrobial Agents and Chemotherapy.

Unlike most antibiotics that target the bacterial metabolism by aiming at the cellular components, the novel molecules inhibit the stress response pathway of mycobacteria. The stress response pathway is crucial for bacteria to survive during hostile conditions such as lack of nutrients and the presence of antibiotics, to name a few. So any inhibition of this pathway will lead to its death.

The master regulator of stress pathway in the case of mycobacteria is (p)ppGpp (Guanosine pentaphosphate or Guanosine tetraphosphate). Though a molecule that inhibits the (p)ppGpp formation has already been synthesised, the ef-
ficacy is not much. “Very high concentration of Relacin molecule is needed to inhibit the pathway and, therefore, the efficacy is low. So we synthesised two new molecules — acetylated compound (AC compound) and acetylated benzoylated compound (AB compound) — by bringing about a modification in the base of the Relacin molecule,” says Prof. Dipankar Chatterji from the Division of Biological Sciences, IISc and the corresponding author of the paper. “We found both the molecules to be very good inhibitors of stress response. The two compounds affected the rate of synthesis of (p)ppGpp and also reduced the cell survival,” he says. Laboratory studies showed that the two molecules were not toxic to human cells and were able to penetrate the human lung epithelial cells.

“We found our compounds were targeting the Rel gene. The Rel gene makes Rel protein, which in turn synthesises (p)ppGpp. When the Rel gene is knocked out, the long-term survival of Mycobacterium smegmatis decreases,” says Prof. Chatterji. “The Alarmone molecule (p)ppgpp, a modified nucleotide, is ubiquitous in bacteria and absent in humans. Inhibiting (p)ppgpp synthesis would specifically target the survival of bacteria without having any effects on humans,” says Dr. Kirtimaan Syal from the Division of Biological Sciences, IISc and the first author of the paper. Earlier studies have shown that when the rel gene is deleted, the long-term survival ability under stress was lost; the M. tuberculosis bacteria was unable to persist in mice and unable to form tubercle lesions in guinea pigs.

“The major reason for prolonged treatment of TB is the bacterium’s ability to persist in dormant form, which is tolerant to most antibiotics used in the treatment regimen. So inhibition of (p)ppGpp-mediated persistence could help in shortening the treatment regime, dealing with the emergence of multiple drug resistance and treatment of chronic infections, Dr. Syal says.

Inhibiting biofilm
Under hostile conditions, bacteria tend to form biofilms, which protect the bacteria from stress and induce tolerance to antibiotics. Recent studies have shown that tuberculosis bacteria that cannot form a biofilm cannot survive inside the host. Evidences have shown that at the time of infection, the M. tuberculosis display a biofilm-like phenotype and this helps the bacteria to survive inside the host.

Both M. tuberculosis and M. smegmatis that do have the Rel gene cannot form a biofilm. Studies carried out by the researchers showed that both the molecules were able to inhibit biofilm formation by M. tuberculosis and M. smegmatis and also disrupt the already formed biofilm. “The biofilm formed by TB bacteria is very dangerous. The ability of the molecules to destroy the biofilm and even prevent its formation is a very important achievement,” says Prof. Chatterji.

Since there are very few antibiotics that target the stress response pathway of the bacteria, the two molecules offer great promise. “The next step is to test the molecules on animals. We have not thought about it. It will also be interesting to see if the bacteria develop resistance against these molecules,” Prof. Chatterji says.

NOT JUST A LOVE HORMONE
Oxytocin, often referred to as “the love hormone,” is involved in a broader range of social interactions than previously understood, according to a study on mice that appears in the journal Nature. The Stanford University School of Medicine discovery may have implications for neurological
disorders such as autism, as well as for scientific conceptions of our evolutionary heritage. Scientists estimate that the advent of social living preceded the emergence of pair living by 35 million years. The new study suggests that oxytocin’s role in one-on-one bonding probably evolved from an existing, broader affinity for group living.

The new study pinpoints a unique way in which oxytocin alters activity in a part of the brain called the nucleus accumbens, which is crucial to experiencing the pleasant sensation neuroscientists call “reward.” The findings not only provide validity for ongoing trials of oxytocin in autistic patients, but also suggest possible new treatments for neuropsychiatric conditions in which social activity is impaired.

“People with autism-spectrum disorders may not experience the normal reward the rest of us all get from being with our friends,” said senior author Robert Malenka. “So we asked, what in the brain makes you enjoy hanging out with your buddies?” Some genetic evidence suggests the awkward social interaction that is a hallmark of autism-spectrum disorders may be at least in part oxytocin-related. Certain variations in the gene that encodes the oxytocin receptor — a cell-surface protein that senses the substance’s presence — are associated with increased autism risk.

For this study, Malenka and lead author Glen teamed up to untangle the complicated neurophysiological underpinnings of oxytocin’s role in social interactions. They focused on the nucleus accumbens.

The group thinks their findings in mice are likely to generalise to humans because the brain’s reward circuitry has been so carefully conserved over the course of hundreds of millions of years of evolution. This extensive cross-species similarity probably stems from pleasure’s absolutely essential role in reinforcing behaviour likely to boost an individual’s chance of survival and procreation.

‘INDIAN FIRM’S ZIKA VIRUS VACCINE 100% EFFICIENT IN ANIMAL TRIALS’

The Hyderabad-based Bharat Biotech’s ‘killed Zika virus vaccine’ using an African strain has shown 100% efficacy against mortality and disease in animal studies, a study has shown. A ‘killed virus vaccine’ or ‘inactivated vaccine’ contains virus that has been grown in culture and then killed using physical or chemical processes.

The results of the study have been published in the Nature group journal Scientific Reports. Two doses (5 and 10 microgram) of the vaccine given through intramuscular route on days 0 and 21 to mice were found to protect the animals against Zika virus seven days after the second vaccination.

The vaccine was found to confer 100% protection against infection caused by an Asian Zika virus strain as well as by the African Zika virus strain.

All the animals that were not vaccinated died eight days after infection by the African strain and 12 days after infection by the Asian strain. While all the animals that received the vaccine exhibited “undetectable” viral load, the amount of virus present in animals that did not receive the vaccine peaked four days after being infected with either the African or Asian Zika virus strain.

“The vaccine was developed using the African strain of the virus. It is important to prove that the vaccine developed with the African strain also protects against Zika infection caused by the contemporary Asian strains of Zika virus. Importing the contemporary Asian strains into the country was difficult, and hence the vac-
cine challenge studies with Asian strain had to be outsourced to a contact research organisation in the U.S.,” says K. Sumathy from Bharat Biotech and the first author of the paper. A particular kind of mouse — AG129 — which is highly immunocompromised and hence highly susceptible to virus infection was used for the study.

**Immune response**

The level of immune response induced by the vaccine was also studied using another kind of mouse model — Balb/c mice. Unlike the AG129 mice, this mouse model is immunocompetent and elicits full spectrum of immune response. Animals that received the vaccine developed Zika-neutralising antibodies on day 14 after the first dose and a week after the second dose. When the animals were infected with Zika virus post-vaccination, the virus in the vaccinated animals was “undetectable”, while 72-96 hours after infection it peaked in animals that did not receive the vaccine.

“In both the mice models, the vaccine-induced protective immunity against virus challenge was observed,” says Dr. Sumathy. “Vaccine was made only with the African virus strain, but the vaccinated mice was challenged [infected] with both the African and the Asian strains. Our vaccine offered equivalent protection against challenge with both the African and the Asian strains of Zika virus.”

Though 5 and 10 microgram of vaccine were tested, the amount of antibodies elicited by the higher dose was “not significantly” higher than that elicited by 5 microgram of the vaccine, says Dr. Sumathy. Vaccination protected the animals against Zika virus and disease up to 14 and 20 days after being challenged with the virus. The company also carried out passive immunisation studies to show that the Zika vaccine-induced antibodies confer protection against the virus in mice that were exposed to the virus. Rabbits were vaccinated with the vaccine and the vaccine-induced antibodies were given to mice. While no virus was detected in mice 24-144 hours after passive immunisation, the viral load peaked 72-96 hours in mice that did not receive vaccine-induced antibodies.

