V.V. KRISHNAN

# Whither House panels?

## In the backdrop of a number of Bills having been passed without scrutiny, why are parliamentary standing committees necessary?

VARGHESE K. GEORGE

**The story so far:** Eleven of the 22 Bills introduced in the ongoing session of Parliament have been passed, which makes it a highly productive session after many years. But these Bills have been passed without scrutiny by parliamentary standing committees, their purpose being to enable detailed consideration of a piece of legislation. After the formation of the 17th Lok Sabha, parliamentary standing committees have not been constituted as consultations among parties are still under way. Partly as a result of this, the Bills were passed without committee scrutiny. They were discussed in Parliament over durations ranging between two and five hours.

**Why have parliamentary committees?**
In a parliamentary democracy, Parliament has broadly two functions, which are lawmaking and oversight of the executive branch of the government. Parliament is the embodiment of the people's will. Committees are an instrument of Parliament for its own effective functioning.

Given the volume of legislative business, discussing all Bills under the consideration of Parliament in detail on the floor of the House is impossible. Committees are platforms for threadbare discussion on a proposed law. At least in principle, the assumption is that the smaller cohort of lawmakers, assembled on the basis of the proportional strength of individual parties and interests and expertise of individual lawmakers, could have more open, intensive and better informed discussions. Committee meetings are 'closed door' and members are not bound by party whips, which allows them the latitude for a more meaningful exchange of views as against discussions in full and open Houses where grandstanding and party positions invariably take precedence.

Disruptive changes in technology and the expansion of trade, commerce and economy in general throw up new policy challenges that require a constant reform of legal and institutional structures. While lawmaking gets increasingly complex, lawmakers cannot infinitely expand their knowledge into ever expanding areas of human activities. For instance, we live in an era of metadata being generated by expanding connectivity. The laws and regulations that are required to govern a digital society cannot be made without highly specialised knowledge and political acumen. Members of Parliament may have great acumen but they would require the assistance of experts in dealing with such situations. It is through committees that such expertise is drawn into lawmaking.

Executive accountability to the legislature is enforced through questions in Parliament also, which are answered by ministers. However, department standing committees go one step further and hear from senior officials of the government in a closed setting, allowing for more detailed discussions. This mechanism also enables parliamentarians to understand the executive processes closely.

**What are the types of committees?**
Most committees are 'standing' as their existence is uninterrupted and usually reconstituted on an annual basis; some are 'select' committees formed for a specific purpose, for instance, to deliberate on a particular bill. Once the Bill is disposed of, that select committee ceases to exist. Some standing committees are departmentally related, an example being the Standing Committee on Human Resource Development. A Bill related to education could either be considered by the department standing committee or a select committee that will be specifically set up. The chair uses her discretion to refer a matter to a parliamentary committee but this is usually done in consultation with leaders of parties in the House. Financial control is a critical tool for Parliament's authority over the executive; hence finance committees are considered to be particularly powerful. The three financial committees are the Public Accounts Committee, the Estimates Committee and the Committee on Public Undertakings.

Parliamentary committees draw their authority from Article 105 (on privileges of Parliament members) and Article 118 (on Parliament's authority to make rules for regulating its procedure and conduct of business). Committee reports are usually exhaustive and provide authentic information on matters related to governance. Bills that are referred to committees are returned to the House with significant value addition. Parliament is not bound by the recommendations of committees.

**What are its origins?**
As is the case with several other practices of Indian parliamentary democracy, the institution of Parliamentary Committees also has its origins in the British Parliament. The first Parliamentary Committee was constituted in 1571 in Britain. The Public Accounts Committee was established in 1861. In India, the first Public Accounts Committee was constituted in April 1950. According to P.D.T. Achary, former Secretary General of the Lok Sabha, "The practice of regularly referring bills to committees began in 1989 after government departments started forming their own standing committees. Prior to that, select committees or joint committees of the houses were only set up to scrutinise in detail some very important bills, but this was few and far between."

# What are the advantages blockchain offers?

## What is the potential of this foundational technology and how much can be tapped? What are the hurdles?

JACOB KOSHY

**The story so far:** For a little over a decade, the term blockchain has been flitting in and out of news cycles, especially in connection with bitcoin, the digital cryptocurrency. The Reserve Bank of India has banned speculation and investment in cryptocurrencies. Of late, however, blockchain is seeing a revival, and companies are looking at how to use the tremendous potential of the technology that underpins the cryptocurrency.

**What is blockchain?**
It is a foundational technology or a platform that allows designing a secure way to record transactions and circulate it among signatories, or any kind of target group with an Internet connection. At its core it is an extremely democratic ledger that cannot be arbitrarily manipulated and easily shareable.

Blockchain's appeal is that it achieves this without a central authority. Blockchain burst into public consciousness because of its association with Satoshi Nakamoto, a mysterious individual or cabal that laid out a white paper on how blockchain could be applied to bitcoin, a virtual currency wrought from the principles of blockchain. Having money free of the fiat of Central governments raised utopian possibilities especially in a world where democracies complain of being subverted and labour and capital continue to be entangled in the elusive quest for equilibrium. Thereafter, it spawned its own hype-cycle, imitation currencies, association with the sordid and Dark Net. While cryptocurrencies have a bad reputation, Silicon Valley tech giants and investment banks are trying to salvage the underlying promise of blockchain and use it for other collaborations.

**How does blockchain work?**
Every block in a blockchain is a record of transactions and the more of the latter, the longer the chain. Just as worthless paper transforms into valuable currency with the signature of the RBI governor, blocks are great because they provide an unalterable document of the history of every transaction. In the context of currency, it stores the place, time, value (rupee, for example) and location of a purchase. There is minimal identifying information and every block is linked to a unique 'digital signature' of the transacting participants. Every block is distinguished from another through a unique code which is a string of numbers. When you use your debit or credit card to make a transaction, VISA or Mastercard employ their technology to verify your bank account, connect with banks and process a transaction.

In blockchain applications, this verifying role is outsourced to several computers on a network – each has the exact same copy of the block. These computers verify the genuineness of transaction by solving mathematical problems that can only be done in brute-force, energy intensive ways that require a lot of computational power, and therefore electricity. This is a key reason why blockchain enthusiasts vouch for the security of blockchain-backed transactions. Depending on where the blockchain technology is deployed, these participating computers or users have to be incentivised for all that energy expenditure.

In the case of bitcoin, the computers are rewarded with bitcoin. This is stored in digital wallets and may be used like money provided there are sellers of real world goods who would accept bitcoins. Nowdays, they are frequently traded as another speculative, volatile asset.

