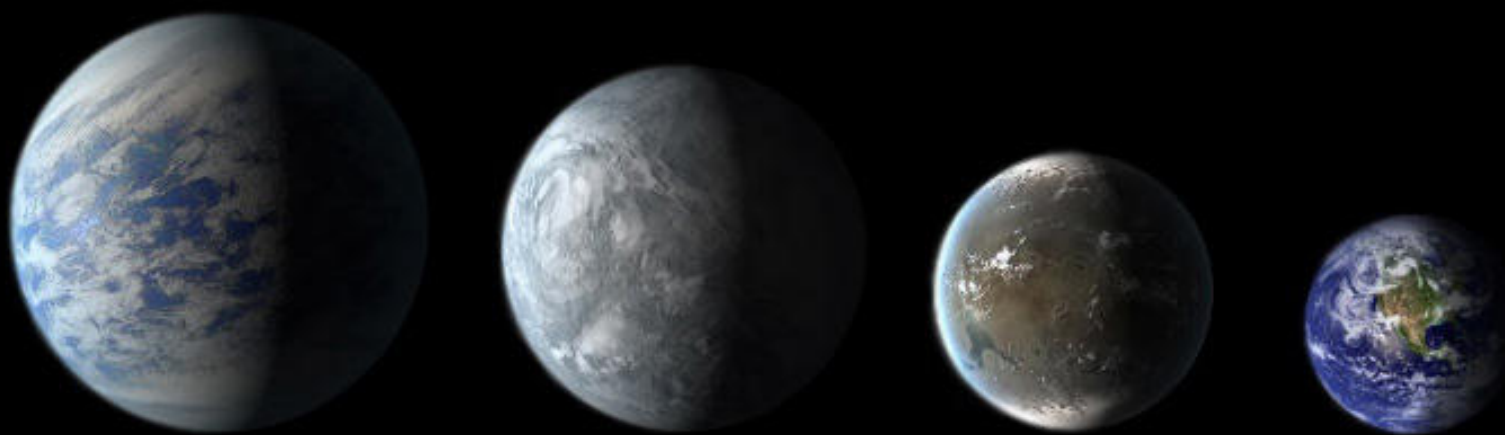


VIGYAN PRASAR

# DREAM

2047

MAY 2021 / Vol. 24 / No. 5 / ₹ 20



## BEACON OF EXOPLANETS – LIGHT OF LIFE?

MADE-IN-INDIA DIET 2021

UNDERSTANDING THE ENVIRONMENTAL AND ECONOMIC IMPLICATIONS OF PLASTIC USAGE

NATIONAL TECHNOLOGY DAY: S&T FOR NATIONAL BENEFITS

**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



Vigyan Prasar is not responsible for the statements/opinions expressed and photographs used by the authors in their articles/write-ups published in "Dream 2047"

Articles, excerpts from articles published in "Dream 2047" may be freely reproduced with due acknowledgement/credit, provided periodicals in which they are reproduced are distributed free.

Published and Printed by  
Dr Nakul Parashar on behalf  
of Vigyan Prasar, A-50,  
Institutional Area, Sector-62,  
Noida-201 309, U.P., India  
and Printed at Chandu Press,  
469, Patparganj Industrial  
Estate, Delhi 110 092  
Telefax: 22424396, 22526936.

Cover Design By: BIPRO KUMAR SEN

# MY WORD

NAKUL PARASHAR

## Aahaar Kranti—New Revolution on the Horizon

### OUR

glorious past has witnessed two major revolutions—first, the green revolution and then the white revolution. Both have left behind an indelible mark on Indian populace. Then very low on the international scale, these revolutions helped us to rise high to produce more than our consumption. Kudos to our scientists and farmers who worked together and rose to the call!

Years after the successful launch and culmination of these two revolutions, scientists, nutritionists, and dieticians have come to realize that, despite high crop yield, we are yet to meet the actual dietary requirements. Malnutrition still exists. It is a serious issue that needs immediate attention. Would another revolution of the same magnitude be an appropriate solution? Interestingly, a group of senior scientists of the Global Indian Scientist and Technocrats (GIST) Forum have come forward to launch a revolution in this regard. Aahaar Kranti was formally launched on 13 April 2021, when a number of Indians celebrated their new years. Logo, website, newsletter, and with a panel discussion with world-known celebrities, Aahaar Kranti was launched successfully. The event was attended online by a huge audience from various parts of the world.

For any revolution of such a mammoth scale, it is important that its planning and execution are very well thought of in advance. Thus, a three-phase implementation was put forth. It is most important to create awareness in the masses or the end users at the very outset. Thereafter, once the basic understanding about Aahaar Kranti is communicated to the masses, roping in other stakeholders to meet the aims of the revolution would be the next step. A number

of media strategies, online and in-person, have been planned out. Special tools and kits, print magazines, and films have to be developed to create the first impression, which must also make a lasting impression. Once the tipping point of general awareness is reached, creating techniques to improve nutrition and establishing the balance in the diet and nutrition of the citizens of the country would become the second step to implement.

