

VIGYAN PRASAR

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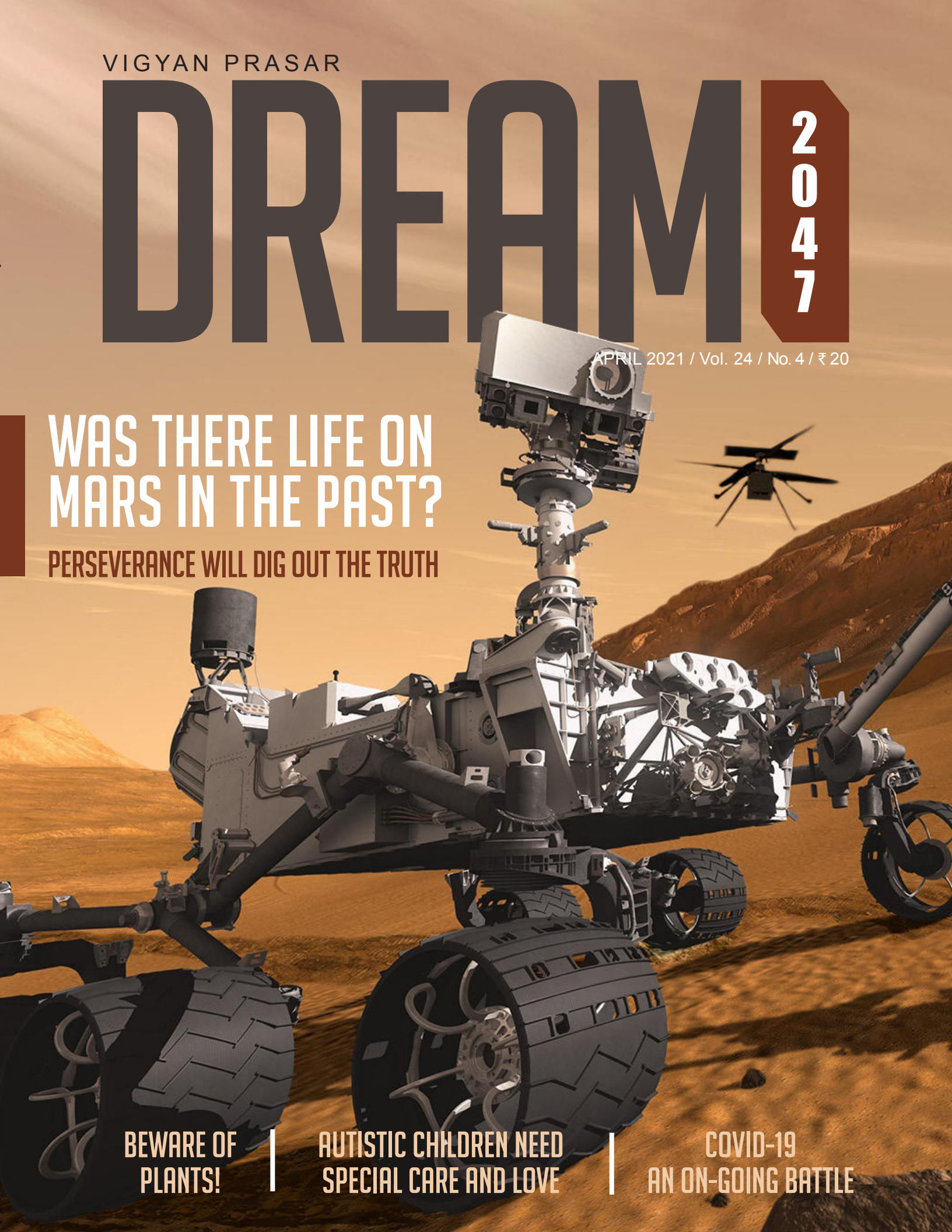
WAS THERE LIFE ON MARS IN THE PAST?

PERSEVERANCE WILL DIG OUT THE TRUTH

BEWARE OF
PLANTS!

AUTISTIC CHILDREN NEED
SPECIAL CARE AND LOVE

COVID-19
AN ON-GOING BATTLE



Editor-in-Chief:

Nakul Parashar

Editor:

Nimish Kapoor

Production:Pradeep Kumar
Bipro Kumar Sen
Amitesh Banerjee**Expert member:**Kollegala Sharma
Sumita Mukherjee**Address for
correspondence:**Vigyan Prasar, A-50,
Institutional Area, Sector-62,
Noida-201 309, U.P., India**Tel:** +91-120-2404430, 35**Fax:** +91-120-2404437**e-mail:**

dream@vigyanprasar.gov.in

website:

http://www.vigyanprasar.gov.in



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MY WORD

NAKUL PARASHAR

Scientific Social Responsibility & SCoPE

FROM

time immemorial, science & technology have been serving humanity. However, a general perception in the minds of a lay person is that whatever happens behind the walls of a laboratory is a mystery. To allay this apprehension, it's very important for scientists to come forward and help a layman understand what they do and how it impacts the society. There lies the challenge: Bringing scientists up to speed with the latest science communication and popularization techniques so that they can communicate effectively with lay persons about their research. In fact, there are sufficient deliberations, discussions, and lectures on S&T communication and popularization that have taken place so far and are available in documented and recorded formats. There also resides a humongous repository of content on how to convert complex S&T facts into easily understandable text, film, or radio script. Yet, the most effective and tested way to prepare every scientist into a science communicator is to take to extension of science communication and popularization, akin to the lab-to-land programme of the ICAR. Launched in 1979, it aimed to provide the research results of the lab to the farmers, directly, in an easily understandable and hands-on, demonstrable method. All of it, interestingly, was emphasized through the local language. This practically converted the so-called hard-core science terms to easy-to-understand lingua franca of the region. Summarily, it was a beginning of what we today call the Scientific Social Responsibility.

The stress laid by the preamble of the draft of the Department of Science & Technology's document on Scientific Social Responsibility of September 2019 is noteworthy. It reads:

"Scientific Social Responsibility (SSR) is the confluence of scientific knowledge with visionary leadership and social conscience. SSR is about building synergies among all stakeholders in our scientific knowledge community and also about developing linkages between science and society." It is "The ethical obligation of knowledge workers in all fields of science and technology to voluntarily contribute their knowledge and resources to the widest spectrum of stakeholders in society, in a spirit of service and conscious reciprocity."

No doubt, the efficacy of linkages between science and society will depend on how the two-way interaction takes place. For this to be impactful, evolving new S&T communication, popularization and its extension (SCoPE) methodologies as well as regular research and development are warranted. There is an urgent need to develop an academic institution that can dedicatedly work in the development of SCoPE at the university level. At present, SCoPE exists as modules subsumed in various courses at the undergraduate and postgraduate level, mostly in journalism & mass communication streams. It is high time that the scope of SCoPE is given its due, like Agriculture Extension, and widened quickly through establishment of SCoPE Centres all over the country at both government and non-government levels.

The journey has just begun, and hopefully, with more SCoPE, a plethora of opportunities would emerge on the national canvas.

Wishing you all a very Chaitra Pratipada, Gudi Padwa, Ugadi, and much more...

Email: nakul.parashar@vigyanprasar.gov.in

RECENT DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

FARFAROUT CONFIRMED AS SOLAR SYSTEM'S MOST DISTANT OBJECT

Perhaps there could not be a more appropriate name for the farthest object—a dwarf planet—in our Solar System. It has been officially announced that ‘Farfarout’ is the farthest object from Earth in our solar system. With an orbit that is at an average distance of 132 astronomical units (AU), where 1 AU is the distance between Earth and Sun, it takes 1,000 years for the dwarf planet to complete one orbit around Sun. Officially called 2018 AG37, the object is nicknamed Farfarout for just how far away from Sun it is orbiting.

Farfarout was discovered at the Subaru 8-metre telescope located atop Maunakea in Hawaii. To determine Farfarout’s orbit based on its slow motion

across the sky, the team used the Gemini North telescopes, also on Maunakea, and Magellan telescopes at Carnegie’s Las Campanas Observatory in Chile.

The discovery was made by a team of astronomers, including Scott Sheppard from Carnegie Institution, David Tholen from the University of Hawaii Institute for Astronomy, and Chad Trujillo from Northern Arizona University, USA. The three colleagues have been surveying the sky since 2012 to map the Solar System beyond Pluto. Farfarout joins a set of these planetoid discoveries—including the previous record holder, Farout at 124 AU, which was also discovered by Sheppard, Tholen, and Trujillo. According to Tholen, because of its long orbital period, Farfarout moves very slowly across the sky, requiring several years of observations to precisely determine its trajectory.