**What real world problem does blockchain solve?**
As of today nothing, but blockchain backers say it solves the problem of 'trust'. Because the major cost of any transaction or exchange of services or goods is the act of verification – VISA charges fees to ensure that your card swipe is connected to your account or a property charges you for the effort of ensuring that you are entering into a genuine transaction – blockchain asks you to trust the energy-intensive nature of mathematical problems and have them masquerade them as 'locks' to secure your money, confidential documents or any kind of information.

Technology has always proved to be disruptive. If blockchain's appeal lies in its appeal to destroy intermediaries such as banks, courts, lawyers, it is unlikely to be smooth sailing

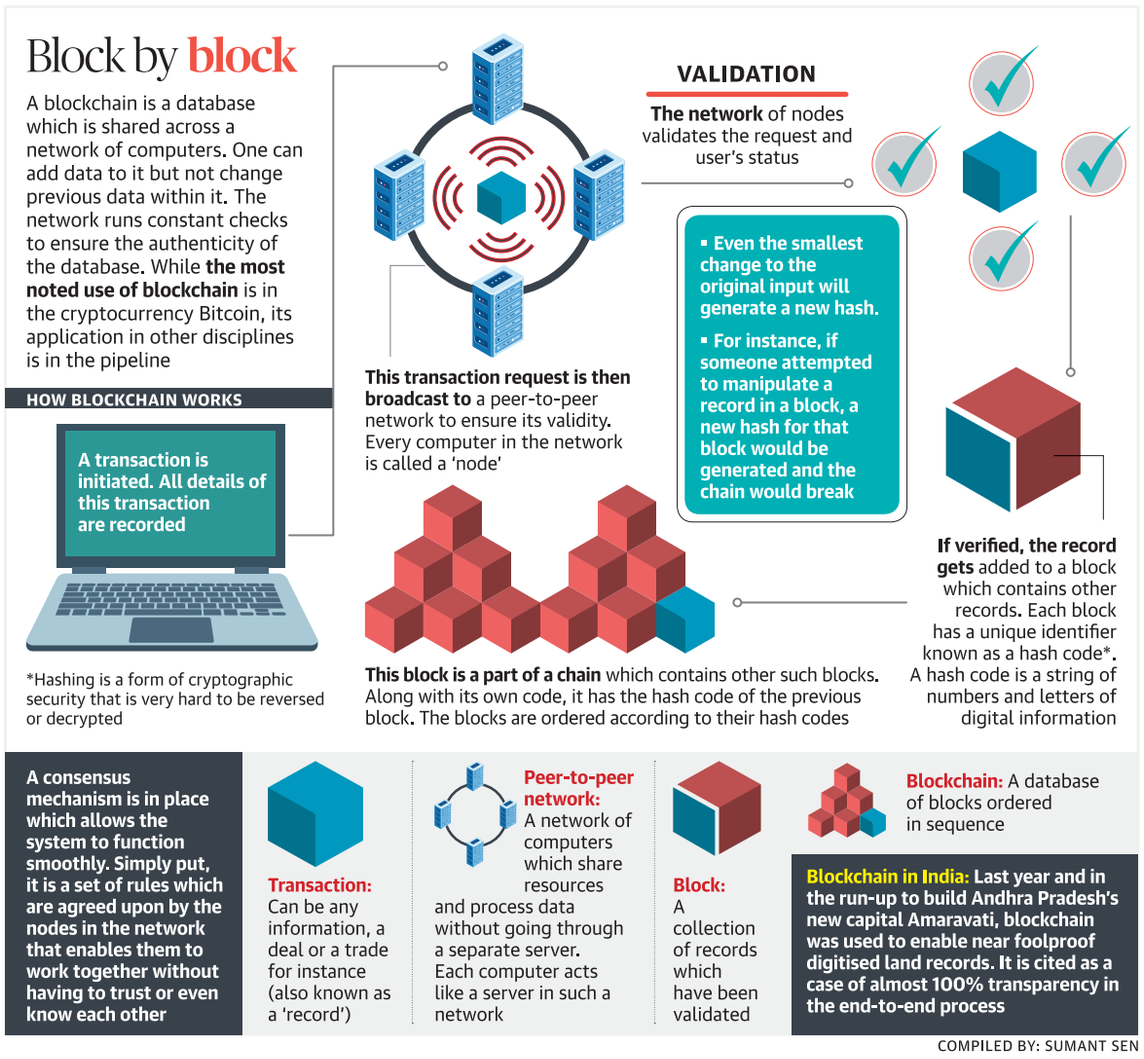
While blockchain has the aura of transparency – anybody supposedly can check the history of a 'block' – it is at its core impervious to common sense. However, just as the inability to grasp in a visceral sense how letters typed on a mobile phone transform and make their way into another phone instantaneously a continent away does not stop people from using WhatsApp, blockchain technology has created enough hype and drama to have drawn the world's wealthiest to invest in it and inveigle it into ordinary lives.

**Where can it be used?**
Facebook this year announced Libra, a kind of blockchain-backed digital currency. According to report in a 2017 issue of the *Harvard Business Review* (*HBR*), "Bank of America, JPMorgan, the New York Stock Exchange, Fidelity Investments, and Standard Chartered are testing blockchain technology as a replacement for paper-based and manual transaction processing in such areas as trade finance, foreign exchange, cross-border settlement, and securities settlement"

Ethereum is another blockchain-based startup that looks to decentralise online information. Its ambition is beyond overturning online banking and it claims that if it were to work as envisioned, it will give users control over their data unlike the present where a lot of our privacy is ceded to Google and Amazon's servers. Some plan to apply blockchain to trace the origin of food and where it is grown and yet others to journalism and 'fact-checking' applications. Unlike blockchain's distributed computing philosophy, all these applications ultimately store information on a coalition of repositories.

**Is blockchain just hype?**
The *HBR* article cited earlier, by Marco Iansiti and Karim R. Lakhani, likens blockchain to the early days of the Internet, which was made possible by so-called distributed computing. A new mode, called the TCP/IP (transmission control protocol/Internet protocol), which specified how computers could be networked to transmit and receive packets of digital information, turned out to be a platform that laid the base for private networks, email, the web, websites, search engines. TCP/IP minimises central management and makes networks resilient and far-reaching. The protocol was not the crying need of humanity but once in place, upended the telecommunications industry and in the last three decades virtually every aspect of life.

Technology has always proved to be disruptive, creating new opportunities and jobs and destroying old ones. If blockchain's appeal lies in its appeal to destroy intermediaries – banks, courts, lawyers – it is unlikely to be smooth sailing. Moreover, there is already serious theorising by economists that shows how blockchain has its own vulnerabilities and susceptibility to creating new hegemons, power networks, cartels and challenges to global energy consumption.