**A FROG’S MUCUS COULD TREAT FLU**

Skin mucus secreted by a colourful, tennis ball-sized frog species found in Kerala can be used to develop an anti-viral drug that can treat various strains of flu, according to a new study. Frog mucus is loaded with molecules that kill bacteria and viruses and researchers are beginning to investigate it as a potential source for new anti-microbial drugs.

**Defence peptides**

One of these “host defence peptides”, found in a frog species (Hydrophylax bahuvistara) native to Kerala can destroy many strains of human flu and protect mice against flu infection, researchers found.

An international team of researchers, including those from Rajiv Gandhi Centre for Biotechnology in Kerala, screened about 32 frog defence peptides against an influenza strain and found that four of them had flu-busting abilities. When researchers delivered small electric shocks, they collected the secretion that contained a peptide, or chain of amino acids, that appears to fight off the H1 strain of flu virus.

“In the beginning, I thought that when you do drug discovery, you have to go through thousands of drug candidates, even a million, before you get one or two hits. And here we did 32 peptides, and we had four hits,” said Joshy Jacob of Emory University in the U.S.
red blood cells in a dish to the flu-buster peptides, three out of the four proved toxic. However, the fourth seemed harmless to human cells but lethal to a wide range of flu viruses.

**Named after ‘urumi’**
The researchers named the newly identified peptide “urumin” after the urumi, a sword with a flexible blade that snaps and bends like a whip. Electron microscope images of the virus after exposure to urumin reveal a virus that has been completely dismantled, researchers said.

Urumin is not toxic to mammals, but “appears to only disrupt the integrity of flu virus”. When researchers squeezed some urumin into the noses of lab mice, the peptide protected them against what would have otherwise been a lethal dose of H1 flu virus, the kind responsible for the 2009 swine flu pandemic. It seems to work by binding to a protein that is identical across many influenza strains, and in lab experiments, it was able to neutralise dozens of flu strains, from the 1934 archival viruses up to modern ones, researchers said.

More research is needed to determine if urumin could become a preventive treatment against the flu in humans, and to see if other frog-derived peptides could protect against viruses like dengue and Zika.

**IISC TEAM UNRAVELS HOW VITAMIN C HELPS KILL BACTERIA**
That vitamin C, an anti-oxidant agent, boosts and strengthens immunity is well known. Its ability to speed-up recovery from tuberculosis and impede the TB causing bacteria from causing disease, and even kill the bacteria in culture at high concentration are also known. Now, a study by a team of researchers at the Indian Institute of Science (IISc), Bengaluru has found the molecular mechanism by which vitamin C impedes and even kills Mycobacterium smegmatis, a non-pathogenic bacterium that belongs to the same genus as the TB-causing mycobacteria. The results were published in the journal FEMS Microbiology Letters.

**Stress response**
During times of stress or hostile conditions, such as increased temperature and presence of antibiotics, bacteria tend to come together and form a biofilm to protect themselves. The stress response pathway is crucial for bacteria to survive during hostile conditions. So blocking this pathway is a sure way of killing the bacteria.

In mycobacterium, the (p)ppGpp (Guanosine pentaphosphatate or Guanosine tetraphosphate) is a key molecule in the stress response pathway. The (p)ppGpp is synthesised by Rel protein, which in turn is made by the Rel gene. The team led by Dipankar Chatterji from the Molecular Biophysics Unit at IISc looked at the effects of vitamin C on the stress response pathway. “We chose vitamin C because its structure is similar to (p)ppGpp,” says Prof. Chatterji. “So we hypothesised that vitamin C should be competing to bind to the Rel enzyme and inhibiting (p)ppGpp synthesis.”

To test their hypothesis, the researchers conducted experiments using M. smegmatis. M. smegmatis is used as a model organism for TB-causing Mycobacterium tuberculosis.

**Role of vitamin C**
In vitro studies showed “significant” inhibition of (p)ppGpp synthesis in the presence of vitamin C. The inhibition level was seen to increase as the vitamin C concentration increased. The more the vitamin C concentration, the greater the possibility of vitamin C binding to the Rel enzyme, thus inhibiting (p)ppGpp synthesis. At about 10 mM concentration, the synthesis of (p) ppGpp molecule was completely inhibited.

The binding of vitamin C to the Rel enzyme is weak and this explains why high concentration
of vitamin C is needed to inhibit (p)ppGpp synthesis.

“Using Mycobacterial cells we found that 1 mM of vitamin C produced 50% inhibition in (p)ppGpp synthesis. Vitamin C is able to get inside cells and inhibit (p)ppGpp synthesis,” says Kirtimaan Syal from IISc, the first author of the paper.

When 2 mM of vitamin C was added, “significant” defect in biofilm formation was seen. There was more than 50% reduction in viability of cells in a matter of four days when M. smegmatis was treated with 2mM of vitamin C. The viability of cells reduced even further with time, raising the possibility of therapeutic implications.

**Therapeutic potential**

“This suggests that vitamin C can act as a precursor for more potential inhibitors; it can be chemically modified into more potential derivatives,” they write. “Vitamin C is natural, and it can form one of the nutrient-based treatments of the disease. Vitamin C is water soluble and has no toxic effect,” says Dr. Syal.

“We are trying to synthesise derivatives of vitamin C to enhance inhibition of (p)ppGpp synthesis even at lower concentration,” Dr. Syal says.

**LIVER CARCINOGEN TRACED TO SUNFLOWER SEEDS**

Researchers have shown that sunflower seeds are frequently contaminated with a toxin which has the potential to cause liver cancer.

In the study published in the journal PLoS ONE, the team of scientists documented frequent occurrence of aflatoxin — a toxin produced by Aspergillus moulds that commonly infect corn, peanuts, pistachios and almonds — in sunflower seeds and their products. The study was conducted in Tanzania, but the problem is by no means isolated there, the researchers said.

Chronic exposure to aflatoxin causes an estimated 25,000-155,000 deaths worldwide each year, from corn and peanuts alone.

Since it is one of the most potent liver carcinogens known, the research to detect and limit its presence in sunflower seeds and their products could help save lives and reduce liver disease in areas where sunflowers and their byproducts are consumed, said study co-author Gale Strasburg, Professor at Michigan State University in the US.

“These high aflatoxin levels, in a commodity frequently consumed by the Tanzanian population, indicate that local authorities must implement interventions to prevent and control aflatoxin contamination along the sunflower commodity value chain, to enhance food and feed safety in Tanzania,” he said.

“Follow-up research is needed to determine intake rates of sunflower seed products in humans and animals, to inform exposure assessments and to better understand the role of sunflower seeds and cakes as a dietary aflatoxin source,” Strasburg added.

**IMPROVING ACCESS TO MENTAL HEALTH SERVICES IN REMOTE AREAS**

While about 10% of the population in India suffers from common mental disorders, only about 15-25% of this receives mental health care.

But a small-scale study carried out on approximately 5,000 people living in 30 tribal villages in West Godavari district of Andhra Pradesh was able to improve the practice of seeking out mental health care significantly.

The intervention was carried out for three months from November 2015 to January 2016 by involving 21 ASHA (Accredited Social Health Activists) workers and two primary health care doctors who were trained for about 10 days. A
mobile technology-based mental health service delivery model was used by ASHA workers and doctors for screening, diagnosing and treating people with common mental disorders such as depression, anxiety, suicide risk and stress.

Destigmatising
Of the nearly 5,000 people who were screened, 238 were identified as being positive for common mental disorders and were referred to primary care doctors for treatment. Thirty of the 238 people visited a primary care doctor for further diagnosis and treatment. The percentage of people who sought mental health care shot up from 0.8% at the beginning of the intervention to 12.6% at the end of the three-month intervention period. The results were published in the Journal of Global Health.

