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Tweaking visa norms

Why are American immigration norms being tightened? Why does the U.S. want to know the Internet history of applicants?

SRIRAM LAKSHMAN

The story so far: On May 31, 2019, the U.S. Department of State introduced a change in online visa forms for immigrant (form DS-260) and non-immigrant visas (form DS-160) requiring applicants to register their social media handles over a five-year period. The newly released DS-160 and DS-260 forms ask, "Do you have a social media presence?" A drop-down menu provides a list of some 20 options, including Facebook, Instagram, Sina Weibo and Twitter. There is also a "NONE" option. Applicants are required to list their handles alone and not passwords. All sites will soon be listable according to an administration official who spoke to *The Hill*, a Washington DC-based newsletter. The policy does not cover those eligible for the visa waiver programme and those applying for diplomatic visas and certain categories of official visas.

How did it come about?
The policy is part of U.S. President Donald Trump's intent to conduct "extreme vetting" of foreigners seeking admission into the U.S. In March 2017, Mr. Trump issued an Executive Order asking the administration to implement a programme that "shall include the development of a uniform baseline for screening and vetting standards and procedures for all immigrant programs."

In September 2017, the Department of Homeland Security started including "social media handles, aliases, associated identifiable information, and search results" information in the files it keeps on each immigrant. The notice regarding this policy said those impacted would include Green Card holders and naturalised citizens. In March 2018, the State Department proposed a similar policy, but for all visa applicants – this is the policy now in effect. Earlier, only certain visa applicants identified for extra screening were required to provide such information. Asking visa applicants to volunteer social media history started during the Obama administration which was criticised for not catching Tashfeen Malik, one of those who carried out a mass-shooting in San Bernardino, California, in 2015. Malik had come to the U.S. on a K-1 fiancé visa, and had exchanged social media messages about jihad prior to her admission to the U.S.

> At least 10 lakh Indians, and these are just those who are successful in their visa applications and not all applicants, will be directly impacted by the policy

How will it impact India?
Most Indians applying for U.S. visas will be covered by this policy. Over 955,000 non-immigrant visas (excluding A and G visas) and some 28,000 immigrant visas were issued to Indians in fiscal year 2018. So at least 10 lakh Indians – and these are just those who are successful in their visa applications and not all applicants – will be directly impacted by the policy.

What lies ahead?
The new policy is expected to impact 14 million travellers to the U.S. and 700,000 immigrants worldwide according to the administration's prior estimates. In some individual cases it is possible that the visa policy achieves what it is (ostensibly) supposed to – allow the gathering of social media information that results in the denial of a visa for an applicant who genuinely presents a security threat. However, the bluntness of the policy and its vast scope raise serious concerns around civil liberties including questions of arbitrariness, mass surveillance, privacy, and the stifling of free speech.

First, it is not unusual for an individual to not recall all their social media handles over a five-year period. Consequently, even if acting in good faith, it is entirely possible for individuals to provide an incomplete social media history. This could give consular officers grounds for denying a visa.

Second, there is a significant degree of discretion involved in determining what constitutes a visa-disqualifying social media post and this could stifle free speech. For instance, is criticising the President of the United States or posting memes about him (there are plenty of those on social media these days) grounds for visa denial? What about media professionals? Is criticising U.S. foreign policy ground for not granting someone a visa?

Third, one can expect processing delays with visas as social media information of applicants is checked. It is possible that individuals impacted by the policy will bring cases against the U.S. government on grounds of privacy or on grounds of visa delays. The strength of these cases depends on a number of factors including whether they are brought by Green Card holders and naturalised citizens (who were impacted by the September 2017 policy not the May 31 one) or non-immigrants. The courts could examine the intent of the U.S. government's policy and ask whether it has discriminatory intent.

How will a 5G network power the future?

The government plans to start trials for next generation cellular tech this year. Is India prepared?

YUTHIKA BHARGAVA

The story so far: On Monday, June 3, Union Communications Minister Ravi Shankar Prasad announced that the government will be holding an auction for spectrum, which includes airwaves that will be used to offer 5G or fifth-generation services, in the current calendar year. While some countries such as South Korea and the U.S. have begun rolling out commercial 5G services, India is yet to begin trials for these even as the government is targeting 2020 as the launch year for 5G in the country. However, during his first address after taking charge of the ministry, Mr. Prasad said the government plans to start 5G trials in the next 100 days or by mid-September.

What is 5G?
It is the next generation cellular technology that will provide faster and more reliable communication with ultra low latency. A government panel report points out that with 5G, the peak network data speeds are expected to be in the range of 2-20 Gigabits per second (Gbps). This is in contrast to 4G link speeds in averaging 6-7 Megabits per second (Mbps) in India as compared to 25 Mbps in advanced countries, it added.

Who does it benefit?
With 5G technology, consumers will be able to download data heavy content such as 8K movies and games with better graphics in just a few seconds. But once 5G becomes commercial, users will be required to change their current devices in favour of 5G-enabled ones.

However, it is likely that the primary use of the technology will go beyond delivery of services on personal mobiles devices. 5G is expected to form the backbone of emerging technologies such as the Internet of Things (IoT) and machine to machine communications, thereby supporting a much larger range of applications and services, including driverless vehicles, tele-surgery and real time data analytics. The ultra low latency offered by 5G makes the technology desirable for such use cases. Latency is the amount of time data takes to travel between its source and destination.

A government panel on 5G says the technology will extend the use of wireless technologies – for the first time – across completely new sectors of the economy from industrial to commercial, educational, health care, agricultural, financial and social sectors.

The report also stresses that even after the entry of 5G into the Indian networks, the earlier generation mobile technologies (2G, 3G and 4G) will continue to remain in use and that it may take 10 or more years to phase them out.

It is widely accepted that 5G's value for India may be even higher than in advanced countries because of the lower levels of investments in physical infrastructure. "5G may offer 'leapfrog' opportunities by providing 'smart infrastructure' that offers lower cost and faster infrastructure delivery," as per the government panel. One of the primary applications of 5G will be implementation of sensor-embedded network that will allow real time relay of information across fields such as manufacturing, consumer durables and agriculture. 5G can also help make transport infrastructure more efficient by making it smart. 5G will enable vehicle-to-vehicle and vehicle-to-infrastructure communication, making driverless cars, among other things, a reality.

