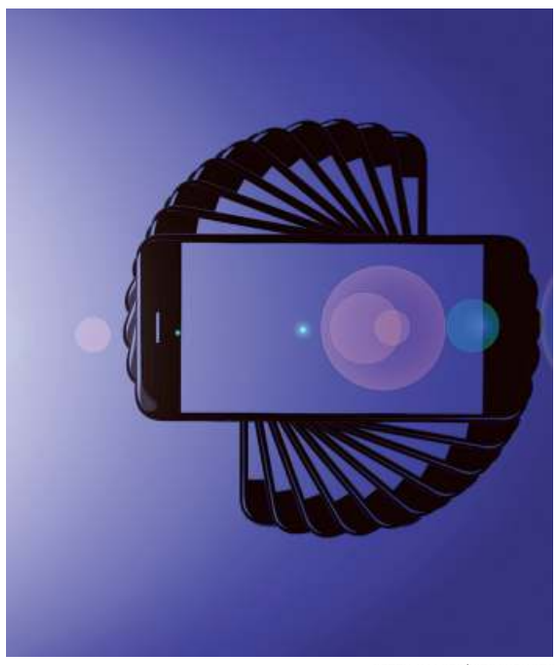

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Registry for phones

How has a database been drawn up to address the issues of security, theft and other concerns regarding mobile phone handsets?

P.J. GEORGE

The story so far: The National Telecom Policy of 2012 calls for the establishment of a National Mobile Property Registry to address the issue of "security, theft, and other concerns including reprogramming of mobile handsets". Based on this, the Department of Telecommunications (DoT) under the Ministry of Communications initiated a Central Equipment Identity Register (CEIR) for mobile service providers. The DoT issued a memorandum in July 2017 announcing the CEIR with a pilot project led by Bharat Sanchar Nigam Limited in Maharashtra. In January 2018, this project was handed over to the Centre for Development of Telematics (CDoT). Now, it is all set to roll out.

What is CEIR?
Based on a 2008 order from the DoT, every mobile network provider in India has an Equipment Identity Register (EIR), or a a database of the phones connected to its network. These EIRs will now share information with a single central database, the CEIR. In essence, it will be a repository of information on all mobile phones connected to networks across India. There were over 1,026 million active wireless phone connections by the end of 2018, according to the Telecom Regulatory Authority of India.

As per the DoT's 2017 memorandum, the CEIR will have information on the device's International Mobile Equipment Identity (IMEI) number (every phone or mobile broadband device has this unique 15 digit code that precisely identifies the device), model, version, and "other information". It will also know if the phone is blacklisted, and the reason why it has been blacklisted.

A database like the Central Equipment Identity Register is meant to identify and block stolen or illegal mobile phones across networks

Phones are identified based on the IMEI number, which you can find under the battery in many mobiles or by dialling '*#06#' on the device. Mobile phone manufacturers assign IMEI numbers to each device based on ranges allotted to them by the Global System for Mobile Communications Association. Dual SIM phones will have two IMEI numbers.

What is the purpose of a CEIR?
Such centralised databases are meant to identify and block stolen or illegal mobile phones across networks. Currently, when a customer reports a mobile phone as missing or stolen, mobile service providers have the ability to blacklist the phone's IMEI in their EIRs and block it from accessing their network. But if the SIM is changed to a new network, it can continue to be in use. With a CEIR, all network operators will be aware that the phone is blacklisted.

The CEIR will also access the GSMA's database of IMEI numbers to check whether the phone is authentic. There are cases of phones being in use with duplicate IMEI numbers, or with all zeroes instead of an authentic IMEI number.

Most importantly, as per the DoT's 2017 memorandum, the CEIR will be able to block services to subscribers. This ability had rested with individual networks till now. The memorandum also mentions enabling "IMEI-based lawful interception", which means allowing legal authorities to use CEIR data.

What are the issues with having a CEIR?
In its 2010 consultation paper on "issues relating to blocking of IMEI for lost/stolen mobile handsets," the Telecom Regulatory Authority of India (TRAI) raises a key issue with the CEIR – who should maintain such a high-value database? Should it be the service provider, or a neutral third party?

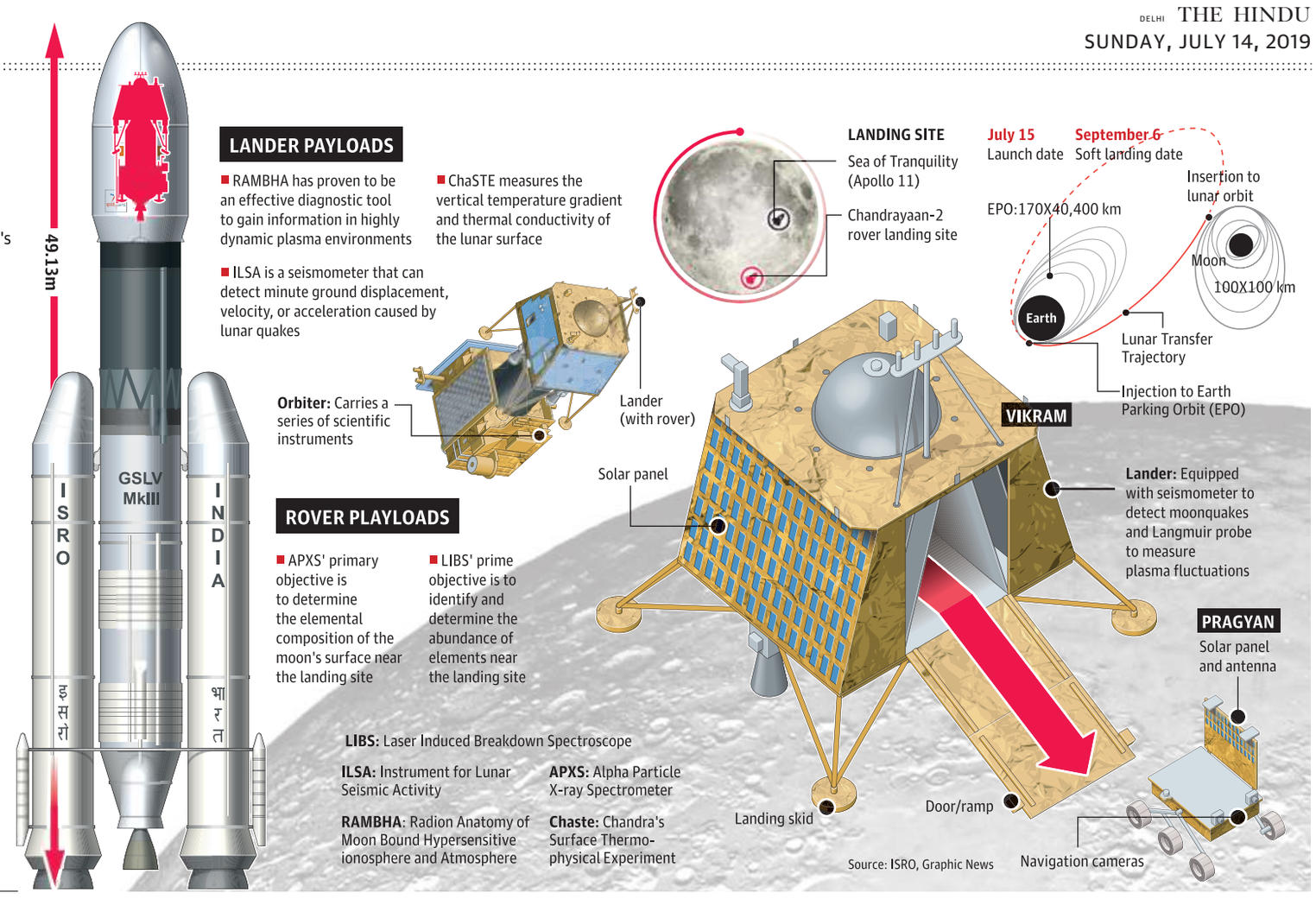
In their responses to the consultation paper, many major service providers preferred having a third party, ranging from international bodies to TRAI itself as suggested by the BSNL. The CDoT, which is reportedly readying to roll out the service, is an autonomous entity under the DoT.