“This is a significant increase in the number of people who accessed a doctor for mental disorder,” says Dr. Pallab K. Maulik from Delhi’s The George Institute for Global Health and the first author of the paper. “There was significant reduction in the depression and anxiety scores between the start and end of the intervention in those who were screened positive.” Considering that there were not sufficient mental health professionals to treat all patients across the country, the study has been successful in training ASHA workers and PHC doctors to provide basic mental health care that included screening and providing treatment.

Prior to intervention, an anti-stigma campaign was carried out for three months. The campaign improved the awareness level and changed the attitude and behaviour related to mental health. “Our study showed that it is feasible to carry out an intervention of this kind, and acceptability was high among the people, especially since we carried out an anti-stigma campaign,” says Dr. Maulik.

Larger study
Following the proof-of-concept study carried out in the 30 villages, Dr. Maulik and his team members are carrying out a larger pilot study in West Godavari district of Andhra Pradesh involving around 40,000 people living in 12 non-tribal villages. While the other protocols such as training of ASHA workers and doctors and anti-stigma campaign are essentially the same, the intervention was carried out for one year, much longer than the intervention in the smaller study, which was only for three months. The primary outcome of the study is to evaluate the use of mental health services by people with depression, anxiety, stress and suicide risk. “The uptake of mental health services by the affected people was more than the smaller study and very encouraging,” says Dr. Maulik. The results of the study are being evaluated and are yet to be published.

WHO REVISES ANTIBIOTICS PROTOCOL

The WHO has now recommended that antibiotics in the ‘access’ group be available at all times as treatment for a wide range of common infections. This includes amoxicillin, a widely-used antibiotic to treat infections such as pneumonia. The ‘watch’ group covers antibiotics that are recommended as first or second choice treatment for a small number of infections. Ciprofloxacin, used to treat cystitis (a type of urinary tract infection) and upper respiratory tract infections (like bacterial sinusitis and bacterial bronchitis), falls under this category. The WHO has recommended that prescription of these drugs should be dramatically reduced to avoid further development of resistance.

The third group, ‘reserve’, includes antibiotics such as colistin and some cephalosporins that should be considered last-resort options, and used only in the most severe circumstances...
when all other alternatives have failed, such as for life-threatening infections due to multidrug-resistant bacteria. The new categorisation will further guide countries in ensuring access to appropriate antibacterial agents and support antimicrobial stewardship effort, said Dr. Sumanth Gandra from the Center for Disease Dynamics, Economics and Policy (CDDEP).

**Model list**

“The Model List of Essential Medicines necessarily has a sharp focus on preserving antimicrobials. This list serves as a guide for the medicine supply system and is responsible for promoting health equity,” said Dr. Gandra, who was a part of the WHO expert committee that helped shape the revised list and recommended these three categories.
New way to fight drug resistant superbugs

Scientists have found that an unusual approach of removing antibodies from the blood stream could reduce chronic infections, an advance that may help humans in the fight against drug resistant superbugs.

Researchers from the University of Birmingham and Newcastle University in the U.K. identified two patients with bronchiectasis who suffered with chronic Pseudomonas aeruginosa infections that were resistant to many antibiotics.

Bronchiectasis is a disease that leads to permanent enlargement of the airways in the lung. Symptoms are debilitating for patients, and typically include a chronic cough, shortness of breath, coughing up blood, and chest pain. Bronchiectasis often affects patients beyond the age at which lung transplantation is possible.

Like kidney dialysis

Chronic Pseudomonas aeruginosa lung infections commonly occur in patients suffering from bronchiectasis.

“We used a process known as plasmapheresis that is somewhat like kidney dialysis,” said Tony De Soyza, Senior Lecturer at Newcastle University.

“The plasmapheresis involved the removal, treatment, and return of blood plasma from circulation, and was done five times in a week in order to remove antibody from the patients,” said De Soyza. “We then replaced antibodies with those from blood donations. This treatment restored the ability for the patients’ blood to kill their infecting Pseudomonas,” he said.

A ‘sci-fi’ therapy to fight brain tumours

It sounds like science fiction, but a cap-like device that makes electric fields to fight cancer improved survival for the first time in more than a decade for people with deadly brain tumors, final results of a large study suggest.

Many doctors are skeptical of the therapy, called tumour treating fields, and it is not a cure. It is also ultra-expensive, at $21,000 a month. But in the study, more than twice as many patients were alive five years after receiving it, plus the usual chemotherapy, than those given just the chemo.

The device, called Optune, is made by Novocure, based in Jersey, an island near England. It is sold in the U.S., Germany, Switzerland and Japan for adults with an aggressive form of cancer called glioblastoma multiforme, and is used with chemo after surgery and radiation to try to keep these tumours from recurring.

Patients cover their shaved scalp with strips of electrodes connected by wires to a small generator in a bag. They can wear a hat, go about their usual lives, and are supposed to use the device at least 18 hours a day. It is not an electric current or radiation, and they feel only mild heat.

It supposedly works by creating low-intensity, alternating electric fields that disrupt cell division, confusing the way chromosomes line up, which makes the cells die.

North India to get DNA bank for wildlife

North India is all set to get its first DNA bank for wildlife. Scientists at the Indian Veterinary Research Institute (IVRI) in Bareilly are in the process of collecting DNA samples of all wild animals to set up the bank. It is expected to help in research and also in bringing down poaching.

At present, the Laboratory for the Conservation of Endangered Species (LaCONES) in Hyderabad is the only such facility in the country.

To start by year-end

According to principal scientist and in-charge of the Centre for Wildlife, IVRI, Anil Kumar Sharma, so far, the scientists have collected 140 samples of 25 wild animals. The DNA bank is expected to start this year-end.

“We are making a baseline data of different animals. Every time we receive some identified specimen, viscera, skin or part of the body of a wild animal from either forest department or zoo, we take out the DNA,” Mr. Sharma told The Hindu on phone from Bareilly.

It took one year for the IVRI to collect the DNA samples of animals such as tigers, leopards, lions, elephants, rhinos and deer, which are on the radar of poachers.

“At present, every time there is an incident of poaching, the specimen is sent to the facility in Hyderabad, which is an expensive affair. Also it is too much of a pressure on the Hyderabad institute. We are starting this to cater to the needs of north India,” Mr. Sharma said.

The DNA bank was the brainchild of Dr. Raj Kumar Singh, the director of Indian Council of Agricultural Research-IVRI, Mr. Sharma added.

“The bank has ‘positive sample’ meaning ‘known sample’ which will have DNA sequencing. In future, if we get some ‘unknown sample’ like hair or skin, then with the help of the DNA bank, we can tell which animal it belongs...
Sewage to battery grade

Sulphur from a contaminated pond has been successfully recovered and used in a high-performance battery. This waste-to-wealth feat was achieved by a group of researchers from CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi, in Tamil Nadu. Published recently in the journal Separation and Purification Technology, this is the first time that the sulphur recovery process was done by an integrated approach of biological and electrochemical oxidation process. Water from a pond contaminated by sodium dithionate-processing industry was collected and studied. Sodium dithionate salt is used in many textile industries to remove the excess dye and unintended colours, thereby improving overall colour quality. It is also used in processes in leather, certain food and plastic industries. The effluents from these industries can cause a range of health and environmental hazards. Removal or reduction of the sulphur in the waste water has always been a challenge.

Bio-electrochemical process

Sulphate-reducing bacteria (SRB), which have a natural ability to convert sulphate to sulphide, were used in the biological treatment process. The bacteria are capable of using sulphate instead of oxygen for their energy source. Due to reduced nutrients, the conversion rate to sulphide was very low in the pond. After 72 hours of incubation in lab conditions with additional supply of nutrients, three dominant strains— Stenotrophomonas maltophilia, Bacillus cereus, and Bacillus licheniformis—in the pond were identified. These bacteria are already used in many industries for treatment of their effluents before discharge.