What will be the economic impact?
5G is expected to create a cumulative economic impact of $1 trillion in India by 2035, according to a report by a government-appointed panel. According to a separate report by telecom gear maker Ericsson, 5G-enabled digitalisation revenue potential in India will be above $27 billion by 2026. Additionally, global telecom industry GSMA has forecast that India will have about 70 million 5G connections by 2025.

When will it be launched?
In April, South Korea and the U.S. became the first countries to commercially launch 5G services. South Korea claimed it was the first to do so, beating the U.S. by a couple of hours, a claim disputed by U.S carriers. China too has handed out commercial 5G licences to its major carriers earlier than expected. Mr. Prasad has promised that trials in India will begin by mid-September. During the first term of the Narendra Modi government, the Central government had set a target of 2020 for the commercial launch of 5G services, largely in line with rest of the world. For the trials to begin, the government needs to allot certain amount of spectrum to telcos.

> A total of 8,644 MHz of spectrum will be up for sale, making it the largest ever such auction. The base price of the total airwaves on sale is about ₹4.9 lakh crore

The government launched a three-year programme that started in March 2018 to advance innovation and research in 5G with a budget of ₹224 crore. Ericsson has also installed a 5G test bed at IIT Delhi for developing applications in the broadband and low latency areas. This will help develop India-specific usage scenarios and applications.

What about spectrum auction?
The government plans to undertake spectrum auction in the current calendar year. In a first step towards preparing for these auctions, the Telecom Regulatory Authority of India (TRAI) had in August last year recommended that entire available spectrum be put to auction in the forthcoming sale. As a result a total of 8,644 MHz of spectrum will be put on sale, making it the largest ever such auction. The total base price of the total airwaves on sale is about ₹4.9 lakh crore.

Spectrum auctions are a major revenue earner for the government. In the last auction, held in October 2016, it fetched the government over ₹65,000 crore. However, 60% of the spectrum remained unsold. For 5G spectrum, i.e. the spectrum in 3300-3600 MHz which will be put out for bids for the first time, the regulator has recommended a pan-India reserve price of about ₹492 crore per MHz for unpaired spectrum.

Are there any apprehensions?
Two of the three private telcos, Bharti Airtel and Vodafone Idea, have, however, expressed apprehensions about the auction this year. They have pointed out that the reserve price of these airwaves is very high. Besides, there are currently no India-specific use cases for deployment of 5G.

Telecom industry body Cellular Operators Association of India (COAI) has also expressed concerns about the financial health of the sector amid intense competition and recent phase of consolidation. Currently, the industry's cumulative debt is pegged at around ₹7 lakh crore.

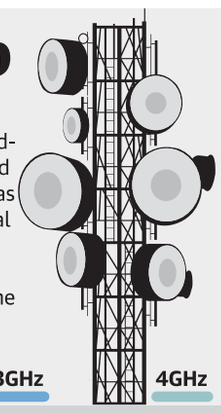
Airtel, for example, has hinted that it may not participate in the auctions at the current "exorbitant" prices. Vodafone Idea, which is the country's largest operator, has requested that the 5G spectrum should not be put on sale before 2020 as there is a need to first develop India-specific use cases.

The COAI has also pointed out that 5G is overpriced by at least 30% to 40% compared to international standards and auction in other markets such as South Korea and the U.S. In previous auctions, the government saw no takers for the 700 MHz spectrum, which is used to offer high speed 4G services and was put on sale for the first time, mainly due to the high reserve price. In its recommendations now, the sectoral regulator has said that the prices be reduced by about 43%. The recommended pan-India reserve price for 700 MHz now is ₹6,538 crore per MHz as opposed to ₹11,500 crore last time. Based on TRAI's recommendation, the Department of Telecom will work out the final details and timing of the auction.

Besides the spectrum, 5G will require a fundamental change to the core architecture of the communication system. Simply upgrading the existing Long Term Evolution core will not be able to support the various requirements of all 5G use cases. A report on 5G by Deloitte stated that it is anticipated that the industry might require an additional investment of $60-70 billion to seamlessly implement 5G networks. Ernst & Young too estimated a similar amount of investment to implement 5G.

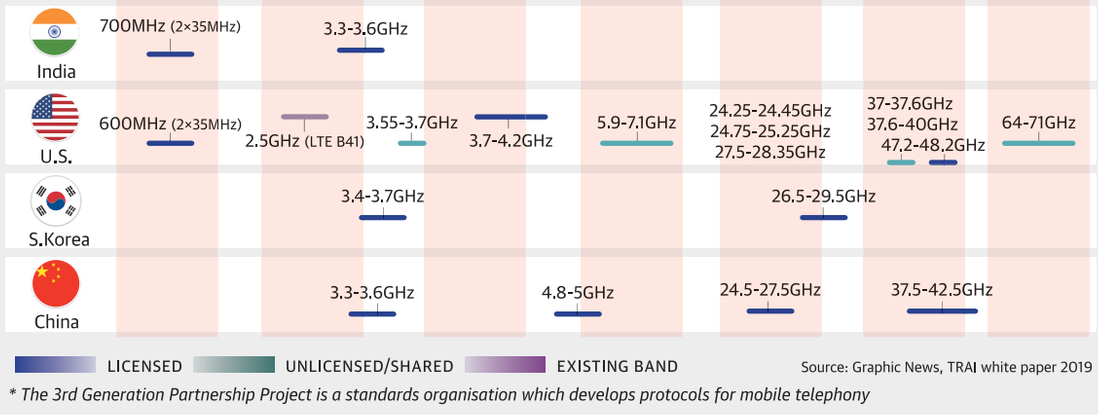
A giga leap

The Indian government has planned to start 5G trials by mid-Sept. 2019. 3GPP* has identified 700 MHz, 3.5 GHz, 26/28 GHz as the 5G pioneer bands. The visual shows the allocated/targeted bands for 5G spectrum in major countries. India has allocated the least number of bands among other major countries



5G is a giant leap forward from the earlier generations. It is expected to offer a peak data speed of 1 Gbps, which is 900% faster than 4G's maximum data speed. 5G also offers an ultra low latency of 1 millisecond which, in 4G is 10 milliseconds

Year	Generation	Maximum data speed	Data transfer per second	Time to download a 5GB movie
1991	2G	14.4 kbps	1.8 K	Over a month
2001	3G	384 kbps	48 K	Over a day
2010	4G	100 Mbps	12.5 MB	7 minutes
2020	**5G**	**1 Gbps**	**125 MB**	**40 seconds**



Source: Graphic News, TRAI white paper 2019

** The 3rd Generation Partnership Project is a standards organisation which develops protocols for mobile telephony*

What is the three-language formula?