With the help of the international Gemini Observatory, a Program of NSF’s NOIRLab, and other ground-based

telescopes, astronomers have confirmed that a faint object discovered in 2018 and nicknamed “Farfarout” is indeed the most distant object yet found in our Solar System. The object received its designation from the International Astronomical Union in February 2021.

From Earth, Farfarout appears very faint, and based on its brightness and distance from Sun, the team estimates its size to be about 400 kilometres across, putting it on the low end of being a dwarf planet assuming it is an ice-rich object. According to the astronomers, while this space rock is big enough to be classified as a “dwarf planet”, it is nowhere near massive enough to be Planet 9, the theoretical object astronomers were searching for when they found it. Planet 9 is believed to orbit well beyond Neptune, if it exists, and have a mass many times that of Earth’s that has allowed it to stretch and warp the orbits of other outer-solar system objects with its gravity. Farfarout does not have the bulk to account for that stretching and warping.



This illustration imagines what the distant object nicknamed “Farfarout” might look like in the outer reaches of our Solar System. (Credit: NOIRLab/NSF/AURA/J. da Silva)

MICROBES DEEP BENEATH SEAFLOOR SURVIVE ON RADIOACTIVE BYPRODUCTS

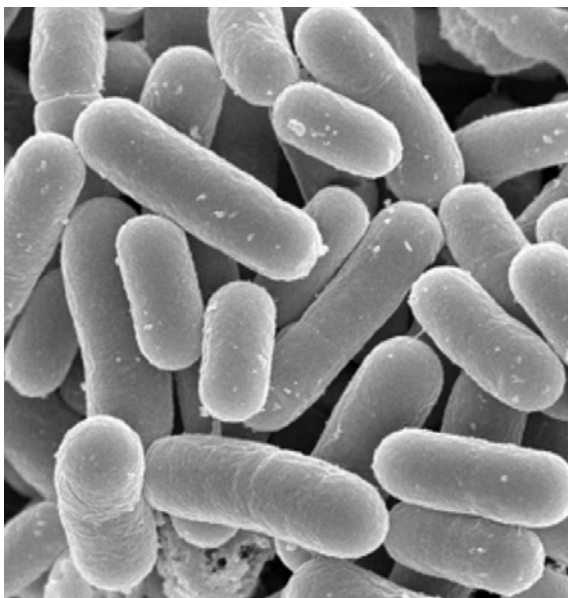
Microbes are unique creatures. They can survive under the most difficult circumstances, even deep beneath the ocean surface. Microbes buried beneath the sea floor for more than 100 million years have been found to be still alive, a new study has revealed. When brought back to the lab and fed, they started to multiply.

Recent research has shown that microbes living in ancient sediment below the seafloor are sustained primarily by chemicals created by the natural irradiation of water molecules. A team of researchers from the University of Rhode Island's Graduate School of Oceanography and their collaborators have revealed these findings.

According to them, the process is driven by the radiolysis of water—the splitting of water molecules into hydrogen and oxidants as a result of being exposed to naturally occurring radiation. The resulting molecules become the primary source of food and energy for the microbes living in the sediment. According to the researchers, “the marine sediment actually amplifies the production of these usable chemicals; in fact, the sediment makes the production of hydrogen much more effective”.

The discoveries resulted from a series of laboratory experiments conducted in the Rhode Island Nuclear Science Centre where vials of wet sediment from various locations in the Pacific and Atlantic Oceans, collected by the Integrated Ocean Drilling Program and by US research vessels, were irradiated. When the researchers compared the production of hydrogen to similarly irradiated vials of seawater and distilled water, it was found that the sediment amplified the results by as much as a factor of 30 (Nature Communications, 27 February 2021 | DOI: 10.1038/s41467-021-21218-z)

According to the researchers, the implications of the findings are significant. They say, “If you can support life in subsurface marine sediment and other subsurface environments from natural radioactive splitting of water, then maybe you can support life the same way in other worlds”. Some of the same minerals are present on Mars, and as long as you have those wet catalytic



Scanning electron micrograph of Lactobacillus

minerals, you're going to have this process. If you can catalyse production of radiolytic chemicals at high rates in the wet Martian subsurface, you could potentially sustain life at the same levels that it's sustained in marine sediment.”

LACTOBACILLUS ALTERS BILE ACIDS TO CREATE FAVOURABLE GUT ENVIRONMENT

Lactobacillus are human-friendly bacteria that normally live in our digestive, urinary, and genital systems without causing disease. There are many species of lactobacillus. It is also found in some fermented foods like yogurt and in dietary supplements.

New research from North Carolina State University in USA has revealed that depending on the situation, probiotic Lactobacillus bacteria use enzymes to manipulate bile acids and promote their own survival in the gut. These findings further make clear the complicated relationship between bile acids and gut bacteria and could eventually enable researchers to design lactobacilli with therapeutic properties, and thus help in engineering a healthier human gut environment.

According to scientists, as bile acids move through the gut, they are initially chemically modified through the addition of an amino acid (such as glycine or taurine), creating a complex “conjugated” bile acid pool. Some gut bacteria have enzymes, called bile salt hydrolases (BSHs), which can split or “deconjugate” these amino acids from the bile acids, allowing other bacteria to further transform the bile acids as they pass through the colon.

It was believed that probiotic bacteria like Lactobacillus have BSHs that deconjugate the bile acid and render it less toxic which allows the bacteria to survive. But, according to Casey Theriot, associate professor of infectious disease at NC State the reality is a lot more complex because these enzymes are more specific than believed earlier.

According to the scientists, the interplay between bile and bacteria has a huge impact on their ability to live, thrive or die in a very competitive environment. So, they set out to further investigate that relationship. They did both in vitro and in vivo experiments to determine how and whether BSHs reduced bile acid toxicity. They found that bile acid toxicity was not merely dependent upon whether the bile acid was conjugated or deconjugated by a BSH; rather, the relationships were dependent upon the type of bile acid, the bacteria being acted upon, and which BSH was present (Proceedings of the National Academy of Science, 9 February 2021).

When the researchers altered the BSH composition of these Lactobacillus strains, they found that “their tolerance of the bile acids and thus their competitive fitness were also altered”. They say, “These BSH enzymes have diverse properties. Bacteria pick up and drop off enzymes regularly—sometimes they pick up enzymes that will help them survive (make bile acid less toxic) or they could pick up an enzyme that will hurt competition”.

Biman Basu is a former editor of the Science Reporter, published by CSIR.
Email: bimanbasu@gmail.com



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COVER STORY

SUSHEELA SRINIVAS



WAS THERE LIFE
ON MARS IN THE
PAST?

PERSEVERANCE
WILL DIG OUT
THE TRUTH





T rue to its name, **Perseverance**, NASA's latest lander-rover to Mars, persevered the excruciating descent and touched down safely on the Jezero crater on Feb 18, 2021. Perseverance is NASA's forerunner mission in their aggressive pursuit to colonize Mars in the coming decades.

The mission stands out as one of its kind, for, Perseverance's agenda is unlike any other previous missions. The US space agency has invested its years of interplanetary exploration experience, space confidence, and advanced technology in making the rover. The rover will scout the Martian landscape and drill through rocks and land. It will extract and stash away mineral and regolith ('a blanket of unconsolidated, loose, heterogeneous superficial deposits covering solid rock') samples. The cached samples will be retrieved and returned to Earth by future missions to check for clues to life on Mars.

Millions of years ago, river channels flooded the Jezero crater creating a lake. The lake has long since dried. However, scientists surmise that the flowing water would have carried minerals from the surrounding area into the lake bed. The combination of water and minerals could have supported some form of life-even if microbial. With data from the previous Mars missions, the scientists are optimistic that the chances of finding remnants of the ancient life on the Jezero crater are rife. Perseverance will explore these remnants in the coming months like an astrobiologist. It will look for signatures of prehistoric lifeforms on Mars.

Perseverance has another important task too: to monitor Ingenuity. Ingenuity is a mini helicopter that will be the first of its kind to fly on another planet. The advanced machine rode along with Perseverance to Mars as a technology demonstration.