When the researchers simulated the micro-environment where oxygen supply is less by keeping the bacteria with out oxygen for 20 days and added iron powder, the bacteria liberated hydrogen sulphide gas. The gas was collected and dissolved in sodium hydroxide to form sodium sulphide. The sulphide was further oxidised to elemental sulphur using an electrochemical process. A double-compartment cell was constructed, and on passing current, the elemental sulphur precipitated at the electrodes. Though the bacteria are used to treat industrial wastes, this is the first time an electrochemical approach is applied to further convert sulphide to elemental sulphur. This sulphur can be used in various applications such as production of sulphuric acid and liquid sulphur dioxide. Since the cost of pure sulphur is high, the new approach can help recover sulphur from waste and turn it into a resource.

When the recovered sulphur was used as cathode in lithium sulphur (Li-S) battery, a current of 1050 mAh/g was produced. After 10 cycles the current produced reduced to 840 mAh/g. The researchers are planning to conduct more studies to improve the conductivity of the sulphur in order to get higher discharge capacity.

Battery-less pacemaker developed

Scientists have developed a new wireless, battery-less pacemaker that can be implanted directly into a patient’s heart, an advance that could lead to “triple crown” of treatment for irregular heartbeat.

The pacemaker harvests energy wirelessly from radio frequency radiation transmitted by an external battery pack, researchers at Rice University in the U.S. said. The chip at the system’s heart is less than 4 mm wide and incorporates the receiving antenna, a current rectifier, a power management unit and a pacing activation signal.

Nanoparticles to treat eye infection

Scientists at the Hyderabad-based CSIR-Centre for Cellular and Molecular Biology (CSIR-CCMB) have developed a novel way to treat fungal keratitis. Keratitis is the inflammation of the eye, which starts with redness and itching and might eventually lead to blindness.

Keratitis can be caused by both bacteria and fungi. Fungi attach themselves to the cornea and release enzymes that break down the corneal proteins for their nutritional requirements.

In the process the cornea also gets inflamed. Corneal damage causes wound and scar formation leading to severe visual impairment. It is estimated that about 30% of keratitis cases in India lead to blindness.

Treating keratitis infection is currently a challenge because it is difficult to maintain a therapeutic dose at the corneal surface for long periods as blinking and tear formation washes off the drug. To address this challenge, a two-member team led by Dr. Ch. Mohan Rao of CCMB has developed protein-based nanoparticles that encapsulate the drug.

Certain antibodies get attached to the outer surface of the nanoparticles, thus anchoring the nanoparticles to the corneal surface. The infected cornea expresses a set of receptors (TLR4) when infection sets in. The team has used antibodies to these receptors to anchor the nanoparticles to the cornea.
“If the infection is severe, more receptors are expressed on the cornea and more nanoparticles get bound to the receptors. Since they are bound, the residence time in the eye is long; neither blinking nor tear formation washes off the nanoparticles,” says Dr. Rao, the corresponding author of a study published in the journal Nanoscale.

**Titrated cure**

The enzymes secreted by fungi breaks down the gelatine protein of nanoparticles that encapsulates the drug, thus releasing the drug. Like in the case of the receptors, more enzyme is secreted when infection is severe leading to more drug being released from the nanoparticles. “The gelatine protein acts as an alternative nutrient for the fungi. The fungi also degrade the gelatine-based nanoparticle to derive nutrients thus minimising the damage to the corneal tissue. In the process it releases the drug. In a sense, the fungi are committing suicide by consuming the gelatine protein,” says Saad M. Ahsan from CCMB and the first author of the paper.

The trials carried out on rats were encouraging on all counts.

As the residence time of the nanoparticle containing the drug is longer, the frequency of drug administration gets reduced significantly.

“In animal trials we found that application of the drug once every 12 hours was sufficient to completely clear the infection in seven or eight days,” Dr. Rao says.

As the use of antibodies on the surface of the nanoparticles makes the drug expensive, the researchers are working on designing a short peptide that can be used in place of the antibodies. They are planning to carry out one more animal trial on monkeys or rabbits before starting trials on humans.

**Promising first step in producing blood cancer drug**

Researchers at the Indian Institute of Science, Bengaluru, have synthesised a small molecule that shows a degree of promise as an anticancer agent. In particular, the inhibitor was effective against leukaemia. The work was done in collaboration with researchers from the University of Mysore.

The molecule (a benzothiazole derivative), codenamed 5g, was found to be effective in inhibiting cell proliferation in both leukaemia and breast cancer cell lines. This was achieved by arresting a particular phase (G2/M) of the cell cycle, thereby preventing cancer cells from dividing and growing in number. In the case of mouse models, the 5g molecule was able to arrest tumour growth without causing significant side-effects.

The inhibitor was able to arrest the cancer cells from proliferating by elevating the levels of intracellular reactive oxygen species (ROS), which, in turn, causes DNA damage by breaking the DNA’s double-strands. The molecule also activated the cell death pathway when higher concentration was used. However, the molecule did not cause any damage to normal blood cells. The results were published in the journal Scientific Reports.

“Depending on the dosage, the molecule can either kill or cause DNA damage thus arresting normal cell cycle, or allow the cells to repair the DNA double-strand breaks and revert to normal cell cycle [at lower concentrations],” says Dr. Sathees C. Raghavan from the Department of Biochemistry at IISc and the corresponding author of the paper.

“At this point we don’t know how exactly the 5g molecule is inducing ROS inside the cells. However, it is well established that elevated levels of ROS damage the DNA,” says Dr. Mahesh Hegde from the Department of Biochemistry at IISc and the first author of the paper.

At a dosage of 50 micromolar, about 70% of leukaemia cells were killed, compared with 25% of normal blood cells. This suggests that the 5g molecule could be “less toxic” to normal cells compared with cancer cells. “The 25% cell death was observed when we cultured normal cells in the lab. However, animal studies did not show significant changes in blood parameters, kidney function and liver function tests,” clarifies Dr. Hegde.

Even when the dosage was reduced to 10 micromolar, the molecule was able to arrest the cell cycle, particularly after 36 hours of treatment. However, at the end of 48 hours, the cells were either dead or repaired their DNA damage and proceeded with normal cell cycle of division and proliferation.

A majority of the cancer cells were killed but some reverted to normal cell cycle. The reason for this is not known. “Although the molecule is good, we are trying to synthesise derivatives so that they are effective even at a lower dosage. Right now, a relatively high concentration of about 10 micromolar is required to kill leukaemia cells,” says Dr. Raghavan. “In the case of non-leukaemial cells, even higher concentration (10-30 micromolar) is required.”

In mouse models, the molecule was able to arrest cancer cells’ cell cycle when 60 and 120 mg per kg of body weight dosages were used. Also, “significant” reduction in tumour volume and “moderate” increase in life-span were observed when treated with 60 mg per kg of body weight dosages.
Novel compound inhibits lung cancer growth in lab studies

A novel organic compound synthesised by a group of scientists from University of Madras, IIT Madras and Sri Ramachandra University, Chennai, has shown it can inhibit the growth of cancer cells by inducing programmed cell death. The alkaline compound (glycopyrrolidine) derivative was tested using various assays and found to be toxic only to the cancer cells and not healthy cells. The results were published in the journal Cancer Investigation.

More than 40 compounds were created using simple starting chemicals such as glucose and proline (an amino acid) and their activity were tested against cancer cells. The compound that exhibited maximum activity at minimal concentration was selected and named RP-RR-210. The effect of the compound was studied on lung and pancreatic cancer cells. “The incidence of pancreatic cancer is increasing in India, and there is a need for new drugs as the available drugs are highly toxic to normal cells and do more damage to the body than killing the cancer cells. Our study focussed on killing tumour cells effectively without damaging the healthy cells,” says Dr. Ganesh Venkatraman, professor at the Department of Human Genetics, Sri Ramachandra University, and co-author of the paper.