Why is there opposition to the teaching of Hindi which crystallised into a policy in an official document in 1968?

K. VENKATARAMANAN

The story so far: A 50-year-old controversy got a new lease of life recently when a paragraph in the Draft New Education Policy 2019 referred to the mandatory teaching of Hindi in States where Hindi is not spoken. This was a reiteration of the Central government's three-language formula, but it set off a storm in Tamil Nadu, which stoutly opposes any attempt to impose Hindi and adheres to a two-language formula. The Union government sought to neutralise the hostile reaction by dropping the controversial reference to Hindi.

What is the formula?
It is commonly understood that the three languages referred to are Hindi, English and the regional language of the respective States. Though the teaching of Hindi across the country was part of a long-standing system, it was crystallised into a policy in an official document only in the National Policy on Education, 1968. This document said regional languages were already in use as the media of education in the primary and secondary stages. In addition, it said, "At the secondary stage, State governments should adopt and vigorously implement the three-language formula, which includes the study of a modern Indian language, preferably one of the southern languages, apart from Hindi and English in the Hindi-speaking States." In the 'non-Hindi speaking States', Hindi should be studied along with the regional language and English. It added: "Suitable courses in Hindi and/or English should also be available in universities and colleges with a view to improving the proficiency of students in these languages up to the prescribed university standards."

On promotion of Hindi, the NPE 1968 said every effort should be made to promote the language and that "in developing Hindi as the link language, due care should be taken to ensure that it will serve, as provided for in Article 351 of the Constitution, as a medium of expression for all the elements of the composite culture of India. The establishment, in non-Hindi States, of colleges and other institutions of higher education which use Hindi, as the medium of education should be encouraged".

Incidentally, the NPE 1986 made no change in the 1968 policy on the three-language formula and the promotion of Hindi and repeated it verbatim.

Why is it in the news now?
The Central government released a draft NPE, a report prepared by a committee headed by space scientist K. Kasturirangan. Its reference to mandatory teaching of Hindi in non-Hindi speaking States set off a political storm in Tamil Nadu, which is traditionally opposed to the compulsory study of Hindi. The draft had a sentence on flexibility on choice of language for school students. Those who wished to change the three languages may do so in Grade 6, it said, "so long as the study of three languages by students in Hindi-speaking States would continue to include Hindi and English, and one of the modern Indian languages from other parts of India, while the study of languages by students in the non-Hindi-speaking states would include the regional language, Hindi and English."

GETTY IMAGES/ISTOCKPHOTO

How did Tamil Nadu react, and what was the Centre's response?
The draft evoked a hostile response from political leaders in Tamil Nadu, who were quick to dub the proposal as an attempt to impose Hindi on the unwilling State. Dravida Munnetra Kazhgam president M.K. Stalin warned that his party would be forced to launch another agitation against Hindi imposition. The State had witnessed massive protests against earlier attempts to impose Hindi in 1937 and 1965. The Centre sought to defuse the situation by first reminding them that it was only a draft, and that the policy was yet to be finalised. Subsequently, the reference to Hindi was dropped by the committee. It reworked the sentence to the effect that students could change their language preference in Grades 6 or 7, "so long as they are able to still demonstrate proficiency in three languages (one at the literature level) in their modular Board examination some time during secondary school".

What is the backdrop to the Hindi imposition row?
The State has been traditionally opposed to any attempt to introduce Hindi as a compulsory language of learning or administration. The origin of the linguistic row, however, goes back to the debate on official language. In the Constituent Assembly, Hindi was voted as the official language by a single vote. However, it added that English would continue to be used as an associate official language for 15 years. The Official Languages Act came into effect on the expiry of this 15-year period in 1965. This was the background in which the anti-Hindi agitation took place. However, as early as in 1959, Jawaharlal Nehru had given an assurance in Parliament that English would continue to be in use as long as non-Hindi speaking people wanted it.

What is Tamil Nadu's stand on this?
Leaders in Tamil Nadu are often at pains to emphasise that they do not oppose the voluntary learning of Hindi and cite the unhindered work of the Dakshina Bharat Hindi Prachar Sabha, established in Chennai by Mahatma Gandhi in 1918. The institution imparts Hindi teaching at various levels to anyone who enrols for its programme. Also, there is no bar on private schools, most of them affiliated to the Central Board of Secondary Education, offering Hindi.

> Tamil Nadu has been traditionally opposed to any attempt to introduce Hindi as a compulsory language of learning or administration. The origin of the linguistic row, however, goes back to the debate on official language

The State has been following the two-language formula for many decades, under which only English and one regional language are compulsory in schools. In 2006, facing criticism that many manage to avoid learning Tamil by opting for Hindi or Sanskrit in private schools, the State government enacted The Tamil Nadu Tamil Learning Act under which Tamil has to be compulsorily learnt in schools operating in the State.

The State is also opposed to the establishment of Navodaya schools by the Centre in any part of Tamil Nadu.

An important aspect of the opposition to Hindi imposition is that many in Tamil Nadu see it as a fight to retain English. English is seen as a bulwark against Hindi as well as the language of empowerment and knowledge. There is an entrenched belief that the continued attempts to impose Hindi are essentially driven by those who want to eliminate English as the country's link language.

CAPSULE

Protein diet
It is a puzzle why pandas have jaws and teeth characteristic of herbivores but resemble carnivores in their gut and digestive enzymes. A study published in *Current Biology* shows that they consume the bamboo at a stage when it has the highest protein content. This puts them on the same bracket as carnivores that obtain 70% of their food from animals.

West Antarctic melt
The melting of Antarctic ice and ensuing rise in sea level will accelerate with climate change. A study published in *Science* argues that this will be delayed by a crustal uplift in the Amundsen sea sector, which helps reduce grounding line retreat. While this won't reverse ice sheet loss, this can delay the progress of dynamic mass loss of Thwaites glacier by about 20 years.

