

Blame it on the genes

About 35 to 40% of Indians carry a set of genetic variations which puts them at a higher risk of heart disease, finds a new study.

A team of Indian researchers at IIT-Madras (and in a collaborative effort) have discovered that carriers of a set of genetic variants in the chromogranin A (CHGA) gene called 'CHGA promoter haplotype2' may be at higher risk for cardiovascular and metabolic disorders. An estimated 35 to 40% of Indian population may be carrying this genetic variant. The study is based on analysis of genomic DNA samples from over 750 individuals in the Indian population. The research findings have been published in the *Journal of Biological Chemistry*. Though the CHGA promoter haplotype is present in other ethnic populations, it occurs more frequently in populations of South Asian ancestry.

"It is a protein of neuroendocrine origin and is secreted along with hormones like catecholamines. Earlier studies had suggested its role in regulation of cardiovascular and metabolic diseases but there was no data about it in South Asian populations," says Lakshmi Subramanian, first author of this paper.

"We studied genomic DNA of Indians and discovered a specific set of changes in the CHGA gene sequence called haplotype2 which contributed to increased CHGA gene expression, and ultimately increased CHGA protein levels in plasma. When the clinical parameters of those in the study were compared, haplotype2 carriers displayed higher levels of metabolic and cardiovascular traits like plasma glucose, blood pressure and body mass index," explains Dr. Nitish R. Mahapatra, professor at IIT-Madras.

Validation needed

However, he adds, these results need further validation in animal models as well as large-scale studies in individuals with metabolic syndrome. "We hope these findings would help unravel biological pathways and mechanisms underlying these complex diseases and would help in the development of therapeutic as well as preventive strategies," says Dr. Mahapatra. "Basic research in cardiovascular biology is at a very nascent stage in India with only a handful of researchers working in this field. This new study significantly contributes towards understanding molecular basis of cardiovascular and metabolic diseases. This is a fast emerging area with tremendous therapeutic and diagnostic potential," says Dr. Shyamal K. Goswami, a professor at School of Life Sciences, Jawaharlal Nehru University, who is not connected with the study. — India Science Wire

Lifestyle-related risk factors are being cited, compounded by an inadequate number of treatment centres in the region

Without policies to stop the worrying spread of antimicrobial resistance, the mortality rate could be disturbing

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A rapid test to diagnose Zika and dengue

An international team, including researchers from India, has developed a low-cost, rapid diagnostic test for diagnosing Zika and dengue viruses and differentiating the four serotypes of dengue virus. None of the rapid tests available is capable of differentiating the four dengue virus serotypes.

While many diagnostic tests cannot strictly distinguish between Zika and dengue infections, the test has nearly 100% ability to distinguish between the two virus infections. *Science Translational Medicine* published the results.

The diagnostic test has nearly 76-100% sensitivity and specificity in the case of dengue, while the sensitivity is 81% and specificity 86% in the case of Zika. "Since the antigens specific to dengue and Zika viruses are identified, there will be no cross-reactivity leading to wrong diagnosis," says Dr. Guruprasad Medigeshi from the Translational Health Science and Technology Institute in Faridabad and one of the authors of the paper.

The researchers injected specific flavivirus nonstructural 1 (NS1) proteins produced by Zika and dengue viruses into mice to generate monoclonal antibodies. They identified pairs of antibodies that can specifically detect and distinguish each of the four dengue serotype NS1 proteins as well as the Zika NS1 protein. They took the antibody pairs and coated each antibody on a strip of chromatography paper at two different spots. One of these antibodies was attached to gold nanoparticles.

"When a serum sample from a patient is added on the chromatography paper where the antibody is spotted, the antigen present in the serum binds to the first antibody. Since it is paper, the antigen bound to the antibody diffuses and comes in contact with the second antibody. The second antibody too binds to the antigen leading to the formation of colloidal aggregates, which then forms a pink spot," says Dr. Medigeshi. A pink spot appears on the strip within 20-30 minutes after the second antibody binds to the captured antigen.

The appearance of the pink spot indicates positivity to either Zika virus or dengue virus. And in the case of a serotype test, it indicates the respective dengue virus serotype.

"Since each pair recognises a particular serotype, we need four strips for dengue serotyping and one strip for Zika for testing each sample," he says.

The team has also developed a pan-dengue strip which indicates positivity to dengue virus without cross-reacting with Zika NS1 unlike the current kits. The strip cannot differentiate between the four serotypes.

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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Large solar storm sparks global aurora on Mars

A view of the planet Mars as taken by the NASA Hubble Space Telescope on May 12, 2016, when it was 50 million miles from Earth. | Photo Credit: [Reuters](#)

An unexpectedly strong solar storm hit Mars this month, sparking a global aurora and doubling radiation levels on the red planet, NASA scientists say.

The solar event on September 11 sparked an aurora more than 25 times brighter than any previously seen by the MAVEN orbiter, which has been studying the Martian atmosphere's interaction with the solar wind since 2014.

It produced radiation levels on the surface more than double any previously measured by the Curiosity rover's Radiation Assessment Detector (RAD) since that mission's landing in 2012. The high readings lasted more than two days.

"NASA's distributed set of science missions is in the right place to detect activity on the Sun and examine the effects of such solar events at Mars as never possible before," said Elsayed Talaat, programme scientist at NASA Headquarters in Washington.

Strangely, it occurred in conjunction with a spate of solar activity during what is usually a quiet period in the Sun's 11-year sunspot and storm-activity cycle.

This event was big enough to be detected at Earth too, even though Earth was on the opposite side of the Sun from Mars.

"The current solar cycle has been an odd one, with less activity than usual during the peak, and now we have this large event as we're approaching solar minimum," said Sonal Jain of the University of Colorado Boulder's Laboratory for Atmospheric and Space Physics, who is a member of MAVEN's Imaging Ultraviolet Spectrograph instrument team.

"This is exactly the type of event both missions were designed to study, and it's the biggest we've seen on the surface so far," said RAD Principal Investigator Don Hassler of the Southwest Research Institute in the US.

"It will improve our understanding of how such solar events affect the Martian environment, from the top of the atmosphere all the way down to the surface," Mr. Hassler said.

RAD monitored radiation levels inside the encapsulated spacecraft that carried Curiosity from Earth to Mars in 2011 and 2012 and has been steadily monitoring the radiation environment at Mars' surface for more than five years.

RAD findings strengthen understanding of radiation's impact on Mars habitability, a key objective of the Curiosity mission.

NASA is also using RAD findings for planning the safety of human-crew missions to Mars.

Highly energetic solar events can significantly increase the radiation that penetrates through the atmosphere to the Mars surface.

The increased radiation also interacts with the atmosphere to produce additional, secondary particles, which need to be understood and shielded against to ensure the safety of future human

explorers.

“If you were outdoors on a Mars walk and learned that an event like this was imminent, you would definitely want to take shelter, just as you would if you were on a space walk outside the International Space Station,” Mr. Hassler said.

“To protect our astronauts on Mars in the future, we need to continue to provide this type of space weather monitoring there,” he said.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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2017 Nobel Prize for Physics for gravitational waves: all you need to know

The collision of two black holes — a tremendously powerful event detected for the first time ever by the Laser Interferometer Gravitational-Wave Observatory, or LIGO — is seen in this still image from a computer simulation released in Washington February 11, 2016. | Photo Credit:

[REUTERS](#)

The prize is shared by Rainer Weiss, Barry Barish and Kip Thorne “for decisive contributions to the LIGO detector and discovery of gravitational waves.”

Dr. Weiss — born in Berlin and now a U.S. citizen — receives half the prize. The remaining half is shared equally by two Caltech scientists — Dr. Barish, Professor of Physics and Dr. Thorne, Professor of Theoretical Physics.

They are receiving the prize for the discovery of the **gravitational waves** released by violent events in the universe such as the mergers of black holes. The first time this was detected was on September 14, 2015, by the LIGO-VIRGO collaboration. Since then three more detections have been made, the **latest one** on September 28, 2017.

The discovery is due to an extremely delicate experiment. Gravitational waves were predicted by Einstein almost 100 years ago. After about 50 years of experimentation the waves were detected for the first time in September 2015.

The discovery and the repeated detection (four times now) has made the possibility of gravitational wave astronomy very real. Gravitational wave astronomy is a way of mapping out some of the most violent processes in the universe such as black hole or neutron star mergers that cannot be detected with light or the conventional methods.

The discovery can pave the way for proving the general theory of relativity, so that we can look deeper and deeper into the universe. It also throws up the possibility of detectors that can look at the beginning of the universe.

The scientists in the collaboration are from five continents, over 1,000 in number.

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Submarine Khanderi begins sea trials

Slowly but steadily, the Scorpene submarine programme is making progress. While the first submarine awaits commissioning, the second one has just begun sea trials, and Mazagon Docks Ltd. (MDL) is gearing up to launch the third vessel.

“After the monsoon, the second Scorpene *Khanderi* began sea trials last week. As per schedule, it is expected to be commissioned within this year. The third submarine, *Karanj*, is on track to be launched by the year-end,” an official told *The Hindu*. *Khanderi*, named after an island fort of Maratha ruler Chhatrapati Shivaji, was launched in January and had undergone some testing. Trials were held up by the rough sea.

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2017 Nobel Prize in Chemistry: All you need to know

Members of the Nobel Committee sit in front of a giant screen displaying the winners of the 2017 Nobel Prize in Chemistry (left to right) Jacques Dubochet from Switzerland, Joachim Frank from the U.S. and Richard Henderson from Britain on October 4, 2017 at the Royal Swedish Academy of Sciences in Stockholm, Sweden. | Photo Credit: [AFP](#)

The [2017 Nobel prize in Chemistry](#) has been awarded to Jacques Dubochet (University of Lausanne, Switzerland) Joachim Frank (Columbia University, New York) and Richard Henderson (MRC Laboratory of Molecular Biology, Cambridge, U.K.) "for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution".

For many years — in the 1970s, the electron microscope was the only way to look into the cell and observe the minute beings that play such an important role in our lives such as viruses. However, the powerful beam of the electron microscope would destroy biological material, so it was believed that such microscopy could only reveal images of dead cells and dead organisms. Also it was then impossible to view solutions as water would evaporate under the microscope's vacuum.

That was until this year's laureate Richard Henderson came on to the scene. To get the sharpest images he travelled to the best electron microscopes in the world. They all had their weaknesses, but complemented each other. Finally, in 1990, 15 years after he had published the first model, Prof. Henderson achieved his goal and was able to present a structure of bacteriorhodopsin at atomic resolution.

However the problem still remained of imaging biological molecules which got destroyed when the electron beam of the microscope was focused on them at normal temperatures.

"Cryo", short for cryogenic refers to very low temperatures. Though the actual temperature is not well defined, it is below minus 150°C. In the context of electron microscopy, it refers to the fact that the object to be imaged is frozen to such low temperatures to facilitate being studied under the beam of the electron microscope.

This method is so effective that even in recent times, it has been used to image the elusive Zika virus: When researchers began to suspect that the Zika virus was causing the epidemic of brain-damaged newborns in Brazil, they turned to cryo-EM to visualise the virus. Over a few months, threedimensional (3D) images of the virus at atomic resolution were generated and researchers could start searching for potential targets for pharmaceuticals.

The question was whether the method could be generalised: would it be possible to use an electron microscope to generate high-resolution 3D images of proteins that were randomly scattered in the sample and oriented in different directions?

Prof. Frank had long worked to find a solution to just that problem. In 1975, he presented a theoretical strategy where the apparently minimal information found in the electron microscope's two-dimensional images could be merged to generate a high-resolution, three-dimensional whole. Between 1975 and 1986, Prof. Frank succeeded in merging two fuzzy images of a molecule to get a three-dimensional image.

in 1978, Prof. Dubochet was recruited to the European Molecular Biology Laboratory in Heidelberg to solve another of the electron microscope's basic problems: how biological samples dry out and are damaged when exposed to a vacuum. The solution he envisaged was to freeze water rapidly so that instead of solidifying into a crystalline solid, it freezes into a disordered state, which is like a

glass. Though a glass appears to be solid, it is actually what is called a supercooled liquid in which individual molecules are arranged at random instead of a periodic crystalline solid structure. Prof. Dubochet realised that if he could freeze the water to form a glassy state, what is known as vitrified water, it would not dry up when excited by the beam.

In the early 1980s, Prof. Dubochet cooled water so rapidly that it solidified in its liquid form around a biological sample, allowing the biomolecules to retain their natural shape even in a vacuum. In 1984, he published the first images of a number of different viruses, round and hexagonal, that are shown in sharp contrast against the background of vitrified water.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Awestruck: on the Nobel Prize for Physics

The [2017 Nobel Prize for physics has been awarded to the LIGO-VIRGO collaboration](#) for their detection of gravitational waves arising from the merger of two black holes. Gravitational waves are ripples in the fabric of spacetime caused by cataclysmic events in the universe such as colliding black holes or neutron stars. Though extremely violent, when these disturbances reach far-off regions in space and time the signals are weak and require extremely sensitive detectors to sense them. The very first detection of gravitational waves was made in September 2015, a signal of a black hole merger 1.3 billion years ago. In other words, the signals took that long to travel to Earth. Hence the observatory offers a way of looking back in time to unravel mysteries pertaining to the early days of the universe's existence. Since then, the LIGO-VIRGO collaboration has detected such signals four times. Just as astronomy offers a way of mapping the visible objects in the universe, gravitational wave astronomy is now a science of the near future whereby black holes, neutron stars and more such objects may be mapped. Rainer Weiss, who identified sources of noise that could drown the signal, gets one-half of the prize. Barry C. Barish's main contribution in scaling up the project and Kip Thorne's vision in guiding the large group of researchers are no less important, and in fact are aspects that capture the marvel of coordination in the LIGO-VIRGO collaboration.