Another major issue is cloning, or reprogramming stolen or unauthorised mobile phones to attach existing genuine IMEI numbers. Blocking cloned IMEI numbers could result in the authentic ones also being blocked. While the actual numbers on phones in circulation with cloned or inauthentic IMEIs are hard to pin down, Parliament, in 2012, was informed of two cases of 18,000 phones using the same IMEI number. In 2015, the government banned the import of mobile phones with fake IMEI numbers. In 2017, the DoT framed the "prevention of tampering of the Mobile Device Equipment Identification Number, Rules, 2017" that makes it punishable to tamper with the IMEI number of a device or knowingly use such a device. However, tools to reprogramme phones remain available online, and cases of such activities are reported frequently. On this issue, the DoT memorandum of 2017 says the IMEI Cloning and Duplication Restriction (ICDR) software is to be integrated in the CEIR.

Moon RUSH

Chandrayaan-2, India's second unmanned lunar mission, is fully indigenous and aims to put a rover on the unexplored south-polar region of the moon

- It will be launched on board GSLV Mk-III. The spacecraft includes the Chandrayaan-2 Orbiter, a Lander called Vikram and a Rover, called Pragyan
- It is the country's first space mission headed by women: Ritu Karidhal, the mission director, and M. Vanitha, the project director
- If successful, India will be the fourth country after the U.S., the former Soviet Union and China to complete a soft landing on earth's only natural satellite



How will Chandrayaan 2 study the moon?

Why is India's first attempt at a powered lunar landing important?

SHUBASHREE DESIKAN

The story so far: When Chandrayaan 1, India's first moon mission was launched on October 22, 2008, from Sriharikota, using the Polar Satellite Launch Vehicle (PSLV), India became the fourth country to plant its flag on the lunar surface. On the moon, the mission conclusively detected traces of water along with magnesium, aluminium and silicon. Now, close to a decade later, India will launch its second lunar mission, Chandrayaan 2, on July 15, 2019, again from Sriharikota, using the Geosynchronous Satellite Launch Vehicle (GSLV) Mark III rocket. The launch falls a day short of the 50th anniversary of the launch of the American mission Apollo 11 which took humans to the moon and back. The first moon landing occurred on July 20, 1969, on the Apollo 11 mission which was launched on July 16.

How will the launch work?
The GSLV Mark III rocket will first launch the spacecraft into an Earth Parking Orbit (170 km X 40,400 km). Then the height of the orbit will be enhanced until the spacecraft can reach out to the Lunar Transfer Trajectory. On entering the moon's sphere of influence, on-board thrusters will slow down the spacecraft, allowing it to be captured by the moon. Then it will be eased into a circular orbit (100 km X 100 km). From this orbit, the lander and rover will separate as a unit from the orbiter, and, through a series of braking mechanisms, the duo will "soft-land" on the moon, on September 6, 2019.

What is special about Chandrayaan 2?
Chandrayaan 2 will be the first mission to reach and study the south pole of the moon. It is made up of an orbiter, a lander named 'Vikram', after Vikram A. Sarabhai, the founding father of space science research in India, and a rover named 'Pragyan', which means 'wisdom'. At about 3,877 kg, the spacecraft weighs nearly four times its predecessor, Chandrayaan 1. It will be launched by the GSLV Mark III, the Indian Space Research Organisation's (ISRO's) most powerful and massive launcher. While Chandrayaan 1 sent its lander crashing into the moon, Chandrayaan 2 will use rocket technology to soft land 'Vikram', carrying its 'Pragyan' rover in a suitable high plain on the lunar surface, between two craters, Manzinus-C and Simpelius N, at a latitude of about 70º South. This landing is scheduled for September 6 this year. The total cost of the project is about ₹978 crore. The lander-rover combo has an expected lifetime of 14 days, while the orbiter will continue for a year.

How does the 'Pragyan' rover operate and what determines its lifetime?
The time taken for the moon to complete one rotation on its axis is approximately equal to 29.5 earth days. This is also equal to the time it takes to complete one orbit around the earth. That is why the same side always faces the earth. But because it takes 29.5 earth days to complete one rotation, every point on its surface experiences daylight for about half the time, or a little more than 14 days at a stretch. Moon days are nearly 14 earth days long. Note that the landing is scheduled for September 6, when we will see the first quarter of the moon. This is a date when the lander will land at a point that is facing the earth and which has started receiving sunlight.

Chandrayaan 2 will be the first mission to study the south pole of the moon. It is made up of an orbiter, a lander named 'Vikram', and a rover named 'Pragyan'

This point will receive light for nearly another fortnight which will match the expected lifetime of the lander-rover combo. Since the 'Vikram' lander and 'Pragyan' rover are powered by solar energy, they will be energised during this period by sunlight on the moon. Once night falls, this energy will not be available as they are plunged into a dark and cold -180º Celsius environment. If the lander-rover duo should kickstart after another half-rotation when day breaks once again, it will be a bonus for the ISRO.

The mission is not designed to survive this extreme cold, unlike some U.S. and Chinese missions which survived on the "dark" side of the moon using special sources of warmth.

How will the mission study the moon?
Using the Terrain Mapping Camera 2 which is on board the orbiter, the mission will produce images of the moon remotely from a 100 km lunar polar orbit. While the moon rotates about its axis, along its east-west direction, say, the lunar polar orbit will be in the perpendicular direction, along the lunar north-south direction. Thus, as the moon rotates, the orbiter gets a view of its entire surface from overhead. This data collected by the orbiter will be used to produce a 3D image of the moon's terrain. This is just one of the eight instruments, or payloads, on board the orbiter. The lander carries three such payloads, some of which will measure the electron density and temperature near the lunar surface; the vertical temperature gradient, and seismicity around the landing site.