COMPILED BY: SUMANT SEN

# How will India contribute to LIGO?

## Why is it important for the country to join the global network studying gravitational waves? What will it achieve?

SHUBASHREE DESIKAN

**The story so far:** On September 14, 2015, the two LIGO detectors in the U.S., at Livingston in Louisiana, and Hanford in Washington, registered a disturbance that was not unlike the chirp of a bird. It was due to gravitational waves travelling outwards from a point 1.3 billion light years away from the earth. At this point, two massive black holes with masses 29 and 36 times that of the sun had merged to give off gravitational wave disturbances. Black holes are exotic objects that we know little about, but their immense gravitational pull which traps even the fastest object in the world, which is light, is legendary. When objects with such an immense gravity merge, the disturbance is felt by the very fabric of space time and travels outward from the merger, not unlike ripples on a pond surface. Thus, gravitational waves have been described as "ripples in the fabric of space time". Following the 2015 detection, which later won the Physics Nobel (2017), the two LIGO detectors detected seven such binary black hole merger events before they were joined by the European Virgo detector in 2017. The two facilities have now detected 10 events. The Japanese detector, KAGRA, or Kamioka Gravitational-wave Detector, is expected to join the international network soon. In the meantime, in a collaboration with LIGO, a gravitational wave detector is being set up in India. The LIGO India project is expected to join the international network in a first science run in 2025.

**What are the LIGO detectors?**
The acronym LIGO stands for Laser Interferometer Gravitational-Wave Observatory. LIGO consists of a pair of huge interferometers, each having two arms which are 4 km long. Remarkable precision is needed to detect a signal as faint as a gravitational wave, and the two LIGO detectors work as one unit to ensure this. Naturally, this requires weeding out noise very carefully, for when such a faint signal is being detected, even a slight human presence near the detector could derail the experiment by drowning out the signal.

LIGO, unlike usual telescopes, does not "see" the incoming ripples in spacetime. It does not even need to, because gravitational waves are not a part of electromagnetic spectrum or light. They are not light waves but a different phenomenon altogether – a stretching of spacetime due to immense gravity. A single LIGO detector cannot confidently detect this disturbance on its own. At least two detectors are needed. This is because the signal is so weak that even a random noise could give out a signal that can mislead one into thinking

An aerial view of the LIGO detector site, at Livingston, Louisiana, U.S. ▪ REUTERS/CALTECH/MIT/LIGO LABORATORY/2016

a genuine gravitational wave has been detected. It is because two detectors have detected the faint signal in coincidence that the observer is convinced it is a genuine reading and not noise.

**What is the need to have another detector in India?**
Right now, with just three detectors, there is huge uncertainty in determining where in the sky the disturbance came from. Observations from a new detector in a far-off position will help locate the source of the gravitational waves more accurately.

**What are the possible sources of gravitational waves?**
Mergers of black holes or neutron stars, rapidly rotating neutron stars, supernova explosions and the remnants of the disturbance caused by the formation of the universe, the Big Bang itself, are the strongest sources. There can be many other sources, but these are likely to be too weak to detect.

**Why does one study gravitational waves?**
As a largely unknown and fundamental phenomenon, gravitational waves are interesting to scientists. But once many more detectors are in place, the study also offers a new way to map out the universe, using gravitational-wave astronomy. Perhaps one day we will have such accurate detection facilities that signatures of gravitational waves bouncing off celestial objects can help us detect and map them.

**What do we know about LIGO India?**
LIGO India will come up in Maharashtra, near Aundha in Hingoli district. Most of the land has been acquired, and the small balance is going through a slightly longer acquisition procedure. The project is formally in the construction phase, with the building design conceptualised. Says Tarun Souradeep, spokesperson for LIGO India, "We are close to finalising the civil infrastructure drawings. The plans for immense vacuum infrastructure have been conceptualized, reviewed and are in an advanced stage."

**Will LIGO India be different from LIGO itself?**
Like the LIGO detectors, the one at LIGO India will also have two arms of 4 km length. But while there are similarities there will be differences too. Being an ultra-high precision large-scale apparatus, LIGO India is expected to show a unique "temperament" determined by the local site characteristics. In an email to *The Hindu*, Dr. Souradeep, says, "LIGO India and its complex feedback control loops to high sensitivity will follow a fairly independent track and poses an exciting full-scale challenge. Under a memorandum of understanding, the National Geophysical Research Institute is carrying out a year-long, multiple-station seismic survey campaign at the LIGO India site to characterise the local properties. This is in addition to the elaborate geotechnical and geophysical survey completed earlier this year."

Observations from a new detector in India will help locate the source of the gravitational waves more accurately. The LIGO India project is expected to join the international network in 2025

**What is the technology being developed in India for LIGO India?**
Some of it includes design and fabrication of ultra stable laser, quantum measurement techniques, handling of complex control system for enforcing precision control, large-scale ultra-high vacuum technology, data analysis and machine learning. This is not a complete list and the development of such indigenous technology is likely to result in many spin-offs for industry and research.

## CAPSULE

**Timing eruptions**
A group from Cambridge University has estimated that magma can be stored from hundreds to a thousand years at the crust-mantle boundary before being let out in a volcanic eruption. Researchers used diffusion of chromium and aluminium atoms to estimate this. The discovery can help forecast volcanic eruptions.

**Similar species**
The brain circuitry involved in the sense of smell is similar across six different mammal species from mice to cats. The relative sizes of three components of the olfactory neural network – nose, olfactory bulb and piriform cortex – are preserved across the six species studied, finds a study published in *Currrent Biology*.

**Mind of the mosquito**
Researchers from University of Washington, U.S., have figured out how female mosquitoes integrate various sensory cues to decide how and where to find their next blood meal. After the mosquito senses chemical cues with her olfactory system, she looks around to scan the area for shapes and integrating these inputs decides where to fly.

**Fossil mammal**
A 165-million-year-old fossil of *Microdocodon gracilis*, a shrew-like mammal, found in China in 2014, was examined recently. Researchers find in it the earliest evidence of tiny hyoid bones that link the back of the mouth, the pharynx, to the openings of the oesophagus and larynx. The tiny animal must have weighed 5 to 9 grams.

# NCBS: How micro RNAs regulate the colour of fruits, leaves

Engineered plants can produce anthocyanin and flavonol which have medicinal uses, the team finds

SHUBASHREE DESIKAN

A team from the National Centre for Biological Sciences (NCBS), Bengaluru, has found that the rich colour in fruits and leaves of plants are indirectly controlled by specific micro RNAs – miR828 and miR858.

Grape plants bear fruits having colours that can be deep purple or green. This colour is due to compounds called anthocyanins and flavonols, both of which are present in grape fruits.