The compound showed prominent growth inhibition on cancer cells but only 10-20% growth inhibition in normal cells. Cancer cells treated with this compound shrank in size, while no morphological changes were seen in healthy cells. The researchers identified the mechanism of cell death, which was brought about by arresting the cell cycle.

Prevents spread

“Another interesting and important finding from our study is that the compound inhibited spread of cancer cell to other organs. This becomes significant as the compound not only killed pancreatic and lung cancer cells at low drug concentrations but also inhibited their migration or movement,” Dr. Venkatraman says.

Further confirmatory tests were carried out by checking the level of proteins causing cell death. The compound-treated cells showed increased level of proteins that cause cell death and reduced level of proteins that prevented cell death.

“The biggest advantage of the compound is that it is made with easily available starting materials. The compound is non-toxic with no side effects, as it acts like bait for the cancer cells alone. It is readily soluble in water and can be easily absorbed by the body,” says Dr. Ragavachary Raghunathan, professor at the Department of Organic Chemistry, University of Madras, and co-author of the paper.

The researchers propose to carry out further studies to fully understand the anti-tumour properties of the compound and carry out preclinical trials on mice models.

‘Photosynthesis can save hearts’

Stanford University scientists have found that using blue-green algae and light to trigger photosynthesis inside the heart could help treat cardiac disease, the top cause of death globally.

Researchers injected a type of bacteria into the hearts of anaesthetised rats with cardiac disease. Using light to trigger photosynthesis, they were able to increase the flow of oxygen and improve heart function.

“The beauty of it is that it’s a recycling system,” said Joseph Woo of Stanford University. “You deliver the bacteria, they take up carbon dioxide, and with energy from the light, they form oxygen,” Mr. Woo said.

The genesis of this somewhat mind-boggling concept sprang from scientists searching for new ways to deliver oxygen to the heart when blood flow is restricted, Mr. Woo said. This condition, known as cardiac ischemia, is most often caused by coronary artery disease.

“In nature, humans exhale carbon dioxide and plants convert it back to oxygen. During a heart attack, the muscle is still trying to pump. There’s carbon dioxide but no oxygen,” explained Mr. Woo.

“We wondered if there were any ways to use plant cells and put them next to heart cells to produce oxygen from the carbon dioxide,” he said.

Researchers first tried grinding up spinach and kale and combining each with heart cells in a dish, but the chloroplasts — the photosynthetic organs — of those plants combing each with heart cells in a dish, but the chloroplasts — the photosynthetic organs — of those plants...
were not stable enough to survive outside of the plant cell. **Stable structure**

Next, they tried photosynthetic bacteria, referred to as cyanobacteria, or blue-green algae, since it has a more rugged structure necessary for living in water. They repeated the same tests to see whether these photosynthetic bacteria had the ability to survive with heart cells in a dish.

The next round of experiments involved injecting the cyanobacteria into the beating hearts of anaesthetised rats with cardiac ischemia. They then compared the heart function of rats with their hearts exposed to light (for less than 20 minutes) to those who were kept in the dark. “The group that received the bacteria plus light had more oxygen and the heart worked better,” Mr. Woo said. The bacteria dissipated within 24 hours, but the improved cardiac function continued for at least four weeks, he said.

The researchers plan to investigate how to apply this concept to humans and how to deliver a light source to the human heart. They are also examining the potential of using artificial chloroplasts to eliminate the need for bacteria.

**Hyderabad team grows miniature eyes using stem cells**

Researchers at the Hyderabad-based LV Prasad Eye Institute (LVPEI) have successfully grown miniature eye-like organs that closely resemble the developing eyes of an early-stage embryo. The miniature eyes were produced using induced pluripotent stem (iPS) cells. The iPS cells are produced by genetically manipulating human skin cells to produce embryonic-like stem cells that are capable of forming any cell types of the body.

Small portions of the corneal tissue were separated from the miniature eyes and used for growing corneal epithelial cell sheets in the lab. Such tissue-engineered cell sheets can potentially be used for restoring vision in patients whose limbus region of the cornea is damaged in both the eyes. The limbus region of the cornea contains stem cells, and chemical or thermal damage to this region affects corneal regeneration and results in vision loss. Stem cells present in the limbus region of a healthy eye have been used for restoring vision when only one eye is damaged. But when the damage is present in both eyes, the only way to restore vision is by using the healthy limbus taken from a related or unrelated donor. Patients have to be on immunosuppressants lifelong when limbus is transplanted from donors. However, immunosuppressants are not required when corneal cells grown using the patient’s own skin cells are used for restoring vision.

**Growing eye-like organs**

A team led by Dr. Indumathi Mariappan was able to grow complex eye-like organs in the lab by allowing the cells to organise themselves in three dimensions. The miniature eye closely resembles the developing eyes of an early-stage embryo. The eye-like structure consists of miniature forms of retina, cornea and eyelid. The results were published in the journal Development.

“It took about four–six weeks for the eye-like structure to form from iPS cells. We then removed the cornea-like structure for further study,” says Dr. Mariappan from the Centre for Ocular Regeneration at the LV Prasad Eye Institute and the corresponding author of the paper.

The cornea has three layers — epithelium (outer layer), stroma (middle layer) and endothelium (inner layer). “All the three layers of the cornea were observed, indicating that the mini cornea had developed correctly,” she says. “The cornea initially forms as a simple bubble-like structure which is very delicate to handle. It later matures to form a thick cornea-like structure over a period of 10–15 weeks.”

The corneal epithelial sheets that would be used for treating the damaged eyes were then grown in the lab using small pieces of the mini cornea containing the epithelium and a portion of the stroma. The stem cells present in the tissue pieces proliferated and gave rise to a uniform sheet of epithelium of about 2.5 cm by 2.5 cm size.

**Animal trials**

The team is currently focusing on testing the usefulness of the corneal cells grown from iPS cells in restoring vision in animal models (rats). “We will soon be starting the animal experiments,” she says. Trials on human subjects will be considered if the animal experiments turn out to be safe and effective in restoring vision.

**In treatment**

In parallel, the researchers are also working on producing mini-retinal tissue and actively exploring iPS cell-derived retinal tissues for treating several retinal diseases such as age-related macular degeneration (AMD), retinitis pigmentosa and certain forms of congenital blindness seen in children and young adults. Already, retinal cells grown using human embryonic stem cells and iPS cells are being tested in clinical trials in a few countries to treat retinal diseases.
A new weapon to fight mosquito bites: light

Exposing malaria-spreading mosquitoes to just 10 minutes of light at night may suppress biting and manipulate their flight behaviour, scientists say.

Critical behaviours exhibited by the Anopheles gambiae mosquito — the major vector for transmission of malaria in Africa — such as feeding, egg laying and flying, are time-of-day specific, including a greater propensity for night-time biting.

Insecticide-treated bed nets and walls have helped prevent bites and reduce malaria, but researchers say mosquitoes are adapting to preventive conditions, leaving adults and children vulnerable in the early evening and early morning hours — when they are not under the nets or in the house.

“Most remarkable is the prolonged effect a short light treatment has on their preference to bite, with suppression lasting as long as four hours after the pulse,” Mr. Duffield said. “This may prove to be an effective tool that complements established control methods used to reduce disease transmission.”

Pulses of light would probably be more effective than constant exposure as the mosquitoes would be less likely to adapt to light presented in periodic doses, researchers said.

‘Super-efficient energy category to be new norm’

The recently-released Energy Conservation Building Codes can save as much as 50% of conventional energy consumption, Bureau of Energy Efficiency (BEE) director general Abhay Bakre said in an interview. However, the decision to make the Codes mandatory lies with the States and not the Centre, he added. The BEE is also working on a ‘super-efficient’ category of appliances that save even more energy than the highest-rated five-star appliances.

Excerpts:

How does one reconcile the huge energy demand in India with the need to also save energy?

On the one side, we have a very clear roadmap for the economy, and on the other hand we have a clear objective in terms of electricity and energy.