The rover will carry two instruments or payloads which will collect and test samples from the moon's surface to identify what elements they contain. The rover moves on six wheels and once let down on the moon, can travel about 500 m from the lander.

What is the success rate of "soft-landing" on the moon?
There have been 38 attempts so far at "soft-landing" on the moon, with a success rate of 52% according to the ISRO website.

Why should we have this mission? Why should we study the moon?
The moon offers a pristine environment to study. It is also closer than other celestial bodies. Understanding how it formed and evolved can help us better understand the solar system and even earth itself. With space travel taking shape and exoplanets being discovered everyday, learning more about earth's celestial neighbour can help in advanced missions. Finally, it is a piece of the larger puzzle as to how the solar system and its planets have evolved.

Why is India opting for overseas bonds?

The government plans to raise a part of its gross borrowing in external markets. What are the advantages and risks?

T.C.A. SHARAD RAGHAVAN

The story so far: The government, Finance Minister Nirmala Sitharaman announced in the Budget speech, plans to raise a portion of its gross borrowing from overseas markets. The government and the Reserve Bank of India (RBI) will reportedly finalise the plans for the overseas issue of sovereign bonds by September. While several commentators have argued that this is a risky move, the government itself is convinced that it will help boost private investment in the country.

What is an overseas bond issue?
A government bond or sovereign bond is a form of debt that the government undertakes wherein it issues bonds with the promise to pay periodic interest payments and also repay the entire face value of the bond on the maturity date. So far, the government has only issued bonds in the domestic market.

According to Ms. Sitharaman, India's sovereign external debt to GDP ratio is among the lowest around the world, at less than 5%. Against this background, the government will start raising a part of its gross borrowing programme in external markets in external currencies. This, she said, would also have a beneficial impact on the demand for government securities in the India. The market estimates that the government will only test the waters and borrow about $10 billion, which works out to about 10% of its gross market borrowing.

What are the benefits of an overseas bond issue?
The government has been arguing that the quantum of its borrowing within India is 'crowding out' the private sector. In other words, it is saying that government borrowing is at such a level that there are not enough funds available for the private sector to adequately meet its credit and investment needs. If the private sector cannot borrow adequately, then it cannot invest as it wants to, and that cripples one major engine of economic growth.

According to Finance Secretary Subhash Chandra Garg, government borrowing accounts for about 80-85% of domestic savings. He also said that the overseas borrowing programme allows the government to maintain its gradual reduction of the fiscal deficit. Had the government listened to some commentators and relaxed its fiscal deficit to say 4.4%, then this would have allowed it to borrow an additional ₹2 lakh crore from the domestic market. However, this would have been ₹2 lakh crore that would not be available now to the private sector for borrowing purposes.

GETTY IMAGES/ISTOCKPHOTO

Therefore, borrowing overseas allows the government to raise funds in such a way that there is enough domestic credit available for the private sector.

The appetite of the international market for Indian bonds and their price will also say a lot about how India is viewed globally on the risk factor. For example, if the rate at which India can borrow overseas is low, then this would mean the global market assigns a low risk to India defaulting. This would undoubtedly be something the Narendra Modi government would take pride in.

What are the risks?
Several economists have expressed their concerns over the fact that India might follow the path of some Central and South American countries such as Mexico and Brazil. In the 1970s, several of these countries borrowed heavily overseas when the global market was flush with liquidity. But then, when their currencies depreciated sharply a decade later, these countries were in big trouble as they could not repay their debt.

India is not likely to be viewed as a risky proposition by the international market and so is likely to fetch an attractive rate for the bonds. Cheap and plentiful funds, however, should not encourage the government to borrow too heavily from abroad.

Another risk to India from overseas borrowings is that this would lead to a quicker increase to its foreign exchange reserves, which would lead to a stronger rupee at a time when it is already appreciating against the dollar. This, many experts say, would be an adverse outcome. A stronger rupee would encourage imports at a time when the government is trying to curb them, and discourage exports at a time when they are being encouraged.

On the other hand, a rupee depreciation for whatever external reason would prove even more disastrous as it would make it far more expensive for India to repay its external debt.

The third problem with an overseas bond issue is that the government would not be able to inflate itself out of trouble. That is, in the domestic market, if the government does ever reach the stage where it is finding it difficult to repay its debt, it can simply print more money, let inflation rise quickly and repay its debt. This is not an option in an overseas bond issue. The Indian government cannot print foreign currency to repay its debt.

What does it mean for the domestic market?
According to the government's own reasoning, there are not enough funds in the domestic market to cater to its needs as well as those of the private sector. This shallowness of the bond market is not a good thing, especially at a time when the government needs the bond market to finance several of its commitments.

The government feels that its borrowing is at such a level that there aren't enough funds available for the private sector to adequately meet its credit and investment needs

The Ujwal Discom Assurance Yojana (UDAY) scheme, for example, involves State governments taking over the debt of State power distribution companies and issuing bonds to repay that debt. Or take the government's Budget announcement of a further ₹70,000 crore capital infusion in public sector banks. A shallow bond market would make it difficult for the government to expand any of these schemes.

Ideally, the government should have enough revenue that it does not need to borrow as much. However, at a time when both direct and indirect tax collections have disappointed, the government is forced to borrow to finance its expenditure. In such a scenario, it is a welcome move for the private sector that the government is leaving it room to borrow in the domestic market.

CAPSULE

Black hole puzzle
The Hubble space telescope revealed the presence of a black hole at the centre of the galaxy NGC 3147 which is 130 million light years away that behaves differently from what is expected. While traditional theories postulated that its accretion disc would puff up like a doughnut, it was in fact flattened like that surrounding a more massive black hole.

Insects feel chronic pain
New research published in *Science Advances* reveals that insects feel chronic pain after injury. The researchers injured one leg of fruitflies (*Drosophila* species) and found that other legs became hypersensitive, trying to protect themselves from injury. They inferred that the fruit flies experienced long-lasting pain in the injured leg.