When the grape plant has a high amount of anthocyanin as compared to flavonol, the fruits are deep purple. When the reverse is true, the grapes are not brightly coloured. The relative abundance of anthocyanin and flavonol is controlled by genes known as the MYB transcription factors. Also referred to as activators, when present in large amounts, they result in dark purple grape, as in the Bangalore Blue variety, and absence correlates with lack of bright colour but high incidence of flavonols as in the Dilkhush grape variety.

**Transgenic:** Plants grown from infected "ex-plants" had reddish leaves and abundant anthocyanin, says (from left) Varsha Tirumalai, Ashwin Nair and P V Shivaprasad.

### Repressor target

"Researchers knew microRNAs can regulate MYBs, but they did not know why such a regulation takes place. They were mostly working with *Arabidopsis* model where one might not see coloured fruits," says P V Shivaprasad of the Epigenetics lab in NCBS, where the work was done.

The team found that the microRNAs miR828 and miR858 were also found in abundance when the grapes had dark colour. Hence they figured out that there must be an intermediary repressor which was what the miRNA targeted.

"The microRNA was targeting something that is competing with the activator MYB. This [competing factor] is a repressor of the anthocyanin pathways," says Varsha Tirumalai, PhD student at NCBS and first author of the paper published in the *Journal of Experimental Botany*.

Micro RNAs are regulators of gene expression, acting like switches. They decide which protein should be made and how much in a given cell or tissue or an organism. They are tiny, having some 20 to 22 digits of RNA. The miRNA inhibit target RNAs by cutting them into two bits in plants. The miRNAs partner with a protein called Argonaute to do this regulation.

### Two experiments

The researchers did two sets of experiments with tobacco plants *(Nicotiana tabacum)*. First, they injected through the stomata in the leaves of the plants, an *Agrobacterium* culture by which overexpression of the gene in question was achieved. This method of feeding the culture led to a local effect in the particular leaf only. Also the cells in the leaves were not damaged as the injection was done through the stomata. The leaves also overexpressed the gene and changed colour to a reddish shade.

They also did another experiment in which instead of pushing the culture through the stomata they infected an "ex plant"– a scientific term for a piece of the plant from which the whole plant can be grown. They found that the plants grown in this manner had reddish leaves and abundant anthocyanin.

"This was very interesting. I have never seen red-leaved tobacco plants earlier. Abundant flavonols were not produced in tobacco earlier," says Varsha.

"Anthocyanins and flavonols remove reactive oxygen species that damage DNA, RNA and proteins. Reactive oxygen species are involved in most human diseases," explains Dr Shivaprasad.

### Biofortification

Plants having anthocyanin and flavonol can be generated by controlling the microRNAs affecting them. "We can make more of them in tobacco, which can be extracted easily and used as supplements," he adds. The genes identified here can be used in biofortification.

The group is trying to patent flavonol engineering. Their next step is to find out how the MYB transcription factor works to make the specific enzymes needed to make flavonols.

# A new 'clutch' to engage the immune cell 'gear'

Two adaptor proteins act like a clutch, help protein condensates get into the correct slot

ASWATHI PACHA

A unique summer institute held at the Woods Hole Marine Biological Laboratory in the U.S. (during 2013-2018) helped unlock a few mysteries of the immune system. A team of leading biologists and biochemists identified a molecular 'clutch' which helps move clusters of proteins inside the immune cells.



**Microscopic mystery:** If the clutch is not active in the immune cells, they are unable to respond to the information from the outside, says Satyajit Mayor (right).

### Signalling machinery

The main aim of the study was to understand how the T-cell receptors, which play a main role in our immunity, form a signalling complex and how they build a signalling machinery that picks up information from the outside and use it to activate the immune mechanism.

The team identified two adaptor proteins which act as clutch and help protein condensates get into the correct slot.

Protein condensates are a form of a macromolecular assembly formed by multivalent proteins coming together to create a region that is highly concentrated. It is in the form of a phase separated patch, like oil droplets that form a distinct patch on water.

The recruitment of these adaptor proteins to the condensates was found to be influenced by where the T-cell receptor clusters are located.

"When a T-cell receptor binds to an antigen, the T-cell undergoes a global reorganisation forming a signalling centre at the site of the antigen-bound receptor. The continuous transport of the studied protein condensates towards this signalling centre is important for maintaining the signalling output which is part of the immune response," adds Prof. Darius Vasco Köster from the Marine Biological Laboratory at Woods Hole, U.S. in an email to *The Hindu*. He is one of the authors of the work published in the journal *eLife*.

The adaptor proteins also promoted association of the protein condensates with actin present inside the cell.

### Crucial role

Actin plays a crucial role in cellular processes required for normal immune function. "We fully don't know the implications of the function of these proteins, but we know that if the clutch is not active in the immune cells, they are unable to respond to the information from the outside. These adaptors are also quite general, they go and adapt to other processes as well," says Prof. Satyajit Mayor, from the National Centre for Biological Sciences, Bengaluru, and one of the authors.

Understanding the cascade of events that take place in the immune cells can help develop new vaccines and treatment regimens.

# Ebola vaccine tested during epidemic saves lives in Congo

Preliminary data from vaccination in Congo suggest the vaccine has 97.5% efficacy in preventing Ebola

R. PRASAD

The 2014-2015 Ebola epidemic mainly in the three western African countries of Guinea, Liberia and Sierra Leone has been the most deadly one since the virus became known in 1976. It caused disease in 28,616 people and killed 11,310 others. But what stands out as a remarkable scientific and public health achievement has been the conduct of a large clinical trial in Guinea to test the efficacy of an Ebola vaccine in the midst of the epidemic.

The phase-3 clinical trial involving thousands of volunteers tested the efficacy of Merck's vaccine (VSV-EBOV) to protect vaccinated individuals from getting infected with Ebola virus.

The phase-1 and phase-2 clinical trials involving fewer volunteers were carried out in Europe and Africa in 2014-2015 and consequently used in Guinea in 2015 during vaccination campaigns even when it was being tested in the phase-3 trial.

**Prevention:** A woman getting vaccinated in Conakry, Guinea, on March 10, 2015, during the first clinical trials of Merck's vaccine. ▪ AFP

### Clinical trials

During the trial, the vaccine was administered to 2,119 individuals who had come in contact with a person infected with or died due to Ebola virus and 2,041 people who had come in contact with the primary contacts (known as contacts of contacts). In July 2015, an interim analysis revealed that the vaccine had 100% efficacy. The final results of the trial, too, showed the same result. The duration of protection is not known, though a few studies suggest protection up to one year.