As with the earlier ones, the implementation strategy continues to involve agricultural scientists and farmers. This is where the revolution enters its next phase of well-planned production of crops that would deliver balanced diet and nutrition. It has been observed that our current diet is highly starch based. As a result, it creates a void in the entire food cycle graph, leading to malnutrition numbers. Thus, regular workshops where subject matter experts would discuss the importance of required research & development and its extension or outreach have to be planned. Workshops, films, radio programs, podcasts, print monthlies, web blogs, tweets, etc. would empower the people involved in the propagation of activity related to Aahaar Kranti.

I hope that this revolution would turn out to be a humongous one, benefiting the entire country. Finally, malnutrition has to go!

Meanwhile, COVID-19 has suddenly taken an ugly turn in the country. While prevention is better than cure, breathing exercises like prona breathing may be strong alternatives to provide immediate relief. We wish you all stay safe and stay happy.

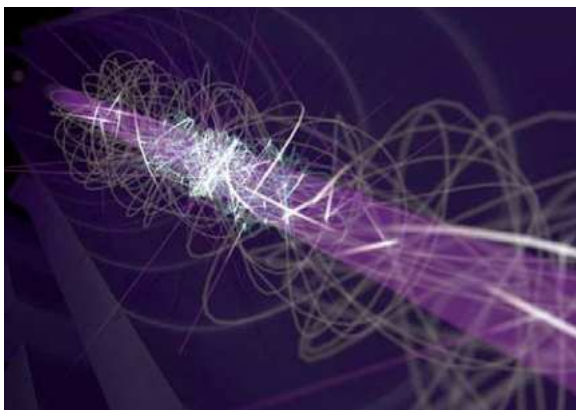
Email: nakul.parashar@vigyanprasar.gov.in

# RECENT DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

## MANIPULATION OF ANTIMATTER WITH LASER

Antimatter refers to a substance composed of subatomic particles that have the mass, electric charge, and magnetic moment of the electrons, protons, and neutrons of ordinary matter, but for which the electric charge and magnetic moment are opposite in sign. The antimatter particles corresponding to electrons, protons, and neutrons are called positrons ( $e^+$ ), antiprotons ( $p^-$ ), and antineutrons ( $n^-$ ); collectively they are referred to as antiparticles. The electrical properties of antimatter being opposite to those of ordinary matter, the positron—the antiparticle of electron—has a positive charge and the antiproton—the antiparticle of proton—has a negative charge. Although the antineutron is electrically neutral, it has a magnetic moment opposite in sign to that of the neutron. Because of their very nature, matter and antimatter cannot coexist at close range for more than a small fraction of a second because they collide with and annihilate each other, releasing huge quantities of energy in the form of gamma rays or elementary particles.

In 1995 physicists at the European Organization for Nuclear Research (CERN) in Geneva created the first antiatom, the antimatter counterpart of an ordinary atom—in this case, antihydrogen, the simplest antiatom, consisting of a positron in orbit around an antiproton nucleus. They did so by firing antiprotons through a xenon-gas jet. In the strong electric fields surrounding the xenon nuclei, some antiprotons created



Artist's impression of antimatter being manipulated by lasers. (Credit: Chukman So/TRIUMF)

pairs of electrons and positrons; a few of the positrons thus produced then combined with the antiprotons to form antihydrogen. Each antiatom survived for only about 40-billionths of a second before it came into contact with ordinary matter and was annihilated.

Because they annihilate upon contact with matter, antimatter atoms are exceptionally difficult to create and control in our world and had never before been manipulated with a laser. But recently, researchers with the CERN-based ALPHA collaboration have announced the world's first laser-based manipulation of antimatter, leveraging a made-in-Canada laser system to cool a sample of antimatter down to near absolute zero. According to the researchers, the achievement, published in the journal *Nature* on 31 March 2021 (DOI: 10.1038/s41586-021-03289-6), will significantly alter the landscape of antimatter research and advance the next generation of experiments.

According to the researchers, the results are the culmination of a years-long program of research and engineering,

conducted at the University of British Columbia (UBC). Says Takamasa Momose, researcher with ALPHA's Canadian team (ALPHA-Canada) who led the development of the laser, "With this technique, we can address long-standing mysteries like: 'How does antimatter respond to gravity? Can antimatter help us understand symmetries in physics?' These answers may fundamentally alter our understanding of our Universe."

Since its introduction 40 years ago, laser manipulation and cooling of ordinary atoms have revolutionized modern atomic physics and enabled several Nobel-winning experiments. The present results mark the first instance of scientists applying these techniques to antimatter.