TIFR desalinates seawater without electricity

Alternatively, gold nanoparticles can be used to convert carbon dioxide into methane

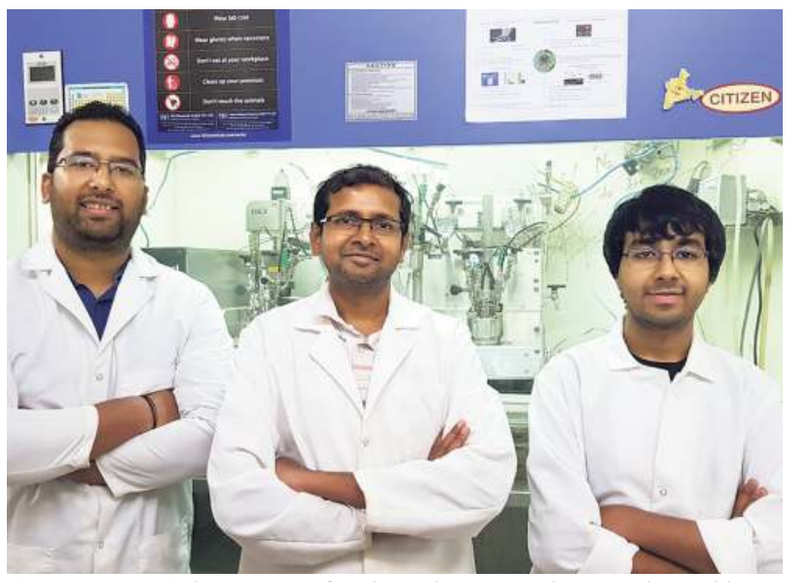
R. PRASAD

Using gold nanoparticles that absorb sunlight over the entire visible region and even the near infrared light, researchers at the Tata Institute of Fundamental Research (TIFR), Mumbai, have been able to desalinate seawater to produce drinking water. Unlike the conventional reverse osmosis that is energy intensive, the gold nanoparticles require no external energy to produce potable water from seawater.

Using 2.5 mg of gold nanoparticles, the team led by Vivek Polshettiwar from TIFR's Department of Chemical Sciences was able to use sunlight to heat the water to 85 degree C and generate steam to produce drinking water from seawater. Since the temperature reached is high, about 10% of seawater becomes steam (and hence drinking water) in about 30 minutes.

Alternatively, the gold nanoparticles can be used to convert carbon dioxide into methane. This happens when the light absorbed by the gold nanoparticles excites the electrons, and the excited electrons when transferred into carbon dioxide converts it into methane in the presence of hydrogen. The hydrogen comes from the water that is used as a reaction solvent.

"At present, the conversion of carbon dioxide to methane is low – about 1.5 micromole per gram. It is desirable to increase the conversion one-fold to millimole range. We are finding ways to improve the conversion rate," says Prof. Polshettiwar. The results of the study were published in the journal *Chemical Science*.



Alternative metal: The next step after this preliminary study is to replace gold with some inexpensive metal to make it sustainable, say (from left) Mahak Dhiman, Vivek Polshettiwar and Ayan Maity. ▪ SPECIAL ARRANGEMENT

The gold nanoparticles decorate the surface of 3D fibrous silica nanosphere structure. The silica nanospheres measuring 400-500 nanometres are first functionalised with amines. In the presence of a reducing agent, the gold chloride gets deposited on the silica nanospheres. The gold nanoparticles were made bigger though cycles of deposition.

"We used a different reducing agent that allows the gold to get deposited only on already formed nanospheres and not form new nanoparticles," says Prof. Polshettiwar. "A weak reducing agent does not allow gold to reach a critical concentration for it to form new nanoparticles. But in certain channels of the fibrous material, the concentration of the gold precursors was sufficient to form new nuclei leading to the formation of new nanoparticles."

The formation of smaller gold nanoparticles allows variation in size, which is essential for harvesting light. Each gold nanoparticle has an electron cloud on the surface that resonates with light. As the gold nanoparticles come closer when they grow bigger, the resonating electron cloud starts coupling together. This allows the gold nanoparticles to absorb light of different wavelength – visible and near infrared light.

While gold takes on different co lours including red at nanometre size, it is not possible to make it black by simply changing the size of the nanoparticle. "By changing the size and shape of gold nanoparticles we can tune the light absorption characteristic in the visible region. When we have plenty of gold nanoparticles in the vicinity of each other we can achieve completely absorption of visible light leading to black colour," says Mahak Dhiman from TIFR and one of the first authors of the paper.

"There is huge electromagnetic field and thermal heat produced about 1 nanometre around the gold nanoparticle. This is called a hotspot. Such hotspots are present only when there is a gap between the gold nanoparticles. The gaps provide higher surface area," says Ayan Maity from TIFR and the other first author. So more number of nanoparticles with gaps in between them are needed to generate more thermal hotspots.

"This is only a preliminary study. The next step should be to replace gold with some inexpensive metal to make it sustainable," says Dhiman.

▪ Uday Khankhoje

IIT-M's model detects cancer with deep learning, microwave

The method offers a portable, low-cost and safe alternative to X-ray and MRI scans

SHUBASHREE DESIKAN

Uday Khankhoje's team at IIT Madras is interested in developing a way of detecting breast cancer using microwaves - or radio frequency (RF) waves, as they are called. While several groups have worked on this in Europe and the US, and even made working hardware for this purpose, Dr Khankhoje's group uses the very popular method of "deep learning" for this. The method not only addresses a mathematical challenge, it also increases the range of the permittivity observed, where permittivity, the square of the refractive index of a material, is the characteristic that distinguishes cancer tissue from normal tissue. Further, this offers a portable, low-cost and safe alternative to X-ray and MRI scans already available for detecting cancer tissue.

In their method, what Dr. Hankhoje's team would do is to surround the patient with RF transmitters and receivers and collect the waves that bounce off the tissues. Analysing the waves reflected by the tissue, they would reconstruct the type of tissue, or the permittivities of the tissues, that scattered the waves.

This is a classic example of what are known as inverse scattering problems. Other examples of inverse scattering problems are the following: detecting buried landmines using ground penetrating radars; archaeological missions for detecting buried artefacts and so on. These are "inverse" problems because you observe the way waves scatter off an unknown object and reconstruct what it is made of, its shape and other characteristics. The innovation used by this group in solving the inverse scattering problem is "deep learning," which is a popular technique involving neural networks. Their article has been published in the journal IEEE Transactions on Computational Imaging.

"A neural network is something that learns a relation between input and output just by looking at data," explains Dr Khankhoje. If you have pairs of numbers (1,1), (2,4), (3,9), (4,16) and so on, a human intelligence would guess that this is a series of numbers and their squares. A machine, on the other hand, "learns" this series, and when given a number as input can produce an output that is the square of that number without having figured out that the relation between them is "square of". Deep learning, simply, is such a learning process made up of a huge number of "neurons."

A neural network thus has to be "trained" on data. "We generate our own input or output training data because we know the physics of the problem. This data is used to train the network for inputs it is yet to see," says Yash Sanghvi the first author of the paper.

He further explains that by this learning, the algorithm positions the analysis approximately in the correct region of the solution. Then existing physics-based algorithms take over, refine the result and arrive at the correct answer. "This exciting new framework of combining physics and machine learning has a very bright future, and in my opinion, it is important to do both," he adds.

The group is yet to work with the actual biological data. "More work needs to be done, including getting biological samples, building a hardware setup and running trials. That is the direction in which we are heading," says Dr. Khankhoje.

Humans drive all-male elephant grouping

These elephants remained solitary or associated in mixed-age and mixed-sex groups within the forested areas.

ILAVENIL I T
ASWATHI PACHA

Environmental and anthropogenic factors have not just degraded elephant habitats and left them stressed, but also changed their social behaviour, notes a recent study conducted by the National Institute of Advanced Studies (NIAS), Bengaluru.