Bitter meal
Bees that get dusty with pollen from the flowers they visit for nectar many times eat the protein-rich pollen. This defeats the interests of the plant, which would like the pollen spread to other flowers. Teasel (*Dipsacus* species) has evolved a distasteful saponin with their pollen. Bees when visiting teasel flowers simply gather the nectar and ignore the pollen.

IISc team submits more evidence of superconductivity

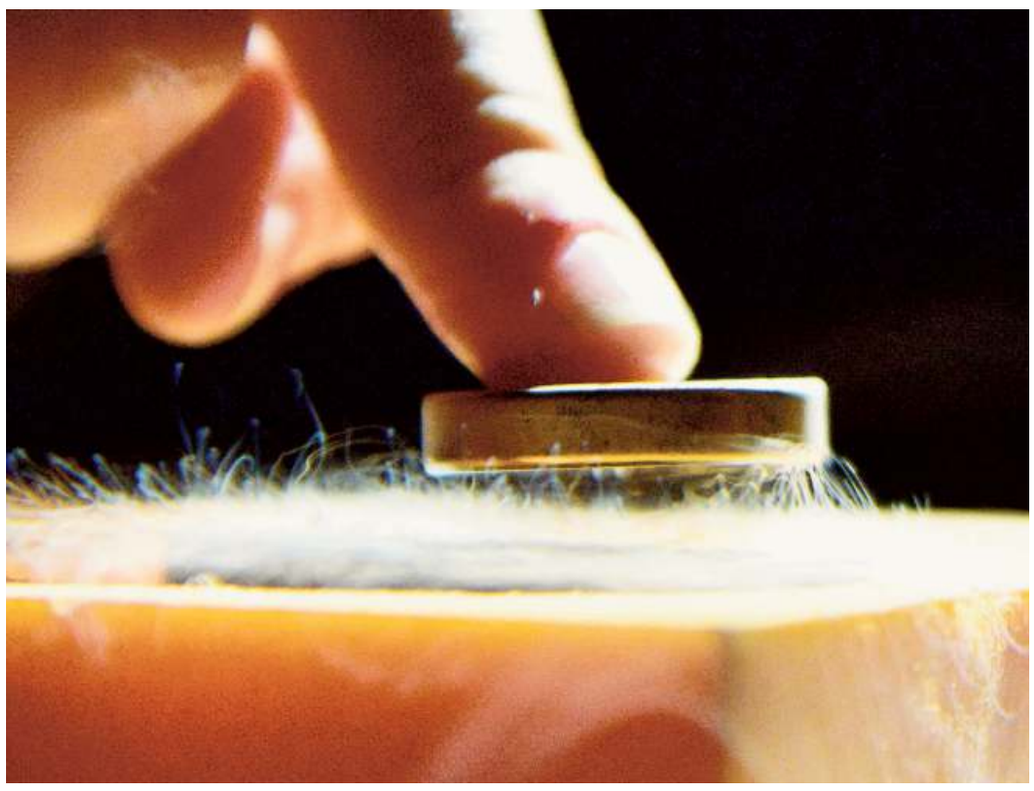
On June 5, they posted a preprint which fills up the lacunae in their previous ones

R. PRASAD

A team of Indian Institute of Science (IISc) researchers led by Prof. Arindam Ghosh from the department of Physics have presented further evidence of possible superconductivity in gold-silver nanostructures in a preprint posted on June 5 in the preprint repository arXiv. The preprint is yet to be peer-reviewed.

In a revised preprint posted on May 21 in arXiv, the IISc team had written about the material exhibiting superconductivity. "Two of the most important properties of superconductivity are diamagnetism and zero resistance. These two were seen in the material we studied. They seem to suggest that the material becomes superconducting below a certain temperature (286 K or 13 degree C). And it can go up to 70 degree C," said Prof. Ghosh. "At 286 K we have seen clear transition from a normal state to a superconducting state. This is more than anyone has reported."

However, the May 21 preprint did not furnish data on current-voltage characteristics and the evidence of critical current.



Closing in: Two of the most important properties of superconductivity are diamagnetism and zero resistance. These two were seen in the material we studied, said Arindam Ghosh. ▪ AFP

Fills lacuna

The latest one posted on June 5 fills that lacuna as it has dealt with current-voltage characteristics in gold-silver nanostructures with regard to superconductivity.

What typically happens in current-voltage characteristics is that as the current is increased the voltage remains zero and at a critical current the voltage suddenly increases and superconductivity is destroyed.

"The current-voltage characteristics was one of the important data that were not presented in the earlier paper. This study shows the material has some signatures of critical current – the current at which the superconductor is no longer stable and becomes resistive," Prof. Ghosh wrote.

The IISc team observed that at a critical temperature of 160 K (-113.15 degree C) and critical current of little less than 10 milliampere the voltage suddenly shoots up and the gold-silver nanostructures no longer exhibit superconductivity as resistance increases rapidly. A superconductor is one which conducts electricity with zero resistance to the flow of electrons.

"The data look interesting but whether they confirm superconductivity is not sure," observed Prof. Pratap Raychaudhuri from the Superconductivity Lab at the Tata Institute of Fundamental Research (TIFR), Mumbai. " The data is not unambiguous," he added.

> **The current-voltage characteristic was one of the important data that were not presented in the earlier paper.**
>
> ARINDAM GHOSH
> Department of Physics, IISc,

Parallel results

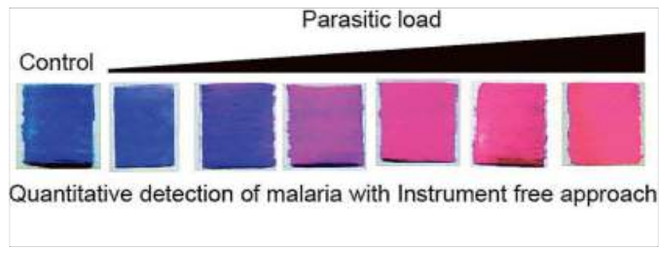
Referring to the figure on current-voltage characteristics, Prof. Raychaudhuri said that though the voltage increased sharply at about 10 milliampere critical current, the voltage was not zero before the sharp increase was seen. He compared the IISc work with another preprint posted by a team led by Prof. Subhankar Bedanta from the National Institute of Science Education and Research (NISER), Bhubaneshwar.

"The current-voltage characteristics [in Prof. Bedanta's preprint] show clear evidence of superconductivity," said Prof. Raychaudhuri. "At the critical current, the voltage is zero before it increases sharply."