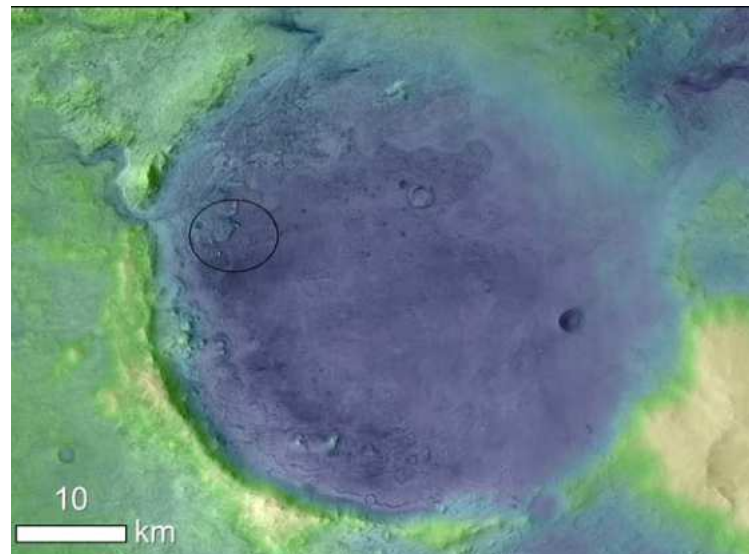
The mean machine

Perseverance is NASA's largest, most sophisticated and rugged rover built so far. Unlike its predecessors, the rover is designed to navigate rough terrain-boulders, small craters, and dunes-in a 28-mile radius on the crater lakebed. During its two-year-long tenure on the planet, the rover has to weather extreme climates, dust storms and unpredictable conditions while performing critical scientific experiments.

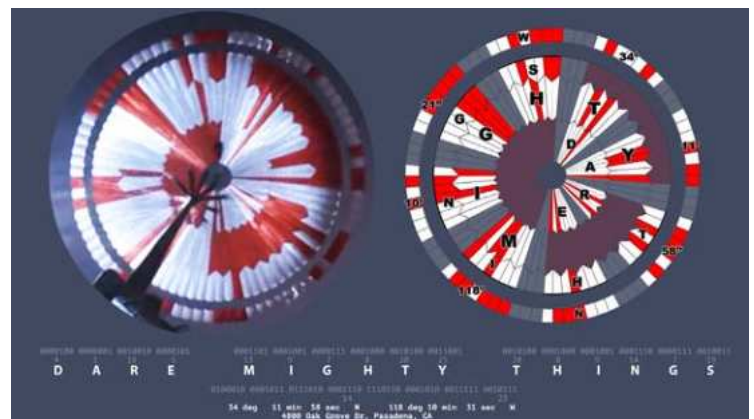
Within two weeks of setting foot on the planet, Perseverance was raring to go for a test drive. The engineers were pleased with its mobility test as it smoothly completed the to-and-fro trajectory. The historic feat of the wheels leaving a trail in the Martian fine dust was captured on camera for posterity. With this success, the



The Perseverance rover and its panel of instruments (Credit: nasa.gov)



The Lakebed on the Jezero crater on Mars (Credit: nasa.gov)



A parachute code (Credit: reddit.com)

ground engineers are enthusiastic about conducting another sortie in the second week of March.

Perseverance has challenging tasks at hand in the coming months set to go on a drilling expedition around the Jezero crater. No doubt, it is equipped with advanced instruments to dig out the prehistoric truth of Mars. Here is an account of how they will aid the exploration.

The investigators

The mission requires Perseverance to perform detailed mineralogical analysis of Martian soil to detect the presence of organic compounds. For this, the rover will employ SHERLOC and Watson. SHERLOC-The Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals is a UV Raman spectrometer perched on the rover's robotic arm; Watson is a highly advanced camera. SHERLOC will scout for changes the ancient rivers may have brought on the Martian soil minerals. Together, the duo will nose-around for signs of past microbial life.

Mounted on the robotic arm's turret is PIXL (Planetary Instrument for X-ray Lithochemistry), an instrument with an X-ray spectrometer. PIXL's job is to zoom in to the soil and rock surfaces, scan them from extremely close ranges and ascertain their textures. NASA claims the instrument can scrutinize minute details of samples as small as a salt grain.

Supercam is another high-resolution imaging device that will explore the minerals 20 feet away. A laser mounted on the camera has the unique capability of clearing away dust and deposits on the sample to obtain clear images. With the help of spectrometry, the camera will analyze rocks and soil as small as pencil points. NASA envisages that the data from these instruments will give us insights into what type of life existed on Mars in the past, and if not, the reasons behind them.

The shutterbugs

The rover's first trek on Mars was captured by its navigation cameras which double up as its sensors to help the machine



The trail left by Perseverance's wheels on its first test drive 13 ft forward, a 150 degree left turn, reverse 8 feet, navigating around small rocks along the way. (Credit: nasa.gov)

THE SEVEN-MINUTES OF TERROR

- Despite several successful missions and advanced technologies to aid, the entry, descent, and landing (EDL) phases of a Mars mission keeps the ground engineers on tenterhooks. This is because the EDL is an excruciating sequence happening faster than radio signals can reach the Earth.
- It takes about 7 minutes for the spacecraft to traverse from the top of the Martian atmosphere to the ground.
- The space vehicle plunges into the planet at 20000km/h. The outer heat shield blazes as it enters the atmosphere. A parachute is deployed to slow down the descent and ensure the probe lands softly on the surface.
- For Perseverance, the EDL was much more challenging. The landing site of the Jezero crater is narrow, and the terrain is filled with rocks, craters and mounts that could critically hamper a safe landing.
- To overcome the hurdles, Perseverance had cameras that first scanned the surface as it descended, then perceived the area and chose where to land. The process was akin to landing with eyes open.
- For the first time in space history, Perseverance sent a hi-res video of the EDL sequence that kept the world hooked to their screens.

navigate the terrain. Perseverance will click pictures of the landscape from all angles. On top of a two-metre tall mast on the rover is a high-speed camera, aptly named MASTCAM-Z, which will take panoramic, 3D images of the Martian land and atmosphere. Features such as zooming and high-speed video imaging will ensure no detail is missed out as the camera focuses on near and far away targets.

Under the Perseverance's belly sits RIMFAX-Radar Imager for Mars' Subsurface Experiment. This radar instrument-the first of its kind to travel to Mars-will scan 30 feet deep into the planet's soil and see what lies beneath. RIMFAX is capable of detecting ice, water, and salt brines that may be present under Mars' ground.

I DARE YOU!

For long, NASA has actively encouraged public participation in its space missions.

- For the Mars explorations, nearly one crore names of people worldwide rode on a microchip along with Perseverance.
- Responding to an open contest, students suggested the names of the rover and copter.
- In a further challenge, the rover engineers (Jet Propulsion Labs, JPL) included a coded message during the EDL phase. They encrypted a binary coded message hidden in the red and white circular patterns on the parachute. In six hours, netizens cracked the code, which read: "Dare mighty things".



The weatherman

Given the red planet's unpredictable and hostile environs, timely weather reports are crucial for Perseverance's optimal performance. MEDA-Mars Environmental Dynamics Analyzer will perform these weather tasks aided by sensors located around the rover's mast-neck, deck, front, and interior portions. They will comprehensively sample the dust, check wind and its speeds, measure air temperature and pressure, humidity exchange in the atmosphere, and map radiation patterns on Mars.

MEDA's inputs are crucial to accurately predicting weather conditions for future space missions, deciphering day-to-day weather and radiation patterns. Besides, MEDA will report on how the weather is affecting Perseverance's performance.

The oxygen tree

Mars has a thin atmosphere predominantly composed of carbon dioxide and no breathable oxygen. Hence, in future, human missions will have to be self-sufficient and produce breathable oxygen and liquid oxygen rocket fuel in-house on Mars. MOXIE or Mars Oxygen In-Situ Resource Utilization Experiment will perform the task. Like a tree, MOXIE will breathe-in the Martian atmospheric carbon-di-oxide and breathe out oxygen to produce oxygen on Mars. This car-battery-sized instrument is an experimental one. If it

FLYING ON ANOTHER WORLD

The atmosphere on Mars is 99 times less dense than that of the Earth and technically insufficient to generate the necessary airlift for a helicopter. However, the copter designers tweaked some elements of the machine. Unlike a regular chopper, Ingenuity has counter-rotating lightweight chopper blades that cut through Martian air at 2400 rpm. The airlift so generated is aided by the low gravity on Mars, which is sufficient to hoist the 2-kg machine.

Ingenuity will rise 10-15 feet above the ground and be airborne for 10-15 seconds initially. As it gains success with each flight, it will autonomously calculate and improve the height and flight distance.