The study revealed that there has been an increase in all-male elephant groups in the regions where landscape have been modified by humans. However, these elephants remained solitary or associated in mixed-age and mixed-sex groups within the forested areas.

From February 2016 to December 2017, the researchers observed Asian elephants in a large area of nearly 10,000 sq. km, encompassing protected forested areas and human-use habitations including crop fields in Karnataka and Tamil Nadu.

Using camera traps, they monitored the elephants that visit the nearby agricultural areas and those that stayed largely within the forests. Mature male elephants are known to move out from their herd to find nutritious forage to improve their reproductive health and also find a mate. But usually they roam around solo.

Pack protection: All-male elephant grouping has become a behavioural necessity for young males in high-risk, high-resource landscape. ▪ SPECIAL ARRANGEMENT

The study found that in recent times the male elephants have started to form small groups. "Since the landscape around them is changing drastically and not necessarily favourable – more roads, more electrical lines have come up – it becomes risky for the young males to be alone. So they have started associating with other male elephants and this helps them in multiple ways," says Nishant Srinivasaiah, PhD Scholar at NIAS and the corresponding author of the research paper published in *Scientific Reports*.

Individuals familiar with the landscape help the group navigate better, find nutritious foraging sites and survive in the human-inhabited area. This has become a "behavioural necessity for the young males in high-risk, high-resource landscape," notes the study.

The researchers found that these groups comprised of mixed age male elephants and their number also varied. The smallest was two and the largest male group comprised of 25 individuals.

Dominance
Some of these elephants have been together for over 10 years. When asked if there has been any homosexual behaviour, Srinivasaiah explains that though they have observed few sexual interactions among the males, they were not aimed at mating but mostly to establish dominance or bonding. It was also observed that musth elephants from these groups moved long-distances into the forested areas and associated with females for reproduction and returned to the original male-group later. "Similar all-male groups are found in baboons, Asiatic and African lions. But this owes mostly to affiliations and establishing domination over mating. But in elephants it's more about security or escaping the risk-areas," he adds.

He adds that these changes are purely environmental and not biologically influenced. More studies are needed to fully understand such emerging behaviours. Decoding them may help frame new strategies to manage human-elephant conflict.

High-fibre diet may promote healthy pregnancy: study

PTI

Consuming a healthy diet rich in fibre during pregnancy may promote the wellbeing of both the mother and child, and reduce the risk of preeclampsia, according to a study published in the journal *Nature Communications*. Plant-based fibre is broken down in the gut by bacteria into factors that influence the immune system, said researchers from the University of Sydney in Australia.

Gut microbiome
The researchers investigated the role of these metabolic products of gut bacteria during pregnancy. They noted the simple recommendation to 'eat real food, mostly plants, and not too much' might be the most effective primary prevention strategy for some of the most serious conditions of our time. "The mother's gut bacteria and diet appear to be crucial to promoting a healthy pregnancy," said Professor Ralph Nanan, from the University of Sydney.

The study found that in humans, reduced levels of acetate, which is mainly produced by fibre fermentation in the gut, is associated with the common and serious pregnancy-related condition preeclampsia. Preeclampsia occurs in up to 10 per cent of pregnancies and is characterised by high blood pressure, protein in the urine and severe swelling in the mother.

Immunity
It also interferes with the child's immune development whilst in the womb, with some evidence suggesting a link to higher rates of allergies and autoimmune disease later in life. The study found that preeclampsia affected the development of an important foetal immune organ, the thymus, which sits just behind the breastbone.

These results showed that promoting specific metabolic products of gut bacteria during pregnancy might be an effective way to maintain a healthy pregnancy and to prevent allergies and autoimmune conditions later in life. They may also, in part, explain the rapid increase of allergies, autoimmune conditions as Western diets are increasingly dominated by highly processed foods, which are very low in fibre.

127 papers from India retracted for image duplication, manipulation

Since 2011 and particularly in the last three-four years more papers are getting flagged and retracted for problematic images

R. PRASAD

Unlike plagiarism in papers published in scientific journals, image duplication in the same paper or in different papers and image manipulation have hardly received any attention. Fortunately, this is beginning to change. Since 2011 and particularly in the last three-four years more papers are getting flagged for problematic images. And the number of papers with questionable images getting retracted is also growing suddenly.

A searchable database of retracted papers launched in October last year by Retraction Watch blog has about 18,000 papers since the 1970s. The database was screened for retracted papers from India. Of the 982 papers that have been retracted so far from India, 330 have been for plagiarism. Surprisingly, 118 papers from India have been retracted for image duplication and/or manipulation.

Of the 118, 54 papers have been retracted for image manipulation and the remaining for image duplication. There are a few papers that contain both image duplication and manipulation. However, nine retracted papers that did not figure in the database have been added taking the total number of papers retracted for image duplication and/or manipulation to 127.

The number of papers retracted has suddenly increased since 2016, with 18 papers retracted in 2019, 37 papers in 2018, 15 papers in 2015 and 21 papers in 2016. At 20, Dr. Rashmi Madhuri and Prashant Sharma of IIT Dhanbad have the most number of retracted papers. They are co-authors in all papers.

While 127 papers retracted might be a fraction of the number of papers published each year from India, it is still a huge number considering how reluctant journal publishers are in retraction.

"Journals are not very responsive [in retracting or correcting papers with problematic images]," Dr. Elisabeth Bik who is a Science Consultant at Harbers-Bik LLC, San Francisco, California and an expert in identifying duplication and manipulation in images says in an email to The Hindu. "Of the 782 papers that I reported in 2014 and 2015 [for image duplication and manipulation], 44 have been retracted, two have an expression of concern, and 196 have a corrigendum or erratum. The remaining 540 papers have not been corrected, as far as I know. That means that five years after problematic papers have been reported, only one third of them have been corrected or retracted. That number is much too low, in my opinion, and it means that journals are not very willing to take any action." The reluctance becomes all the more glaring as at least 50% of papers had images suggestive of deliberate manipulation.

Dr. Bik along with two other authors found 782 papers with problematic images from a dataset of 20,000 papers published by researchers from many countries in 40 journals from 1995 to 2014. The study was published in 2016 in the journal *mBio*. The authors reported the problematic papers to the respective journals.

Compared with the U.S and China, there are relatively fewer papers from India that gets published. But Bik's study found India had 1.93 higher-than-predicted ratio of papers containing image duplication. In 2018, Dr. Bik and others analyzed 960 papers published in *Molecular and Cellular Biology* from 2009 to 2016. They found 59 papers contained duplicated images leading corrections for 41 papers and five retractions. "The majority of inappropriate image duplications result from errors during figure preparation that can be remedied by correction," they write. The journal instituted a pilot program where all the accepted papers were screened for images prior to publication. In just two months, the journal identified image concerns in 12 of the 83 papers. "Image screening can identify papers with problematic images prior to publication... and required an average of 30 minutes of staff time per problematic paper," they write.