Prof. Raychaudhuri added: "It would take more effort by the authors to convincingly show that the nanomaterial is indeed superconducting. The preprint posted earlier had very little data. Now, more data are available. Whether the data are correct or not can be settled only though scientific discourse – peer-reviewing and other groups reproducing it."

Clarifying about the zero voltage Prof. Ghosh said, "At temperatures slightly below 161.3 K the voltage is zero up to 10 milliampere current. The voltage may increase at higher current, which was not tested. Similar behaviour was observed in metal whiskers where superconductivity is observed at a lower temperature.

"At a lower temperature the voltage becomes zero. This further supports the original claim. The critical current data is a strong indicator of superconductivity," emphasised Prof. Ghosh. "We observed critical current behaviour which is one of the important characteristics of traditional superconductors."



Colour change: When the captured antigens interact with specific substrates inside the syringe, the blue dye turns into pink.

New paper-based test kit for malaria detection

The team has applied for patents for one aptamer and the detection strategy used

ASWATHI PACHA

With over one million reported cases in 2017, malaria still continues to be a burden for India and most countries of southeast Asia. Now, a group of researchers from IIT Guwahati has developed a simple detection method that uses an instrument when in the lab or a piece of chromatographic paper when in the field.

The kit can be used to detect *Plasmodium* parasite, which causes malaria and also specifically detect *Plasmodium falciparum*, a notorious species.

Simple instruments

Using an ordinary syringe fitted with a small magnet, magnetic beads and few chemicals inside, the researchers were able to specifically capture the antigen released by the parasites in the blood of malaria patients.

"As the blood has many interfering agents, we used magnetic bead-tethered aptamers (two small DNA molecules), which capture only the specific antigens and separate these from the blood serum to perform the reaction. The magnetic bead helps in holding the aptamers," explains Naveen Kumar Singh, Ph.D. scholar at the institute and first author of the paper published in *Analytical Chemistry*. "This kit also has high stability in hot and humid conditions. When mass produced, the kit can be cheaper than the existing rapid detection test kit available in the market."

One of the aptamers selectively captures the antigen (*P. falciparum* glutamate dehydrogenase - PfGDH) from the *P. falciparum* strains, while the other captures another antigen (*Plasmodium* lactate dehydrogenase - PLDH) that is common to all the *Plasmodium* species.

The team used PfGDH instead of the currently used HRP-2 as there have been several reports of HRP-2 gene deletions in P. falciparum. This absence of gene allows the parasite to evade HRP-2-based detection tests, resulting in a false-negative test result.

When the captured antigens interact with specific substrates inside the syringe, the blue dye turns pink. The dye is then adsorbed over a modified chromatographic paper. The formation of pink colour on the paper is a direct indication of the presence of parasites in the blood serum. The intensity of the colour increases when the concentration of antigen is high.

"The paper-based method offers the result rapidly and the aptamer-tethered magnetic beads can be reused too." adds Naveen.

Sensitivity

In the instrument-based method the intensity of the colour change is measured using a spectrophotometer. This gives a quantitative measurement and can detect very low level of the antigen in blood.

The team has already filed patent applications for one of the aptamers as well as for the detection strategy used to develop the kit. "The next phase of the work involves validation of the kit through field trial for point of care applications," says Prof. Pranab Goswami from the Department of Biosciences and Bioengineering at IIT Guwahati and the corresponding author.

IIT Mandi observes zero resistance at high temperatures in gold-silver nanostructures

The group has fabricated structures that could be superconducting at relatively high temperatures

SHUBASHREE DESIKAN

New results from IIT Mandi indicate that nanostructures made of gold embedded with silver show zero resistance to the flow of electric current through them. Interestingly, this happens at the relatively high temperatures, between 240 K and 275 K, that is, approximately between -33 degrees Celsius and 2 degrees Celsius. "The resistance fluctuated as we lowered the temperature and suddenly fell below the limit of resolution of the apparatus on cooling below a critical temperature. As we repeated the heating and cooling, this critical temperature varied between 240 K and 275 K," says C.S. Yadav from School of Basic Sciences, IIT Mandi. This poses the interesting question of whether the group has fabricated structures that are superconducting at relatively high temperatures. A superconductor is a material that, for one, allows electricity to pass through it with zero resistance.

Hopeful: Effort is needed to dentify and stabilize the superconducting phase in these materials to pave the way for room temperature superconductivity, says Dr. Yadav. ▪ IIT MANDI

Reproducibility

Though six gold-silver nanostructure samples were studied, the team was able to see such a fall in resistance only in one sample. They also did not observe the other important property of superconductors, namely, when a superconductor is cooled below the critical temperature in the presence of a magnetic field, it suddenly expels the magnetic flux from its insides below the critical temperature. This is because it turns into what is called a diamagnet at this temperature. A perfect diamagnet does not allow magnetic fields to penetrate its bulk.

The team was inspired by the work of Anshu Pandey and Dev Kumar Thapa of the Indian Institute of Science, Bengaluru, who had posted on ArXiv their observations on carefully fabricated nanostructures of silver embedded in gold. They observed a transition with resistance dipping to zero as the samples were cooled, and also a diamagnetic transition. Even as their preprint is under review, the IIT Mandi researchers bring to the public forum these observations on gold-silver nanostructures, albeit differently fabricated. "We started the work last year after the first report by Thapa et al," says Dr Yadav.

Viswanath Balakrishnan, from the School of Engineering at IIT Mandi, who led the study along with Dr. Yadav, explains the lack of diamagnetism as follows: "Our film was of thickness approximately 55 nanometre, so back-calculating, the amount of material must be just a few micrograms. It is very unlikely this can give a good signal of diamagnetism." He agrees that their plans include fabricating the nanostructure in bulk form: getting at least 1 square centimetre sample, get detailed characteristics and study the variations in microstructure. "The structure needs to be stabilised," he adds.

Puzzling feature

The group also observed that the transition temperature was unaffected when they cooled the sample in very high magnetic fields, such as 14 tesla. "This is puzzling because normally the magnetic field is detrimental to the transition," says Dr. Yadav.

> **Our repeated measurements on this sample did show zero resistance transition over multiple cycles.**
>
> VISWANATH BALAKRISHNAN
> School of Engineering, IIT Mandi

As for the reason for observing zero resistance in only one sample, Dr. Balakrishnan explains, "We speculate this has to do with spatial inhomogeneity and instability issues associated with the particular phase. We could not observe this in other samples of same batch."