## CLIMATE CHANGE HAS REDUCED GLOBAL AGRICULTURAL PRODUCTIVITY BY 21% SINCE 1960S

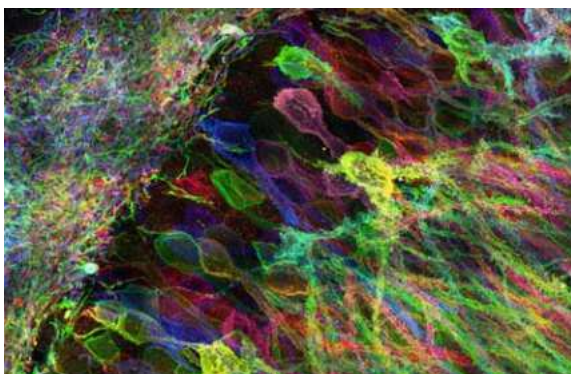
The deleterious effects of climate change on global agriculture have long been debated. Now, it has been established that there has been a 21% reduction in global agricultural productivity since 1961. This has been revealed by the first ever study by the University of Maryland (UMD) in collaboration with Cornell University and Stanford University in the US to quantify the man-made effects of

climate change on global agricultural productivity growth. Results of the new study have been published in *Nature Climate Change* (DOI: 10.1038/s41558-021-01000-1). To arrive at the conclusion, the researchers developed a robust model of weather effects on productivity, looking at productivity in both the presence and absence of climate change. According to the researchers, the loss in productivity is equivalent to completely losing the last 7 years of productivity growth. This work suggests that global agriculture is becoming more and more vulnerable to on-going climate change effects, with warmer regions like Africa, Latin America, and the Caribbean being hit the hardest.

According to Robert Chambers, professor in Agricultural and Resource Economics (AREC) at UMD and an agricultural productivity researcher, the study suggests climate and weather-related factors have already had a large impact on agricultural productivity. The model in this paper was used to estimate what total factor productivity patterns would have looked like in the absence of climate change.

'Total factor productivity' is a calculation that is used to measure the growth of an industry, in this case agriculture. However, agriculture is a unique industry because not all the inputs that determine productivity are in the farmer's direct control, like the weather, for example. The researchers on this work have been pioneering new productivity calculations in agriculture to include weather data in a way that has not been addressed earlier, bringing new accuracy to these types of climate models.

When a farmer makes an economic decision like what to plant in June, for example, they do not necessarily know the outcome of that decision until 6 months later. So, there is a distinct break between input and output, and random events like weather can severely affect that. Productivity is essentially a



MIT researchers have developed a new way to image proteins and RNA inside neurons of intact brain tissue using expansion microscopy.

calculation of the inputs compared to the outputs, and in most industries, the only way to get growth is with additional inputs. In this case, weather data was an integral part of the model, looking at productivity in both the presence and absence of climate change.

Further, the study finds that while global agricultural productivity growth has slowed by about 21% since 1961, areas like Africa, Latin America, and the Caribbean that are in warmer climate regions already have experienced slowing down in growth of 26-34%. The US seems to be less affected, with slowing down in growth of approximately 5-15%.

## IMAGING VIRUS PARTICLES USING ORDINARY MICROSCOPES

Engineers at the Massachusetts Institute of Technology (MIT) have devised a novel technique for imaging biological samples down to a resolution of 9 nanometres using an ordinary microscope. This technique should enable them to image viruses and potentially even single biomolecules.

The new technique builds on what is known as 'expansion microscopy', an approach that involves embedding biological samples in a hydrogel and then expanding them before imaging them with a microscope. For the latest version of the technique, the researchers developed a new type of hydrogel that

maintains a more uniform configuration, allowing for greater accuracy in imaging tiny structures.

Edward Boyden, a member of MIT's McGovern Institute for Brain Research and Koch Institute for Integrative Cancer Research says, if you could see individual molecules and identify what kind they are, then you might be able to actually look at the structure of life (*Nature Nanotechnology*, [dx.doi.org/10.1038/s41565-021-00875-7](https://doi.org/10.1038/s41565-021-00875-7)).

In a 2017 paper, Boyden's lab demonstrated resolution of around 20 nanometres, using a process in which samples were expanded twice before imaging. This approach, as well as the earlier versions of expansion microscopy, relies on an absorbent polymer made from sodium polyacrylate, assembled using a method called free radical synthesis. These gels swell when exposed to water; however, these have one limitation that they are not completely uniform in structure or density. This irregularity leads to small distortions in the shape of the sample when it is expanded, limiting the accuracy that can be achieved.

To overcome this, the researchers developed a new gel called tetra-gel, which forms a more predictable structure. By combining tetrahedral polyethylene glycol (PEG) molecules with tetrahedral sodium polyacrylates, the researchers were able to create a lattice-like structure that is much more uniform than the free-radical synthesized sodium polyacrylate hydrogels they previously used.