Leading the pack: At 20, Dr. Rashmi Madhuri and Prashant Sharma of IIT Dhanbad have the most number of retracted papers. ▪ SPECIAL ARRANGEMENT

According to a small study of 200 papers that were about to be accepted for publication in *The Journal of Clinical Investigation*, 21% (42 of 200) of papers had issues with Western blots and 27.5% (55 of 200) of papers had problems with images. The study was carried out between July 2018 and first week of February 2019. They found 49 of 55 papers with image issues were "minor transgressions".

"The absolute number of retractions has risen over the past few decades, from fewer than 100 annually before 2000 to nearly 1,000 in 2014. But retractions remain relatively rare: Only about four of every 10,000 papers are now retracted," says an article in the journal *Science*.

Shift of opinion
The good news is that journals are beginning to shed their reluctance to retract papers involving problematic images. "There appears to be a trend towards a faster response time; perhaps under the influence of social media discussions or a shift of opinion of the general audience that these cases should be handled faster," Dr. Bik says.

Unlike in the case of plagiarism where there are software available to detect it and almost all journals routinely use them, no such software or system is available for detecting image duplication and manipulation. But that shortcoming is to a small extent getting addressed in a completely different way. The Journal of Clinical Investigation is relying on Dr. Corinne L. Williams, an editor who has an "excellent eye for image duplication", to find such faulty papers. "The *Journal of Biological Chemistry* has been a pioneer though, screening images after acceptances very carefully and asking for originals if there was any doubt. But only if they suspected something," says Dr. Bik. The *Molecular and Cellular Biology* "instituted a program to analyze the figures in all accepted manuscripts before publication, modeled after a similar program used by the *Journal of Cell Biology*" Dr. Bik and others write in the 2018 paper. Now, more and more journals have started demanding for unedited, raw image data from authors at some stage of the publication process.

A catalyst that is bringing about this change is the PubPeer website, which allows independent researchers to publish post-publication review of scientific papers. The independent researchers are "increasingly making use of PubPeer or social media to describe papers of concern," says Dr. Bik. "Almost all remarks about problematic images on PubPeer appear correct, and there is an active community who will comment if they do not agree," she adds. The popularity of PubPeer can be gauged by the regular mention of the website in articles on science misconduct. "So we can assume that more and more people are becoming familiar with PubPeer," Dr. Bik says.

And the results are showing. At least one paper from India with questionable image gets posted on PubPeer at least once in two days. With *The Hindu* reporting on papers with problematic images from half a dozen institutions, there is a sudden rush by Indian researchers to post their responses on PubPeer.

A different set of notes with music

R.W. ALEXANDER JESUDASAN

Human beings face different kinds of sicknesses in life. While many overcome them, some succumb to one or the other. As the world progresses, concomitant problems surface in different ways, and as a result humanity doesn't progress in the manner it could be expected to.

While there are many stress-busters available to handle tensions in life, music seems to have an overriding and therapeutic effect on the stresses and sickness that humans endure. Music is thought to bring forth miracles by healing wounded hearts and minds; it has magical powers to transform lives. Even a foetus in the womb apparently vibes with certain types of it. So, how exactly can music help us in our lives and influence us in a positive manner?

Diversity in sickness

Sickness can be quite diverse. It could be physical, physiological, psychological, psychosomatic and so on, and it can have a profound impact on one's body and mind. Today we find psychological stress to be more common than before, leading to a situation of concern to humanity. While there are different medical methods available to handle medical conditions, with their own promise and challenge, virtually all treatment regimes have side-effects too. Appropriate music is a therapy that would largely bring down the intensity of such medical aberrations in an individual, as it has its soothing effect in bringing down stress.

Diversity in notes

Music is not restricted to one note or an entity. Whether it is string instruments or wind instruments (veena, guitar, and so on, or piano, or organ, or saxophone) we find a fusion of many notes when played. The notes, though diverse, when simultaneously played in a synchronised manner present a chord which is the unification and blending of many notes. These result in calmness and peace.

Diversity and peace

There is no better country than India to explain diversity in its totality, as it is rich in every sense of the term. We could learn clear and apt lessons from music. Musical notes are diverse, each superior in its own way. For example, the treble cleft notes EGBDF, space notes FACE, or the bass cleft notes, GBDFA, space notes ACEG, or the strings of the guitar bearing the notes EBGDAE, each when played can give a unique tone.

The grandeur of music comes from the harmony they bring when these notes are struck or played together through the musical instrument. Harmony and peace are entwined, and where there is harmony, there is peace, whether between two or among a multitude. Accomplishing this virtue is the need of the hour both in India and the world at large.

Orchestra & harmony

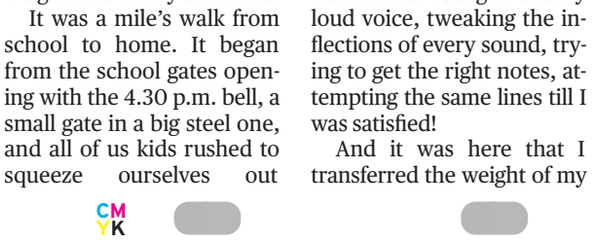
In a musical orchestra we find a multitude of instruments of a varied nature being used to provide scores and background for playback singers. We find the controlling and facilitating power of the music director to synchronise the different musical tones that come from instruments, to the taste and design of the musical composition the music director has conceived. So is the human population in a given environment: though it is diverse in every sense, if blended well as a music director handles music, it could lead to peaceful and harmonious coexistence of the biota, which include the environment, too.

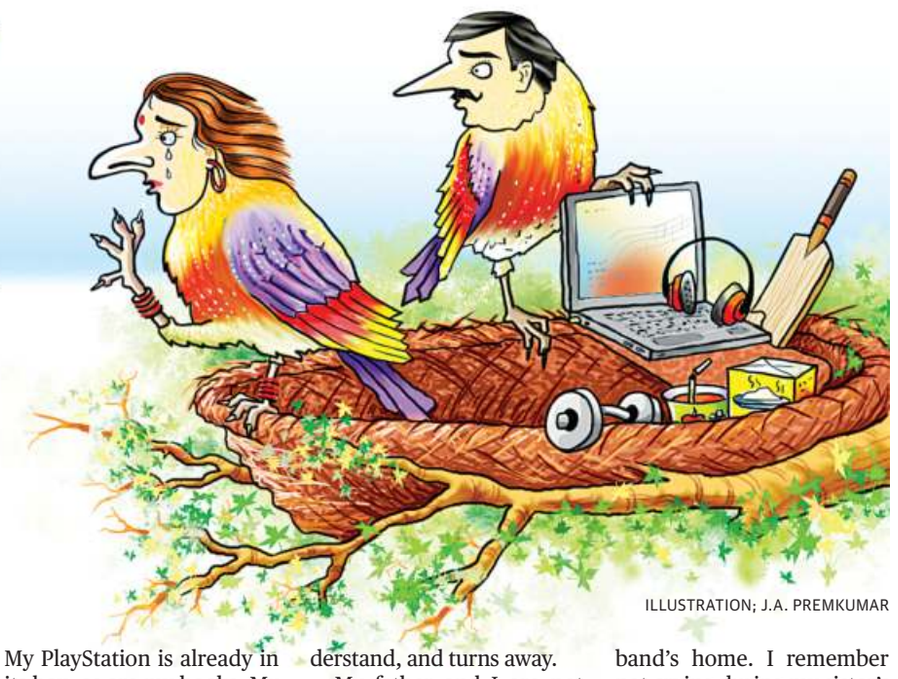
United we progress

It is essential that we work in tandem: we all know unity is power. As a country with over 1.3 billion people representing a wide range of diversity, it is imperative that we stand united even as divisive forces impede us in many walks of life. The lesson from music should bind us together in order to bring out the best from each one of us and create a synergy for goodwill and progress.