An example was the effort made to bring some coherence into the source modelling. Even though the detector had been built and was functional, the theory had to be developed. In order to coordinate this, Dr. Thorne invited researchers from around the globe to Caltech in the United States, and over a year and a half thought about the models of the source that had to be calculated. An ensuing paper published in *Physical Review Letters*, titled "The Last Three Minutes", described issues of source modelling. Several Indians, including Bala Iyer and Sanjeev Dhurandhar, were involved in this work. It was then that Dr. Thorne realised that numerical models of relativity that could be fed into the computer and solved were needed. He roped in groups from the U.S. and Germany to develop numerical gravity. In addition to two detectors of LIGO, the Advanced VIRGO came online on August 1 this year. The advantage of having three detectors is that the location of the source can be determined more accurately. With the Japanese KAGRA detector set to go online in 2019 and LIGO India set to join in 2024, the possibility of using gravitational wave astronomy to look back in time, at the very origin of the universe, becomes a real possibility. When realised, this operation would owe, in no small measure, to the time spent in organising and focussing, even directing, the efforts of the large group of researchers, numbering over a thousand.

Rajasthan's ordinance shields the corrupt, threatens the media and whistle-blowers

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Mysterious dimming of star caused by dust

Unusual dips in brightness shown by the mysterious Tabby's Star may be caused by an uneven dust cloud moving around the star, say scientists, debunking an imaginative theory that blames a "megastructure" built by an advanced alien civilisation for the phenomenon.

Called KIC 8462852, also known as Boyajian's Star, or Tabby's Star, the object has experienced unusual dips in brightness — NASA's Kepler space telescope even observed dimming of up to 20% over a matter of days.

The star has had much subtler but longer-term enigmatic dimming trends, with one continuing today. None of this behavior is expected for normal stars slightly more massive than the Sun.

Speculations have included the idea that the star swallowed a planet that it is unstable, and a theory that a giant contraption built by an advanced civilisation could be harvesting energy from the star, causing its brightness to decrease.

Researcher from the University of Arizona in the US, used NASA's Spitzer and Swift missions, as well as the Belgian AstroLAB IRIS observatory, and found that the cause of the dimming over long periods is likely an uneven dust cloud moving around the star.

They found less dimming in the infrared light from the star than in its ultraviolet light. Any object larger than dust particles would dim all wavelengths of light equally when passing in front of Tabby's Star.

"This pretty much rules out the alien megastructure theory, as that could not explain the wavelength-dependent dimming," said Huan Meng from University of Arizona.

"We suspect, instead, there is a cloud of dust orbiting the star with a roughly 700-day orbital period," said Mr. Meng, lead author of the study published in The Astrophysical Journal.

Researchers observed Tabby's Star in ultraviolet using Swift, and in infrared using Spitzer. Supplementing the space telescopes, they also observed the star in visible light during the same period using AstroLAB IRIS, a public observatory with a 68 centimetre reflecting telescope located near the Belgian village of Zillebeke.

Based on the strong ultraviolet dip, the researchers determined the blocking particles must be bigger than interstellar dust, small grains that could be located anywhere between Earth and the star.

Such small particles could not remain in orbit around the star because pressure from its starlight would drive them farther into space.

Dust that orbits a star, called circumstellar dust, is not so small it would fly away, but also not big enough to uniformly block light in all wavelengths.

This is currently considered the best explanation, although others are possible, researchers said.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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The rhythm of life: on the Nobel Prize in Medicine

Time and clocks have held a special fascination for humankind down the ages. So, it is particularly revealing that two of the three Nobel Prizes for the sciences announced this year have been linked to time. While the [Nobel Prize for Physics](#) was awarded to a trio of physicists for their work in the detection of gravitational waves emanating from the recesses of the space-time continuum, the 2017 [Nobel Prize in Physiology or Medicine](#) was won by a triumvirate of chronobiologists for their work in discovering the mechanisms controlling the internal clocks that keep time in all living organisms, including humans. Jeffrey C. Hall, Michael Rosbash and Michael W. Young, three Americans born in the 1940s, made pioneering contributions in helping unravel the genetic coding and protein pathways that regulate the circadian rhythm — that rhythm which tells us when it is time to eat and sleep, or wake up even when we have no bedside alarm. Working with the humble fruit fly, the three scientists isolated a gene named *period* that studies had shown disrupted the fly's circadian clock. Dr. Hall and Dr. Rosbash then went on to discover that the protein PER, which acts as a functional communicator for this gene, accumulated at night and then diminished during the day. Independently, Dr. Young made a couple of seminal breakthroughs that helped complete the jigsaw puzzle — first by identifying a second gene *timeless* that through its TIM protein, working in conjunction with PER, helped engender the seesawing of cellular protein levels. He then spotted the third gene, *doubletime*, which through an encoded protein served as the regulator of the frequency of the oscillations.

In its nod to the trio's contributions, the Nobel Assembly at Sweden's Karolinska Institute referred to how their work had led to circadian biology developing into a "vast and highly dynamic research field, with implications for our health and well-being." It is this crucial human health angle that has spawned a mushrooming body of science centred on understanding the linkages between sleep and normal metabolic activity, and the potentially deleterious effect of sleep deprivation. From "jet lag", when people travel across different time zones challenging the internal biological clock, to the difficulties people engaged in shift-based jobs have in resetting their sleep-wake cycles, contemporary medical science acknowledges the hazards that lack of adequate sleep can pose. The ubiquitousness of the smartphone, tablet, computer and TV screens that may disrupt the circadian rhythm because of the light they emit is being studied extensively. The Nobel-winning researchers' contributions have also led to an improved understanding of the link between peak physical performance in sport and the time of the day. Ultimately, the prospect that the circadian rhythm may well hold the key to future breakthroughs in the modulation and treatment of various diseases is truly tantalising.

Rajasthan's ordinance shields the corrupt, threatens the media and whistle-blowers

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Embryo Transfer Technology, a promising revolution in Bovine breeding**Embryo Transfer Technology, a promising revolution in Bovine breeding**

Embryo transfer technology (ETT) has revolutionized the breeding strategies in Bovines as a tool to optimize the genetic improvement in cattle.

Department of Animal husbandry, Dairying and Fisheries in co-operation with 12 States has undertaken a Mass Embryo Transfer programme in Indigenous Breeds under the scheme, National Mission on Bovine Productivity. It has been planned to carry out 440 embryo transfers during October 2-10, 2017 throughout the country. The programme is implemented with the objective of conservation and development of indigenous breeds under Rashtriya Gokul Mission.

Through the use of ETT, (i) a farmer can get a 5-6 fold increase in number of offsprings , (ii) the calves so born will be of high genetic merit and (iii) the offsprings born will be free from diseases.

The programme has been initiated in 12 ETT centres across the country from 2nd October and will continue till 10th October 2017. Under this programme, embryos of higher genetic merit indigenous bovines are being transferred in to surrogate cows. Embryos of Indigenous breeds such as Sahiwal, Gir, Red Sindhi, Ongole, Deoni and Vechur have been proposed to be transferred under this programme. On first day of ET programme held on 2nd October, 35 Nos. of embryos were transferred in to recipients. Remaining will be transferred on different days till 10th of October 2017.

The technology now being taken up to the doorstep of the farmers will result in rapid propagation of high genetic merit indigenous cattle.

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Nobel Prize for Physics, 2017 – Indian Connection**Nobel Prize for Physics, 2017 – Indian Connection**

The 2017 Nobel Prize for Physics has been conferred to three scientists namely Rainer Weiss, Barry C Barish & Kip S Thorne under the LIGO Project for their discovery of gravitational waves, 100 years after Einstein's General Relativity predicted it. The Nobel Prize for Physics 2017 celebrates the direct detection of Gravitational waves arriving from the merger two large Black holes in a distant galaxy a Billion of light years away. Gravitational waves carry information about their dramatic origins and about the nature of gravity that cannot otherwise be obtained. This opens a new window to Astronomy since Gravitational Waves are an entirely new way of observing the most violent events in space.

This is a proud moment for India also, since the discovery paper has 39 Indian authors/scientists from nine institutions-, CMI Chennai, ICTS-TIFR Bengaluru, IISER-Kolkata, IISER-Trivandrum, IIT Gandhinagar, IPR Gandhinagar, IUCAA Pune, RRCAT Indore and TIFR Mumbai. primarily funded through individual/ institutional grants by Department of Atomic Energy, Department of Science & Technology and Ministry of Human Resource Development AE, DST and MHRD, who are co-authors of this discovery paper.

Late Professor CV Vishveshvara of RRI, Bengaluru (DST AI) and Professor SV Dhurandhar of IUCAA, Pune and some other Indian scientists made seminal contributions to this field which contributed towards the principles behind the LIGO Detector.

The group led by Bala Iyer (currently at ICTS-TIFR) at the Raman Research Institute in collaboration with scientists in France had pioneered the mathematical calculations used to model Gravitational Wave signals from orbiting black holes and neutron stars. Theoretical work that combined black holes and gravitational waves was published by C. V. Vishveshwara in 1970. These contributions are prominently cited in the discovery paper.

An opportunity for India taking leadership in this field has opened up with the LIGO-India mega-science project that was granted 'in principle' approval by the Union Cabinet on Feb 17 2016. LIGO-India brings forth a real possibility of Indian scientists and

technologists stepping forward, with strong international cooperation, into the frontier of an emergent area of high visibility and promise presented by the recent GW detections and the high promise of a new window of gravitational-wave astronomy to probe the universe.

The global science community is unanimous that the future of Gravitational wave astronomy and astrophysics, beyond the first discovery, lies with the planned global array of GW detectors, including the LIGO-India observatory. Inclusion of LIGO-India greatly improves the angular resolution in the location of the gravitational-wave source by the LIGO global network. For the discovery event observed by the two advanced LIGO detectors in the US, with a hypothetical LIGO-India in operation, there would have been 100 times improvement in the angular resolution.

The LIGO-India proposal is for the construction and operation of an Advanced LIGO Detector in India in collaboration with the LIGO Laboratories, USA. The objective is to set up the Indian node of the three node global Advanced LIGO detector network by 2024 and operate it for 10 years. The task for LIGO-India includes the challenge of constructing the very large vacuum infrastructure that would hold a space of volume 10 million litres that can accommodate the entire 4 km scale laser interferometer in ultra high vacuum environment at nano-torr. Indian team is also responsible for installation and commissioning the complex instrument and attaining the ultimate design sensitivity.

The LIGO-India project is being jointly executed by lead institutions: the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune of the University Grants commission, and DAE organisations, Institute for Plasma Research (IPR), Gandhinagar, the Raja Ramanna Centre for Advanced Technology (RRCAT), Indore and the Directorate of Construction & Estate Management (DCSEM) of DAE.

LIGO-India is being jointly funded by the Department of Atomic Energy (DAE) and the Department of Science and Technology (DST). A LIGO-India Apex committee, together with the LIGO-India Project Management Board (LI-PMB) and LIGO-India Scientific Management Board (LI-SMB), were constituted in August 2016 to oversee the project execution, and there has been rapid pace of progress since then. LIGO-India is on track for commencing operations by 2024.

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IISc team fabricates nanomaterial to treat Parkinson's

Nuances “The nanomaterial was not toxic probably because manganese is naturally present in our body and is an essential trace element,” says Namrata Singh.

A team of researchers from the Indian Institute of Science (IISc) Bengaluru has fabricated a metal oxide nanomaterial that is capable of mimicking all three major cellular antioxidant enzymes, thereby controlling the level of reactive oxygen species (ROS) inside cells. Based on *in vitro* test results, the nanomaterial appears a promising candidate for therapeutic applications against oxidative stress-induced neurological disorders, particularly Parkinson's. The results were published in the journal *Angewandte Chemie*.

Reactive oxygen species, such as superoxide, hydrogen peroxide and hydroxyl radical, which are generated as part of a normal physiological process, are essential for the normal functioning of cells. Excess of ROS generated is usually controlled by the action of three antioxidant enzymes (superoxide dismutase, catalase and glutathione peroxidase).

Excess ROS

A problem arises when ROS is generated in excess and the enzymes are unable to control the level of ROS. Oxidative stress due to excessive ROS causes damage to DNA, proteins and lipids; oxidative stress is implicated in several diseases such as neurodegeneration, cancer, diabetes and cardiovascular diseases.