In terms of electricity, we have a very definite programme that it has to reach every household. That means there will definitely be an increase in demand. On the other side, the economic development and growth will again increase energy demand, including electricity demand. But we have to match the supply. So, not only do we have to increase supply, but also whatever new demand that is coming up, we want it to be as optimised as possible, as efficient as possible. So, in new homes, buildings, factories, they should have energy efficient appliances like LED lighting, and very efficient ACs.

So, even though the size of energy demand is increasing, we want it to be efficient so that the overall demand is not as high as expected.

The BEE introduced the star-rating system for energy efficiency in appliances a few years ago. How is it evolving? We can broadly categorise this into three different phases. The first phase was in 2006-10, when pieces of equipment were first put into the star labelling band. Many manufacturers at the time were not even manufacturing one-star rated appliances. So, they were brought into the star-rated category. In a complementary manner,
consumers started gaining awareness that they should go for star-rated appliances. So that increased the demand, which increased the attraction for the vendors and manufacturers to increase their share of star-rated products. That has [brought] the market and the manufacturing into the star-rating system.

The second phase was increasing customer awareness even more. They had to believe that investing in a star-rated appliance was worth it. Instead of going for one-star and two-star, consumers began demanding four-star and five-star appliances. This, again, induced the vendors to stock more four-star and five-star appliances. By 2014-15 or so, we came to a situation where the one-star and two-star appliances were wiped out.

In the last three years, we have come out with an even more efficient category. The four-star and five-star of a few years ago have become one-star and two-star now. Now there are vendors aspiring for the new four-star and five-star appliances. The new phase is that we are moving towards new ‘super-efficient’ equipment, which is beyond five-star. If there is ACs, LED lamps, and even ceiling fans that are more efficient than five-star, then they will be deemed super-efficient. We haven’t worked out a rating for them, but we have begun calling them super-efficient.

We are at international levels in terms of the energy efficiency of some of these appliances.

Biological E in vaccine tie-up with Takeda
Japan’s Takeda and Biological E. Ltd. have agreed to collaborate on affordable combination vaccines. Takeda will transfer its measles and acellular pertussis vaccine bulk production technology to BE under license, the firms said on Monday. It would also provide support for production and quality control and technical assistance in preclinical study design and production of clinical and first commercial batches.

BE gets the rights to use Takeda’s measles and pertussis vaccine technologies for combinations such as MR vaccine as well as any pertussis-containing combination, and will be solely responsible for conducting and funding the development activities.

BE will commercialise the vaccines in markets including India and China.

The tie-up gives BE an opportunity to diversify its geographic reach, Managing Director Mahima Datla said. "We look forward to contributing to the measles elimination goals and protection against rubella.”

Cholesterol-cutting vaccine shows promise
A cholesterol-lowering vaccine has shown promise in mice, said researchers who announced they had started early-phase trials to see if it also works in humans.

Such a treatment could offer a welcome alternative to statins, the main pharmaceutical choice today for lowering cholesterol in people at high risk of heart attack or stroke.

The vaccine, dubbed AT04A, reduced cholesterol levels in trial mice by half, and reversed damage done to blood vessels due to plaque build-up by more than 60%, researchers said in a statement.

Fatty diet
The mice were given the vaccine after they were fed a fatty diet to resemble the high-cholesterol intake of a human Western-style diet.

“Levels of cholesterol were reduced in a consistent and long-lasting way,” said study co-author Guenther Staffler of the AFFiRiS biotech. This resulted in “a reduction of fatty deposits in the arteries and atherosclerotic damage, and reduced arterial wall inflammation.” Atherosclerosis occurs when a waxy compound lines blood vessel walls, limiting blood flow and potentially triggering dangerous blood clots.

Statins have been used for about 30 years to bring down “bad” LDL cholesterol blamed for such deposits. But conflicting reports on statins’ benefits and harms have made headlines in recent years, prompting some people prescribed the drugs to stop taking them.
INDIA URGENTLY NEEDS A DATA SECURITY POLICY

Amid the ongoing debate over data security and focus on connectivity in the country, V.C. Gopalratnam, senior vice president, IT and CIO—International, Cisco, in an interview shares his perspective on the issues, highlighting that India needs to accelerate the development of a security policy. “In my opinion, it was probably needed yesterday. It is that urgent,” he said. Excerpts:

You mentioned that security today dominates any conversation that you have with companies...

If you look at the world today, there is so much information being generated. So much data is being exchanged. Naturally, there are questions about what is happening to this information, which is using this and for what purpose. It is natural that security is at the forefront of any conversation.

The other part of the security is that once something bad happens, it is hard to recover from that… not only from an individual's perspective but also from a company’s reputation and branding perspective. If something is hacked or you lose customer information, the trust is very difficult to get back. Therefore, it becomes imperative that organisations stay ahead of the curve and be more proactive than necessary to make sure these things don’t happen. It is critical to the survival of the organisation.

Second, with the global model, boundaries are disappearing between countries and between companies… with the cloud everywhere. No one has figured out a holistic information security policy because it’s just too complicated. Every country is at various levels of security. The U.S. and Australia, for example, have minimum viable guidelines for security which are national security policies. We don’t have that here. It is still in the process of being developed and we need to accelerate it.

How urgent is this?

It was probably needed yesterday. It is that urgent. Any asset that can be linked to a human being can be protected through passwords. For example laptop, mobile device, bank account… these can be for identity and access management. But things that cannot be tied to human beings are also connected to the Internet like a car or a plane or an assembly line. There are no standards for security for all of those things. That is the world of OT (operational technology). The world of IT (information technology) is OK.

Then we talk about IoT (Internet of Things) which is an intersection of IT and OT… In the world of IoT, without security standards for 90% of the assets which are non-human connected, we have a problem. IoT cannot become real.

What key points should the policy cover?

The policy clearly needs to address standards around identity and access management. It needs to address issues around data storage and data sovereignty. It needs to address standards on encryption. It should also talk about… when you are developing products, how you should test the products to make sure they are robust, particularly in the telecom space.

India imports a lot of hardware. What standards are needed there?

Conversations are going on between the private sector and the public sector. Cisco has also been part of those conversations… it is the establishment of common criteria. For products brought into India and sold here, the question is whether those products need to be tested in India or if they can be tested by an accredited organisation outside India. The government is working with a cross-disciplinary team to establish common criteria required before any company can sell its product here.

You are working on a project to reduce poaching of rhinos in South Africa. Is there something you are working on with the Indian government, too?

We have started conversations with the government but they haven’t progressed much… These conversations are around wildlife conservation and sustainability.

How difficult will it be to implement in India?

It will be difficult because connectivity is not pervasive and [reliable]. If you go into the middle of Gir forest or Ranthambore, you are not going to necessarily get the connectivity you want. You can use satellite but that’s expensive and slow. Connectivity is the building block. The challenge is also that, much like the U.S., the central government is one party and the state government is another party. So who drives the agenda? …Connectivity to every corner of India is not something that a private sector can do on its own.

What skills are companies looking at today?

New skills obviously include data science. It is a big thing.
There isn’t enough data scientists. Then there is security...security architects, cloud architects... there is an abundant shortage of those skills. In infrastructure, we are looking at network architects, virtualisation specialists etc. Strangely enough, the number one skill set looked at around the world today is psychology. Because you need to understand the human psyche as everything today is about experience and a lot of companies are investing in psychologist and user experience.

**GOOGLE UNVEILS NEURAL TRANSLATION TECHNOLOGY**

Google said it had unveiled a new set of products and features for Indian languages to better serve the needs of Indians who were coming online rapidly.

It said Google Translate will use a new ‘neural machine translation technology’ to translate between English and nine widely-used Indian languages, including Tamil, Kannada, Malayalam, Telugu, Hindi, Punjabi, Bengali, Marathi and Gujarati. "We’re taking a huge step forward to bring down barriers that stop Indian language users from getting more out of the Internet and helping the industry to solve the needs of a billion Indians,” said Rajan Anandan, VP, India and South-East Asia, Google.