The engineering marvel called Ingenuity (Credit: nasa.gov)

THE INDIAN ANGLE

- Swati Mohan is an Indian-American aerospace engineer and leads the attitude control system for the Mars 2020 mission. She has earlier worked on the CASSINI and GRAIL projects for NASA.
- Ingenuity got its name thanks to Vaneeza Rupani, a 17-year old student of Indian-origin.
- Bob Balaram is the chief engineer of Ingenuity helicopter.

succeeds, the actual oxygen generators of the future could be 100 times bigger.

An engineering marvel

Tucked under Perseverance's belly is Ingenuity, a solar-powered, lightweight helicopter whose purpose is technology demonstration. Ingenuity will take a few short flights and prove its worthiness as a robotic scout. It has no scientific payloads. The future helicopters will aerially survey the land and transport equipment, adding a new dimension to surface activities.

For now, Ingenuity is still tucked under Perseverance and will remain there for another couple of months. The copter makers are jubilant as Ingenuity survived the rigorous journey and the excruciating descent to the planet. The onboard computers reported back the healthy and robust state of the copter at regular intervals. The next schedule for Perseverance is to scout the surface for a suitable airfield. When it zeros-in on a flat piece of land, it will release Ingenuity from under its belly. Till then, Ingenuity must prove its resilience to the frigid Martian temperatures of -90 °C and keep its instruments warm and ready for the historic flight.

Long-distance communication

All through, Perseverance will be monitoring Ingenuity from far and relaying the performance to Earth-based engineers. Another remarkable feature of Ingenuity is it will self-navigate on Mars. Commanding the copter like a drone from the Earth in real-time mode is not viable due to the vast distances separating the planets and the considerable delay in communication. Owing to the time lapses, Ingenuity will be operating autonomously.

Assisting the helicopter's solo sojourns are sensors and cameras that will continuously feed inputs to help Ingenuity make navigation decisions. The solar panels mounted on Ingenuity will ensure it stays warm through the freezing nights and protecting its electronics.

"The adventure is yet to unfold," says NASA, as Perseverance gears up to reveal the hidden mysteries of our planetary neighbour-hitherto left only to our imagination.

The author is an independent science communicator, writer, and journalist.

Email: sushsri@gmail.com

India faces hunger in abundance. Studies estimate that India produces twice the calories it consumes, yet many of its people are malnourished. The root cause of this is a lack of nutritional awareness in all sections of our society.

To spread the message of the need for nutritionally balanced diet and to understand the importance of economically accessible local fruits and vegetables, Vigyan Bharati (ViBha) and Global Indian Scientists' and Technocrats' Forum (GIST) have come together to launch a mission, *Aahaar Kranti*, the diet revolution with a motto: *Uttam Aahaar Uttam Vichaar*, which translates to good diet good thoughts.

In this endeavour to provide knowledge and create awareness about various diets a number of agencies have joined hands. Pravasi Bharatiya Academic and Scientific Sampark (Prabhaas) of CSIR, various central and state government ministries and agencies and non-government organizations have already been collaborating. Many more continue to join this Mission.

Interestingly, the United Nations has also declared 2021 as the International Year of Fruits and Vegetables, which



Good Diet Good Thoughts Aahaar Kranti

vibes very well with Aahaar Kranti. In any case, fruits and vegetables make a large part of a balanced diet. We all know that diet and well-being are inseparable partners. The UN sustainable goal # 3 that emphasizes on human well-being reads, "Ensure healthy lives and promote well-being for all at all ages." This goal too makes Aahaar Kranti more meaningful.

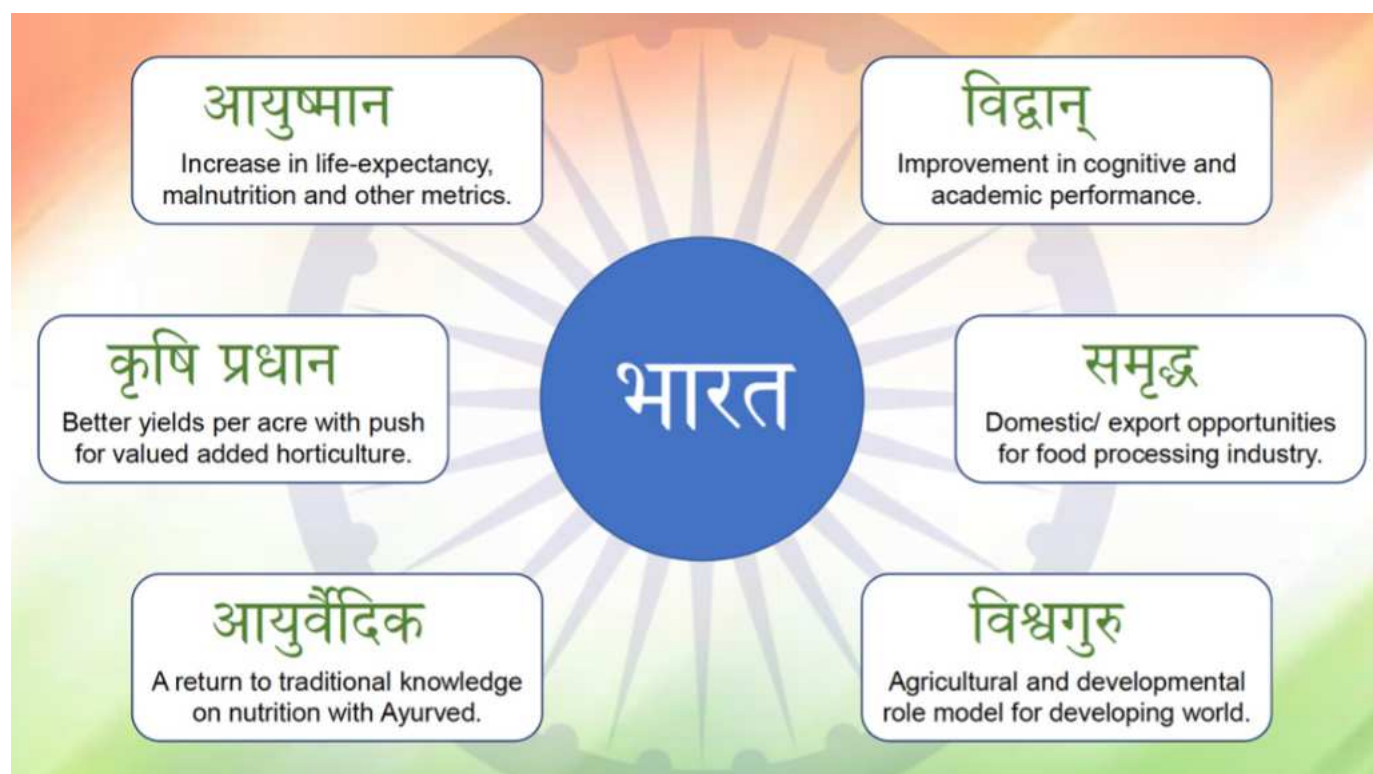
What is Aahaar Kranti?

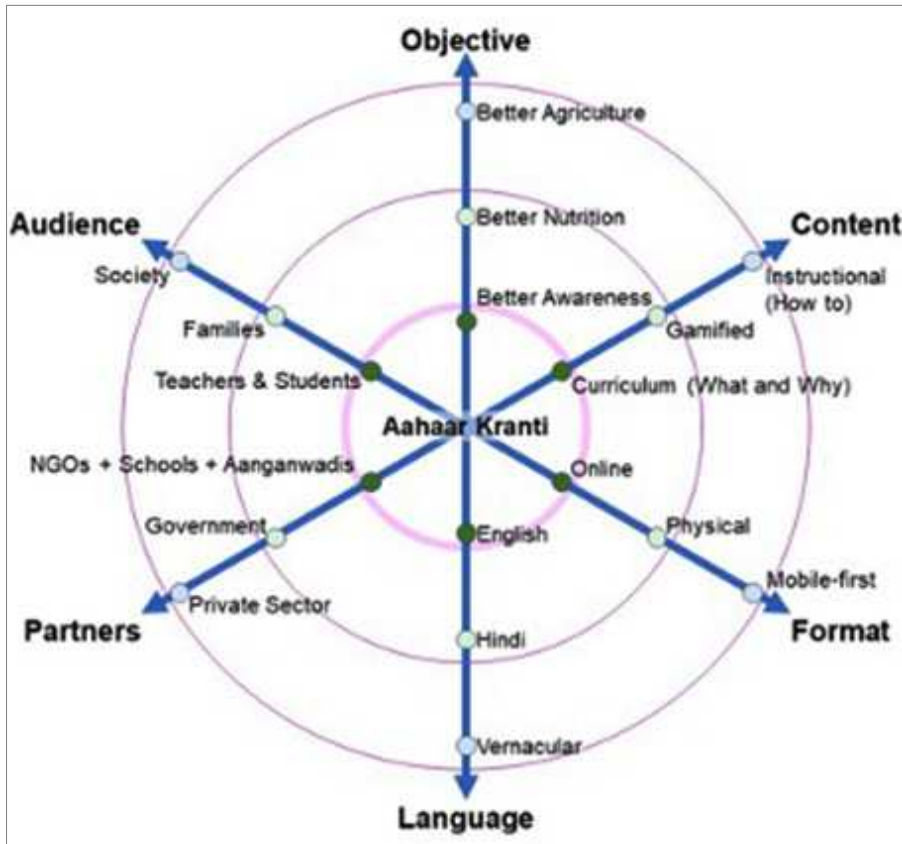
Aahaar Kranti is a movement to raise awareness about the importance of nutritionally balanced diet in India. It is an effort to rouse the people to the value of our traditional diet, to the healing powers of local fruits and vegetables, and to the miracles of a balanced diet.