“We have developed a manganese oxide (Mn_3O_4) nanomaterial which functionally mimics all the three antioxidant enzymes. Earlier, we had shown that vanadium oxide (V_2O_5) nanowire is capable of exhibiting glutathione peroxidase enzyme activity,” says Prof. Govindasamy Muges from the Department of Inorganic and Physical Chemistry, IISc, and one of the corresponding authors of the paper. Nanomaterials with enzymelike activity are called nanozymes. “This is the first time the activity of all three major antioxidant enzymes are seen in a nanomaterial.”

The researchers tried several morphologies and found the flower-like morphology had the best activity of all three enzymes. Pores present on the nanomaterial play an important role as enzyme-active sites and help in scavenging excess ROS. The larger pore diameter and pore volume capable of accommodating all the three ROS were found to be critical in determining the enzyme activity of the nanomaterial.

No toxicity

In vitro studies using human neuronal cell lines found that the nanomaterial caused no cellular toxicity when internalised by the cells and hence safe. Metal-based complexes are generally toxic to cells. “The nanomaterial was not toxic probably because manganese is naturally present in our body and is an essential trace element. It is not toxic up to a few microgram. This prompted us to use manganese-based nanomaterial,” says Namrata Singh from the Department of Inorganic and Physical Chemistry, IISc and the first author of the paper.

The nanomaterial was found to protect against neurotoxin-induced cell death by scavenging the excess ROS that was artificially generated inside the cells.

“Inside the cells, the nanomaterial was able to substitute the cellular enzymes effectively when the enzymes are inhibited. Due to high pore size and volume, it was able to achieve better activity. So we don't need much of the nanomaterial inside the cells,” says Prof. Patrick D'Silva from the

Department of Biochemistry at IISc and the other corresponding author.

Optimum effect

“The manganese oxide nanomaterial was able to control the level of ROS inside the cells. They did not scavenge the ROS completely. If they do then the normal physiological functions of the cells get affected,” says Prof. Mugesh. “It actually scavenges ROS and brings it to optimum level so normal functions of the cell are not affected.”

The superoxide dismutase enzyme has two forms and one functions in the cytosol and the other inside the mitochondria. “Some amount of nanomaterial gets inside the mitochondria as well and controls the ROS produced there. The nanozymes have therapeutic potential particularly for Parkinson’s disease,” says Prof. D’Silva.

Parkinson’s model was tested in the lab. The researchers are trying to design an animal model in mice for in vivo testing.

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From noise to music: How the LIGO team heard the famous 'chirp'

Determination: "Once we went down the road of making the detailed study of noise a science in itself, we realized that there are no limits to measurement," says Rana Adhikari.

With the 2017 Nobel Prize for physics going to the LIGO-VIRGO collaboration for having directly observed gravitational waves for the first time, black hole mergers have become a byword. The instrumentation to differentiate and detect this faint signal from the noise was a crucial contribution made by Nobel Laureate Rainer Weiss.

The first gravitational waves that were detected were small fluctuations of spacetime caused by a violent merging of two black holes about 1.3 billion light years away. We know that light bends due to a change in refractive index of the air near hot objects like a heated asphalt road. Light also bends when spacetime curves due to the presence of massive gravitational fields. When a gravitational wave is incident on the detector, the laser beam behaves in a similar manner. One main difference is the magnitude. The difference between bending of light in cool air and hot air is about 1%, whereas the bending caused by a gravitational wave is about one billion times smaller than the thickness of a human hair.

"That's pretty small. How can we turn something like this into a signal that's measurable to us?" asks Rana Adhikari, Professor of Physics at Caltech, who has been involved in the construction and design of the detectors since 1997. He explains, "From my PhD advisor, Rai Weiss, I got the strong impression that it was embarrassing to not understand in exacting detail all the constituents of the noise in the experiment. Once we went down the road of making the detailed study of noise a science in itself, we realized that there are no limits to measurement. Everything that we wish to understand about the universe can be revealed by careful design of experimental apparatus."

The photodetectors are sensitive to the brightness of the incoming signal. When there is no signal, the two arms of the LIGO detector are arranged so that there is cancellation of contribution of light. There is still some small amount of light coming through. When there is a signal, this light shows a variation. "We measure how much light is seen when it is very dark [that is, there is no signal]. This is about the same as a small handheld laser pointer. On top of that brightness, we are trying to measure a variation in brightness level of about one part in one billion. This is manageable. This is just what can be done with the best electronics that we have today," he says.

The electronics converts photons into electrons. Like in the human ear, there is an electrical signal which has to be turned into sound. The detection is in the range of frequencies from about 20 Hz to 10 kHz. "The challenge is how to reduce the vibration from the ground at those frequencies," Prof Adhikari says.

"[The relevant] ground vibrations are about 1% of the diameter of the hydrogen atom, or one hundred million times larger than we can handle. We need this vibration to be reduced by a factor of one hundred million. We do this by using many, many springs" The arrangement is that of some six layers of heavy metal beds connected by strong springs. At every layer the vibrations of the ground are cut off by a significant factor.

LIGO's interferometers are a ten orders of magnitude improved as compared to the first interferometer made by Albert Michaelson in 1881, which was able to measure a displacement in nanometres.

Under the high degree of vacuum needed, stainless steel has the problem that the hydrogen separates out. So a special stainless steel called low-hydrogen stainless steel was needed. The

steel tubes are also used to house the lasers and have to be very clean. These are being made at Institute for Plasma Research in Ahmedabad.

In all, the tubes measure 8 km in length and have a diameter of 1.2 m. "So it's quite a large empty space, and it's all one piece. No one had made such a large vacuum chamber earlier, so this is the largest empty space in the world," Prof. Adhikari smiles.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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India, U.K. to firm up defence links

Sanjay Mitra

India and Britain hope to agree on concrete measures to take forward their defence partnership by next year, ahead of the next meeting of the two Prime Ministers, India's Defence Secretary Sanjay Mitra said during a three-day visit to the U.K. The meeting of the two leaders is widely expected to take place at the Commonwealth Heads of Government meeting in London in April 2018.

Following Prime Minister Narendra Modi's visit to London in 2015, the two countries agreed to hold regular dialogues, as part of the India-U.K. Defence Consultative Group. Since then, a step change in terms of depth had taken place in cooperation and dialogue in the area, Mr. Mitra said.

Wide-ranging dialogue

Mr. Mitra has met with Michael Fallon, who heads the Ministry of Defence, and the department's Permanent Secretary during his trip which focussed on meetings of the Defence Consultative Group.

"The military community dialogue has been going well and there have been a wide range of visits that have been taking place at the level of chief of staff, and senior operatives ... we have a road map going and we hope that by the time of the meeting of the Prime Ministers, we will have some meat on this," he said, adding that talks had ranged from capability development, defence equipment and cybersecurity to counter-terrorism.

'Make in India' push

India has pegged the defence sector as one of the major areas where the bilateral partnership could be expanded around the "Make in India" campaign. During Mr. Modi's visit in 2015, the two sides agreed to move towards a new Defence and International Security Partnership that would "intensify cooperation on defence and security, including cybersecurity, and maritime security" pushing for joint working in key strategic areas.

"We are very keen that U.K. firms participate in our 'Make in India' process and in our strategic partnership exercise that we've just begun," the Defence Secretary said.

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Science and Technology Minister stresses on the need to encourage and empower Young Innovators

Science and Technology Minister stresses on the need to encourage and empower Young Innovators

Dr Harsh Vardhan inaugurates four-day India International Science Festival 2017 at Chennai

Union Minister for Science and Technology and Earth Sciences, Dr Harsh Vardhan, has said that India is home to lakhs of grassroots innovators and it is important to empower them with modern entrepreneurial skills and assist them.

Inaugurating the India International Science Festival 2017 at Anna University in Chennai today, the Minister said that National Innovation Foundation-India (NIF) will be organizing the Grassroots Innovators Summit, as part of this four day festival.

He said the Innovators Summit aims to strengthen the grassroots technological innovations and outstanding traditional knowledge and provide a common platform for various stakeholders – from innovators, students, researchers to policy makers.

He urged the scientific community to contribute in realizing Prime Minister's vision of establishing A New India by 2022. Detailing the initiatives launched by the Government in the last three years, Dr Harsh Vardhan said there has been a 60 per cent hike in the budget for Science and Technology.

The Minister lauded the contribution of Shyama Prasad Mukherjee who laid the foundation stone for Central Leather Research Institute (CLRI) and recalled the important role played by the country's first Prime Minister Jawaharlal Nehru in developing scientific institutions of repute. The Minister said eminent scientists like Sir C.V.Raman, Prof S.Chandrasekar, Sir Srinivasa Ramanujam, Dr Abdul Kalam, contributed significantly to the advancement of science.

Shri Y. S. Chowdary, Minister of State for Ministry of Science & Technology & Earth Sciences, welcomed the august gathering. The key participants at the grand inaugural ceremony included Dr. Vijay Bhatkar, National President, VIBHA, Minister of Higher Education of Afghanistan Shri. Abdul Latif Roshan, Science & Technology Minister of Bangladesh Shri Yeafesh Osman and Minister for Higher Education, Science and Technology, Government of Tamil Nadu Shri. K. P. Anbalagan shared their vision on science and technology, while addressing the gathering. Vote of thanks was proposed by

Dr. M. Rajeevan, Secretary, MoES, stressed the need to translating the scientific knowledge to achieve inclusive and sustainable growth.

The third edition of India IISF 2017 is being held at Chennai during 13th – 16th October 2017 and National Institute of Ocean Technology (ESSO-NIOT) is the main coordinator.

The theme of the Science Festival is “**Science for New India**”. The events are held simultaneously at five venues Anna University (main venue), ESSO-NIOT, Council of Scientific and Industrial Research -Central Leather Research Institute (CSIR-CLRI), Council of Scientific and Industrial Research- Structural Engineering Research Centre (CSIR-SERC), and Indian Institute of Technology Madras (IIT Madras). Stake holders from various fields, academia, industry, government, social organizations, school teachers and students to name a few are participating in the four-day event. On 13th October 2017, IISF 2017 kick started with grand inauguration followed by events held at various venues. The highlights of the day are as follows:

Science & Technology Ministers’ Conclave: The event is hosted as part of IISF 2017 to provide a platform for deliberations with India’s neighbouring countries in an effort to build and strengthen a partnership through science, technology and innovation. This conclave provided an opportunity to exchange the scientific and technological priorities and challenges of some of our neighbouring countries that can help to develop a road map of Science & Technology cooperation by developing human capacity and infrastructure. The conclave was held at Industrial Consultancy & Sponsored Research at IIT Madras on 13th October 2017. Bangladesh Minister of Science & Technology, Yeafesh Osman and Afghanistan Minister of Higher Education, Abdul Latif Roshan participated in the discussions and shared their views on Science & Technology cooperation.

Sensitizing Youth to Flagship Programs of Government (SYPOG): SYPOG is an effort to sensitize the youth about Government’s policies and success stories related to national flagship programs like Swachh Bharat, Make in India, Digital India, Climate Change and Swasth Bharat. SYPOG is an opportunity for young scientists, scholars and faculties from all over the country to showcase their innovations and scientific contributions to the mentioned National Programs. The activities of SYPOG will be held on all four days of IISF 2017. Plenary Sessions on themes ‘Swachh Bharat’ and ‘Digital India’ were held on 13th October at Vivekananda Hall in Anna University.

Science Village- Parliament to Panchayat: The science village is aimed at providing exposure to the students from rural India and make them aware of India's achievements in the frontier areas of science and technology. The participants of science village student delegates were selected and nominated by Members of Parliament from the adopted villages under the aegis of Pradhan Mantri Sansad Aadarsh Gram Yojana. More than **2000 students** along with their teachers from 22 states are participating in the event. The students and accompanying teachers are grouped into six houses named after eminent Indian Scientists. Each group of students and teachers are being trained as part of the science village. Each group also visited research ship ORV Sagar Nidhi in Chennai port.

Mega Science and Technology Expo: Mega Expo is aimed at showcasing the achievements and success stories of Indian scientific/academic organizations, R&D labs, PSUs and Indian Industry. A comprehensive show of Scientific, Technological and Industrial programs and achievements of India have been arranged under 12 theme pavilions at the expo.

Grassroot Innovators Summit: Grassroot Innovators Summit aims at providing a common platform for various stakeholders –students, researchers to policy makers under the 'Innovation Exhibition' held at Anna University. About 100 innovative technologies from several states of the country are showcased at the exhibition. Special focus is given to those which could be diffused socially and generate employment. About 100 innovative technologies from several states of the country are being showcased at the exhibition. A seminar/round-table on innovation was held, during which speakers delivered lectures on three focal themes 'Scouting and Documentation of Green Grassroot Innovation and Outstanding Traditional Knowledge practices', 'Value Addition Research & Product Development', and 'Intellectual Property Rights'.