So when Ebola struck the Democratic Republic of Congo on August 1, 2018, the decision to use Merck's vaccine, which has not been licensed in any country for clinical use, was taken without much thought as it was the only vaccine that been tested in phase-3 trials. Also, the World Health Organization's Strategic Advisory Group of Experts on Immunization (SAGE) had in March 2017, recommended that in the absence of a licensed vaccine for Ebola, the investigational vaccine could be used during an outbreak caused by the Zaire strain of the virus.

The vaccine was developed by the Public Health Agency of Canada and licensed to NewLink Genetics. In November 2014, Merck entered into a licensing agreement with NewLink Genetics to research, develop, manufacture and distribute the vaccine.

The vaccine was administered to nearly 29,000 health-care workers and about 94,000 primary contacts and contacts of contacts in Congo under "compassionate use". The vaccination began a week after the outbreak was officially declared.

### Efficacious vaccine

Putting to rest the debate on the extent of efficacy during the phase-3 trial, the WHO noted that the preliminary data suggest that the vaccine used during the current outbreaks in Congo was 97.5% efficacious in preventing Ebola infection.

Of the 94,000 people who were vaccinated during the current outbreaks, only 71 developed the disease. Of the 71, only 15 developed symptoms 10 or more days after vaccination. The majority – 57 individuals – displayed symptoms within nine days of vaccination, before the vaccine could fully protect them. It had become clear during the trials that the vaccine needed 10 days to fully protect vaccinated individuals.

There were only nine deaths among the 57 people who developed the disease before the vaccine could be fully protective. In comparison, no deaths were reported among people who developed the disease more than 10 days post vaccination.

More importantly, 54 of the 71 Ebola cases were in high-risk contacts, and only two cases were among the contacts of contacts, thus underlining the effectiveness of the ring vaccination strategy in preventing the spread of the disease. In the ring vaccination strategy, the spread of the virus is curtailed by creating protective rings by vaccinating people based on the risk of infection. The first ring of protection is created by vaccinating everyone who has come in contact with infected persons or their bodies, or has lived in the same house. The second ring – contacts of contacts – comprises neighbours and family members of all contacts.

As a result of delay in detecting and isolating cases and tracing the contacts, the virus continues to spread, and about 80 new cases are reported each week, the WHO said on July 17. The hotspots have been shifting and new cases are being reported from areas that were previously cleared. In May 2019, SAGE cautioned that virus transmission continues to occur in areas where there is difficulty in implementing ring vaccination and that new cases are being reported among unknown contacts.

### Third ring

In order to cut the transmission chain, SAGE recommended the inclusion of a third ring of contacts to be vaccinated. Currently available evidence does not support mass immunisation of the population.

There are indications that the epidemic is not going to end anytime soon, and the number of people who need to be vaccinated is bound increase. To avoid any diversion of critical human resources and being in the thick of an epidemic, the Congo health minister has ruled out a clinical trial using Johnson & Johnson's experimental vaccine. This would mean that more Merck vaccines would be needed to end this epidemic. Though Merck intends to double the supply by 2020, vaccine supplies are currently insufficient. The only way to stretch supplies of the vaccine to meet the ever-increasing demand is to use smaller doses.

In May 2019, SAGE recommended that the currently administered dose (1 ml) can be halved to match the dose tested in phase-3 trial in Guinea to protect health-care workers, contacts and contacts of contacts. People in the third ring could be given one-fifth the current dose. Instead of 10, it would take 28 days for the vaccine to confer protection when one-fifth of the current dose is used. But it would provide a "reasonable risk-benefit trade-off for protection," SAGE noted.

# Yes we can, indeed we must, restore forests

An outstanding example of reforestation is Philippines

SPEAKING OF SCIENCE

D. BALASUBRAMANIAN

Global warming, largely caused by industrial development and consumer demands, has been causing havoc across the world. Temperatures are shooting up, floods have been ravaging South China and Northeast India, unseasonal rains and, ironically, delayed and poor monsoon rains are experienced. A major solution to mitigate such climate changes is to reduce the levels of greenhouse gases, particularly carbon dioxide, which cause this warming. In an effort to try and limit this warming, many countries across the world are gathering together and agreeing to make efforts to limit the rise in temperature to no higher than 1.5 degrees by the year 2050.

The major way to do so is to increase the number of plants, trees and forests across the world. They all absorb carbon dioxide from the air, and with the help of sunlight and water, produce food (staple for us) and oxygen (which we breathe). And the wood and timber they offer are used by us in buildings and furniture. They are thus justly named in Sanskrit as Kalpataru – the wish-giving tree.

Yet, we kill them: deforestation has been going on decade after decade across the world, affecting the weather as well as the lives of plants, animals, microbes and the livelihood of human tribes that live in forests. The total surface area of our Earth is 52 billion hectares (Ha), and 31% of this has been forest cover. But the huge Amazon forests of South America are being chopped off for commercial reasons. Peru and Bolivia in the western Amazon region are the worst affected by such deforestation; so are Mexico and its neighbours in Mesoamerica. Russia, with forests occupying 45% of its land area, is chopping off trees. Large scale deforestation this kind has contributed to global warming over the years.

### What is a forest?

The Food and Agriculture Organization (FAO) defines a "forest" as a land area of at least 0.5 hectares, covered by at least 10% tree cover, without any agricultural activity or human settlement. Using this definition, a group of Swiss and French ecologists have analysed these 4.4 billion hectares of tree canopy that can exist under the current climate. And, excluding existing trees and agricultural and urban areas, there is room for an extra 0.9 billion hectares. Their analysis using the latest ecological methods, was published two weeks ago (Bastin et al., *Science,* 365 76-79, 5 July 2019). Thus, there is the potential climate change mitigation through global tree restoration. They point out that more than 50% of this restoration potential can be found in six countries (Russia, USA, Canada, Australia, Brazil and China). While it is not clear how much of this land is public or private, they confirm that the calculation of 1 billion hectares (>10% tree cover) is achievable.

Happily enough, several group (and governments) in countries, notably Philippines and State government in India (see the report for the Forest Survey of India, and an analysis by Down to Earth) have moved towards more tree plantations. In India with its 7,08,273 sq km land area, 21.54% has tree cover. And between 2015 and 2018, we have added 6,778 sq km. Madhya Pradesh has the largest forest cover, followed by Chhattisgarh, Odisha and Arunachal Pradesh while Punjab, Haryana, UP and Rajasthan have the least. Andhra Pradesh, Telangana, Karnataka, Kerala and Odisha have improved their forest canopy somewhat (<10%). Private groups, notably The Guru Nanak Sacred Forest in Ludhiana, Punjab, the middle-of-the-town forest in the heart of Raipur, the "Afforest" group of Shubhendu Sharma (The Hindu Business line, 3-12-2018) are some notable non-government initiatives. Readers will surely add more. (On an aside, who can forget the centenarian Salumarde Thimmakka, who has planted 385 banyan trees and 8,000 other trees, or Sunderlal Bahuguna of the Chipko movement of Uttarakhand?)