The reason for this, according to them, could be that microstructural and compositional distribution in the sample plays an important role in the transition. Dr. Balakrishnan adds, "Nevertheless our repeated measurements on this sample did show zero resistance transition over multiple cycles which are presented in our paper."

The researchers found that the control and stabilization of the correct phase of Au-Ag nanostructure present in thin film was the most challenging part of the work. But they are excited that their results will generate further interest in Au-Ag and other nanostructure systems in the quest for superconductivity at ambient conditions (that is, room temperature and normal pressure).

Efforts needed

"Consistent efforts are required for the identification and stabilization of superconducting phase in these materials which will pave the way for room temperature superconductivity," says Dr. Yadav.

While there are questions, such as difficulty in reproducibility of the microstructure, it is undeniably an interesting phenomenon that the IIT Mandi researchers have come up with.

"We did not observe room temperature superconductivity but observed zero resistance in Au-Ag thin films. In the light of recent report from IISc, our study surely provides some evidence and strengthens the need for the further exploration in these systems," says Dr. Balakrishnan.

Scientists create a global map of where groundwater meets oceans

PRESS TRUST OF INDIA

Scientists have created high-resolution maps of points around the globe where groundwater meets the oceans – the first such analysis of its kind that may help protect both drinking water and the seas.

In a study published in the journal *Geophysical Research Letters*, researchers from The Ohio State University in the U.S. showed that nearly one-half of fresh submarine groundwater discharge flows into the ocean near the tropics.

They also found that regions near active fault lines send greater volumes of groundwater into the ocean than regions that are tectonically stable.

They found that dry, arid regions have very little groundwater discharge, opening the limited groundwater supplies in those parts of the world to saltwater intrusion.

The team worked with researchers at NASA's Jet Propulsion Laboratory and the University of Saskatchewan to combine topographical data from satellites and climate models to show the flow of groundwater around the world's coasts.

Aquifers: Regions near active fault lines send greater volumes of groundwater into the ocean than tectonically stable ones. ▪ K. R. DEEPAK

Managing freshwater

The findings may help coastal communities better protect and manage their drinking water.

"Freshwater-groundwater discharge is a natural line of defense against saltwater intrusion," said Audrey Sawyer, an assistant professor at Ohio State.

"It's a problem that dry regions have as little groundwater discharge as they do because these are also the places where people are going to tend to look for groundwater to meet their freshwater needs," said Dr. Sawyer.

The research work, the first near-global and spatially distributed high-resolution map of fresh groundwater flow to the coast, could give scientists better clues about where to monitor groundwater discharge.

When researchers think about coastal water quality and the way water affects the biochemical makeup of the world's lakes and oceans, they typically think about rivers and streams – and for good reason. Most of the water that gets to lakes and oceans comes from surface water sources. However, groundwater plays an important role, too, carrying minerals and, in some cases, pollutants, to surface bodies of water.

"If you've ever been swimming in a lake or in the ocean in the summertime and you go through a cold patch, that is probably a place where groundwater is coming out," Dr. Sawyer said.

"And that's just one way that groundwater affects surface water – in that case, it's affecting temperature, but it also affects the chemistry of the water. These effects can be hard to measure over large scales," he said.

The team started building these images. The research group focuses on groundwater, and realised that there was limited information showing where groundwater was most likely to flow into the oceans.

The study found that in some parts of the world, groundwater could be polluting oceans and lakes with nutrients and other chemicals.

Groundwater, for example, can carry higher concentrations of nitrates – a key contributor of the types of harmful algal blooms – as well as high concentrations of mercury.

Understanding how and where groundwater gets to surface water could help policy-makers create better plans to improve those bodies of water.

The study also found that climate heavily influences groundwater flow, and that cities in dry areas are especially vulnerable to salt water contamination of aquifers.

Go for the blank space

PRIYA VADLAMUDI

When was the last time you thought about blank space left on a hand-written page? Not Taylor Swift's 2014 sensation with 2.4 billion views on YouTube. For a student going to school or college for several hours a day, keeping the head down and filling blank pages in the notebook is an everyday routine.

Most children in today's world have the privilege to buy fancy notebooks with machine-ruled lines to make their lives easier and their study sessions hassle-free. However, as the world's resources dwindle, it is high time we acted to curb the current level of environmental degradation and wastage of resources, and this also includes the avoidance of wastage of paper resources.

If you ever wondered about the small blank space at the top and bottom of every page of a ruled notebook, you must have also realised that it may not be an absolute necessity. On an average, about 2 inches are allocated to these margins on a sheet of paper, which may account for about 7% to 10% of the page area. This means that in a 100-page ruled notebook, seven to 10 pages are only margin spaces.

This might not seem like a heavy loss to most students, but the current, deteriorating ordeal of the environment does not allow us to let this wastage just pass. One estimate says it takes 24 trees to make one tonne of paper. If one assumes that a school student uses an average of five ruled books in a year and there are about 10 lakh students in a city like Hyderabad, the number of trees cut for the paper they use is between 225 and 450. The margin space alone is the life of 30 to 50 extra trees for students in Hyderabad alone.

It is understandable that students might not be able to allocate much time to constructively execute novel actions meant for environmental protection, but a conscious effort in saving the margin space, which could be encouraged by teachers and school managements too, will be a small but helpful act that reduces one's carbon footprint. It does not require any extra effort or separate allocation of time.

Therefore, to mark this year's World Environment Day (which fell on June 5 this year) and the new school year that is upon us, do not just go back to school with excitement about the new stationery. Go with a motive to chip in with your own small efforts for your beloved and currently mildly sick planet.

Unable to just 'be': looking back on a lived life

Does anyone think about the importance of happiness, equanimity, self-confidence and sensitivity to nature anymore?

SAKUNTALA NARASIMHAN

At the age of 10 I gave my first full-length public concert, and there was a review in a major English language newspaper by the music critic Charles Fabri. At the age of 12, I sang in the Central Hall of Parliament and was hugged by Prime Minister Jawaharlal Nehru. At 16, I had gathered 10 gold medals. Soon I had postgraduate degrees in both economics and music, and began doctoral research with a UGC fellowship.