The researchers demonstrated the accuracy of this approach by using it to expand particles of herpes simplex virus type 1 (HSV-1), which have a distinctive spherical shape. After expanding the virus particles, the researchers compared the shapes to the shapes obtained by electron microscopy and found that the distortion was lower than that seen with previous versions of expansion microscopy, allowing them to achieve an accuracy of about 10 nanometres.

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



# india SCIENCE

A DST-Vigyan Prasar Initiative

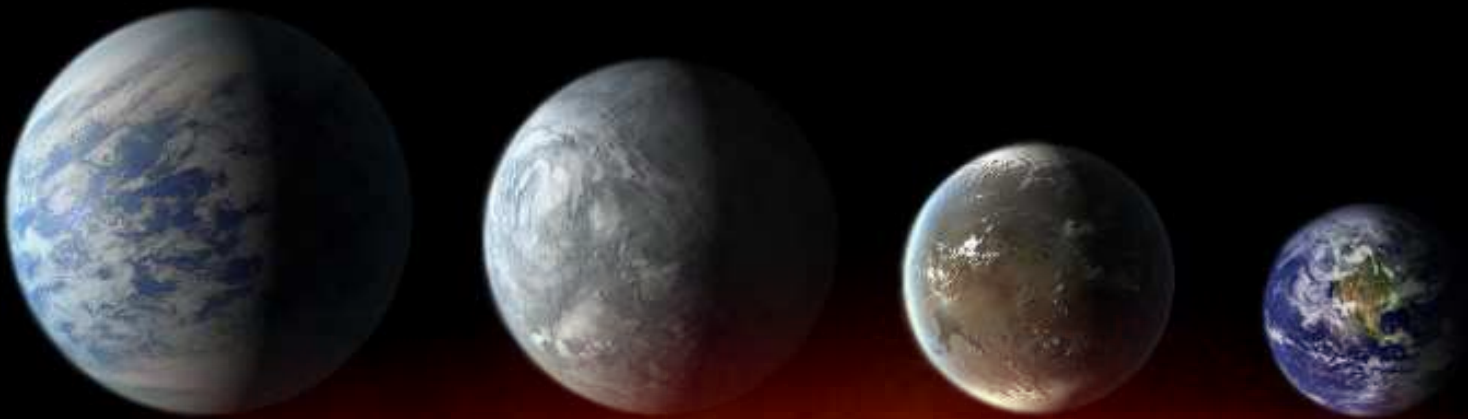
## INDIA'S OWN 24X7 **SCIENCE &** TECHNOLOGY **CHANNEL**

India Science is an Internet-based Over-The-Top (OTT) TV channel. This 24x7 video platform is dedicated to science and technology knowledge dissemination, with a strong commitment to spreading scientific awareness with Indian perspectives, ethos and cultural milieu.

[www.indiascience.in](http://www.indiascience.in)



# BEACON OF EXOPLANETS –



# LIGHT OF LIFE?



**1979, while writing about the possibility** of balloon-like creatures existing in the clouds of Venus, Carl Sagan popularised the concept of ECREE - acronym for “Extraordinary Claims Require Extraordinary Evidence”. The aphorism

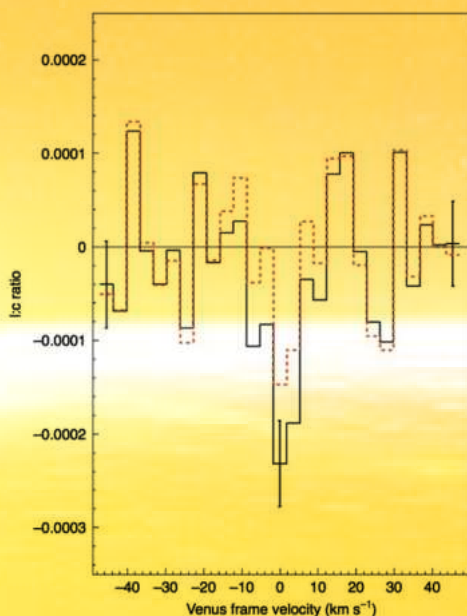
is as old as the 18th Century and has been used by many thinkers - from English philosopher David Hume (1711-1776) in his essay “On Miracles” to the French Mathematician Pierre-Simon, marquis de Laplace (1749-1827). The principle states that “the weight of evidence for an extraordinary claim must be proportioned to its strangeness”. ECREE, which decrees that the more unlikely a scientific claim is against the existing evidence, the more stringent the standard of proof that is required to establish it, has remained a gold standard for the scientific method and critical thinking ever since. A piece of such an “extraordinary evidence” was obtained by scientists in September 2020 from the noxious clouds of Venus again, hinting at the possibility of life there.