### Leading by example

But the most outstanding example of reforestation is Philippines, an archipelago of 7,100 islands, with a total land area of 3,00,000 sq km and a population of 104 million people. Way back in 1900, about 65% of its land mass was covered in forest canopy. Large-scale commercial deforestation continued after that, so by 1987, it was reduced to 21%. The government thereafter committed itself to steady reforestation, and by 2010, the forest covered 26%. It has now introduced a remarkable programme in which it makes it mandatory for each elementary, high school and college student to plant 10 trees before graduating. The sites where they plant and the location-appropriate plant are advised to them; (see<news.ml.com.ph> of *Manila Bulletin*, July 16, 2019). The mover of this idea, Gary Alejano, stressed on the need to utilise the educational system as an avenue for propagating ethical and sustainable use of natural resources among youth to ensure the cultivation of a socially responsible and conscious citizenry.

Here is an excellent example for our Indian students. Your columnist has recommended this model to be added to the National Education Policy 2019, so that we may demand youngsters to follow and gain from the Filipino experiment.

*dbala@lvpei.org*

# The tale of a gritty survivor's battles

ARUL P. SRINIVAS

I was diagnosed with cancer of the thyroid in April 2014, a few months before I was to join Purdue University in the United States. My doctors told me that if I had to have cancer, this was the 'best' one of all the varieties. Rest assured that I'm now happy and healthy, and I only have very ordinary human ailments such as sinus headaches, acne, stubbed toes and the occasional Game of Thrones spoiler.

I spent a couple of months in and out of hospitals and I had more doctors than friends. They cut my throat, pilfered my thyroid, and in the process snipped a nerve to my shoulder and shocked some vocal cords. Worst of all, they had only one side of my head shaved before the neck surgery and didn't let me even out the other side after the surgery (don't ask why). So, for a few weeks I looked like Cruella from *101 Dalmatians* when people came to visit. A few days after the surgery, I downed 150 millicurie of radioactive iodine, spent two days in quarantine where I binge-watched *Death Note* behind lead walls, and then underwent various tests. Finally, in June 2014, the doctors informed us the cancer was gone.

Then there came the question of Purdue. I said (or more accurately, croaked) that I still really wanted to study in the U.S. despite the possibility of a relapse, my frailty and my voice – and my parents probably wondered if I had brain cancer as well! We debated and argued a lot, but in the end my awesome, awesome parents set aside the obvious fears they had and allowed me to enroll at Purdue.

Since I don't have my thyroid gland, I have to take supplements every day, which quickly became a morning habit in my first semester at Purdue. Thanks to that, I soon cultivated the convenient superpower of swallowing tablets without water. My inaudible voice cost me participation points in some classes, but on the brighter side, for about six months, I could perform one of the gruffest Batman impersonations in the Midwest.

Things sailed smoothly after my second semester. With voice therapy exercises, Batman gradually became an articulate South Indian Bruce Wayne. I had blood tests every three months (and will continue to) but the news has always been good. I had to follow month-long iodine-free diets (did you know even chocolates contain iodised salt?) followed by radioactive-iodine tests every summer in Chennai. These tested for any recurring cancer, and these have always turned out negative as well.

Thanks to the consistent good news, tackling college has been, well, *ez pz* (easy). It was hard initially, but once I got past those initial semesters and received positive news, there was no reason to quit. Giving up after that would be like Mario rage-quitting after beating Bowser.

The real heroes of this story were my parents. The way they have supported, tolerated and motivated me through all my ups and downs is unreal.

My dad has himself taken me to every single doctor's appointment, X-ray, ultrasound, blood test, iodine scan and everything else in Chennai, over the past five years. He has maintained a chronological record of the details and results of every single one of these events so systemically (almost psychotically) that it puts the various hospitals' medical records departments to shame. During the month of my iodine-free diet each year, I couldn't eat almost any kind of processed food, since they all invariably contained iodised salt. Through those months, my mom learned how to make homemade cheese, bread, ketchup and various other things from scratch (using non-iodised salt) that her fussy son couldn't live without.

They've done a lot. They've been strong, patient, trusting and just all-round awesome. They made my undergrad *ez pz*.

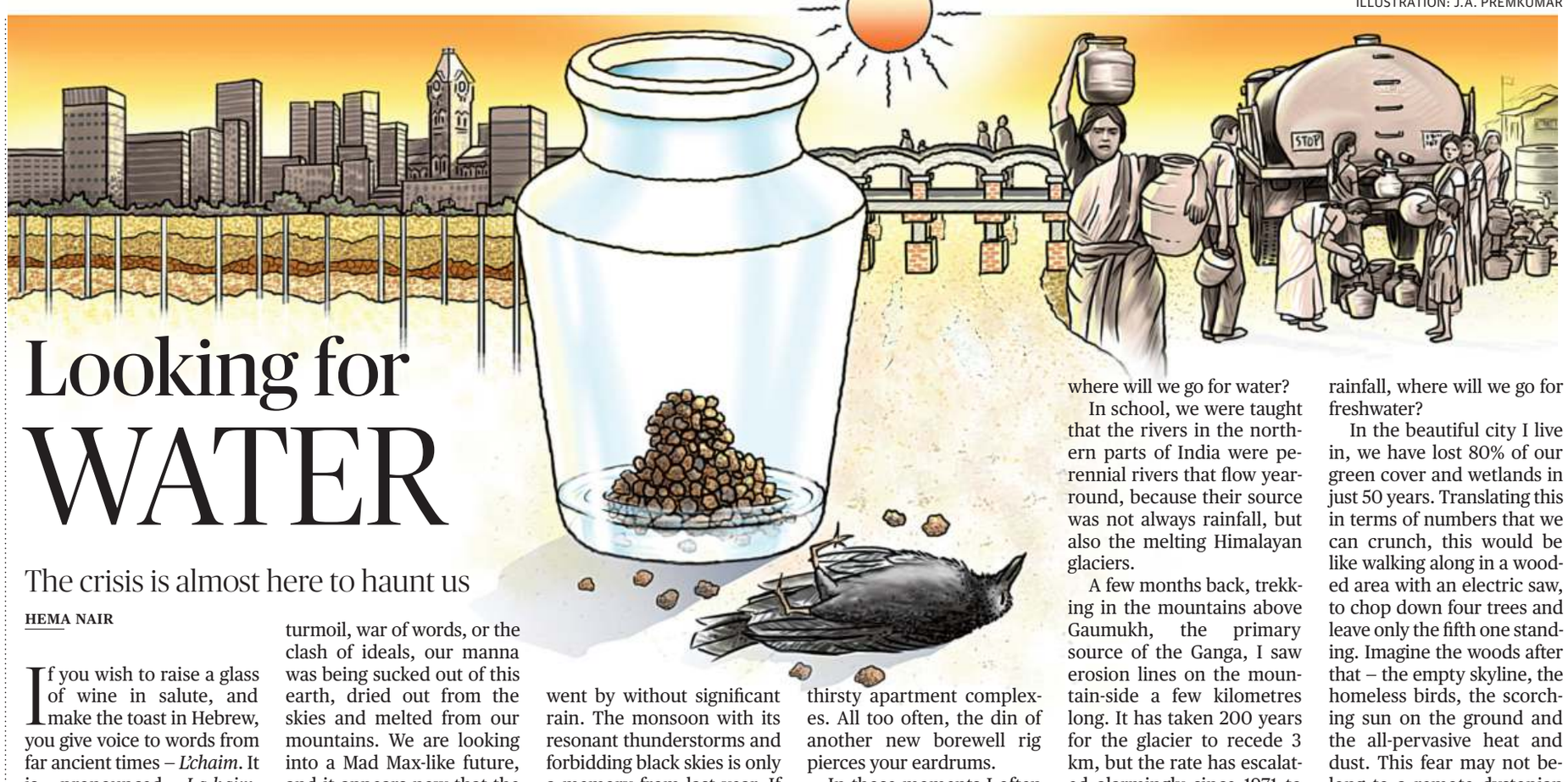
Recently I graduated from Purdue. I'll try to avoid the myriad cliches about graduating (obviously Purdue was like a second home and obviously I'll miss my friends, and obviously I'm glad to be done), so I'll paraphrase Purdue's president Mitch Daniels instead: "As every mechanical engineer knows, without friction, there is no traction."