We all know that nutrition is at the heart of many things in our lives.

- It is required from birth all the way till our last breath. Thousands of studies have linked the importance of nutrition for better health and longevity across all ages.

- It is a major factor in the growth of children and helps develop superior cognitive skills in early years leading to better performance and outcomes





through all phases of their lives.

● It holds the key to many health and societal challenges. For instance, we have the unique advantage of having the knowledge of Ayurveda, which lays more emphasis on nutrition. It is time to apply this rich knowledge of Ayurveda-based nutrition to practice.

Thus, Aahaar Kranti is meant to focus on nutritionally balanced diets (Uttam Aahaar Santulit Aahaar) that can be completely replenished through locally sourced fruits and vegetables. For this message to reach our masses, it is thus, necessary that Aahaar Kranti reaches every nook and corner of the country. It, therefore, plans to train teachers, and reach through them the multitudes of students and their families.

India has remained the world leader or *Vishwa guru* for ages, and in case of diet and nutrition, it has remained a source for a number of researches made in this domain. It is time again for India to set a model with Aahaar Kranti for the entire world.

How will Aahaar Kranti succeed?

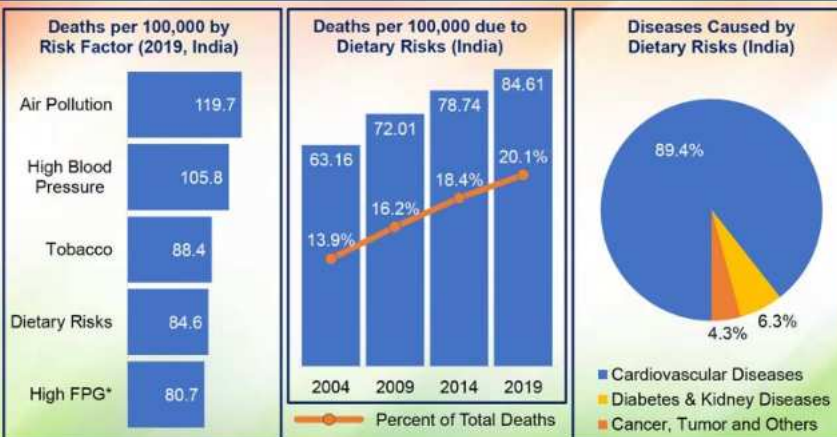
Any movement is an idea throbbing in crores of hearts that beat to the same tune. For Aahaar Kranti this tune is a clear message with the scientific nutritional facts. To succeed in this movement will mean working on many dimensions together, to build an infallible coalition, set high aspirations, and start with small steps.

To know more about Aahaar Kranti, visit website www.aahaarkranti.org.

Dr Yelloji K Mirajkar is executive director of the Hindu University of America and the former senior technical associate at Colgate-Palmolive, USA.

Email: mirajkary@gmail.com

Dietary Risk is among Fastest Growing Factors in India



* Fasting Plasma Glucose – An indicator of Diabetes/ Pre-diabetes
Source: [Institute for Health Metrics and Evaluation, University of Washington](https://www.ihme.washington.edu/)

To learn about:
What is Aahaar Kranti, Why, and What would be the outcome?
 visit www.aahaarkranti.org

Would It Help

- ✓ INCREASE COGNITIVE ABILITIES IN CHILDREN?
- ✓ INCREASE ABILITIES TO LEARN AND PERFORM IN SCHOOL?
- ✓ PREGNANT AND LACTATING MOTHERS? IMPROVE HEALTH OF EVERYONE?
- ✓ SAVE LIVES?
- ✓ THE ECONOMY?
- ✓ BHARATH BECOMING SELF RELIANT? GLOBAL WELFARE?

Shefali was upset about her two-and-a-half-year-old son, Nilesh, who was different from other children. He kept repeating things. While playing with his toy cars, he arranged them one behind the other instead of moving them. If he found anything amiss in the arrangement, he would get excited and start hitting his head on wall or whatever he found nearby. Or he will simply go round and round. Sometimes, instead of playing, he would sit staring at the ceiling or the fan, lost in his own world. He would not respond to calls, as if he went deaf. Shefali took him to the paediatrician, who, after some examination, found him suffering from autism disorder.

What is Autism Disorder?

Not just Nilesh, if we look around carefully, we may find many children around us who appear to be like others, but behave differently. The development in such children is slower than others. In medical science, the condition is called autism. Autism is not a disease, but rather a neurodevelopmental disorder.

Usually, this disorder develops during the development of brain in the foetus and remains throughout the life. It hinders a child's mental development and affects their behaviour and day-to-day activities. The life of these children becomes very challenging due to this.

Parents usually notice these differences in their child at the age of 2-3 when the child starts speaking or playing with others. Autistic children have difficulty in speaking, understanding or explaining to others, or expressing themselves. They behave strangely because they are unable to express themselves. They are neither able to connect with their family members nor with their friends and prefer to remain in their own world rather than mingling and playing or interacting with others.

According to the World Health Organization (WHO), autism disorder ranks third among the main causes of developmental disability found in children. According to data for the year 2018, one in 59 children worldwide suffered from autism disorder. In India



Autistic children need special care and love

about one crore children suffer from autism. In comparison to girls, more boys suffer from this disorder.

Symptoms

American Psychiatric Association names it as 'Autism Spectrum Disorder', because of the variations in the behaviour of these special children. The problems, habits and behaviour of each autistic child are different from other autistic children. Autistic children can be easily identified from their behaviour and gesture patterns.

- ▶ Some children with autism disorder are as intelligent as other unaffected children but are unable to interact with others and behave socially. In some autistic children the intelligence could be average or lower. They have difficulty in reading, writing or learning something new.
- ▶ Because of squint in their eyes, some children find difficulty while reading.
- ▶ In the absence of physical and mental balance, such children also depend on others for their daily chores.
- ▶ Many children lack emotions. They neither understand other's feelings, nor are they able to express their own feelings.
- ▶ While talking to other people, they

neither smile nor make eye contact. Many don't even talk to others.

- ▶ Even if someone tickles, they do not respond.
- ▶ They are lost in their own world and often like to be left alone or play alone.
- ▶ If someone calls them, they do not react in any way, as if they have not heard or it seems that they are deaf.
- ▶ Most children don't speak much, which also means that they do not learn the language. Usually they speak a few words, but are unable to speak a whole sentence. Many children make strange sounds.
- ▶ They scream and laugh spontaneously and often utter meaningless words or sentences.
- ▶ They also use gestures to get their work done. If a child wants something, they point towards that thing. If they want to eat, they might lead the mother to kitchen and indicate by gestures what they want.
- ▶ They enjoy doing repetitive tasks, like going round and round, turning keys, keep their toy cars in a line, dropping toys, playing with fingers or repeating a word or line. If someone interrupts or tries to change the pattern, they turn restless or scream in anger.
- ▶ Repeating the words of others is also one of the habits of such children, which is called 'Echolalia'.
- ▶ While eating an autistic child may not realize that their stomach is full and keep eating more. They also have difficulty in chewing food, due to which diseases like indigestion, obesity, or diabetes are common among them.
- ▶ They are often unable to play games like Ludo, cards, or chess that have several rules. The rules confuse them, and they are also not able to sit at one place.