Round Table Meet on "Mass Communication": As part of the IISF, a Round Table Meet on Mass Communication is being organized at National Institute of Ocean Technology (ESSO-NIOT), Chennai. The Round Table Meet is being coordinated by the CSIR-National Institute of Science Communication and Information Resources (CSIR-NISCAIR), New Delhi and National Institute of Ocean Technology (ESSO-NIOT), Chennai. The Round Table Meet is aimed to address various methods and techniques to popularize science and its applications. On the first day, the inauguration of the round table meet and a panel discussion was held on the contemporary topic 'Why science coverage in mass media is abysmally low? How it can be increased?' Prominent media persons, science communicators, science journalists, social, electronic and print media

journalists dealing with science and passionate science and journalism students discussed various aspects of mass communication in science and technology. The Meet also showcased various science communication products, such as publications, audio-visual communications, digital and other software materials.

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Boosting horticulture through remote sensing

Union Agriculture Minister Radha Mohan Singh on Monday announced March 2018 as the deadline to complete the ambitious project of developing the horticulture sector using remote sensing technology and geo-informatics.

India is the second-largest producer of fruits and vegetables in the world and the biggest producer of fruits such as banana, mango, papaya and lemon among others. But the country still has some distance to cover in terms of exports as post-harvest wastage of produce in India is high.

In 2015, the Modi government started project CHAMAN — acronym for Coordinated Horticulture Assessment and Management using geo-informatics — to prepare a comprehensive horticultural plan. Using remote sensing technology to study soil conditions, land use, weather and cropping pattern, the Centre has chosen 185 districts across the country where seven selected crops are being promoted.

Once complete, the findings of the project would be shared with all states to give a boost to cultivation of horticultural crops.

States put into groups

Different states have been divided into different groups to grow banana, mango, citrus fruits, potato, tomato, onion and chilli.

Sharing the progress of the project CHAMAN at a press briefing, Mr Singh said the Centre would convene a meeting of the northeastern states by January next year as the report on horticulture development for this region was ready.

“This sector provides nutrient rich crops to the people and better remunerative prices to the farmers and increases their incomes,” Mr. Singh said.

Under CHAMAN, Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat and Maharashtra have been identified as the major banana-growing states. Mango cultivation is being promoted in Andhra, Bihar, Uttar Pradesh, Karnataka and Telangana, while onion is the focus for Maharashtra, Gujarat, Karnataka and Madhya Pradesh.

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With stealth ship, India in elite group

Self-reliance: The newly commissioned warship *INS Kiltan* in Visakhapatnam on Monday. C.V. Subrahmanyam

The country is rapidly marching towards indigenisation and the commissioning of the third Kamorta class Anti-Submarine Warfare (ASW) stealth corvette is a classic example of that, said Defence Minister Nirmala Sitharaman.

She was in Visakhapatnam on Monday at the Eastern Naval Command to commission *INS Kiltan*, the third of the four Project-28 Kamorta class ASW.

Addressing the naval officers and the media from the deck of the newly commissioned ship, she said, "This ship is unique, as about 81% is built indigenously and is the first built by India that has a superstructure made up of carbon fibre composite material. This makes it a stealth corvette and makes India one among the few nations that have this technology or this class of ships."

Builder's Navy

The keel was laid in 2010 under the Project-28 scheme and was built by Garden Reach Ship Builders and Engineers (GRSE), Kolkata.

Ms. Sitharaman said the Indian Navy was moving from the status of a 'buyer's navy to builder's navy.'

"This is part of Prime Minister Narendra Modi's 'Make in India' initiative and we need to become more self-reliant. We have already gained the expertise in building hulls and we now need to focus on propulsion and weapon technology," she said. She pointed out that India had a long coastline with a vast EEZ (Exclusive Economic Zone) and there was a need to have a capable and potent navy.

The Indian Navy, she said, had been playing an important role in defending the borders as well as in peace and humanitarian missions.

Chairman and Managing Director of GRSE V.K. Saxena said the partnership between GRSE and the Indian Navy began in 1961 and so far it had built over 100 ships for the Navy and the Indian Coast Guard. "In the next few years, we will be delivering about 10 ships to the Navy with state-of-the-art technology," he said.

Tough steel

INS Kiltan has been constructed using high grade steel (DMR 249A) produced by the state-owned Steel Authority of India Limited (SAIL). It has a displacement of 3500 tonnes, spans 109 meters in length and 14 meters at the beam and is propelled by four diesel engines to achieve speeds in excess of 25 knots with an endurance of 3450 nautical miles.

The carbon composite material gives it an extra stealth edge and also lowers the top weight and maintenance cost.

The installed propulsion and auxiliary systems provides very low radiated underwater noise feature, required for anti-submarine warfare.

The enhanced stealth features include 'X' form of Hull, full beam superstructure, inclined ship sides and use of Infra Red Signature Suppression (IRSS).

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Observations confirm neutron star merger

Cataclysmic collision: An illustration of two merging neutron stars. NSF/LIGO/Sonoma State University/A. Simonnet NSF/LIGO/Sonoma State University

The announcement of the neutron star merger, detected on August 17 by the LIGO-VIRGO collaboration of gravitational wave detectors, has been reinforced by the observation of short gamma ray (light waves) bursts almost simultaneously by other space and earth-based observatories.

“This discovery is so fundamental that it is definitely a strong candidate for another Nobel prize,” K.G. Arun, who was part of the team that studied the astrophysical implications of the joint detection, said in a press release from the Indian Institute of Technology- Madras.

Dr. Arun is one of nearly 40 members of the LIGO-VIRGO scientific collaboration who have contributed to the source modelling, developing the algorithms that search for binary mergers amid noisy data from many detectors, testing Einstein’s theory and separating signals from experimental and environmental artefacts. The second part of the discovery — the observation of Gamma ray bursts by several telescopes — includes the observations by the Giant Metrewave Radio Telescope (GMRT), the Himalayan Chandra Telescope (HCT) and AstroSat.

The sensitive CZTI instrument on AstroSat helped narrow down the location of the gamma-ray flashes. The HCT obtained optical images at locations of neutrinos detected by other telescopes at the same time as the burst, and showed that they were unrelated to the gravitational-wave trigger. The GMRT played a key role in understanding jet physics and refining models of radio emission from the remnant formed by the merging neutron stars.

P. Ajith of ICTS-TIFR, Bengaluru, one of the leading scientists in the LIGO-VIRGO collaboration, on the importance of the discovery, said: “Neutron-star mergers are incredibly rich and complex phenomena. Virtually every area of physics and astrophysics can learn something from this unique laboratory set up by nature!”

Nobel-winning team spots merging neutron stars

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Tejas jets to get French-made radars

Take off: The radar has been built to HAL parameters.

Thales, a French multinational that makes aerospace and defence equipment, has flight-tested an active array radar built specifically for Tejas, the indigenously built light combat aircraft.

The radar is based on the company's successful RBE2 radar installed on Rafale fighter jets, 36 of which India is buying from Dassault. It meets the specific requirements of the Hindustan Aeronautics Ltd. to equip the 80 Tejas-Mk1A aircraft under development.

"In just four months, thanks to our solid, proven experience with the RBE2, we've been able to carry out successful flights to test the performance of the key features of the radar we're offering for the Tejas Mk1A light fighter," Philippe Duhamel, executive vice-president, Defence Mission Systems, Thales, said in a statement on Monday.

The tests were conducted during summer this year at the Cazaux air base in France, on a test-bench aircraft, focussed on metrological analyses of the radar performance, Thales said.

"These test flights proved that the radar is fully operational and perfectly corresponds to the specific requirements of the HAL for its combat and air-superiority missions. It is therefore ready and able to adapt to the tight schedule imposed by the Mk1A LCA," the statement said.

A Tejas Mk-1A variant with specific improvements is under development and HAL had earlier this year floated a tender for Advanced Electronically Scanned Array (AESA) radar and Self-Protection Jammer.

The Defence Ministry has already approved 83 Mk1A for the Air Force, in addition to the 40 basic variants.

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New frontiers

The advancement of technology has led to new domains of warfare being opened to the militaries world over. Space and cyber warfare are two such domains where most modern militaries have focused on. The US pushed the Iranian nuclear programme back by use of the Stuxnet virus, while Russian and Chinese governments have also been suspected of using tools of cyber warfare against other countries.

China has also demonstrated its capabilities of space warfare by shooting down a satellite, challenging the American prowess in that field. Equally pathbreaking has been the use of Special Forces in an independent role in global missions. All this had happened years ago, but Indian military neither had any domain expertise nor any dedicated agencies to work in these areas.

Five years ago, the Chiefs of Staff Committee, comprising of three military chiefs had asked the government for establishing three new military commands in these domains - cyber, space and special operations. These commands were proposed to be raised tri-service commands, modelled on the Andaman and Nicobar Command, thereby also enhancing jointness among the three defence services. After going through multiple rounds of deliberations and discussions at the defence ministry, including a change of government, the proposal was finally approved in July this year.

The proposal, however, had been diluted in a major way. Instead of commands, which are headed by Lt Generals, cyber and space would be agencies - and special operations a division - to be headed by Major Generals. In keeping with the motto of promoting integration and jointness among services, these would however still be tri-service organisations. It is a matter of time before the formal governmental sanction leads to creation of these new agencies.

Although there is merit in the argument that this marks a beginning in these fields of warfare, there is a fear that creating of agencies - and not commands - may lead to these domains not getting adequate importance, thereby defeating their very purpose.

While there is a likelihood that these agencies would eventually be upgraded to commands, this points to a bigger problem in higher defence organisation: The lack of a single point military commander or advisor. India still doesn't have a Chief of Defence Staff (CDS) or a Permanent Chairman of Chiefs of Staff Committee (PC-COSC), who would have then overseen these joint agencies and given them due importance. The creation of a CDS or PC-COSC has been delayed for too long; any further delay will only prevent India from leveraging its military power effectively.

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Nobel-winning team spots merging neutron stars

The LIGO-VIRGO collaboration, [three members of which won this year's physics Nobel Prize](#), strikes again, this time, to detect the merger of two neutron stars — extremely dense, massive but tiny, objects. What is more striking is that gamma rays bursting from the event were observed by nearly 70 ground and space-based observatories.

This is the very first time that a cosmic event has been observed with gravitational waves as well as the light emanating from it. Earlier observations made by LIGO have been of black hole mergers, and as no light can escape from a black hole, there was no such light counterpart to the measurements.

According to a press release circulated by the collaboration, “On August 17, LIGO’s real-time data analysis software caught a strong signal of gravitational waves from space in one of the two LIGO detectors. At nearly the same time, the Gamma-ray Burst Monitor on NASA’s Fermi space telescope had detected a burst of gamma rays.”

“The fact that these two signals [the gravitational waves and the gamma ray bursts, which are essentially light waves] arrived at nearly the same time tell us that the speed of gravitational waves is extremely close to the speed of light. This was predicted by Einstein, but it is the first time we are making a direct measurement,” says P. Ajith, of International Centre for Theoretical Sciences, Bengaluru. Dr. Ajith is one of the leading contributors to the theoretical studies on gravitational waves. In all, the LIGO-VIRGO collaboration includes about 1,500 scientists and of this about 40 are Indians.

The neutron stars of the signal detected on August 17 were located about 130 million light years away. As these neutron stars spiraled together, they emitted gravitational waves that were detectable for about 100 seconds. When they collided, a flash of light in the form of gamma rays was emitted. This “gamma ray burst” was seen on Earth about two seconds after the gravitational waves were observed. As a result, the gravitational wave detectors caught the signal which is the longest “chirp” heard so far — it lasted 100 seconds.

Neutron stars are the smallest, densest stars known to exist. These could be about 20 kilometres in diameter and have masses much greater than the Sun. A teaspoonful of neutron star material could hold a mass of a billion tonnes. They are formed when massive stars explode in supernovae.

“From informing detailed models of the inner workings of neutron stars and the emissions they produce, to more fundamental physics such as general relativity, this event is just so rich. It is a gift that will keep on giving,” David Shoemaker, spokesperson of the LIGO collaboration, is quoted as saying in the press release.

Observations confirm neutron star merger

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Science is the cornerstone for progress of mankind: Vice President

Science is the cornerstone for progress of mankind: Vice President

Addresses valedictory session of 3rd India International Science Festival – 2017

The Vice President of India, Shri M. Venkaiah Naidu has said that science is the cornerstone for the progress of mankind. He was addressing the valedictory session of the 3rd India International Science Festival – 2017, jointly organised by the Ministry of Science & Technology and Earth Sciences, in Chennai today. The Governor of Tamil Nadu, Shri Banwarilal Purohit, the Union Minister for Science & Technology, Earth Sciences and Environment, Forest & Climate Change, Dr. Harsh Vardhan, the Minister of State for Science & Technology and Earth Sciences, Shri Y.S. Chowdary and other dignitaries were present on the occasion.

The Vice President said the scientific inventions have revolutionized the world and shaped every aspect of the modern life. He further time has come now for every Indian to work towards recapturing our past glory and make India one of the leading nations in scientific and technological innovations.

The Vice President said India to reach new pinnacles in Science & Technology concerted efforts from governments as well as different sections of the society is needed to hugely step up large scale R & D activities in different domains. He further said that artificial Intelligence, robotics, Internet of Things, big data analytics and digital manufacturing are going to change the way we are going to live. Corporate bodies and industries have to set aside an exclusive corpus for encouraging innovative, out-of-the-box R & D projects and disruptive technologies that could provide long-lasting answers to problems faced by the people, he added.