Comparing our nation with other developed countries and also with those that are younger to us, we are far behind. We should and can do much better in any field provided we pool all our resources, including our intellectual resources. Music teaches us to have an amalgamation of our strengths both individually and collectively.

The author, the Principal of Madras Christian College, is a music-lover and a professional player of a few instruments. Elmhurst College, Chicago, conferred the Lamda Sigma Psi on him recently. E-mail: alexjesu62@gmail.com





ILLUSTRATION; J.A. PREMKUMAR

The farewell

A strange kind of melancholy overcomes a family as a young person leaves home for greener avenues

NAITIK JAIN

It's the morning of my departure. My elder sister just went home to her husband. I'm scheduled to leave at night. I start my first 'real' job tomorrow. I take a deep breath and head out, where mum greets me with instant noodles, as I've decided to discontinue eating for today. Today's lunch will be the first in many months, a welcome change from my fruit diet.

It's the afternoon of my departure, and mom is visibly upset. She has barely spoken all day, and I don't have the necessary tools to break the silence. These are times when I wish my extroverted sister were present. Somehow, her heading home has created an eerie silence in the house. Dad walks into my room as I'm fiddling with my phone and lies down beside me, asking me when my flight is. It takes him a couple of minutes to get comfortable, as he tries giving me 'the talk'. He reminds me that they're there for me whenever I need them. He talks to me about the new world that I'm entering – the responsible, adult world. I nod and pick up the phone up again, trying hard not to display any emotion.

A gap to bridge

Mom and I sit beside each other and read, both needing each other's presence, yet unable to bridge the gap. The silence is deafening. I steal occasional glances at her, as she continues to bury herself in her book, trying hard not to let her emotions show. I keep reading, continuing to suppress every single emotion I've been feeling; not that I haven't done that before.

It's evening by the time we speak to each other about this. "What will I do when you're gone?" mom asks. I reply with a joke, trying to act foolish to lighten the mood. I'm thinking of joking about how she won't need to restock the cashew nuts every three days now that I'm not home anymore, but decide against it. I fool around for a while and then go into my room to change. My PlayStation is already in its box, as are my books. My clothes will travel with me.

I look at my room once more. No mess of wires in the corner of the bed. No gadgets strewn all over it. This has been my room for over a decade, ever since we moved into this house. Now I'll have my own place. No more dorm rooms. I'll be entering the world of 'adulting.' I change into my new clothes and head out.

The drive to the airport is in absolute silence. No one speaks a word as my parents drive me. As we hug our goodbyes, mom breaks down and cries. I hug her tighter, reminding her that I'll see her in a month, and then again, every couple of months. She pretends to understand, and turns away.

My father and I are not good at handling these emotions. Both of us stand and try our best to console her. She eventually waves me away, and asks me to go in.

Strange melancholy

I've left home too many times for many things to be feeling as sad as I am. I don't understand this strange melancholy, especially considering that this is exactly what I wanted from life. This kickstarts my career and helps me move forward in life. Why, then, do I want to rush back out, get into the car and drive back home?

Many Indian weddings have a *vidai* ceremony, where the daughter is said to leave her home for her husband's home. I remember not crying during my sister's *vidai*, because for me, she had left home many years before that. Today, I stand at the precipice of my house, having broken into tears every night for the past few days.

I sit at the boarding gate, 30 minutes to the scheduled departure of the flight. It's the last call for my name. I'm still torn between turning back and rushing to the comfort of my home, and moving forward to start my new life – a life of 'independence'. It took me 24 years, but now I have the scissors in my hand. Do I dare to cut the umbilical cord?

I dare.

njain1804@gmail.com

Art, the brain and the mind

More and more people are beginning to understand the role art can play in emotional well-being

GEORGE JOHN

Creativity takes courage.
- Henri Matisse

Every child is an artist. The problem is how to remain an artist once we grow up.
- Pablo Picasso

Art in some form or other has existed from the Palaeolithic period, and as long as humans have existed, we have been attracted by and fascinated by it. Art affects society by its power to change opinions and translate human experiences. It is a repository of our collective memory.

But it is the effects that art has on the mind and brain that truly deserve admiration. Art has been shown to have an impact on the brain by causing an actual increase in the levels of 'feel-good' neurotransmitters.

Humans have two types of skills – physical and cognitive. Neurosciences show that even the simple act of drawing can improve our cognitive and higher cerebral functions. The essence of art is its perceptibly imaginary nature, which reflects actual experiences, feelings and sentiments. The mind being the target behind the idea of art as therapy, the same art can purify our sensual world through artistic catharsis-on-canvas, which could even 'correct' some psychological dispositions.

Art therapy is one of the newer technologies in the tool kit of psychiatric treatment; some call it 'person-centred'. The essence of art is its perceptibly imaginary nature, which reflects actual experiences, feelings and sentiments. And the mind being the target behind the idea of art as therapy, the same art can purify our sensual world through artistic catharsis-on-canvas which could even 'correct' some of our psychological dispositions.

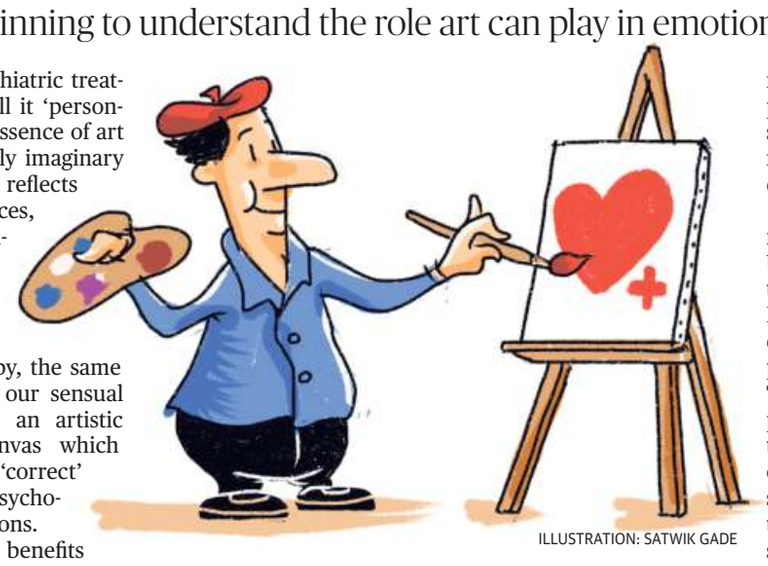


ILLUSTRATION: SATWIK GADE

Because the benefits of such therapies in some cases are seen to outweigh the advantages of treatments with pills alone, today they have become part of some mental health treatments. The American Art Therapy Association describes it as using "the creative processes of art-making, to improve and enhance the physical, mental and emotional well-being in individuals of all ages." Such therapy involves "creative processes involved in artistic self-expression which helps people to resolve conflicts, develop interpersonal skills, manage behaviour, reduce stress, increase self-esteem, self-awareness and achieve insight."