Sharing insights from the joint report “Indian Languages — Defining India’s Internet”— by Google and KPMG India, Mr. Anandan said the country had 234 million Indian language users who were online compared with 175 million English users. “We expect another 300 million Indian language users to come online in the next four years.”

Google also announced the extension of neural machine translation to Chrome browser’s auto-translate feature to web content.

**A ROBOTIC SYSTEM THAT 3D PRINTS BUILDINGS**

MIT scientists have designed a new robotic system that can 3D print the basic structure of an entire building, an advance that would make building houses a faster, less expensive process.

The building could be completely customised to the needs of a particular site and the desires of its maker. Even the internal structure could be modified in new ways, researchers said.

Different materials could be incorporated as the process goes along, and material density could be varied for optimum combinations of strength, insulation, or other properties.

**Precision-motion arm**

"Ultimately, this approach could enable the design and construction of new kinds of buildings that would not be feasible with traditional building methods, according to Steven Keating, from the MIT.

The system consists of a tracked vehicle that carries a large, industrial robotic arm, which has a smaller, precision-motion robotic arm at its end. This highly controllable arm can then be used to direct any construction nozzle.

**APPLE’S ‘HOMEPOD’ SPEAKER TO TAKE ON AMAZON, GOOGLE**

Apple will later this year release a ‘HomePod’ music-centric smart home speaker, challenging a market currently dominated by Amazon and Google in its latest move to weave deeper into people’s lives.

HomePod, aided by Apple’s Siri digital assistant, will be priced at $349 when it begins shipping in December in the United States, Australia and Britain, the tech giant announced at its annual Worldwide Developers Conference.

“We really believe it is going to take your home music experience to the next level,” Apple chief executive Tim Cook said as he unveiled it.

HomePod will take on lower priced Amazon Echo and Google Home, which have had momentum in the arena of voice-controlled speakers capable of controlling smart appliances, fetching content from the internet and more.

It is designed to work with the Apple Music subscription service and can produce rich sound while tapping into the artificial intelligence power of Siri.

Apple Vice-President Phil Schiller said the company’s Siri team had tuned the assistant into a “musicologist” that learns the tastes of listeners and gets songs from the Internet cloud.

The speaker has the “power to rock the house,” according to Mr. Schiller, and the aim is to make HomePod a potent assistant for news, messages, weather, traffic, home controls and more.

HomePod capped a keynote presentation that included updates to Apple’s iPad and Mac laptop lines, and upgraded operating software enabling augmented reality for iPhones and iPads.

**Playing to strength**

Analysts said Apple is playing to its strength in the music industry by focusing on sound quality and its catalogue of songs.

“Apple is smart to frame the HomePod as a music-centric and audio-centric device rather than just another smart speaker or another home for Siri,” said Jackdaw Research analyst Jan Dawson. “The fact that Apple is claiming to marry really great and smart audio with a smart...
assistant and cloud music service makes this device unique in the market.” Some industry insiders, however, note Apple will be under more pressure to improve the computing smarts of its Siri software in the face of offerings from rivals Google and Amazon.

Apple has given Siri new male and female voices, described as more natural and expressive, and added abilities such as translating English phrases into Chinese, French, German, Italian or Spanish. Apple said it is also using ‘on-device learning’ to enable Siri to take people’s tastes into account.

Amazon has dominated the connected speakers category since 2014 when it introduced its first Echo, which responds to voice commands and allows users to order goods and control connected appliances.

**Macs and iPads**

A survey released last month by research firm eMarketer found Echo speakers held 70.6% of the U.S. market, compared with 23.8% for Google Home.

Mr. Cook also used the Apple keynote to show off new iPad and Mac computer models, as well as provide glimpses at coming versions of the software powering the technology titan’s devices.

Apple senior Vice-President of software engineering Craig Federighi said the next Mac operating system will be named “High Sierra” in tribute to the California mountain range.

High Sierra features will include being able to stop unexpected videos from starting to play automatically when landing on web pages and ‘intelligent tracking prevention’ that will prevent ads from following people about the internet. High Sierra will be released later this year as a free update, according to Mr. Federighi.

Along with upgraded versions of iPad and Mac laptops, Apple unveiled an iMac Pro work station that had the computing built in behind the screen and was touted as the most powerful computer the company has ever made. Aimed at high-end design professionals rather than the home market, the iMac Pro is to begin shipping in December with a starting price of $4,999.
DEFENCE

QUICK REACTION SURFACE-TO-AIR MISSILE TEST-FIRED
India successfully test-fired an indigenously developed quick reaction surface-to-air short range missile from Chandipur along the Odisha coast. The missile, which has a strike range of 20 to 30 km, is capable of engaging multiple targets.

NAG MISSILE TEST-FIRED
The Defence Research and Development Organisation (DRDO) successfully test-fired the third generation Nag Anti-Tank Guided Missile (ATGM). “The successful flight test of 3rd generation ATGM Nag further strengthens the country’s defence capabilities,” Sateesh Reddy, Scientific Adviser to Defence Minister, said. The fire and forget ATGM incorporates imaging infrared radar seeker with integrated avionics, the DRDO said in a statement.

NEXT BIG INDO-ISRAELI DEFENCE PROJECT: UNMANNED HIGH ALTITUDE COMBAT DRONES?
India will start taking deliveries of its first High Altitude Combat Heron TP Drone from Israel at around the time when Indian Prime Minister Narinder Modi will be visiting Tel Aviv to conclude multi-billion $ deal for Medium range Surface-to-Air missile which was jointly developed by Israeli IAI and India's DRDO.

Isreali Defence Analyst while speaking to i24NEWS said that after concluding first Joint-Defence venture between two countries, and India and Israel are likely to set a stage for next big defence project to develop jointly Unmanned High Altitude Combat Drones.

Indian Government has expressed its desires to acquire 100 + Combat drones from the United States for last few years but due to noncommittal issues and strict export guidance of United States, little headway has been made on Indian request, while Indian development of arming locally developed drones will take another decade or more. The export variant of 4.5-ton Heron TP can carry only 500kgs of payload and have limited range and India decided to procure only 10 such drones from Israel after Indian Army carried out cross-border surgical strikes in Pakistan occupied Kashmir against Pakistan-sponsored Terrorist locations.

Indian Special Forces after their mission had put forward need for Drones which has the ability to conduct long-range, high-risk bombing missions and also which can be used to provide prestrike information on targets, to eavesdrop on electronic communications and to send battle damage assessments back after an attack.

United States inability to supply India with such High Altitude Combat Drones and slow local Indian drone developmental programs would be one of the reasons why India and Isreal might work together for the joint development of Unmanned High Altitude Combat Drones.

Isreali Companies are keen on Jointly developing new drones in India as per needs of Indian Armed forces and have shown their willingness to tie up with both Public-Private Defence Sector companies in India.

Source: idrw.org

WHY CHINA CANNOT AFFORD A WAR WITH INDIA RIGHT NOW

Chinese Media and Chinese Diplomatic circle have been on the offensive lately after Tibetan Spiritual Guru Dalai lama recently visited Tawang region in Indian State of Arunachal Pradesh which China claims Historically belonged to Tibetan region, a claim not backed by Tibetans them self.

China for long without even firing a shot after 1962 Sino-India war was able to keep New Delhi on back-foot almost on all issues ranging from boundary disputes to India’s acceptance of One China policy but change of guard in 2014 saw new policy shift by New Delhi, where India is seen more keen on engaging a regional bully rather than keeping quiet.
No matter how angry or furious China is on India, it’s now more or less assured that other than economic and diplomatic retaliation, China cannot afford to punish India even with small-scale border conflict to put India on backfoot for various reasons singed out below.

Korean Peninsula: War of words between North Korea and the United States is heating up due to continuous missile and nuclear test by North Korea leaving Trump administration furious. China is the only country which has some leverage left with Pyongyang to avoid serious military conflict in the region and One miscalculated step in the region, China will be staring at a war which might be forced on them if things escalate fast in the region.