The Vice President said that we need to create an ecosystem for bright researchers to thrive and ensure that youngsters do not get stifled by rules, red tape and favoritism. He further said that they must feel free to discuss ideas and take up innovative research. Ultimately, science should find solutions to the problems faced by mankind and make this planet a better place for the present and future generations, he added.

Following is the text of Vice President's address:

"I am delighted to be present at the India International Science Festival-2017, the third in the series of such events being organized by the Ministry of Science & Technology, Ministry of Earth Sciences and Vijnana Bharati.

Science is the cornerstone for the progress of mankind. Scientific inventions have revolutionized the world and shaped every aspect of the modern life. Indians have made significant contribution to the field of science from ancient times and are now in the forefront in state-of-the-art space technologies and the IT revolution sweeping the world.

Friends, Science & Technology has been part of India's culture and tradition. The scientific bent of mind in ancient India was reflected right from the use of zero, place values, algebra, concept of atom, calculation eclipses, among others. 'Sushruta Samhita' talks of surgery while Charak describes hundreds of diseases, their causes and treatment methods.

The urban settlements of Mohenjo Daro and Harappa, production of highest quality steel and extraction of sugar are other examples when India was more advanced than the rest of the world.

"We owe a lot to the Indians, who taught us how to count, without which no worthwhile scientific discovery could have been made", vouched the great scientist, Albert Einstein.

Well-known writer and philosopher, Will Durant had this to say: "India was the motherland of our race and Sanskrit the mother of Europe's languages. India was the mother of our philosophy, of much of our mathematics, of the ideals embodied in Christianity... of self-government and democracy. In many ways, Mother India is the mother of us all".

After demonstrating our knowledge to the world in the ancient times in the fields of astronomy, mathematics, yoga and ayurveda, India somehow lost its way following Mughal invasions and colonization. The time has now come for every Indian to work towards recapturing our past glory and make India one of the leading nations in scientific and technological innovations in the coming decades.

For this to happen, there has to be concerted efforts from the governments as well as different sections of the society - right from teachers, who mould young minds, to universities and industries, who need to hugely step up R & D activities in different domains. Unless research is taken up on a large scale, India will not be able to reach new pinnacles in Science & Technology.

In spite of the remarkable scientific achievements the world has witnessed from invention of telescope to discovery of Higgs boson, mankind continues to face numerous challenges such as those relating to climate change, global warming, sustainable development, clean energy and water and diseases. Only science can throw up solutions for the present and emerging problems in the years to come. Artificial Intelligence, robotics, Internet of Things, big data analytics and digital manufacturing are going to change the way we are going to live. These areas need to be fully exploited with innovative and disruptive technologies.

Investments in S & T need to be stepped up to address various problems the country is facing today such as poverty, unemployment, pollution, diseases, urban-rural divide, lack of clean drinking water as also the issues relating to crime and security, among others.

Here, I would like to appeal to various corporate bodies and industries to join hands and set up an exclusive corpus for encouraging innovative, out-of-the-box R & D projects and disruptive technologies that could provide long-lasting answers to problems faced by the people.

I am happy that successive governments at the Centre have accorded importance to S & T and created the necessary infrastructure for scientists and academics to pursue their research. CSIR and ICMR are among the leading research bodies and have earned global recognition for their cutting edge work.

My advice to these two premier organizations is to create an ecosystem for bright researchers to thrive and ensure that youngsters do not get stifled by rules, red tape and favoritism. They must feel free to discuss ideas and take up innovative research.

I would like the Department of Science and Technology to work closely with the Ministry of Human Resources to make science learning interesting and interactive right from early schooling. This is needed to inculcate greater interest in science among school students so that more and more

youngsters take up basic research.

I am happy to note that the ministries have aligned their activities with the national agenda of the government towards Make in India, Start up India, Digital India, Swasth Bharat and Swachh Bharat. It is also a matter of pride that Department of Science & Technology is involved in a number of global projects like the 30-meter Telescope Project and Laser Interferometer Gravitational Wave Observatory project. I am also happy to note that India today is among the 12 biotech destinations and ranks third in the Asia-Pacific region. India also has the second highest number of US Food and Drug Administration (USFDA) approved plants after the USA and is the largest producer of recombinant Hepatitis B vaccine.

I am sure this series of India International Science Festivals will generate new ideas and act as a catalyst in promoting scientific temper among the people. Ultimately, science should find solutions to the problems faced by mankind and make this planet a better place for the present and future generations.

JAI HIND!"

KSD/BK

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Hon'ble Raksha Mantri Smt. Nirmala Sitharaman Commissions INS kiltan ASW stealth corvette
Hon'ble Raksha Mantri Smt. Nirmala Sitharaman Commissions INS kiltan ASW stealth corvette

INS Kiltan (P30), third Anti-Submarine Warfare (ASW) stealth corvettes built under Project 28 (Kamorta Class) was commissioned into the Indian Navy by Hon'ble Raksha Mantri Smt. Nirmala Sitharaman at an impressive ceremony held at Naval Dockyard, Visakhapatnam today, 16 October 2017. Admiral Sunil Lanba, the Chief of the Naval Staff, Vice Admiral HCS Bisht, Flag Officer Commanding-in-Chief Eastern Naval Command, Rear Admiral VK Saxena (Retd), CMD, Garden Reach Shipbuilders & Engineers Limited, Kolkata (GRSE), Kolkata, Commodore MB Kunte (Retd) first Commanding Officer of erstwhile Kiltan and a host of other dignitaries were also present during the commissioning ceremony. The event marked the formal commissioning into the Navy of the third of the four ASW Corvettes, indigenously designed by the Indian Navy's in-house organisation, Directorate of Naval Design and constructed by Garden Reach Shipbuilders & Engineers Limited, Kolkata.

On arrival at the Naval Jetty, Hon'ble Raksha Mantri Smt. Nirmala Sitharaman was received by Admiral Sunil Lanba, the Chief of the Naval Staff. The Hon'ble Raksha Mantri was presented with a Guard of Honour and was introduced to the dignitaries' present prior commencement of commissioning ceremony.

Welcoming the gathering, Admiral Sunil Lanba stated that this commissioning marks yet another milestone in our journey of indigenous warship building. The Indian Navy is deeply committed to the principle of indigenisation and the Government's thrust on 'Make in India'. Commissioning of four ships in the last year, all built in Indian shipyards, is a testimony of our resolve. Our commitment to indigenisation also assumes special significance as we have steadily broadened our indigenisation efforts beyond ship building. We have achieved considerable success with indigenous sonars such as Abhay and HUMSA-NG as well as weapons such as Varunastra and BrahMos. These achievements are a result of the Indian Navy's proactive and integrated approach to achieve self-reliance said the Admiral.

.This was followed by reading out the Commissioning Warrant of the Ship by the Commanding Officer, Commander Naushad Ali Khan. Subsequently, hoisting of the Naval Ensign onboard for the first time and 'Breaking of the Commissioning Pennant' with the National Anthem being played marked the completion of the Commissioning

Ceremony.

During her address post commissioning of INS Kiltan, the Hon'ble Raksha Mantri, Smt Nirmala Sitharaman congratulated the Indian Navy, M/s. GRSE, other Indian PSUs and a host of small and medium scale industries, which have contributed towards building this fine ship. She emphasised that the Navy's relentless pursuit of self-reliance through indigenisation is highly appreciable and this has helped the Indian Navy to seamlessly transform from a Buyer's to a Builder's Navy. She highlighted that the addition of INS Kiltan to the naval fleet is a reaffirmation of this transformation. She further exhorted that we need to benchmark our shipbuilding practices to international best practices and produce quality ships in a shorter time frame and at competitive costs. She further stated that the Government fully appreciates the nation's defence requirements and requisite finances for the Armed Forces and Defence industry would be made available for the modernisation and development plans of the Navy. The Raksha Mantri later unveiled the Commissioning Plaque and dedicated the ship to the nation.

Regarded as a very prestigious acquisition, INS Kiltan is one of the most potent warships to have been constructed in India. The ship's keel was laid on 10 August 2010 and launched on 26 March 2013. Her maiden sea trials commenced on 06 May 2017 and finally was handed over to the Indian Navy by GRSE on 14 October 2017. The sleek and magnificent ship is propelled by 'Combination of Diesel and Diesel (CODAD)' propulsion system of four diesel engines to achieve speeds in excess of 25 knots and has an endurance of around 3,500 Nautical Miles.

The ship has enhanced stealth features resulting in a reduced Radar Cross Section (RCS) achieved by X-form of hull and superstructure along with optimally sloped surfaces. The very low under water acoustic signature makes it a 'silent killer on the prow'. This has been achieved by using advanced techniques for propeller design and mountings of main machinery. The ship's advanced stealth features make her less susceptible to detection by the enemy and help in effective employment of soft kill measure like the Chaff.

More than 80 % of the ship is indigenous with state of the art equipment & systems to fight in Nuclear, Biological and Chemical (NBC) warfare conditions. Also, P-28 weapons and sensors suite is predominantly indigenous and showcases the nation's growing capability in this niche area. INS Kiltan is the first major warship with superstructure entirely of composite material.

Weapons and Sensors have been installed/ interfaced on this composite superstructure for the first time on a major warship. Composite superstructure fitted on INS Kiltan ushers the usage of advanced engineering materials on Indian Naval warships with significant improvement in weight and stability parameters.

Apart from her integral ASW capable helicopter, the formidable array of weapons include heavy weight torpedoes, ASW rockets, 76 mm caliber Medium Range gun and two multi-barrel 30 mm guns as Close-in-Weapon System (CIWS) with dedicated fire control systems. She is also fitted with indigenous missile decoy rockets (Chaff) and advanced ESM (Electronic Support Measure) system to detect and map enemy transmissions and direction finder equipment. The ship boasts of a highly advanced Combat Management System and a sophisticated Integrated Platform Management System.

The ship gets her name from old INS Kiltan (P79), a Petya class ASW ship that served the nation for 18 years before being decommissioned in June 1987. Named after the coral island belonging to the Lakshadweep group of islands in India, the ship has a total complement of 15 officers and 180 sailors. The sleek and magnificent ship spans 109 meters in length, 14 meters in breadth with a displacement of 3,300 tonnes and can rightfully be regarded as one of the most potent Anti Submarine Warships to have been constructed in India.

With the changing power dynamics in the Indian Ocean Region, INS Kiltan will augment the Indian Navy's mobility, reach and flexibility whilst proudly flying the Indian Flag. The ship is manned by a team comprising 13 officers and 178 sailors with Commander Naushad Ali Khan at the helm as her first Commanding Officer. The commissioning of Kiltan will add a new dimension to the ASW capability of the Indian Navy and the Eastern Fleet in particular. The multifarious missions that can be undertaken by the ship truly reflect the enhanced multi-dimensional capability of the Indian Navy.

DKS/ CGR

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Planet Nine does exist in solar system: NASA

An artistic rendering of Planet Nine, with the Sun seen at the back. Photo: Caltech

The elusive 'Planet Nine' does exist, and may be 10 times the mass of the Earth and 20 times away from the Sun than Neptune, NASA scientists say.

Planet Nine could turn out to be our solar system's missing 'super Earth' — a planet with a mass higher than the Earth's, but substantially lower than the masses of ice giants Uranus and Neptune.

The signs so far are indirect, mainly its gravitational footprints, but that adds up to a compelling case, they have said.

"There are now five different lines of observational evidence pointing to the existence of Planet Nine," said Konstantin Batygin, a planetary astrophysicist at the California Institute of Technology (Caltech) in the U.S.

"If you were to remove this explanation and imagine Planet Nine does not exist, then you generate more problems than you solve. All of a sudden, you have five different puzzles, and you must come up with five different theories to explain them," said Mr. Batygin.

Six known objects in the distant Kuiper Belt, a region of icy bodies stretching from Neptune outward towards interstellar space, all have elliptical orbits pointing in the same direction, researchers have said.

However, these orbits also are tilted the same way, about 30 degrees "downward" compared to the pancake-like plane within which the planets orbit the Sun, they added.

Computer simulations of the solar system with Planet Nine included show there should be more objects tilted with respect to the solar plane.

The tilt would be on the order of 90 degrees, as if the plane of the solar system and these objects formed an "X" when viewed edge-on.

Caltech graduate student, Elizabeth Bailey, showed that Planet Nine could have tilted the planets of our solar system during the last 4.5 billion years.

In the study published in the *Astronomical Journal*, researchers wondered why the plane in which the planets orbit is tilted about 6 degrees compared to the Sun's equator.

"Over long periods of time, Planet Nine will make the entire solar-system plane precess or wobble, just like a top on a table," Mr. Batygin said.

The last telltale sign of Planet Nine's presence involves the solar system's contrarians: objects from the Kuiper Belt that orbit in the opposite direction from everything else in the solar system, researchers have said.

Planet Nine's orbital influence would explain why these bodies from the distant Kuiper Belt ended up "polluting" the inner Kuiper Belt, they said.

"No other model can explain the weirdness of these high-inclination orbits," Mr. Batygin said.