What causes autism is yet a mystery. However, there are some general indicators of causes. ☺ In some, autism could be due to genetic cause. A disorder in the chromosomes of the parents, called Fragile X syndrome, blocks the mental development of the infant. About 10 per cent of cases of autism are caused by Fragile X syndrome.



If one of the parents, siblings, twins or close relatives in the family suffers from autism disorder, the child has chances of getting it.

- ☺ Lack of oxygen during childbirth or damage to the baby's brain cells due to any type of trauma or injury at child birth can also cause autism.
- ☺ Not having proper immunization after birth is also cited as a reason.
- ☺ A pregnant women suffering from diseases like obesity, diabetes or thyroidism, rubella infection during pregnancy, imbalanced diet and under-nutrition etc. have greater chances of having a child suffering from autism.
- ☺ Smoking, alcoholism or consumption of drugs or any other form of intoxicant by pregnant mother is another risk factor.

When to visit doctor?

It is important that parents do not ignore the behaviour of a special child. As they are unable to speak properly, they often lag behind children of their age. When other kids make fun of them, they become upset and may go into depression. Usually, the brain of a child develops at the age of 2-3. If autism conditions are identified at an early stage, proper treatment and special care give positive results. With proper therapies some children may become independent and start doing their daily chores.

Treatment

As autism is a disorder it is not possible to cure the child completely. Treatment requires, besides paediatricians, help from developmental neurologist, occupational therapist, speech therapist, and special educators. These experts, through various therapies, and love and affection, enable children with autism to improve their ability to behave, learn and

speak, and to reconcile with the society.

Occupational therapy is used to control hyperactivity of autistic children so that they can do their day-to-day chores on their own.

Speech therapy helps in developing the vocabulary of the child with the help of many types of cards, photographs, illustrated books etc. Children are prompted to speak the sentence slowly.

Behavioural therapy helps the children learn communicate with others and to express themselves with gestures. This boosts confidence in them. When a child learns any new thing or does some work or activity with other children, they are praised and encouraged.

Educational Treatment helps those 10 per cent of autistic children who have some innate talent. They may be good in mathematical calculations, painting, music, or making toys with clay. Specialists recognize their talent and provide special education and training to further develop their skills, so that they can lead their own life independently.

Do medicines help?

There is no particular medicine to treat autism, but certain medicines are given according to the condition and need of the child, like for controlling hyperactivity or increase concentration. Some brain tonics, iron supplements, omega 3 fatty acid supplements, biotin vitamins may be given.

Parental involvement is important

Parenting special children is very challenging for the parents. Besides being emotionally and mentally weak, the child's physical development also often slows down. The parents need to have a positive attitude. It is important for them to have patience to spend time

with the children, talk to them, make them part of a discussions and teach them in steps. It is necessary that the children are taken to a park to play or for a walk, so that they feel comfortable in presence of others. Such steps may improve the condition of the child.

Parents also need to take care of their food. To avoid problems caused by overeating, the child should be given a gluten- and casein-free diet. Wheat and wheat products, milk and milk products may be avoided, as research has shown that such foods can reduce the physical activity of an autistic child. Instead, multigrain flour made from millet, soy, amaranth, rice, gram flour etc. are better and animal milk may be replaced with soy, almond and coconut milk. Soaked almond and walnut rich in omega 3 fatty acids, which help in their mental development may be given regularly.

Prevention

During pregnancy the would-be mother should take proper care. She should check with the gynaecologist for vaccinations, especially the rubella vaccine. Regular check-ups during pregnancy are a must. Folic acid supplements should be taken regularly. She should adhere to healthy lifestyle and food habits. Cigarettes, alcohol or drugs should be avoided.

World Autism Awareness Day is observed on April 2 in recognition of people with autism and those who love and support them. United Nations General Assembly declared the day in 2007. Various programmes and conferences are organised to make parents, teachers and other people aware of autism. Along with this, the talent of these children and their creative works are also displayed through exhibitions.

(Based on interaction with Dr Priyanka Jain, Paediatrician, JP Hospital, Noida and Dr Pragya Pandey, Junior Gynaecologist, Guru Gobind Singh Hospital, Delhi)

Translated by Suman Bajpai

Image Courtesy: Action for Autism, New Delhi

The author is a science writer and communicator.

Email: rajniarora11@gmail.com



Beware of Plants!

Are plants vulnerable and defenceless? Certainly not! They have very efficient defence mechanisms and careful observation is required to understand them.

There's no brain in a plant, but the lack of a central nervous system does not prevent them from protecting themselves. Some species have weapons such as thorns or spines that keep away predator herbivores. Others secrete poisons to disable or kill predators and some plants emit compounds that warn nearby plants of approaching threats: the botanical equivalent of a smoke signal.

Plants and insects have been in existence for more than 350 million years. In the process of evolution, both have evolved strategies to avoid each other's defence systems.

To counter insect attack, plants develop specialised structures or produce certain chemicals known as secondary metabolites and also some proteins that have toxic, repellent, and/or anti-nutritional effects on herbivores.

Mechanical protection on the surface of plants in the form of hairs, trichomes, spines, thorns and thick leaves gives direct defences. Some plants are protected by production of toxic chemicals such as terpenoids, alkaloids, anthocyanins, phenols, and quinines that either kill or retard the development of insects. In many plants

some structures are already present to defend the attack of pests while in others the structures to defend the host develop after infection.

Cuticular wax

Wax-mixtures get deposited on the outer skin of some plants, which play a defensive role by forming a water-repelling surface. Due to the wax coating, pathogens do not get sufficient water to survive or multiply.

Cuticle thickness

The plant cuticle is a protecting film covering the outermost layer of leaves, young shoots and other aerial plant organs. The thickness of the cuticle is most important defence mechanism which prevents the entry of pests or pathogens through the leaf surface. In addition, a thick cuticle checks the exit of the pathogen from inside the host, thus reducing the secondary infection.

Structure of natural openings

The structure of openings like stomata and lenticels also prevents the entry of pathogens. In some varieties of citrus, the stomata are small and possess very narrow openings surrounded by broad-lipped raised structures which prevent entry of water drops containing citrus canker bacterium.

In the same way, the size and internal structures of lenticels may play a defensive role against pathogens. For

example, small lenticels in the apple fruits prevent the entry of pathogens.

Nectaries are flower parts that secrete sugar-containing nectar to attract insects and other creatures. It may play a defensive role due to its high osmotic concentration. In resistant varieties of apple, presence of abundant hairs in the nectaries acts as a defence mechanism.

Mechanical defence

The first line of mechanical defence in plants is an intact and impenetrable barrier composed of bark. Other adaptations against herbivores include hard shells, thorns (modified branches), and spines (modified leaves). They discourage herbivores by causing physical injury or by inducing rashes and allergic reactions.

The thorns we see on rose plants are not actually thorns or spines. They are prickles. Unlike thorns, prickles are actually pointed protuberances from a plant's skin. They shield the plants that bear them from predators.

The density of trichomes affects the location of egg, feeding and nutrition of the insect larvae on the plant surface, thereby, reducing their access to leaf surface.

Not all plants bear their defences on the surface. If thorns, spines, prickles, and trichomes are lethal weapons, idioblasts are the landmines. Idioblasts are isolated plant cells that differ

from neighbouring tissues. They have various functions such as storage of reserves, excretory materials, pigments and minerals and a variety of defensive compounds. The Dieffenbachia, a common houseplant, contains idioblasts that fire sharp calcium oxalate crystals into the mouths of predator and then release an enzyme similar to reptilian venom. This can cause paralysis and thus loss of voice, hence the plant is called “dumb cane”.

The sensitive plant *Mimosa pudica* closes its leaves when it is touched, making the leaves appear dead and therefore unappetising. Some Acacia tree species have developed symbiotic relationships with ant colonies: they offer the ants shelter in their hollow thorns in exchange for the ants’ defence of the tree’s leaves.

Structural defences include morphological and anatomical traits that assist the plant by directly preventing



Mimosa pudica

herbivores from feeding. They range from prominent protuberances on a plant to microscopic changes in cell wall thickness as a result of lignification and suberisation (conversion of the cell walls into corky tissue by infiltration with suberin). Sclerophylly refers to hardened leaves and plays an active role in plant defence against herbivores by reducing the palatability and digestibility of the leaf tissues, thereby reducing the damage.

What happens in the plant after the attack of a pathogen?

After a pathogen has successfully managed to overcome the pre-existing

defence mechanisms of the host, it invades the cells and tissues of the host. In order to check further invasion by the pathogen, the host plants develop some structures/mechanisms, cell-wall defence structures, defence structures developed by the tissues and ultimately the death of the invaded cell, i.e., necrosis.