Though the brightest star in the night sky, Venus has always been overlooked as a possible candidate for the existence of extra-terrestrial life as life is thought to be impossible in a planet roasting at hundreds of degrees and surrounded by clouds of carbon-di-oxide and corrosive sulfuric acid. However, on September 14, an international team led by Jane Greaves of Cardiff University in Wales detected signs of phosphine ( $\text{PH}_3$ ) -a molecule of phosphorus and oxygen, in Venus’s clouds by using two different telescopes-the James Clerk Maxwell Telescope in Hawaii and the powerful ALMA Telescope Array in Chile. Instead of visible light, these telescopes work with millimetre-wave radiations lying between the infrared and the

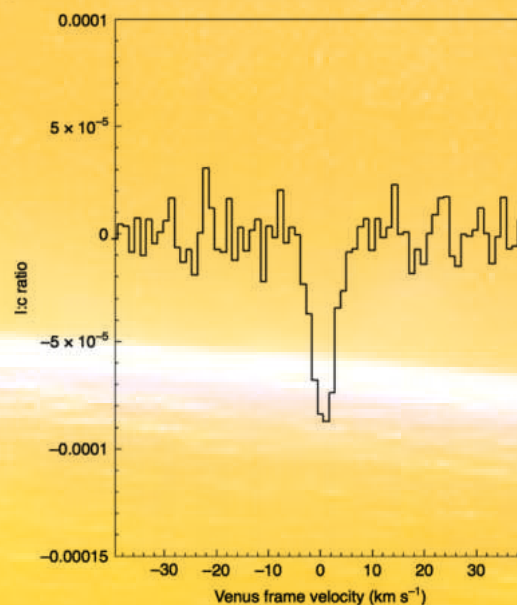
radio wavelengths. Molecules in Venus’s toxic hot atmosphere give out quite a bit of radiation at these wavelengths (which can be detected from their absorption spectra) which is produced when the molecules in the cooler air above the atmosphere absorb some of these radiations while moving out into space. The specific wavelengths absorbed depend on the absorbing molecules, and the spectrum shows a dip at the corresponding wavelength, revealing a chemical present in the atmosphere of the planet. Phosphine showed up as a dip in Venus’s spectrum at about 1.12 mm.

On Earth, Phosphine is made by bacteria from the phosphate of minerals or biological material and hydrogen. Being a gas produced by non-oxygen-using life, it can be a biomarker to indicate the possibility of existence of life on planets around other stars. But the discovery of phosphine in Venus's clouds indeed comes as a huge surprise, because such a molecule is unlikely to survive in the highly corrosive, carbonated and acidic atmosphere of Venus. Its chemistry would destroy it as soon as it is formed. So something must account for the observed incidence of about 20 parts per billion in Venus’s atmosphere. Something else must be producing it at the same rate as atmospheric chemistry destroys it. That something could only be a living organism - a microbe.

It is not easy to interpret scientific data from the space with any certainty, especially when trying to detect a tiny amount of gas in another planet’s atmosphere. The observed dip attributed to phosphine could have been caused by other sources which could be anything - from the Earth’s thick atmosphere to the inner workings of the telescope itself that produce wiggles that scientists call “noise”. Any particular



The detection of  $\text{PH}_3$  towards the entire planet of Venus. The left is the detection with JCMT and right is with ALMA. The x-axis is labelled 'Venus frame velocity' because the observed spectra need to be corrected for the velocity at which Venus is spinning.  $V=0$  on the x-axis corresponds to the frequency at which  $\text{PH}_3$  emits. On the y-axis, l:c stands for line:continuum ratio. Continuum can be thought of as the background and the line corresponds to the  $\text{PH}_3$  detection. Any value away from zero means that there is flux at that frequency. Bumps and wiggles are normal and are called 'noise'. The authors are able to determine the significance of the detection based on the depth of the line compared to the noise (plus some other fancy statistics).



Source: Nature Astronomy, <https://astrobit.es.org/2020/09/21/phosphine-in-venus/>, accessed 15/09/2020.

dip could just be a random, extra-large wriggle. The intrinsic brightness of Venus may also introduce such wriggles. The standard practice, therefore, is to write an equation of the wriggle and subtract it from the observed data. The equation is generally expressed by a polynomial. The team used a twelfth-order polynomial, that is, an equation with twelve variables (the simplest second order polynomial is:  $ax^2 + by + c = 0$ , where  $x, y$  are variables and  $a, b, c$  are constants) to describe the noise in their ALMA data, but other astrophysicists found “no statistically significant sign of phosphine” in the ALMA data. Obviously, many more confirmations will be necessary before accepting or rejecting the possibility of life in Venus - an extraordinary claim. The next mission to Venus from the Earth should give us enough time to design an appropriate experiment for this, and it will be sent by none other than India: the Shukrayaan-1 orbiter is currently scheduled for launch in 2023.