“It turns out that Planet Nine provides a natural avenue for their generation. These things have been twisted out of the solar system plane with help from Planet Nine and then scattered inward by Neptune,” said Mr. Batygin.

“The possibility of a new planet is certainly an exciting one for me as a planetary scientist and for all of us,” said Jim Green, director of NASA’s Planetary Science Division.

“This is not, however, the detection or discovery of a new planet,” said Mr. Green.

“What we’re seeing is an early prediction based on modelling from limited observations. It’s the start of a process that could lead to an exciting result,” he said.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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All you need to know about the neutron star merger

On August 17, this year, the LIGO and VIRGO detectors picked up another disturbance due to a gravitational wave. The signal was different from the earlier four they had sensed. Not surprising, for the earlier signals were due to the distant mergers of black holes. This signal was much much longer – lasting 100 seconds – and had a different signature as it originated not from merging blackholes, but from merging neutron stars. The component neutron stars were estimated to have masses between 1.1 and 1.6 times the solar mass. They were also estimated to be about 130 million light years away, which is, relatively speaking, quite close.

Unlike earlier detections, this time the source was located more precisely because of the involvement of the VIRGO detector which is much farther away. Also, since the neutron stars threw off energy and light during their merging – unlike black holes that do not allow light to escape from within their boundary, neutron stars can throw off matter and light – the merger also had a light signal. This was not in the visible spectrum but in the form of gamma radiation. This was picked up by 70 telescopes around the world and in fact the source was traced quite accurately. The actual object before and after the collision was imaged. This is another “first” in the line of many that we are now getting used to.

Nobel-winning team spots merging neutron stars

Analysis showed that during the merger, the force of the merging melded together smaller nuclei to form heavy metals like gold and platinum. This explains how the universe contains a large amount of such heavy metals.

This was the first time a celestial event was observed both through gravitational waves and light waves emitted. Thus it opens the idea of not just gravitational wave astronomy – which is a way of mapping the universe’s violent, massive, dark and distant mergers – but also multimessenger astronomy, which will use many tools to cross check and make more accurate the said map.

Neutron stars are the final stage in the curve of evolution of very massive stars – which are around two times as massive as the sun. Initially, the stars glow and burn up their fuel. Due to internal pressure building up, they expand and since their mass is so high, they actually undergo a supernova explosion, throwing out the outer layers into space. The inner core collapses under its own gravity, shrinking to a small size, of a few tens of kilometres diameter. It stops short of becoming a black hole, as the mass is not sufficient to enable that. But this is a neutron star – its density is extremely high. As explained by Dibyendu Nandi of CESSI Kolkata explains, a spoonful of the material can weigh more than Mount Everest. Their magnetic fields are also huge in comparison to the Earth’s.

An earlier version of this article said that neutron stars are 20-30 times as massive as the sun. It has now been corrected to around two times as massive as the sun. The error is regretted.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Innovators, not pirates

Prime Minister [Narendra Modi](#) has expressed his desire to make India a hub of innovations at several fora, be it in his address to young CEOs or in his speech during his recent visit to Israel. In his words: "Innovation is life. When there is no innovation, there is stagnation". In his budget speech in 2015, the finance minister announced the setting up of the Atal Innovation Mission. But the progress in this respect has been tardy.

This is not the first time that India has aspired to be an innovation hub. The importance of innovation was also recognised by the UPA government, which constituted the National Innovation Council (NIC) in 2010 under Sam Pitroda, then adviser to the prime minister on innovations. The NIC's key mandate was to draw a roadmap for innovations between 2010 and 2020. The council submitted three annual reports to the government, the last of which was in 2013. Sectoral innovation councils were set up in 25 major departments of the Union government, including in the ministry of agriculture. State Innovation Councils were also set up. The idea behind the setting up of these councils was to mainstream the idea of innovation in the functioning of the Union and state governments. However, it soon became evident that despite the government's best intentions, there were hardly any innovative ideas which could be scaled up to the national level. This shows that government organisations are not ideally suited to devise game-changing innovations as they are mired in routine work. The work of the councils proves that innovations are designed in a supporting environment, irrespective of the size or nature of an organisation. The most important support that the government can provide is to protect the innovation itself.

The first lesson, therefore, for the NDA government would be to create an enabling environment to safeguard the intellectual property of individuals, private and public companies that develop new products and ideas using their own investments. India is placed 60th among 127 countries according to the Global Innovation Index of 2017 - an index prepared by Cornell University, INSEAD and the World Intellectual Property Organisation. Switzerland tops the list followed by Sweden, the Netherlands, the US and UK. Singapore is ranked seventh, Japan is at the 14th position, Israel is ranked 17th, and China 22nd.

In the Forbes list of the 10 most innovative companies in the world, six come from the US. Interestingly, in a recently released International intellectual property (IP) index that studied 45 countries, India ranked a poor 43rd. It is this poor record on IP protection that is holding India back from being a leading nation when it comes to innovations.

In this article we focus on innovations in agriculture as the challenge to feed 1.3 billion people cannot be met without innovations along the agri-value chains. Take the case of herbicide tolerant (HT) Bt cotton. It is now widely known that one of the biggest innovations in Indian agriculture in the past 15 years was the introduction of Bt cotton in 2002. The innovation owed much to a policy decision of the [Atal Bihari Vajpayee](#) government, which made India one of the top producers of cotton and the second largest exporter of the crop. Mahyco Monsanto Biotech, which released Bt cotton through its 40 or so odd licencees, wanted to release HT Bt cotton as well and applied to the Genetic Engineering Approval Committee (GEAC). HT cotton is an innovation on Bt cotton, as it takes care of the problem of weeds at a cost much lower than that incurred by farmers in employing labour to take out weeds.

But before Mahyco Monsanto Biotech could be granted permission for HT cotton, some unscrupulous elements pirated this cotton variety, probably from countries like the US and Australia, where HT cotton had already been released. These pirated seeds were multiplied in the country and this kharif season, several companies have sold an estimated 35 to 45 lakh packets of HT Bt cotton seeds. About 7 per cent to 10 per cent of the area under cotton in the country is now

under this counterfeit crop. In view of the blatant violation of its IPR, Mahyco Monsanto Biotech withdrew its application in 2016. Interestingly, the company had alerted the GEAC, the ministries concerned and the states way back in 2008 about such illegal activities. Mahyco Monsanto Biotech had even provided details of plots where such activities were taking place. But the government of the day did not take action to stop these activities. The scale of pirating has become so large that it poses a major challenge to the current government.

It is, of course, noteworthy to see farmers' appetite to acquire better technologies and even pay premium prices ranging from Rs 1,100-1,500 per packet - despite the price cap of Rs 800 per packet for Bt cotton. But such illegal sales of HT cotton seeds indicate an "organised racket" by a few companies that seem to be making a mockery of the regulatory system comprising the GEAC and the Ministry of Environment and Forests.

How can India aspire to be an innovation hub, if such clandestine activities flourish and innovators suffer? Only stern and exemplary action by the prime minister can restore the credibility of India's regulatory institutions and put innovations on a safe and reliable path. Also, regulatory bodies need to clear applications for innovative products (like GM mustard or Bt brinjal) quickly, lest they are introduced by pirates surreptitiously. Without such action, making India an innovation hub will remain a pipe dream for decades - pirates can never be innovators.

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Unbundling of space

The meaning of “space” for mankind has evolved over the last few decades. What was once a battleground for one-upmanship during the Cold War is now morphing into a cauldron of entrepreneurship. While there are several interesting threads in the space entrepreneurship narrative, I find what I call “the unbundling of space” the most interesting.

First, some context. The de-escalation of the space race from the heights of animosity in the days of the Apollo and Luna missions was a precursor to the end of the cold war. The last lunar mission from the US and the former USSR happened in the mid-1970s. Through the 1980s and the 1990s, the romantic notion of exploring space gave way to talks on making it useful for mankind. Satellites became the centrepiece of this era rather than the adventurous narrative of footprints on the Moon.

Humanity is going through a resurgence of interest in space exploration. Entrepreneurs like Elon Musk, CEO of Tesla Inc., and Space Exploration Technologies Corp. (SpaceX)— where he oversees the development and manufacturing of rockets and spacecraft—have shattered the status quo and revived the idea that mankind could one day become a space-faring species. We have already heard of announcements of human flights to Mars in the next decade including one from SpaceX about two American space tourists signing up to orbit the moon. What is different in this era is that human interest in space does not merely come from a position of curiosity or of geopolitical muscle flexing: what comes along with it is a nose for business opportunities. One of the forces underlying this shift is the arrival of specialized firms doing specialized things in space—a massive shift from an era defined by national space agencies which did everything to one where smaller firms focus on a wider variety of things.

This is the start of an era of “unbundling” where there would be firms exploring how to mine space resources (Planetary Resources Inc., for one) and those clearing space junk (Astroscale). There would be firms talking about colonizing planets (SpaceX) and firms that beam down the internet from high up. Firms like Planet Labs Inc.—the one that accounted for the bulk of the 104 satellites Indian Space Research Organization (Isro) launched in February—intend to provide imagery and data derived from that imagery for sectors including agriculture, defence, energy and infrastructure, finance, forestry and mapping. Applications stemming from investments in space are clearly there to be seen and can be game changers. Parallels can be drawn with how the internet grew and changed the world through entrepreneurial innovations. Think of the number of multibillion-dollar firms that the global positioning system (GPS) has spawned.

There is a big opportunity in space for a nation like India where talent and cost advantage combine in large numbers to make business sense. With Isro, India already offers the lowest-cost space projects in the world. Private enterprise, working with the space agency, can further streamline this and develop India into a destination for low-cost development of space hardware and continue to provide affordable launch services. Think “Make in India—Launch in India”. This is key to what we at Team Indus envision as our future. The capabilities we have built through the Moon Mission will be invaluable as we explore other areas of space, for it is one of those industries whose impact goes way beyond its immediate periphery. It breeds and enables an ecosystem spanning everything from super light and super strong materials to beaming down television channels and even the internet.

Adding value to the space GDP will come from many ways; that includes evolution of existing services—next-generation GPS, wide area Wi-Fi and sharper, more local space-based weather prediction that is married to big data and introduction of new services like space-debris removal. Add to that space tourism of the Virgin Galactic ilk, evolution of Terra Bella (formerly Skybox

Imaging, it is now a Planet Labs subsidiary) type services, renewed interest in exobiology (possibility of life on other planets), and research into sustainable multi-planetary life; you can see a host of services that can come out of investing into space. This is why I call this the unbundling of space and space applications.

The unbundling of space has immense potential to generate a large number of jobs in India—reminiscent of the information technology revolution in India. I do hope more of the best minds in India will make their move into space-based entrepreneurship over the next few years.

Rahul Narayan is fleet commander of Team Indus, part of Bengaluru-based aerospace start-up Axiom Research Labs Pvt. Ltd.

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Novel technology to boost Internet speed

Slow Internet and ‘rush hour’ — the peak time when data speeds drop by up to 30% — could soon be history, thanks to scientists who have developed new hardware that consistently provides high-speed broadband connectivity.

The new technology enables dedicated data rates at more than 10,000 megabits per second (Mb/s) for a truly superfast, yet low-cost, broadband connection, researchers said.

“By 2025, average speeds over 100 times faster will be required to meet increased demands for bandwidth-hungry applications such as ultra-high definition video, online gaming, and the Internet of Things,” said Sezer Erkilinc, from University College London in the U.K.

Bandwidth restrictions

“The future growth in the number of mobile devices, coupled with the promise of 5G to enable new services via smart devices, means we are likely to experience bandwidth restrictions; our new optical receiver technology will help combat this problem,” said Mr. Erkilinc, lead researcher of the study published in *Nature Communications*.

Scientists, including those from the University of Cambridge in the U.K., developed a simplified receiver to be used in optical access networks: the links connecting Internet subscribers to their service providers.

“To maximise the capacity of optical fibre links, data is transmitted using different wavelengths, or colours, of light. Ideally, we’d dedicate a wavelength to each subscriber to avoid the bandwidth sharing between the users,” said Polina Bayvel, from the UCL.

Though this is possible using highly sensitive hardware, they are costly.

In an apparent attempt to crack down on revenge porn, Twitter has introduced a new policy that states that no one can post or share “intimate photos

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Mars has near ideal conditions to create oxygen from atmospheric CO₂, says study

This breathtaking colour photo of the surface of Mars unveiled by NASA is the sharpest photograph ever taken on the surface of Mars. The picture was taken by the panoramic camera on the Mars Exploration Rover Spirit. | Photo Credit: [AP](#)

Mars has near ideal conditions for efficiently creating oxygen from atmospheric carbon dioxide in the future using plasma technology, a study has found.

According to researchers from University of Porto in Portugal and Ecole Polytechnique in Paris, Mars has 96 per cent carbon dioxide (CO₂) in its atmosphere.

The research, published in the journal *Plasma Sources Science and Technology*, shows that the pressure and temperature ranges in the Martian atmosphere mean non-thermal plasma can be used to produce oxygen efficiently.

“Sending a manned mission to Mars is one of the next major steps in our exploration of space. Creating a breathable environment, however, is a substantial challenge,” said Vasco Guerra, from the University of Lisbon in Portugal.