South China Sea: Chinese military offensive in the South China Sea, is been monitored closely by many countries in the region. While China wants to enforce its claims on others instead of negotiation will keep the region a hot zone for potential military conflict in the region.

CPEC: China–Pakistan Economic Corridor is one of the vulnerabilities which Chinese Military planners are adamant to safeguard their investment in the region and want India to join CPEC initiative to keep India in the loop , but Chinese are also worried that too much heat on India in terms of economic and diplomatic retaliation will mean India will try to sabotage its CPEC initiative. Any Small scale border conflict will monitored closely by India is forced to target China’s CPEC investment which ever way it can afford to, in an attempt to get the project derailed.

Chinese Economy: China knows that its economy is slowing down no matter how many times it will try to come up with fudged numbers to claim it is still on right track. India has been on of its key markets in the region, China can ill afford to have a small scale border conflict at this stage of the economic situation.

Indian Military: Modernized and Battle trained Indian Military will not be easy to achieve any small military objective in the region like in 1962 war. India has been shorting up its forward bases near adjacent to the Chinese border to hold on and also plan counter offence in case Chinese military turns adventurous in the region.

Indian military is in a better position to hold its ground this time and fight a longer war which Chinese military won’t like and Chinese military planners will also be wary of conflict becoming larger or escalate faster leading to full-scale war which might see the involvement of the United States and Russia.

Source: idrw.org

DEVELOPMENT OF INDIGENOUS

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in Pakistan nervous. Split between Terror groups will mean a loss of direct control over them and infighting will only lead to varying fractions tipping of each other positions and man to security forces.

Pakistan and Hurriyat Conference wants to keep terrorism in Kashmir as a local uprising against the Indian Republic since it suits their narration in the International community but ISIS dimension or Islamic caliphate dimension in Kashmir will ensure that International community will be least interested in Kashmir issue due to rising attacks in Europe and America by Islamic Jihadists in their own country.

Change of narrative from Kashmiriyat to Islamic Terrorism is actually good for India, Since it will be easy for India to unmask this ingenious uprising claim which has been peddled for over 70 years now by Pakistan and paid stooge of Pakistan in Kashmir.

Kashmiriyat or Kashmiris are not superior breeds of people who require individual identity which entitles them to superior privileges over other regular Citizen of India. Extra privileges granted under Article 370 and under other state regulations will need to be withdrawn one step at a time so that demography change which Kashmiris fear the most can be initiated.

Modi is fully aware that no amount of talks with Separatist or Pakistan will lead to a change of Status of Chaos in Kashmir and no amount of welfare schemes or development will ensure loyalty towards India. for a solution to emerge Kashmir will need more Chaos for India to make inroads to ensure that the state is fully integrated into the Indian Union.

Source: idrw.org
Rejigged cotton project on the anvil: Textile Commissioner

In an effort to give a thrust to the cotton sector, the Textile Ministry is looking to introduce a revamped Technology Mission on Cotton, Textile Commissioner Kavita Gupta told The Hindu. The office of the Textile Commissioner would send a draft on the revamped project to the Textile Ministry in a couple of months. “We have had a series of meetings with stakeholders and researchers,” Ms. Gupta said.

Four parts
“We will propose it to the Ministry. The mission will have four parts. The first two will deal with cotton productivity and will come under the Agriculture Ministry. The third and fourth missions will be under the Textile Ministry.”
A Technology Mission on Cotton was implemented by the Union Government from 2000 to 2012 and it had four “mini missions.” India is now the largest producer of cotton globally.

“There is a need for a revamped Technology Mission on Cotton as the country needs to adopt global standards and focus on quality,” said J. Thulasidharan, president of Indian Cotton Federation. Ms. Gupta added that apart from this, in order to get a clear picture on production and capacity of various segments in the textile value chain, the Ministry has now made annual and monthly filing of data mandatory.
All units from ginning to garmenting will have to file data on quality and quantity. Till October, this can be done manually or online and from October it can be done only online.
The annual data will give the profile of the unit and the monthly information will give a clear picture on production of various textile products. “This is filed by the industry and for its benefit. It will help the Government come out with the right policy interventions,” she said.
The system is simplified for the MSMEs and for the very small units, a survey will be done, she added.

Private Banks’ rate cuts slower: RBI data

While the median benchmark lending rate of commercial banks have fallen 90 basis points (bps) to 8.55% since April last year, the median rate of private banks has fallen by 70 bps from 9.8% to 9.1%, latest data released by Reserve Bank of India (RBI) showed.
The median rate for the one year marginal cost of fund based lending rate (MCLR) of public sector banks that accounts for 70% of the market, fell by 90 bps from 9.50% to 8.60% between April 2016 and May 2017, according to the data.
Foreign banks’ median rate was the lowest in May 2017, at 8.55%, and came down from 9.45% in April 2016. State Bank of India, the country’s largest lender, reduced its one-year MCLR by 120 bps to 8%, while ICICI Bank, the country’s largest private sector lender, lowered it by 100 bps to 8.20% in the last one year.
The MCLR regime came into effect on April 1, 2016, replacing the earlier base rate regime.
All the loans are linked to MCLR rate. Most loans are linked to one-year MCLR. Since April 2016, RBI has reduced the key policy rate or the repo rate by 50 bps to 6.25%.
Since January 2016, the policy rate has been reduced by 175 bps.
RBI has been prodding banks to enable monetary transmission by lowering lending rates. After demonetisation, banks cut the MCLR sharply in January, as their cost of funds fell.

Japan’s NEC to invest $10 million in 3 years

Japanese technology giant NEC, which announced a new Centre of Excellence in India, said it will be investing $10 million over the next three years in the country, while targeting revenues of $100 million during the same period.
The Centre of Excellence in Noida will work on building Big Data and analytics solutions for clients across sectors such as banking and financial services (BFS), telecom, retail and the Government. The company said Centre of Excellence will not only focus on the India market, but also cater to Japan, Singapore, Philippines and Hong Kong. “Then gradually expand services throughout APAC and other regions,” according to a company statement.
The Centre of Excellence will help NEC leverage India’s strong talent base, the company said. It plans to employ about 100 professionals within the first few years, as the Global Big Data & Analytics market is expected to reach $210 billion by 2020. “The key to success for organizations today is to make fast and informed decisions by extracting insights out of the huge volumes of data that are available to them,” Tomoyasu Nishimura, Senior Vice
President, NEC Corporation said.

India’s textile heritage showcased online

Google’s “We Wear Culture” project includes digitised exhibits from Indian institutions too. “You might be surprised to find out that your sari, jeans or the black dress in your wardrobe has a century-old story. What you wear is true culture and, more often than not, a piece of art,” Amit Sood, director of Google Arts and Culture, said in a statement.

The project includes collections from Chhatrapati Shivaji Maharaj Vastu Sangrahalaya (CSMVS) and varied weaves from across India, from Gharchola to Patola to Temple to Ikat styles, as it traces the story and importance of Indian textiles, the company said.

Tribal designs

It showcases designs from north-eastern India, including the weaves of the Nagas, Meiteis and traditional attire from Meghalaya called ‘Dhara’ or ‘Nara’ worn by the Khasi women. The virtual exhibits can be viewed on the project website or through the Google Arts and Culture app.

Making a pitch to young users, the website features YouTube personality Ingrid Nilsen in short videos, in which she explains the evolution of the various garments and jewellery.

Joint framework

In this regard, she said the MoU on joint framework for parliamentary support and capacity building is a “visionary step forward”, according to a statement issued by the Lok Sabha Secretariat.

She said the Parliament of India accords great importance to the steady development of parliamentary relations between the two countries. Ms. Mahajan said the relations between the two countries are based on centuries of cultural, linguistic, social and spiritual links that transcend extraneous considerations.

More than political and other considerations, it is the commonality between the two societies and depth and nature of their people-to-people contacts which provide a platform for the sustained growth of friendship and partnership, she said.