## Ideal worlds for life

For life to evolve and thrive anywhere, a set of conditions needs to be satisfied, the most important of which is the presence of water. Further, there has to be a ‘habitable zone’ conducive to life, the so-called Circumstellar Habitable Zone (CHZ), also known as the Goldilocks Zone. This means that a candidate planet’s distance from the parent star has to be such that water can exist in liquid state under ordinary temperature and pressure. There also has to be an abundance of organic elements necessary for making the complex organic molecules to capture and reflect the complexity of life - 99 per cent of all living forms on Earth are composed only of six elements - carbon, hydrogen, nitrogen, oxygen, phosphorus and sulphur (CHNOPS). Organic molecules of these elements dispersed in water provide an ideal environment for chemical interaction between these molecules which forms the basis of all metabolising mechanisms on Earth.

Are there such other worlds? Scientists have identified nine bodies inside the solar system where life might exist in subsurface oceans of water or other organic liquids like methane or ammonia. These are Mars; Ceres-the largest asteroid; Europa, Ganymede, and Calisto-all moons of Jupiter; Enceladus and Titan - moons of Saturn; Triton, the largest moon of Neptune; and Pluto. Mars once had free flowing water on its surface. Some of it may still be flowing underground. Life had so far been ruled out in Venus which once was within the Goldilocks Zone. But the Goldilocks Zone also changes its boundaries due to the brightening of the Sun over the past billions of years. On Venus, it triggered a “runaway greenhouse effect” which boiled its seas away, driving any living microbes which existed on its surface waters into the Venus skies, where the temperature remains bearable and water remains liquid even now as droplets.

Beyond our Solar System, scientists have discovered nearly 3400 Earth-like rocky planets within the Goldilocks Zone in



James Clerk Maxwell Telescope in Hawaii

other stellar systems within and outside our galaxy capable of nurturing life, though without any evidence of life so far. Such planets, called ‘exoplanets’, are detected indirectly from the stellar properties like brightness, position etc. or by direct observations made by telescopes in space, like Hubble, Spitzer, Corot, and Kepler Space Telescopes.

## Signs of Life

Once an exoplanet is discovered, scientists look for bio-signatures of life in it. The planet’s visible or infrared spectrum may reveal the presence of oxygen or methane, two gases produced by life through photosynthetic or other biological processes. They may look for evidence of liquid water which is essential for life. Ozone will provide another bio-signature as also the compounds of organic sulphur or carbon-di-oxide. However, some of these gases and compounds may even be produced by abiotic processes; there also remains the possibility that even when no bio-signature is detected, some form of life can still be ebbing and flowing beneath the surface of the planets - in subsurface oceans of water or organic compounds like methane or ammonia, though less likely.

## In Search of Super-habitable Exoplanets

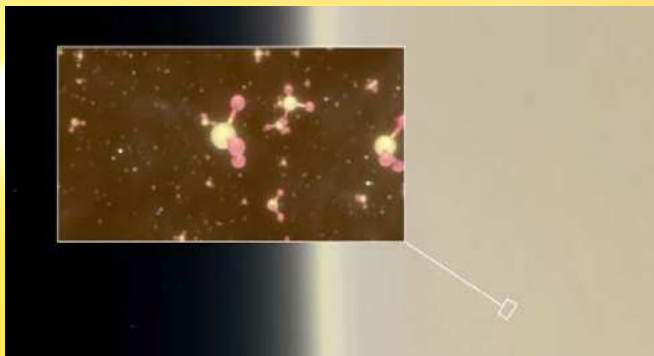
Given that vastness of the universe and the immensity of time through which it has evolved, it is unlikely that a single planet like our Earth in this Universe harbours life, where in fact it has been proved to exist and proliferate under the most extreme conditions, in highly acidic, alkaline or radioactive environments, in hot springs and frigid lakes deep below the surface. In September 2020, in a research paper titled “In Search for a Planet Better than Earth: Top Contenders for a Super-habitable World” astrophysicists Dirk Schulze-Makuch, René Heller and Edward Guinan from Washington State University identified the conditions that will make an exoplanet habitable - in fact more habitable than our Mother Earth. According to them, it should be about 5-8 billion years



old and up to 1.5 times heavier and 10 per cent larger than the Earth, with mean surface temperature about 5°C higher. It must also have a large moon with up to 10 per cent of planetary mass at a moderate distance of 10-100 planetary radii, with plate tectonics or similar geological and geochemical recycling mechanism as well as a strong protective geomagnetic field. Further, it must be orbiting around a K-type dwarf star with surface temperature lower than the Sun which is a G-type dwarf star. The Sun, in fact, has a relatively short lifespan of 10 billion years. Since it took some 4 billion years for complex life to emerge on Earth since its formation, it is likely that many stars like the Sun would live out their lives before complex life - unlike simple microbial life - could evolve upon them. K-type dwarf stars, being smaller, cooler and less bright than the G-stars, can shine for 20 to 70 billion years - time enough for complex life to evolve. Further, planets get cooled once they grow older, making them less suitable for life. Earth is about 4.5 billion years old and from probabilistic calculations, researchers estimated between 5 billion and 8 billion years as the optimal age of a planet to harbour complex life.