Healing strategies

When psychiatrists and psychologists found that those with mental health issues often express their emotions through art and drawings, such therapies started evolving into healing strategies. Today they are even used in mental health assessments of trauma survivors and victims of abuse.

When mental illness and its treatment face considerable stigma in society and when only a small percentage of the population that would benefit from treatment actually receive it, it is unwise to ignore the therapeutic value of art, especially when there are those who do not wish to take medicines although they may benefit from them. And there are others who have trouble finding the right pharmaceutical formulae. Although some may dismiss art as frivolous, more and more people are beginning to understand the role it plays in emotional well-being.

Human beings have an inordinate capacity to be creative but there is also great variability. Some are hardly creative. The creative energies of Picasso, Cezanne, Monet and others, including the likes of Newton and Einstein, were exceptional.

Art is also a symbolic communication system practised only by humans and it may have helped us in creating social cohesion and ensuring survival itself.

New prescription

In November 2018, the British Health Secretary unveiled an initiative that might soon enable doctors in the U.K. to prescribe art, music, dance and even singing lessons as 'treatment' for a variety of ailments, from some forms of dementia and early psychosis to various respiratory conditions. This could mean that in the future, with this form of 'social prescribing' in the U.K. and other countries that had for decades fostered a culture of reliance on antidepressant pills to ease the dyphoria associated with illnesses, could find patients enrolling for dance and singing lessons.

In order to prevent any misuse of the system, the U.K. is aiming to create a National Academy for Social Prescribing to ensure that doctors only refer suitable patients for art as treatment. The King's Fund, an independent charity that works to improve health and social care in England, says more should be done for prevention, and that social prescribing can help combat over-medicalistion.

Although we tend to think of art as a luxury, art tends to give rise to feelings of pleasure, which in turn become the personification of hope. Life itself is art and it is because life is sacred that art that comes from within, rather than from the ego, is also sacred. Hence art speaks more eloquently than a thousand spoken words and has the potential to become a messenger of love.

Even when art is beneficial, comforting, pleasurable and healing, all art is not art because it should never be *Exitus acta probat* (the end justifies the means). And because art is to do with perceptions, it is not always very easy to distinguish good art from bad art.

The author was a psychiatrist in the U.K. specialising in stress, anxiety and depression. Email: docjohn@aol.com

Finding joy

SHOBHA ANAND

The refrain these days is: 'I am bored'. Kids, housewives, elderly, all seem bored. Those busy with careers may not be bored but prone to depression. What has led to this?

A couple of decades ago children were happy playing outdoors and reading story books. School vacations invariably meant taking the train to the ancestral town or village. Housewives were happy preparing good, healthy food at home. Now cooking is regarded as a mundane chore. Eating out or ordering online is the 'in' thing.

Many senior citizens are no longer content with playing with their grandchildren or being involved in religious activities: they aspire to travel to exotic locations. Everyone wants to enjoy. A great idea; but has the pursuit of enjoyment led to discontent too?

Perhaps the social media and the Internet are the causes. We envy our Facebook friends who post pictures of holidaying in exotic locations. Many post pictures of their beautiful houses. Most people have more 'FB' friends than real friends. Since we don't get to really know them, we think everyone is having a great time, except us.

The cure: adopt what American writer Robert Brault said, "Enjoy the little things for one day, you may look back and realise they were the big things."

shobhaanand@yahoo.com

The song of the open road recalled

A walk across memory lane of a deserted path where you were all alone and sang to yourself heartily

SUDHA VIDYASAGAR

It was hot as usual in my Madras those days, half a century ago. The sweat made a track from my scalp through my forehead to my cheeks, plastering strands of hair in front of my ears. I walked alone. I had a school bag made of cloth – I even remember the multi-coloured threads of green and red and blue than ran through it, anchored on my shoulders. There was no concept of a backpack then. My textbooks and notebooks of Class 6 weighed down my thin arms.

It was a mile's walk from school to home. It began from the school gates opening with the 4.30 p.m. bell, a small gate in a big steel one, and all of us kids rushed to squeeze ourselves out through the three-feet-wide opening. Outside was freedom, conversations, loud laughter and goodbyes, till we met the next day.

The road was tarred to begin with, with some two-wheelers and cars hurrying along though the small lanes. Then I turned into a mud track, formed by human feet, through open land with hardly anybody around.

It is here that I began to sing. All kinds of songs: the ones that I learnt in my music class, classical ones, or contemporary movie songs that I liked. I sang in a fairly loud voice, tweaking the inflections of every sound, trying to get the right notes, attempting the same lines till I was satisfied!

And it was here that I transferred the weight of my schoolbag on to my head. I made a hair band out of the sling of my bag, and centred it, balancing it on my head. This way my hands were free, to move around, provide the beat for my songs and generally swing around.

I also told myself stories. Made-up ones, of teachers and cousins and heroes and heroines. Dramatic ones, with some catastrophe or the other that the hero had to overcome, and always ended in success. The ground was full of small pebbles, brown and shiny. Some were big enough to be kicked along, and I transported them to the path to the main road. Some I picked up to throw at imaginary villains and vanquish them.

The open ground ended in the main road. In fact, the ground was a short-cut, and I gained a good ten minutes by taking it. The main road was full of people and vehicles. I stopped my self-chatter and my singing. Down came the bag from head to shoulder, and I transformed myself into a regular, short schoolgirl going back home. My secret stories and songs lay in wait for me, in the open ground, to be continued the next day.

ILLUSTRATION: SREEJITH R. KUMAR

Not once did I feel fear. It was a testimony to the safety of those times, that I walked all alone, and no one bothered me. Closer to home, my stomach rumbled, and mouth watered imagining the snacks and coffee that my mother would have made for me.

When I turned into my lane and opened the steel gate with a particularly loud bang, I could hear my dad saying, "She is back!"

His laughter rippled through his voice. And my mother rushed to take my bag from me, as I kicked my shoes off to free my feet.

Some journeys in life are just sheer joy. It was a walk that I thoroughly enjoyed.

vsagar33@yahoo.com

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