After pathogen attack, the cytoplasm becomes dense and develops granular particles. These result in the disintegration of the pathogen and thus the invasion stops.

A plant’s cell walls have the vital function of acting as an outer skeleton that protects them against various threats. When a cell wall sustains damage, the plant will normally try to minimise the damage and repair it. The goal is to restore the plant’s normal state.

Plants produce a variety of gummy substances around lesions or spots as a result of infection. These gummy substances inhibit the progress of the pathogen.

Formation of layers

Some pathogens, like bacteria, fungi and even some viruses and nematodes stimulate the host to form multi-layered cork cells in response to infection and these develop as a result of stimulation of host cells by substances secreted by the pathogen. These layers inhibit further invasion by the pathogen and also block the flow of toxic substances secreted by the pathogen.

Chemical defences

When a plant’s exterior protection is affected by mechanical damage, it may provide an entry point for pathogens. If the first line of defence is broken the plant produces toxins and enzymes. Secondary metabolites are compounds that are not directly derived from photosynthesis and are not necessary for respiration or plant growth and development.

Most of the secondary metabolites are toxic and can even be poisonous to animals that consume them. Some metabolites are alkaloids, which discourage predators with noxious

odours (such as the volatile oils of mint and sage) or repellent tastes (like the bitterness of quinine).

Biochemical defence in plants before the onset of infection

Plants generally release organic substances through the parts above ground and roots. Some of the compounds released by plants are known to have an inhibitory effect on certain pathogens before they penetrate the host plant. For example, chemicals released by tomato and sugar beet prevent the germination of certain fungi.

Presence of several phenolic compounds, tannins and some fatty acid-like compounds in cells of young fruits, leaves or seeds render them resistant to pathogens.

Biochemical defence mechanism following infection

In order to fight infections caused by pathogens or injuries caused by any other means, the plant cells and tissues produce many substances (chemicals) which inhibit the growth of the infecting organism. These substances are generally produced around the site of infection or injury with the main aim of overcoming the problem.

Detoxification of pathogen toxins and enzymes

In some cases, the plants produce chemicals which deactivate the toxins produced by the pathogens. For example, the fungus *Pyricularia oryzae*, which causes blast disease of rice, produces picolinic acid and pyricularin as toxins.

Knowing more about the various defence mechanisms in plants opens up new possibilities for solutions that may help plants’ ability to resist different threats more effectively. It could play an important role in agriculture. Many people and livestock rely on the plants as a central part of their diet.

The author is a retired Vice Principal from a CBSE School in Chennai and presently engaged in preparing educational software for school children.

Email: vathsalarangachari@gmail.com

COVID-19: An On-going Battle

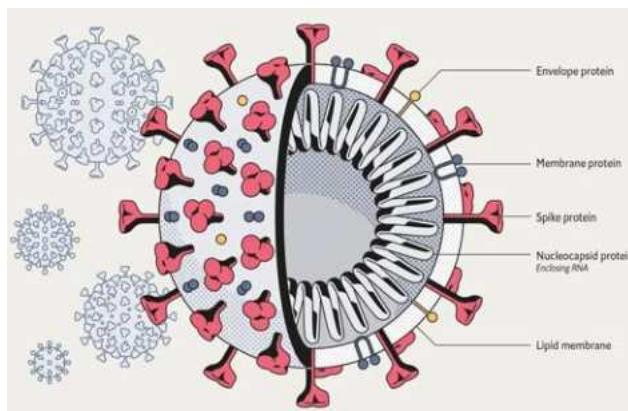
The outbreak of SARS (Severe Acute Respiratory Syndrome), caused by the coronavirus SARS-CoV, had resulted in a severe global epidemic in 2003 causing hundreds of deaths and thousands of hospitalizations. In January 2019, a new strain SARS-CoV-2 surfaced in Wuhan, China which has been wreaking havoc worldwide leading to extreme human sickness and mortality.

To analyse the genome sequence of the new strain of the virus, scientists around the world had collected samples from COVID-19 patients. The samples were then sequenced and the sequence analysis revealed that it has 88% genetic similarity to SARS-CoV and 50% similarity to MERS-CoV; also, the genome sequence does not support the belief that COVID-19 is laboratory construct.

Infection mechanism

The infection process has a lock-and-key mechanism. Here the lock is the spike surface glycoproteins present on SARS-CoV2 virus and the key is the ACE2 receptor present on the surface of human cell. These ACE2 receptors unlock the virus by binding to spike surface glycoproteins that allow it to enter into the host body after which a second protein called TMPRSS2 activates the virus, allowing it to reproduce and transmit within the cell.

Once the virus starts multiplying inside the body, the infected person starts showing symptoms (symptomatic); although in some cases no symptoms are observed (asymptomatic). The absence of symptoms does not mean that the individual is safe and would not spread any infection. In fact, they may suffer irreversible damage to their vital organs resulting in death. In Vishakhapatnam, for instance, a doctor working at Anti-Retroviral Therapy (ART) Centre, in the premises of the old Government Hospital in Vijayawada died suddenly after having breathing problems, though he was asymptomatic otherwise. When it comes to sudden deaths, silent hypoxia caused by SARS-CoV-2 may be the main cause of death. More studies are required to identify why exactly the virus causes silent hypoxia, compared to other viruses like influenza, where it is not seen as often.



Structure of SARS-CoV-2 (Source: The Economist 2020)

Genetic variation among individuals plays an important role in COVID-19 infection. The severity depends on the genetic makeup of an individual. Understanding these differences may help in designing drugs against SARS-CoV-2 and minimise the morbidity and mortality of COVID-19 infection worldwide.

Morbidity and mortality

When the SARS-CoV-2 virus enters our body, it binds to two kinds of cells in the lungs-goblet cells that produce mucus and ciliated cells, which have hair on them and mainly protect our lungs from dust particles, virus and bacteria. The virus attacks these cells and starts destroying them. As a result, the lungs get filled with fluid, creating breathing problem due to lack of oxygen. In addition to this, abnormal blood clotting in COVID-19 infection leads to microclots within the lungs that contribute to death of some patients. The two factors which contribute most to infection and mortality are mutation in viral genomes and genetic variation in humans.

Mutation in SARS-CoV-2 genome

The genome of the SARS-CoV-2 changes slightly as it is transmitted from one person to another. The genome analysis of virus isolated from early patients in Wuhan revealed a single mutation, where the 186th base of RNA was U instead of C. It shows that the virus mutates as it spreads from one person to the other. According to some researchers, there are three distinct variants of COVID-19 consisting of clusters of closely related lineages labelled as A, B, and C. By analysing first 160 complete viral genomes it was discovered that SARS-CoV-2 spread through the mutation in its lineages.

Wuhan's predominant virus type is B which is derived from A through two mutations. But it does not spread that much without further mutations. The subtype C in turn is an offspring of variant B. The C variant is the major European subtype, mainly isolated from France, Italy, Sweden, and England. It is absent from the study of Chinese Mainland sample,

but seen in Singapore, Hong Kong, and South Korea. Variant A is closely related to the virus that infects bats and pangolins and is considered as the root of the outbreak.

Comparative analysis of Indian SARS-CoV-2 genome from different geographical regions

Systematic mutation analysis of the genome helps to identify several unique features of SARS-CoV-2 genome, which includes a unique mutation in the spike surface glycoproteins in the Indian SARS-CoV-2, absent in other strains. Studies indicate that both viral and host microRNAs (miRNAs) have a lot of influence on viral pathogenesis. Analysis also reveals that there are nine host miRNAs which act on the SARS-CoV-2 viral genome and act by cleaving their target sites in the viral genes. These nine miRNA targets are absent in SARS and MERS genomes.

Major challenges due to mutation

A major challenge in designing a vaccine had been that it may not be effective for a long time if the virus changes its coat continuously via mutation. However, awareness regarding these mutation hotspots ensures a greater chance of developing vaccines that will be effective in the long term. According to scientists, the spike surface glycoprotein -the protruding structure that gives the coronavirus a crown-like appearance and allows it to enter human cells -is the part which is more likely to mutate. Of the approximately 50,000 viral genomes screened so far, about 70% carry the mutation in this part, officially designated as 'D614G' mutation. Preliminary research by GISAID (a global science initiative and primary source that provides open-access to genomic data of influenza viruses and the novel coronavirus responsible for COVID-19) found D614 mutation as the urgent concern because it appeared to be emerging as dominant and could make the disease more deadly. Many of the genetic mutations in the virus are silent and have no impact on the resulting protein.