Exoplanets can not only be habitable but 'super-habitable' if they are also larger, heavier, warmer, and wetter compared to Earth. Heavier planets with larger surface areas would feature stronger gravity to support and retain atmosphere, provide more space to support "more biomass and a higher biodiversity", besides adequate plate tectonics to form large landmasses like continents as on Earth and strong protective geomagnetic shields. However, there is a fine trade-off - too large a planetary mass might make the planet evolve into a "gas giant or mini-Neptune retaining the light gases such as hydrogen or being an undifferentiated iron-rich body." A planet with sufficient water content in the form of moisture would guarantee sufficient humidity, clouds, rainfall, and tropical forests. It should have oxygen content between 25 and 30 per cent compared to Earth's 21 per cent and should be warmer than the Earth so that with the additional moisture it can generate vast tropical areas with fewer regions of extreme climate. A large moon at a moderate distance would impart stability to its orbital motion and ensure stable seasons like the Earth.

Based on the above criteria, the team identified some 24 super-habitable planets out of some 4500 candidate exoplanets that could support life better than on Earth. However, none of



Phosphine in Venus (Source MIT News)

## HOW LONG CAN EARTH SUPPORT LIFE?

Old and exploited though the Earth is, it now looks as if she might just be able to support her 8 billion human children. A study of population trends in 195 countries by the University of Washington's "Institute for Health Metrics and Evaluation" published in the reputed medical journal, *The Lancet*, in July 2020 projected the world population to reach its peak at 9.73 billion in 2064 and then gradually to decline to 8.79 billion in 2100, as against the current world population of around 8 billion. Stability of population is defined by the Total Fertility Rate (TFR) which is the average number of children per woman. A TFR of 2.1 just replaces the current population. The Lancet study estimated that the TFR in 183 of the 195 countries will fall below the replacement level, with the global TFR declining from 2.37 in 2017 to 1.66 in 2100. Population will shrink by more than 50 per cent in 23 countries including Japan, Thailand, Italy and Spain. With lesser population, environment and climate will become sustainable and with appropriate global regulation on conspicuous consumption, the planetary carbon footprints can also be brought within manageable levels. Progress in technology will ensure adequate food production for the current level of population well into the future and even to meet their future energy demand.

course could be found to satisfy all the criteria; the most that any exoplanet could meet were three, as in the case of exoplanet designated KOI 5715.01. Our current technology is also unable to measure many of the parameters, like atmospheric oxygen, plate tectonics, geomagnetism and natural moons, etc., on extra-terrestrial planets. But, two of them - Kepler 1126 b and Kepler-69c, have been designated as "statistically validated planets", and the rest being only "unconfirmed Kepler Objects of Interest". The upcoming probe tools like NASA's James Webb Space Telescope, LUVIOR Space Observatory, ESA's space telescope and the other new generation telescopes and radio telescopes might help bring more clarity on this aspect. But the time to pack our bags is still far away as all these 24 exoplanets are more than 100 lightyears away, a distance we still do not know how to negotiate. Kepler-69c, for example, lies at a distance of 2000 light years - too far away even for a target to be investigated by telescopes. It also does not mean we should pack our spaceship with deadly missiles to face any threats from creatures living there! Being super-habitable does not automatically mean that life or intelligent life actually exists on these remote worlds.

Dr Govind Bhattacharjee is a retired civil servant, a popular science writer and author of trilogy on evolution published by Vigyan Prasar.

Email: govind100@hotmail.com



# Made-in-India Diet 2021

Just imagine a pendulum in your mind oscillating between what I would like to eat and what I should eat? And when you give it a thought, you know there has to be a balance in what you eat, and the pendulum must stop at the centre. But the pendulum almost always stops on the side where you decide to eat what you like. Most striking part is that we know it is wrong but we fail to alter it. Sometimes you can listen to your heart when it comes to food but not always.

To help and guide you in the right decision making, here comes the 'Aahaar Kranti' for the well being of each one of us. It aims to create nutritional awareness in all sections of our society.

## OBJECTIVE OF AAHAAR KRANTI

To promote better awareness, better nutrition and better agriculture.

**Aahaar Kranti helps educate the people about:**

- values of India's traditional diet
- healing powers of local fruits and vegetables
- miracles of a balanced diet

It is an indigenous initiative made by Vijnana Bharati and Global Indian Scientists' and Technocrats' Forum (GIST). They have come together to launch the programme Aahaar Kranti, with the motto-*Uttam Aahaar, Uttam Vichaar*. Aahaar Kranti Initiative is also supported by Council of Scientific and Industrial Research (CSIR)'s Pravasi Bharatiya Academic and Scientific Sampark (Prabhaas) and various central and state government ministries and agencies.