I'm glad things happened the way they did (thyroid cancer, losing my voice, becoming Batman, everything!) because these hurdles are what have given me the fortitude and confidence to keep going.

Onward to CMU (Carnegie Mellon University)!

*Arul schooled in Sishya and later Vidya Mandir, both in Chennai, before joining Purdue for his bachelor's in Mechanical Engineering. He is now going to Carnegie Mellon to do his Master's. Email: det.abu@gmail.com*

ILLUSTRATION: J.A. PREMKUMAR



# Looking for WATER

## The crisis is almost here to haunt us

HEMA NAIR

If you wish to raise a glass of wine in salute, and make the toast in Hebrew, you give voice to words from far ancient times – *L'chaim*. It is pronounced *La-haim*, meaning 'To Life'.

I think the time has come for us to make the toast every morning to ourselves and to those with us, with a glass of water. Perhaps it will remind us how precious those drops are, and how scarce it is becoming. While we were distracted by our socio-political turmoil, war of words, or the clash of ideals, our manna was being sucked out of this earth, dried out from the skies and melted from our mountains. We are looking into a Mad Max-like future, and it appears now that the nightmare will step out of the big screen and turn into our reality not too far away.

As school kids trot off to the first day of school, the monsoon always came in to ruin the shine on the brand-new shoes and white school uniforms. But it is July now, and the whole month of June went by without significant rain. The monsoon with its resonant thunderstorms and forbidding black skies is only a memory from last year. If July is scarce, too, I wonder what will happen to us for the rest of the year.

As I cycle around the villages near my home, scarcely do I go more than a couple of kilometres before I find a borewell that pumps out water into a tanker, which then carts it off into the city for thirsty apartment complexes. All too often, the din of another new borewell rig pierces your eardrums.

In those moments I often think of these monstrosities as giant spears piercing the flesh of Mother Earth, trying to suck the marrow out of her body. Many of you may not think in the hyperbole as I tend to, but I hope you catch the drift.

If the rain doesn't come and the earth dries up, where will we go for water?

In school, we were taught that the rivers in the northern parts of India were perennial rivers that flow year-round, because their source was not always rainfall, but also the melting Himalayan glaciers.

A few months back, trekking in the mountains above Gaumukh, the primary source of the Ganga, I saw erosion lines on the mountain-side a few kilometres long. It has taken 200 years for the glacier to recede 3 km, but the rate has escalated alarmingly since 1971 to about 22 metres a year.

They say it is only going to be a few decades more before they evaporate into nothingness.

If the northern rivers are in jeopardy from the disappearing Himalayan snow cover and the southern ones are parched from absent rainfall, where will we go for freshwater?

In the beautiful city I live in, we have lost 80% of our green cover and wetlands in just 50 years. Translating this in terms of numbers that we can crunch, this would be like walking along in a wooded area with an electric saw, to chop down four trees and leave only the fifth one standing. Imagine the woods after that – the empty skyline, the homeless birds, the scorching sun on the ground and the all-pervasive heat and dust. This fear may not belong to a remote dystopian future anymore. If the monsoon doesn't come to our land soon, this could well be our present.

Suddenly, toasting with a tumbler of water 'To Life' doesn't seem all that far-fetched.

*drhemanair@gmail.com*

# Creative destruction in full flow

## Change is sweeping over the road transport sector in an inevitable re-run of the technology cycle

PAROMITA FALIA

As Alexa plays 'Radio Killed the Video Star', think of the products lying in their graves now or are in need of some life-saving surgery. Cable TV killed antenna TV but it is in turn now getting stabbed by media service providers such as Netflix and Hotstar. Smartphones have almost replaced keypad phones. Timely resuscitation of the latter by adding features such as 3G/4G support and enhanced memory have managed to sustain their support among people, who would like to know what's happening around the world and yet not get overwhelmed by it.

Economics gives us a term to understand this transition of products happening in the market – Creative Destruction. Inspired by Karl Marx, J.A Schumpeter defined the 'gale of creative destruction' as a "process of industrial mutation that incessantly revolutionises the economic structure from within, incessantly destroying old ones, incessantly creating new ones."

According to Schumpeter, without disruptions in the market there would be no development. In his analysis, he gives us the concept of circular flow. Circular flow is when the economy is in a stationary equilibrium, which is basically a static setting where economic activities follow a repetitive course. In order for further development to take place, it is essential to break this circular flow. And here comes the role of entrepreneurs with their innovations.

Today, electric vehicles (EVs) present one of the best examples of creative destruction. The alarm set off by radical changes in the global climate system has provided a wake-up call to leaders all over the world. They see EVs as a crucial element to minimise environmental casualties from the pursuit of human endeavours. They see it as an essential element of sustainable development.

Strategically, EVs have presented India with a rare opportunity to emerge as a global leader in the climate forum as well as a chance to unshackle itself from the hardships that oil have been creating ever since it went hyper-commercial. The evolution in the automobile industry riding on the internal combustion engine has been an interesting process.