“Plasma reforming of CO₂ on Earth is a growing field of research, prompted by the problems of climate change and production of solar fuels,” said Guerra.

“Low temperature plasmas are one of the best media for CO₂ decomposition — the split-up of the molecule into oxygen and carbon monoxide — both by direct electron impact, and by transferring electron energy into vibrational excitation,” he said.

Mars has excellent conditions for In-Situ Resource Utilisation (ISRU) by plasma.

As well as its CO₂ atmosphere, the cold surrounding atmosphere may induce a stronger vibrational effect than that achievable on Earth.

The low atmospheric temperature also works to slow the reaction, giving additional time for the separation of molecules.

“The low temperature plasma decomposition method offers a twofold solution for a manned mission to Mars. Not only would it provide a stable, reliable supply of oxygen, but as source of fuel as well, as carbon monoxide has been proposed as to be used as a propellant mixture in rocket vehicles,” said Guerra.

“This ISRU approach could help significantly simplify the logistics of a mission to Mars. It would allow for increased self-sufficiency, reduce the risks to the crew, and reduce costs by requiring fewer vehicles to carry out the mission,” he said.

A study of nearly 300 people living in different parts of India found that nine single-base variants (single-nucleotide polymorphisms or SNPs) account

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Organic near-infrared filter developed by NIIST team

A. Ajayaghosh, right, and Samrat Ghosh. | Photo Credit: [Special Arrangement](#)

An organic filter that allows only near-infrared (NIR) light to pass through has been developed by scientists at the CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST) based in Thiruvananthapuram.

The new NIR filter can be used for night vision glasses, night photography, and will have applications in security and forensics such as identifying blood stains on a dark fabric.

Currently available inorganic filters are expensive and brittle whereas organic filters are easy to process and flexible too.

The filter was prepared by mixing a black dye (diketopyrrolopyrrole or DPP) having an amide group that helps the molecules to be in close contact with each other and interact, leading to changes in their optical properties.

“The amide group helps in binding and self-assembly of the molecule leading to the formation of a soft organogel,” says Ayyappanpillai Ajayaghosh, Director of NIIST, who led the team of researchers.

Organogel is key

The organogel-based filter has the ability to absorb both ultraviolet and visible light while allowing the near-infrared light alone to pass through. The nanofibres formed through the self-assembly of the DPP molecules are responsible for the broad light absorption of the material, making it appear dark.

The researchers developed the filter by mixing the organogel with a transparent polymer (polydimethylsiloxane). The addition of the dye turns the transparent polymer into a semi-transparent one and the filter appears black as it absorbs most of the ultraviolet-visible light.

“Only very little of the organogel has to be added to the polymer to make the filter. The material is present throughout the polymer matrix even though very little is added,” says Samrat Ghosh from the Chemical Sciences and Technology Division at NIIST and the first author of the paper published in the journal *Advanced Materials*.

The filter was found to absorb light from 300-850 nm (both ultraviolet, visible and a part of NIR light) and transmit NIR light from 850-1500 nm. The researchers tested it for night photography and found the filter responsive only to NIR light.

Dried blood stains on a black cloth that remained invisible to naked eyes became clearly visible and detectable when viewed through a camera with the NIR filter. Tampering of a cheque which was not discernible to naked eyes could be easily identified when viewed through a camera with the filter.

A potential application of the new material is in the design of hidden security codes on documents which can be viewed only through a NIR-readable camera.

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Should robots be nationalised?

As we ask ourselves how employment is threatened by technology, we should look at how labour has changed in recent decades. Before we get so attached to the current job market, and feel we must defend it from an eventual robot takeover, we should examine how unfair the labour system has become and how robotics could contribute to change that.

If properly managed, the [robotic revolution](#) could be a chance to free millions of people from a system of exploitation of labour which is unprecedentedly inhumane. Or not.

In ancient Rome, a slave worked a maximum of six hours a day. A third of the year was spent in festivities. European workers in the Middle Ages had a six-hour work day and spent 150 days in religious celebrations — almost half the entire year off!

Nothing close to the 13 to 14 hours put in by the average, always-on entrepreneur of our times. Or the 10 hours a regular employee often clocks in, which explains why overwork is causing so many deaths across Asia.

The Industrial Revolution and the continuous automation of work have morphed us into becoming increasingly less human workers. This is the central premise before looking into what robotisation can offer to the future of work in India.

Is there also a continuing percolation, in India, from the agricultural sector, through urbanisation and its consequences, into the service and manufacturing sectors? Certainly.

'Robotics revolutionising labour market'

Could this happen in a more humane way, as easily automated jobs are slowly stolen by robots? Is farming also destined to be substituted by Artificial Intelligence (AI)? Could we then envision a future of a widely urbanised class with more leisure time thanks to robots? Utopia.

But there may be a way to go in that direction, if we think about the advantages of robotisation being equally distributed among those who will lose their jobs.

A socially sensitive policy should consider this a chance for the government to gather advantages from higher robotisation and distribute them to the work force by creating job alternatives. Or by providing subsidies and employment systems with less working hours — such as part-time and work from home. Finally, robotised work should distribute earnings to those who will permanently lose their jobs. And this could be done in very specific ways.

First, we should consider how to capitalise from the current market. The premise for doing so requires a radical change of perspective.

When we read that in a town in Andhra Pradesh, an AI company hires women and youth and spends some of its profit on education and drinking water for the community, we should not be humbly thankful. We should be worried.

But what is passed for bringing employment to underdeveloped areas is neo-colonial exploitation at its best. Workers are paid peanuts to build the very same AI that will render them obsolete. This is not explained to them. So they are thankful for an extra little water and infrastructure, in exchange.

This trick is fooling Western underprivileged people as well. To refine conversation skills, a digital AI assistant needs to be told over and over when it has failed. There are plenty of American college students spending 10 to 30 hours a week, for \$10 an hour, on phones or computers as AI supervisors, evaluating search results and chats through sites such as Clickworker. If they understood the ramifications of their work, they might demand to be paid much more.

Robots that steal human jobs should pay taxes: Bill Gates

This is policy recommendation number one: enforce a high international minimum wage for all data-entry and data-supervision workers. Help people who are “feeding the machine” be better paid for contributing to coding reality into its virtual version.

There is a more serious issue in the Indian job market. In 1810, the agricultural sector was 90% of the U.S. economy. In 1910, it was down to 30%. In 2010, it was 2%.

Is this what's in store for India, where agriculture is still occupying half of the work force? Will it happen faster here? How do we retrain farmers? And where are they to relocate?

What will happen to “the rejected” as Pope Francis called them, “the forgotten,” as U.S. President Donald Trump labelled them during his campaign?

More interestingly, will we move into a “humanistic intelligence” era in which we transform our workers, first with wearable computers (smartwatches and Google glasses are a beginning, the new smartphones operating according to moods, gaze and gestures are the next step), and then with deeper integration, like the Swedish company Biohax, implanting chips under the skin of their employees' wrists?

It is called “shortening the chain of command”— from the smart screen era, to the cyborg era.

At first, technology might not immediately take all our jobs, it will take over our bodies. Of course, it's already doing that. For example, I wear a hearing aid. Would I wear a bionic eye for sensory and visual augmentation, or for, say, drone operation? Maybe.

Is this how humans will compete with robots in an intermediary phase? What does it mean for society and its sense of identity, our relationship to our bodies?

There might be a lot of jobs for our new cyborg selves out there, in what is called the augmented reality. Humans, some argue, are not to be defended, but expanded. So, will we become transhumanistic, pimped-up cyborgs, with mechanical elements expanding our physical limitations? Isn't this already happening? Is this the Nietzschean Übermensch we are supposed to become? Shouldn't policy regulate that as well?

The focal question here is: as labour is being transformed at its roots, should economic forces be the only thing that matters? Aren't we in front of an ethical and political, rather than an economic, question? And what if the answer is simply that everyone must benefit from the capital generated by robotisation?

Shouldn't we begin to think of an alternative form of ownership of the robots? Shouldn't they be public property, since they are objects that occupy and operate on public grounds, impacting public economy and nation-wide employment?

Shouldn't they be owned by everyone? Should India consider nationalising robots? As ludicrous and anachronistic as it may sound in the post-neoliberal zeitgeist, it is something at least worth

opening up for reflection.

Or could robots owned by private companies be allowed to operate only by purchasing a costly state licence, benefitting society at large or, specifically, displaced workers, thus funding unemployment?

Is it conceivable to create “job permits for robots” so that 30% of the revenue they raise with their work goes directly to finance the pension funds of the workers made redundant by robotisation?

This may not be the specific solution, but discussion should begin on these topics, as one of the ways to avoid famine and death possibly brought on by massive unemployment in a relatively short time.

Carlo Pizzati is an author and professor of communication theory. This text is part of his contribution to the “Technology Foresight Group on the Future of Work in India,” a collaboration between Tandem Research and the International Labour Organisation

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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The future of networking

The year 2017 has been a watershed year for digital transformation in India, with an increased focus on customer/citizen experience as a key driver. Indian business leaders have widely embraced the idea that they need to be a “digital organization” to enable growth. Besides, the government’s Digital India initiative has made notable strides, with more than 20 new projects under way. Spending on core technologies enabling digital transformation like software and information technology (IT) services soared, while the adoption of public cloud services became increasingly mainstream. But it is far from smooth sailing ahead for India’s digital leaders.

In 2018, the digital hype of 2017 may turn into an uncomfortable reality for many businesses and governments—both globally and in India—as they stretch to make new platforms deliver. Cloud, mobile, the Internet of Things (IoT), everything-as-a-service—it’s all happening. However, with research firm International Data Corp. (IDC) predicting that 60% of digital initiatives will be unable to scale due to lack of a strategic architecture, chief information officers are in for some challenging moments at the boardroom table.

It’s not surprising. Traditional networking technology, which had been serving as the on-ramp to digital projects and connects increasingly far-flung users, was designed long before the cloud or IoT ever existed.

While the world at “either end of the pipes” has changed dramatically, networks haven’t changed much since the 1990s. As organizations embraced disruptive technologies and hybrid networks added countless more users, applications and devices, legacy approaches to managing complex, distributed networks and routing traffic remained much the same—hardware-centric, manpower-intensive, rigid and error-prone.

As a result, these networks have the potential to be a major roadblock for Indian businesses and government, threatening early gains in this new wave of the cloud and digital business. There’s a lot at stake in the current era of “disrupt or be disrupted”. A fundamental rethink to networking—a revolution—is needed.

Enter the future of networking: Software-defined wide area networking, or SD-WAN, is a set of capabilities that enables the network to be more flexible and efficient—especially as businesses look to connect offices and workers to the cloud and for hybrid networks. SD-WAN supersedes the managing of individual network devices using arcane command line interface commands and scripts, automating some of the most complex network tasks. This makes organizations more agile, transforming the way they are able to innovate.

Poised to be an \$8 billion global market by 2021 according to IDC, the emerging SD-WAN market is attracting a myriad of companies. Early use cases for SD-WAN paint the picture of an exciting new future that could have significant implications for India’s manufacturing, healthcare, banking and retail industries, and more.

For example, one multinational manufacturer is using SD-WAN across its over 100 sites to transform network security, and dramatically reduce the cost and complexity of managing its large ecosystem of partners, joint ventures and customers. Another global retailer is leveraging SD-WAN to help in their store of the future, delivering a “millennial grade” user-experience to customers via rich media and in-store Wi-Fi. SD-WAN has also given one Australian start-up, SimplePay, the power to instantly scale the network to follow the pace of its global expansion and cloud growth without any security or performance compromises.

Each of these examples represents a revolution in networking: software-defined, application-centric and as agile as the business demands.

This starts with unified connectivity of a company's network connections—cloud, WAN and wireless local area networks—and includes complete visibility for end-users, networks and applications. Networks shouldn't be managed through the configuration of individual appliances or at the network/hardware layer, but rather policy-based orchestration naturally aligned to the language and priorities of business. Simply put: deploying and managing network services should be as intuitive as downloading apps onto your smartphone and as instant as spinning up compute and storage resources into a public cloud.

Taking a cloud-first approach to software brought about the first revolution in enterprise IT; a cloud-first approach to networking is set to catalyze the next leap forward. In India, where legacy players have traditionally dominated the networking industry, it can be tempting to go with what is known. But the strategies and technologies that worked yesterday are not suited to deliver results tomorrow. The time for a revolution is now.

Jerry Kennelly is chairman and CEO of Riverbed Technology Inc.

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The identity puzzle: DNA Bill

The Law Commission of India submitted a draft of the [DNA Based Technology \(Use and Regulation\) Bill, 2017](#) to the government in July. Given that there are no appropriate legal mechanisms with regard to identifying missing persons, victims of disasters, etc., the DNA Bill seeks to regulate human DNA profiling and establish standard procedures for DNA testing.

The draft Bill has substantially modified the earlier Bill and suggested various measures to fortify the use of uncontaminated DNA samples for investigation purposes and for identifying missing persons.