Genetic variation in humans

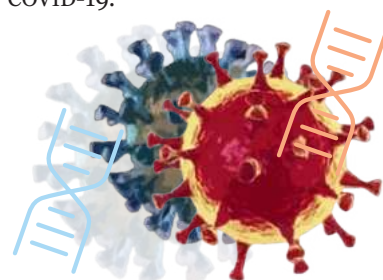
Another important factor which influences morbidity and mortality of COVID-19 patients is human genetic variation. Most people experience mild symptoms when they get infected by SARS-CoV-2, but a few have a severe, life-threatening response. While some of the differences can be explained by older age or health conditions, some answers could lie in the human genome. Typically, two individuals have 99.9% similarity in their genomes and the remaining 0.1% makes them different. This variation may be important in determining how different individuals respond to infections.

Within the genome, human genes involved in the response to infection are several and highly varied. Some of these are present on the X chromosome, leading to a bias in infection and immunity patterns in males versus females. This could be one of the reasons why males with a single copy of X are more severely affected by COVID-19 infection than females who have two copies. One of the important genes, angiotensin I converting enzyme-2 (ACE2), the primary receptor for the spike (S) protein of SARS-CoV-2, that facilitates attachment of virus to target cells, is in fact present on the X chromosome. On the other hand, the trans-membrane protease, serine 2 (TMPRSS2) protein, which cleaves the viral protein S at the S1/S2 and the S2 sites, permitting fusion of viral and cellular membranes, is regulated by androgens or male hormone. Both genes have been proposed to modulate susceptibility to SARS-CoV-2 and are good candidates to mediate sex-related effects.

There are at least 60 immune-responsive genes present on X chromosome and females have double copy of X chromosome while males have only one X chromosome. This gives females a stronger immune system than males and may be the reason why females are less susceptible to viral infections.

However, in females, the advantage of two X chromosomes is balanced by silencing of one of the X chromosomes in early development. Surprisingly, the X chromosome inactivation (XCI) is incomplete and about one-third of genes

escape from inactivation. ACE2 is one of the genes that escapes X inactivation. Also, it belongs to a subgroup of X-chromosome genes that exhibit an uncharacteristically heterogeneous pattern of male-female expression, with higher expression in males in several tissues. A study using single-cell sequencing, found a higher expression of ACE2 in men. Thus, the variation in ACE2 expression could influence the entry of virus into the cells and infection. Genetic variation in individuals may also affect severity of COVID-19.



Relationship between the ABO blood group and the COVID-19 susceptibility

The blood groups of individuals have been implicated in susceptibility to SARS-CoV-2 infection. When scientists compared the distribution of blood types among 2,173 COVID-19 patients in three hospitals in the Chinese cities of Wuhan and Shenzhen areas, blood type A appeared to be associated with a higher infection risk whereas type O offered the most protection.

The coronavirus keeps changing every day. The original viral strain that surfaced in Wuhan is much different from the current viral strain. The mutation poses major challenge in developing a vaccine that is effective in the long run against the virus. Genetic variation among individuals also has a direct influence on the infection and immunity of COVID-19 patients. Understanding these differences may help in designing drugs against SARS CoV-2 and minimise the morbidity and mortality of infection worldwide.

Dr Gargi Bagchi is Associate Professor and Pooja Yadav and Bhawna Yadav are M.Sc students, Amity Institute of Biotechnology, Amity University Haryana. (SERB CRG/2019/002583)

Email: gbagchi@ggn.amity.edu



Celebration of National Science Day and DST Awards for Science Communication 2021

The National Science Day is celebrated every year on the 28th of February. On this day, Physicist CV Raman announced the 'Raman Effect' for which he was awarded the Nobel Prize in 1930.

This year the theme of the National Science Day was "Future of Science, Technology and Innovation: Impacts on Education, Skills and Work". The chief guest of the function was Dr Harsh Vardhan, Union Minister for Science and Technology, Earth Sciences, and Health and Family Welfare. The function was graced by the auspicious presence of Prof. Ashutosh Sharma, Secretary, DST; Dr Sekhar C Mande, DG, CSIR; Prof Sandeep Verma, Secretary, SERB; and Dr Praveen Arora, Head, NCSTC.

Dr Harsh Vardhan spoke at the event about how science, technology, and innovation (STI) will affect our future education, ability, and functioning in the post-pandemic world. He was addressing the function through video-conferencing from Manipur. He also unveiled the first-ever National Science and Technology Databases on Science and Technology Awards in India and Indian origin Academicians abroad and Academicians of Indian Descent in other Countries. It provides data on various aspects such as discipline, periodicity, categories, awards level, chronology and state-wise distribution of awards and their sponsors. It will be useful for planners, policymakers, funding agencies and other stakeholders to chalk out their programmes as per the priorities of R&D activities.

Prof. Ashutosh Sharma emphasised that the Ministry of Science & Technology and Earth Sciences cover a vast canvas of R&D from deep oceans to mysteries of the universe. DST's activities impact right from a farmer in a remote corner of the country to sophisticated industries such as space. The investments in science and

technology endeavours and new thrust given to several new initiatives which directly benefit the common person have translated into prosperity and general welfare of the masses. Therefore, Science and Technology have a critical role in creating 'Atmanirbhar Bharat', ready for the future.

Dr Gargi B Dasgupta, Director IBM Research India and CTO, IBM India and South Asia delivered a special lecture on National Science Day and emphasised that the science and scientist group provided a ray of hope during the pandemic last year and that it is the need of the hour to use S&T in every sphere to keep people secure, jobs safe, and the economy safe. She also highlighted that the fourth industrial revolution is generating a market for new skill sets, displacing existing workers, and creating new ones. She discussed the new careers and five new work clusters that have been found in a recent WEF survey. These are: Data and Artificial Intelligence (AI), Engineering and Cloud, Product Development, People and Sales, and Marketing. She emphasised that it was past time for policy changes to ensure that science (particularly data science) is ubiquitous and that digital and human factoring is in high demand. She also said that scientists have a more significant role to play in society and that societies must think scientifically.

Dr Harsh Vardhan presented the National S&T Communication Awards, Augmenting Writing Skills for Articulating Research (AWSAR) awards, and SERB Women Excellence Awards and conferred Rajendra Prabhu Memorial Appreciation Shield for outstanding work in science media and journalism.

A cash prize of Rs. 2 lakhs was awarded in five categories. Dr S. Anil Kumar of Kerala received the National Award for Outstanding Efforts in Science and Technology

Communication through Print Media, including Books and Magazines. Indian Resource and Development Association, Haryana and Dr Mihir Kumar Panda, Odisha won the National Award for Outstanding Efforts in Science and Technology Popularization among Children. Dr Sheffali Gulati and Shri Rakesh Khatri of Delhi received the National Award for Outstanding Efforts in Science and Technology Communication through Innovative and Traditional Methods. Dr Krishna Kumari Challa of Telangana received the National Award for Outstanding Efforts in Science and Technology Communication in the Electronic Medium. Dr S. Anil Kumar of Kerala won the Rajendra Prabhu Memorial Appreciation Shield for Excellent Work in Science Media and Journalism. Appreciation Shield for National S&T Databases S&T Awards in India was given to Dr Lalit Mohan, Society for Environment & Development (SED), Delhi. Under AWSAR award category, Dr Sangeeta Dutta of Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru won the AWSAR Award for Outstanding Story in the PDF category. Ms Pooja Maurya, CSIR - Central Drug Research Institute, Lucknow received the First Prize in the PhD category. Ms Indu Joshi, Indian Institute of Technology, Delhi, won the second prize in the PhD category. Ms Shruti Soni, Indian Institute of Science, Bengaluru was awarded with third place prize in the PhD category.

The SERB awards, which strive to serve as a source of inspiration to women scientists who have the potential to become world-class leaders in their field of research, have been presented to Dr Shobhna Kapoor, Assistant Professor, Indian Institute of Technology Bombay; Dr Antara Banerjee, Scientist B, National Institute for Research in Reproductive Health, Mumbai; Dr Sonu Gandhi, Scientist D, National Institute of Animal Biotechnology, Hyderabad; and Dr Ritu Gupta, Assistant Professor, Indian Institute of Technology, Jodhpur.

Gaurav Jain is Jr. Scientific officer; K. B. Bhushan is Scientist E; and Avilekh Naryal is Program Coordinator, AWSAR in Vigyan Prasara,

Email: bharatuhf@gmail.com