Motor cars came on to the scene in the 19th century. The German engineer Karl Benz invented it in 1885. Later Henry Ford in 1908 came up with the Model T, which was relatively affordable. Demand for motor cars accelerated after the First World War and with it, the value of gasoline, or what we commonly call 'petrol'. Oil went on to be called black gold. In fact, control over oil was one of the factors that determined victory in the First World War. And the oil industry as we know it began with the discovery of commercially viable oilfields in the United States in the mid-19th century.


ILLUSTRATION: SREEJITH R. KUMAR

The advent of motor cars destroyed the economic feasibility of bullock carts and horse-drawn carriages. Journeys became comparatively faster and safer than before. Distances that could be covered easily increased manifold. Besides, carts and carriages were labour-intensive for they required careful maintenance of horses and oxen. The animals had to be bathed and fed from time to time. Creative destruction of these found many peasants becoming unemployed.

Of course, the automobile industry opened up new opportunities, but in the short run, because of lack of adaptability amongst workers, there was a prevalence of structural unemployment. After the Great Depression, horse-drawn carriages more or less went out of vogue.

Thus, an old economic structure was gradually replaced by a new economic structure. And as Schumpeter said, the success of an innovation makes other entrepreneurs follow the original innovator in 'swarm like clusters'. True to this, today we have companies such as Toyota, Renault-Nissan and Volkswagen, which are performing better than the original innovators in terms of sales. Will a rational consumer miss carriages over cars today? Heck no! Despite pollution, oil wars and road congestion. In terms of economics, this is development.

However, it seems that the dominance of traditional fossil fuel-based cars is coming to a slow end. Its agent of destruction is the electric vehicle.

It is important to note here that EVs are not a new invention. They go way back to a time when the Model T was not yet around; for that matter, Henry Ford was not yet born. The credit for inventing EVs goes to different people. In 1828, Anyos Jedlik created a small model car powered by an electric motor. Similarly, in 1834, Vermont Blacksmith Thomas Davenport and Professor Sibrandus Stratingh created their own models.

But it was only after 1895 that they started enjoying active consumer support. In cities such as London and New York, electric battery-powered taxis became available. But their popularity didn't last in the face of competition from the oil-based car. EVs back than had slow speed and low range, and there was the problem of power inadequacy. Its market was restricted to the affluent sections.

In the early 20th century, oil was cheap and the introduction of the Model T, which was affordable to middle class Americans, cut short the success of the EVs of that era.

Thus, if a century ago oil-based motor cars creatively destroyed EVs, in the present time the tables have been turned yet again. In fact in India, NITI Aayog has proposed that by 2030 only EVs should be sold. While the game is on, let's wait and watch!

*pfalia7@gmail.com*

# Light of life

RUPSHA BOSE

Human emotions fascinate me – the lips displaying feelings, wrinkled brows, glittering eyes, contented faces. Humans have a tendency to be happy when something good happens. But we seldom feel someone else's joy.

I capture the emotions of people on my camera, going for the faces of vendors, or shops that trigger my curiosity. I saw a shop shimmering with lights: old, new, vintage, modern, hand-made, factory assembled, and more. But what caught my attention was the owners, three people, all over 65, smiling and welcoming all.

The passion in them was that of teenagers, always on their feet and eager to help. One of them approached me as I was staring at the beautiful lights. I started a conversation with him. It felt like home all of a sudden; it wasn't just a shop, they made it feel like home.

I didn't need any lights, but bought one anyway for the sake of the smiles on their faces. They happily packed three lamps for me and asked me to stop by even if I don't buy anything.

That day I realised that we can nurture a form of this within us. Hug someone even if you are a non-hugger, smile at someone even if you are feeling murky, buy something from someone even if you don't need it. It might make their day. Try and be the happiness you search for in others, and the light will guide you.

*rupsha41@gmail.com*

# A glean revolution in a world of food shortages and hunger

## Picking up after a harvest the good and usable fruit of human activity that is inadvertently left behind, is now a movement

MINI KRISHNAN

If you're bored, go out and grab a pizza. Or better still, have it delivered to your sofa or desk. How many half-eaten pizzas are dumped? If you want variety, surf a few cafes: pastry in one, bonda and coffee at another. A dosa before a film in a multiplex, popcorn and cola during it, and a hot-chocolate afterwards. Food for fun, not health or hunger!

Just when I was wondering about the explosion of food-tourism that we are constantly being subjected to, I happened to read something that is a counter to the modern trend to treat food as another form of entertainment; so I share the gist of it, particularly as we live in a country where, while some of us can feast continuously, thousands die of malnutrition every day.

The article on gleaning titled 'To the Last Grain' was about picking up, after a harvest, the good and usable fruit of human activity. Not what is discarded, but those items that were overlooked. After the giant combine-harvesters move on, there is still plenty left for the birds and perhaps a sackful for the farmer also. Gleaning is now a campaign in the U.S. and in Europe.

What is gleaning? Some 30% of fruit and vegetables are rejected simply because they do not look nice. These 'uglies' go into the baskets of gleaners. After a terrible summer, fruit might be smaller than what the supermarkets ask for; so instead of leaving them to rot on trees and on the ground, they are 'gleaned' and used by a less formal market.

ILLUSTRATION: SATWIK GADE

Unlike scavenging, which has commercial implications, gleaning is rooted in charity and group effort. It is an ancient practice, dating back centuries to when farmers were told to leave a portion of their harvest behind for the less fortunate. In the Old Testament, God instructs Moses to tell his people that they are not to wholly reap the corners of their fields. Nor are they to take every single grape or olive from their trees. "[T]hou shalt leave them for the poor and the stranger" (Leviticus, 19:10).

In Punjab there is a farming rule which says a certain portion of the field is to be left unharvested by the owner. It is for those who work his land for him. Gleaning was a significant part of the income of peasants and villagers in England in the 18th and 19th centuries. It was highly regulated and timed with bells being rung for the entry and exit of gleaners.

According to reports, 30 to 40% of American food is wasted. It is estimated that more than 60.3 billion kilograms of that could have been eaten by someone. In Britain that statistic is 10 million tons. Thrown out by households! Considering the millions of "food insecure" people in the world many organisations send volunteers – or gleaners – into the fields and farms of neighbours to pick up the left-behind produce for people in need and local charities. In turn, farmers benefit with a small tax deduction for everything they donate.

Today, with increased attention on food waste and the need for fresh produce in local food banks, the act of gathering left-behind produce that is not sellable from farms and farmers' markets has steadily grown.

The scale of gleaning has changed but the philosophy remains the same. It brings the harvest full circle wherein nature and man combine for the benefit of the greatest number especially the poor.

*minioup@gmail.com*

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