All very commendable? Today, in my late-seventies, I am not too sure. And therein lies a lesson perhaps, in lifestyle goals that we choose – or rather, what parents choose for their children.

My parents believed that wasting time was a crime. *Edaana pannu* (do something) was the constant exhortation in Tamil. During one summer vacation when I was seven, I had to take Kathak classes. A year later, it was learning to read Tamil and memorising the 30 Tiruppavai songs of Andal, one of the 12 Alvar saints. Another summer, I was taking lessons in Sanskrit, learning to play the veena, then machine embroidery and painting. (I still have those artefacts.)

My mother was a gifted musician and trained painter. With two full-time domestic help, she spent her time in radio rehearsals and broadcasts, teaching music, and producing musical features. Any moron can chop and cook; if you have artistic talent, it's a crime not to develop them, she would say, citing the biblical story of a master distributing talents to his group members and chiding those who had wasted them.

As Amy Chua says in her book, *Tiger Mom*, I had to not only learn varied skills but also excel in them – once when I got the second prize in an inter-school competition, my mother forbade me from going on stage to receive my prize and certificate, for only the first prize was acceptable. My classmates wondered why I didn't go on stage when my name was called out. If I got 95% in an examination, she would ask where I had lost the five marks, before signing the report card.

And so I grew up learning a variety of skills. Marriage to a man who believed that a woman's place was in the kitchen ministering to the needs of her spouse and raising a family, brought sharp discrepancies in what I thought I should be spending my time on, and what I was expected (and forced) to do. The end of each day left a sense of huge guilt – that I had wasted my time, doing nothing creative. The only way to cope was to somehow fit in 26 hours into each 24, so that after finishing the day's chores I would still have some time for my own artistic pursuits. Which meant I multi-tasked and pushed myself physically beyond what the body could endure in the normal course. Coffee was gulped down in five seconds, standing up, while getting on with the cooking. (My daughter still teases me that I have forgotten how to sit, slowly sipping a steaming, leisurely cup, enjoying the aroma and flavour. Indeed, I have.) If I was supervising school homework, I was also darning or ironing clothes at the same time. Relaxing with the music on, was a no-no; I had the music on while I chopped vegetables, or could read the newspaper only as I sat with my toddler son at the playground.

ILLUSTRATION: J.A. PREMKUMAR

When Penguin commissioned me to write a book, the only way I could find the time was to get up at 3 a.m. and put in three hours of typing before starting the day's work at six, preparing breakfast, packing lunch boxes and getting the kids ready. My husband had declared that I needed no help since we were a small family of four. After all, his mother used to cook for a dozen people.

Awards and honours rolled in – but something had to give, and my body began to protest. Now that the children are off my hands, I have time to work on the four book drafts that I have pending. But, my eyesight is failing.

I have severe low backache, and I am in constant pain. I am tired. Not the best of conditions to focus on creative work. And this again is causing irritability, frustration, and a massive sense of guilt that I am forced to rest when I have multiple assignments to complete.

Author R.M. Lala says in his book *Celebration of the Cells* (on his encounter with cancer) that even a walk became "a chore, something to be completed and ticked off a list". That's exactly how I feel. I haven't done anything "for enjoyment", never just "sat around" for the sheer pleasure of "just being". And that's what my doctor now advises. "Just be," she says. "Relax. You have done enough. Teach yourself to take time off – look at the trees, listen to the chirping of the birds as they return to their nests in the evening, watch the eagles soaring overhead...."

I try, I try, but after the initial two minutes, I fret – shouldn't I be checking email, or mixing the dough for dinner? "Just be," my doctor-friend admonishes, pushing me firmly back into my chair. "See that line of tiny ants creeping along the sheer wall?"

Yes, but what does watching a line of ants bring? The doctor glowers at me. "It brings peace, calmness, soothes the mind. Remember, stress causes cancers, and keeping the mind calm is as important as the capsules you swallow." Fun can be therapy. Especially in today's milieu where the rat race traps even children.

No one teaches "just being". High school kids run from one tuition class to another, vying for medical or engineering seats. When the cut-off points are at 95%, the boy who scores 94 is a "failure", and debarred.

A child prodigy student of mine is now a mental wreck, undergoing psychiatric treatment, after taking four hours of tuitions each day, after classes, to "improve" upon his 93% in the school final examination.

No one stresses the importance of happiness, equanimity, self-confidence, sensitivity to nature. Only 96% counts. Sad indeed, isn't it?

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The simple pleasures of a momentary wink

The once-popular eyelid gesture that could say a lot without a word being spoken, seems to be flirting with extinction

R.S. KARUNARATNE

What we mean by the word 'wink' is to close one eye briefly as a way of greeting someone or showing friendliness, affection or sexual attraction, or showing that you are not serious about something you have just said. So you can praise someone and wink at them when they turn their back. Sometimes a friend may talk about something seriously but if he winks at you, it means he is joking. Similarly, winking is used to control interaction to indicate that something is not to be taken seriously or to show a friendly attitude towards the other. A wink may seem to be simply an eye movement, but it is also a facial expression. Since the head usually moves slightly to one side while winking, it is a head movement. However, when you wink surreptitiously there will be no head movement. In fact, the presence or absence of head movement can be a crucial factor in the beholder interpreting the significance of a wink.

Winking accompanied by a short, sharp downward tilt of the head to one side is a useful gesture. It can mean that a statement is not to be taken seriously. It can be humorously conspiratorial, saying, "This is a secret between the two of us." It can simply be used as a gesture of friendly social acknowledgement.

While studying in a co-educational school, I winked at a girl who was my first love. She winked back. It was a great day for me and I recorded it in my diary. A girl's wink is like an arrow piercing your heart. In those halcyon days, schoolgirls used to wink at boys and *vice versa*. However, in the new millennium I hardly see girls or boys winking at each other. Instead, they send short messages to express their feelings electronically. When we winked at girls, the class teacher frowned. But I distinctly remember a jovial young teacher who loved winking girls and boys. He also winked at good-looking girls surreptitiously.

Mobile phones

I have failed to find anyone winking today because they are glued to their mobile phones. When I recently travelled from Sri Lanka to India, I found the same situation prevailing there. It may be that owing to the generation gap and amid technological advances such as smart phones, simple pleasures like winking have vanished. Even some of our elders savoured this playful aspect of flirting. How would you react to someone who dares to blow you a kiss with the drop of a lid? Would you dare to wink back?