The salient features of the recommendations include the constitution of a statutory body called the DNA profiling board and a DNA data bank. The profiling board will undertake functions such as laying down procedures and standards to establish DNA laboratories and granting accreditation to such laboratories, and advising the concerned Ministries/ departments of the Central and State governments on issues relating to DNA laboratories. It will also be responsible for supervising, monitoring, inspecting and assessing the laboratories.

The Board will frame guidelines for training the police and other investigating agencies dealing with DNA-related matters.

Its functions also include giving advice on all ethical and human rights issues relating to DNA testing in consonance with international guidelines. It will recommend research and development activities in DNA testing and related issues. DNA profiling will be undertaken exclusively to identify a person and will not be used to extract any other information.

The Bill has also recommended the setting up of a DNA data bank both nationally and on a regional basis in the States. The data bank will primarily store DNA profiles received from the accredited laboratories and maintain certain indices for various categories of data such as crime scene index, suspects index, offenders index, missing persons' index and unknown deceased persons' index with a view to assisting families of missing persons on the basis of their bodily samples and substances. Strict confidentiality will be maintained with regard to keeping records of DNA profiles and their use.

The DNA profiles shall be shared with and by foreign governments or government organisations or agencies only for the purposes enumerated in the Act.

Violators of the provisions will be liable for punishment of imprisonment which may extend up to three years and also a fine which may extend up to 2 lakh.

The new U.S. Fed Chairman is unlikely to opt for policies that might upset the President's plan

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Scientists link new virus to kala-azar

Researchers have stumbled upon tantalizing evidence of an unknown virus that may be responsible for the persistence of kala-azar or visceral leishmaniasis, a parasite infection that has spawned epidemics and sickened thousands of Indians for over a century.

It's still early to pointedly blame the virus but its discovery portends a new kind of treatment regime and may aid attempts to eradicating the disease.

Historically, the parasite *Leishmania donovani* is believed to be responsible for the dreaded infection. People get infected when bitten by an insect called the sandfly, which harbours the disease-causing parasite.

This month, a group of scientists from West Bengal and Uttar Pradesh said that another parasite may be involved. Another parasite called *Leptomonas seymouri* may also be present, according to Subhajit Biswas, one of the scientists involved in the study.

The researchers inferred this after they found the *L seymouri* and a virus called Lepsey NLV1 within it in 20 of 22 biological samples of patients who had a residual *L donovani* infection. They reported their findings in an online version of the peer-reviewed *Archives of Virology*.

Endemic to subcontinent

Kala-azar is endemic to the Indian subcontinent in 119 districts in four countries (Bangladesh, Bhutan, India and Nepal). India itself accounts for half the global burden of the disease. If untreated, kala-azar can kill within two years of the onset of the ailment, though the availability of a range of drugs has meant that less than one in 1,000 now succumbs to the disease.

However, scientists are still not clear how the parasites cause the infection and how they manage to hide within the body.

“So far researchers weren't looking for parasites other than *donovani* and hopefully this finding should lead to collaborations with other labs to explore this link,” Dr. Biswas told *The Hindu* .

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Arctic sea ice waning faster than predicted, says study

Dwindling Arctic sea ice will impact global weather patterns and terrestrial and marine life, according to a study.

Arctic sea ice, a key indicator of climate change, could be dwindling faster than predicted, according to a study by the University of Calgary, Canada.

Research undertaken by the Cryosphere Climate Research Group under the Department of Geography at the university has found that satellite measurements over the years have overestimated the thickness of Arctic sea ice by as much as 25% because of the presence of salty snow.

“The implication is that the prediction of an ice-free Arctic ocean in summertime by 2050 could happen much earlier,” says Vishnu Nandan, lead author of the work published in *Geophysical Research Letters*, a peer-reviewed journal by the American Geophysical Union. Dwindling ice cover hastens the warming of oceans, and has an impact on weather phenomena like the El Niño that influences the Asian monsoon.

“The thinning ice would make it difficult for animals like polar bears and seals and organisms like phytoplankton to survive,” says Mr. Nandan who hails from Thiruvananthapuram.

The study, based on satellite data and extensive field measurements, found that salty snow — formed when brine is expelled upward from the ice surface — does not allow radar waves from satellites to penetrate, leading to skewed measurements.

Correction factor

The researchers have proposed a snow salinity correction factor that could bring down the error in estimation of sea ice thickness.

Mr. Nandan and his team members braved hostile weather, polar bears and treacherous ground in the Canadian Arctic to generate field data for the study.

“We spent months in sub zero temperatures upto minus 40 degrees. The barren land, deafening silence and absence of communication often got on our nerves. Our only contacts were with the Inuit people who guided us through the ice routes”, recalls Mr. Nandan who has worked on Antarctic ice shelves during a previous stint at the Alfred Wegener Institute, Germany.

Jaggi Vasudev’s Rally for Rivers claims they will, but this is not based on the most nuanced science

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Experimental vaccine may protect against HIV

Researchers designed a vaccine candidate using an HIV protein fragment. | Photo Credit: [Biswaranjan Rout](#)

Scientists have developed a novel vaccine candidate that may prevent HIV infection by stimulating an immune response against sugars that form a protective shield around the virus.

“An obstacle to creating an effective HIV vaccine is the difficulty of getting the immune system to generate antibodies against the sugar shield of multiple HIV strains,” said Lai-Xi Wang, a professor at the University of Maryland in the U.S. “Our method addresses this problem by designing a vaccine component that mimics a protein-sugar part of this shield,” said Mr. Wang.

Researchers designed a vaccine candidate using an HIV protein fragment linked to a sugar group. When injected into rabbits, the vaccine candidate stimulated antibody responses against the sugar shield in four different HIV strains.

The protein fragment of the vaccine candidate comes from gp120, a protein that covers HIV like a protective envelope. A sugar shield covers the gp120 envelope, bolstering HIV's defences. The rare HIV-infected individuals who can keep the virus at bay without medication typically have antibodies that attack gp120.

Small fragment

Researchers tried to create an HIV vaccine targeting gp120, but had little success as the sugar shield on HIV resembles sugars found in the human body and does not stimulate a strong immune response. Over 60 strains of HIV exist and the virus mutates. As a result, antibodies against gp120 from one HIV strain will not protect against other strains.

small fragment To overcome these challenges, researchers focused on a small fragment of gp120 protein that is common among HIV strains.

Lifestyle-related risk factors are being cited, compounded by an inadequate number of treatment centres in the region

Without policies to stop the worrying spread of antimicrobial resistance, the mortality rate could be disturbing

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The IoT wars

Most of us are familiar with Bluetooth headphones which we use with our cellular devices. While the communication between the Bluetooth device and the cellular device is limited to a few feet, it is the cellular device, in turn, that maintains the connection with the long-range telecommunications network.

These “last mile”—or more accurately, “last feet” radio devices need to be charged frequently, since the radio in each device needs a considerable amount of power in order to be able to transmit and receive information at a respectable range. The trade-off that designers of these devices have always faced is between battery life and device range. The longer the range you want, the more power your device needs—and the more frequently it needs to be recharged.

If the Internet of Things or IoT is to be useful, then IoT devices need to have the ability to communicate with each other over long distances. When this long-range communication variable is thrown into the equation, the only way is for firms to limit the battery-constrained radio communication to short distances and then switch over to the capabilities of cellular providers, on whose network they can piggy-back to send data over long distances.

Many potentially “connected things” are located in remote areas at long distances from the nearest cellular base station, or deep within buildings, which shield them from a cellular signal. Yet others are constantly on the move—being shipped from factory to consumer in a long supply chain, for instance. While en route, coverage is spotty and requires the device to operate at high power, thereby draining the battery.

In addition, the type of cellular network over which machine-to-machine communications are carried also makes a difference. The old 2G or GPRS networks were ideal for the very low levels of data transmission that IoT-enabled devices need—often not more than just a few packets (or bytes) of data each day. In fact, 2G or GPRS networks are responsible for most of today’s machine-to-machine communication.

However, 2G, while sufficient for machine-to-machine communication, simply doesn’t cut it for the vast majority of human smartphone users. 2G networks are beginning to be shut down as the world has moved on to 3G, 4G and LTE networks as cellular companies fight to serve billions of smartphone users who demand vast amounts of data throughput. LTE build-outs continue apace, as we have recently seen in India with Reliance Jio.

These new cellular networks are not yet optimized for applications that only transmit small amounts of infrequent data. In the rush for greater data throughput for smartphones, the 3rd Generation Partnership Project or 3GPP, the international body that sets cellular standards, was slow to set out “Narrowband IoT” standards meant for machine-to-machine communications for newer cellular networks like 3G, 4G and LTE.

Interestingly, the slow death of 2G and the delay of standards for deploying IoT over newer cellular networks has contributed to a welcome development. Scientists have worked on a new class of radios that would allow IoT devices to communicate over larger distances. These radio devices deliver both long-range communications and years of battery life. A set of technologies collectively called the “Low Power Wide Area Network” or LPWAN have been promulgated by firms such as SigFox, Ingenu, and LoRa as an alternative to the delayed Narrowband IoT from 3GPP.

That said, 3GPP and telecom providers now have solutions for IoT on the newer LTE networks, called LTE-M (where M stands for Machine). Even here they haven’t been specific, since there are

two competing Narrowband IoT standards, one backed by Nokia and Ericsson and the other by Vodafone and Huawei. This further leads to a delay in adoption, which will allow the LPWAN device makers more time to seize the market.

The leaders in the LPWAN space appear to be SigFox and LoRa, which are both well-funded French firms producing devices meant for IoT communications. Their batteries last for years while emitting or receiving a usable signal. I shall not go into the competing technologies in any depth here. Suffice to say that the underlying radio technology that the firms are using has been around for a while but what's new is that it has now been encoded to microchips which can be cheaply produced at a large scale. One can now buy a long-range radio chip for pennies and add it to any device.

The main difference between SigFox and LoRa is that SigFox is both a device manufacturer and a network operator. SigFox licenses out its device technology, so any manufacturer can make use of the technology, but the user is constrained to the proprietary SigFox network. With LoRa, there is only one chip manufacturer, so you pay for the chip, but can install it without recurring costs if, like many communications companies, you already control a network. For instance, Tata Communications already has a tie up with LoRa to offer IoT solutions.

One way to make sense of these divergent business models is to think of the differences between Apple and Google in the smartphone arena. Apple has always maintained control over both the device and the software, while Google licensed out its Android software to a plethora of manufacturers.

Google has recently seen the light of being both a device manufacturer as well as an operating software provider, while Apple hasn't yet let go of its proprietorship of both hardware and software. The battle for LPWAN device supremacy will see similar twists and turns.

And yes, like the smartphone space, the Chinese are hovering over all of this. Huawei is pushing one of the two standards for the alternative technology of LTE-M. Considering that they own a chip manufacturer in HiSilicon and probably can get the Chinese government to deploy millions of devices in China, they may create the eventual de facto standard. Maybe an Indian IT major should acquire an LPWAN player to thwart this.

Siddharth Pai is a world-renowned technology consultant who has personally led over \$20 billion in complex, first-of-a-kind outsourcing transactions.

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MHA gives a boost to “Make in India” in the field of manufacturing of arms**MHA gives a boost to “Make in India” in the field of manufacturing of arms**

The Ministry of Home Affairs has liberalised the Arms Rules to boost “Make in India” manufacturing policy of the Government as also to promote employment generation in the field of manufacturing of arms and ammunition.

The liberalisation of the Arms Rules will encourage investment in the manufacturing of arms and ammunition and weapon systems as part of the “Make in India” programme. The liberalised rules are expected to encourage the manufacturing activity and facilitate availability of world class weapons to meet the requirement of Armed Forces and Police Forces in sync with country’s defence indigenization programme. The liberalised rules will apply to licences granted by MHA for small arms & ammunition and licences granted by Department of Industrial Policy and Promotion (DIPP), under powers delegated to them, for tanks and other armoured fighting vehicles, defence aircrafts, space crafts, warships of all kinds, arms and ammunition and allied items of defence equipment other than small arms.

The salient features of the liberalised rules are:

(i) The licence granted for manufacturing shall now be valid for the life-time of the licensee company. The requirement of renewal of the license after every 5 years has been done away with.

(ii) Similarly, condition that the small arms and light weapons produced by manufacturer shall be sold to the Central Government or the State Governments with the prior approval of the Ministry of Home Affairs has been done away with.

(iii) Further, enhancement of capacity up to 15% of the quantity approved under licence will not require any further approval by the Government. The manufacturer will be required to give only prior intimation to the licensing authority in this regard.

(iv) The licence fee has been reduced significantly. Earlier the licence fee was Rs. 500/- per firearm which added up to very large sums and was a deterrent to seeking manufacturing licenses. The licence fee will now range from Rs. 5,000/- to the maximum of Rs. 50,000/-.

(v) The fee for manufacturing licence shall be payable at the time of grant of license rather than at the time of application.

(vi) Single manufacturing licence will be allowed for a multi-unit facility within the same State or in different States within the country.

A notification for the Arms (Amendment) Rules, 2017 has been issued by MHA on October 27, 2017.

Click here for notification:

<http://egazette.nic.in/WriteReadData/2017/179873.pdf>

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