The father of a friend of mine was a great winker. He had two winks. One was for his wife, which was a romantic invitation. The other was for his children, which meant "I love you."

You cannot just wink at someone; you have to do it with panache. There were winking celebrities such as Marilyn Monroe, Greta Garbo and Elizabeth Taylor. I still remember the wink Elizabeth Taylor gave Richard Burton in *Cleopatra*.

Flattered

I asked a 96-year-old man whether he had received any winks.

ILLUSTRATION: SREEJITH R. KUMAR

"Many times," he said with a smile. "I was flattered when I received them from members of the opposite sex." Then I asked him whether he still winks. "Yes, of course, I wink at close associates and some of my former students as a way of greeting them. It is tragic that people have stopped winking at others for some unknown reason."

Then I asked a woman in her eighties whether she still winks. "It's out of fashion now. Today there are better ways of attracting the attention of others. So I think that winking is somewhat passé."

Winking at strangers is somewhat risky. Jim Steele, a Sociology Professor at the James Madison University in Virginia, U.S., says winking is safe in office settings where co-workers are allowed to tease gently.

Some famous people wink just to make headlines in newspapers. President George W. Bush did it famously to Queen Elizabeth in 2007. Australian Prime Minister Tony Abbott's infamous wink during a 2014 radio show went very differently.

Psychologists consider the wink as ambiguous behaviour. This is because a wink can be friendly, conspiratorial, flirtatious, lecherous or sinister. Robert Provine, Psychology Professor at the University of Maryland and the author of *Curious Behavior: Yawning, Laughing, Hiccupping, and Beyond*, describes winking as a distortion of natural behaviour.

An Internet sensation

The emerging south Indian actress Priya Prakash Varrier became an Internet sensation because of her wink that went viral. She has both offended and impressed the Internet with her viral scenes from the film *Oru Adaar Love*. Her wicked winking won over millions of netizens. Actor Noorin Shereef, who played the female lead in the school romance drama, confessed that Priya's wink led to her own performance in the film getting sidelined. In 2018, Priya Varrier turned out to be one of the most Googled names in India.

As the generations progress, some simple pleasures like winking are left behind. Sadly, a gesture once popular among people is now flirting with extinction.

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Finding contentment wherever you are

An observed instance of an insect not hankering after newer opportunities and greener pastures

ANUSHA SINGH

We have a plantation of roses hugging an entire wall of the porch at our home in Ambala. Come March and April, it explodes into kaleidoscopic blossoms, each with a character of its own. This year we have had blood-red roses effusing a strong and authentic *gulabari jal* (rose water) scent, peach pink half-open buds unfolding with an elite aura about them, fairly large off-white ones in the unique shade of semi-baked cake batter, scarlet-red ones that are so plump they're nearly kissing the ground, and a velvety soft mango-yellow one in full bloom.

I observe these roses closely. In recent days I noticed a tiny guest in the plantation – an insect similar to a grasshopper, but smaller in size and pale green in colour. It sat on the crown of the mango-yellow rose. I assumed it was there for a moment to sip nectar.

In the evening the same day, I was amused to see it perched at the same place. I leaned in to check if it was alive. I couldn't imagine any other reason for an insect to sit on the same flower all day! After all, the yellow rose was in a rich plantation of very exciting opportunities. The other roses were as nutritious and promising, if not more. There was nothing to stop the insect from hopping from one rose to the other, enjoying different creamy petals, multiple fragrances and flavours.

I assumed so based on my understanding of common behaviour. Whether insect or human, we often feel lured towards 'other' opportunities, greener pastures, more perks and greater joys, especially when they are within our reach. Whether we need them or not is another matter. Whether their achievement brings lasting happiness is also quite another matter.

Soon I saw it twitching its front legs and curving its spine. It was not only alive, it had no injury. A bumblebee buzzed off and on. A wasp hovered over the rose. Our guest was active and so was life all around it. I thought that it probably wanted to absorb the goodness of one flower in its entirety, and had hence settled down on one rose for the whole day.

The next day, Day 2, I went to our porch for a chore. The sun was overhead. I wishfully glanced at the yellow rose, secretly hoping to spot our tiny guest. I couldn't. I went closer to take a look again.

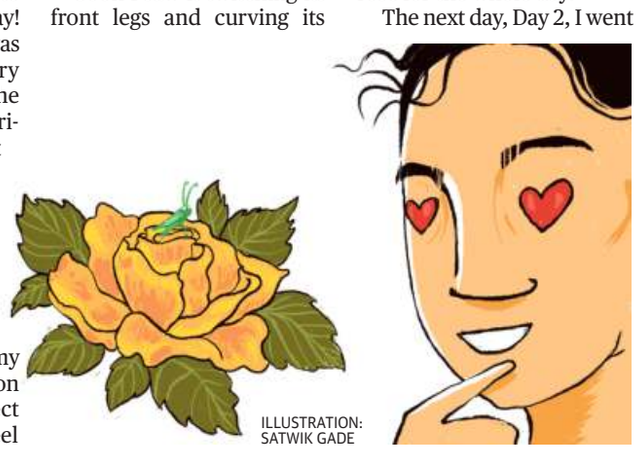

ILLUSTRATION: SATWIK GADE

And there it was... in a cozy, shaded space formed by a petal giving cover to the petal below it! Since the crown of the rose was exposed to direct sunrays, our guest had found a way to deal with the heat within the petals of the same rose. It could've taken a short flight to another rose that was fully under the shade at that time. But it didn't.

A small but meaningful example of willingness to find a solution instead of escaping the problem. In the latter half of the day, when the sun's rays had sobered, I found it had moved back to the crown of the rose, and swayed in tandem with the gentle evening breeze.

Came Day 3. I stepped out with my morning cup of tea. No surprise, I saw our guest still perched peacefully. It seemed as satisfied sitting on the yellow rose on that third day as it was on the first. It enjoyed food and health from it. Day turned to night, and it continued to enjoy the familiar position.

It was happy there. And that happiness was independent of the dynamics and opportunities in its environment. Isn't that precious?

In the next few days, as the rose withers, our humble guest must fly away to another one. Until then, as it rests on the yellow petals regardless of the scarlet-red, peach-pink, and off-white temptations in the backdrop, I know I'm looking at contentment.

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