Uttam Aahaar is one that provides all nutrients in required amount and proportions for maintaining good health and general well being and makes small provision for extra nutrients to withstand short duration of illness. A balanced diet which provides all the nutrients is needed throughout our lives at all ages. They must be obtained through a judicious choice and





combination of a variety of foodstuffs from different food groups.

Aahaar Kranti initiative will help you understand the basic concept of balanced diet which includes macronutrients that are required in large amounts like carbohydrates, fats and proteins and micronutrients that are required in small quantities like vitamins and minerals. These nutrients are necessary for the human body to acquire, assimilate and utilize food to maintain health and activity.

### Balanced Diet Mantra

Dr Seema Puri, Associate Professor from Department of Nutrition at Institute of Home Economics in University of Delhi mentions three Mantras that matter with food: Balance, variety and moderation.”

These mantras must be inculcated in our lives from birth or from early childhood. We all need nutrition, but early childhood needs proper nutrition investment.

### WHAT IS A BALANCED DIET?

A balanced diet is one which provides all the nutrients in required amounts and proper proportions. It can easily be achieved through a blend of the four basic food groups.

Dr Alok Kumar Agarwal, Consultant Paediatrician at Lal Bahadur Shastri hospital emphasises that, “Proper nutrition in first 1000 days (270 days of pregnancy and 2 years, i.e., 730 days of child’s life) have permanent bearing on the health of the individual throughout life. Exclusive breast feeding for first 6 months after birth followed by proper complimentary feeding is very crucial for developing brain. By one year of age, the child should be eating around 250 ml, 4-5 times per day from family pot. This should provide around 1000-1200 kcal along with 15-20 gram of proteins. By 10-16 years of age, a child requires 2100-2700 kcal from diet which should include 54-78 gram of proteins, 500-600

mg of calcium and 30-50 mg of iron. This varies with age and physical activity level of the child. Children undernourished during this period are far more likely to suffer from long-term health problems, poorer educational performance, and lower economic prosperity.”

It all begins even before the birth of a child when we take care of a would-be mother. So, during pregnancy a woman should eat the best. That is why it is often said and believed that a pregnant woman should eat for two.

But, Dr Puri clarifies, “While nutritional requirements of pregnant women increase during pregnancy, the increase is not double and varies during the course of pregnancy. During the first trimester there is a greater need for proteins and micronutrients for development of organs. During the third trimester, emphasis is on increasing the birthweight of the baby, so the mother should have higher energy diets or foods like panjiri.”

She also mentions that too much tea or coffee could provide substantial amounts of caffeine which is detrimental to the development of the baby and therefore should be avoided.

Dr Agarwal strictly warns that “Junk food including cold drinks, burgers, fries should best be avoided as they give empty calories in the form of carbohydrates and fats only, thus leading to obesity.”

### Balanced Diet and gender

Making the right choice of food is most important. As a child always needs assistance to understand and build good eating habits, it is our responsibility to guide them. But being an adult, what do we understand about our diet. Let's start with the basics of what differs in diet of a man and woman.

Dr. Hemalatha R., Director of ICMR-National Institute of Nutrition in Hyderabad explains, “The definition of balanced diet remains same for both genders. However, the nutrient requirement varies with age, gender, activity and physiological status. To meet

this varied requirement the portion sizes of each food group needs to be changed.”

She also decodes the science of calorie intake based on gender. “A sedentary adult man requires 2110 Kcal and a sedentary woman requires 1660 Kcal. Though the calorie requirement is lesser for women, their micronutrient requirement may be higher. For instance the iron requirement for adult men is 11mg/day while it is 15 mg/day for adult women and 21 mg/day during pregnancy. Similarly, during lactation the calcium requirement of women becomes higher.”

### Balanced diet and ageing

If we understand the concept of balanced eating, the purpose of Aahaar Kranti will be fulfilled. This revolutionary programme aims at well being of all age groups. Because, a healthy child develops into a healthy adult and in turn has a healthy ageing.

Dr Hemalatha R. explains, “In elderly people metabolism is altered and also their food consumption is affected due to various factors. Due to decreased food

consumption their micronutrient status is compromised along with their muscle mass. Though the calorie requirement is less due to decreased physical activity, their requirement of protein and micronutrients, especially vitamin D and calcium, remains higher.”

So, how can the elderly meet these requirements? Dr Hemalatha suggests, “they should include fresh foods, fruits and milk in their daily diet. Their diet should be made soft, easily digestible and palatable. In addition to the diet regular physical activity is important to retain muscle mass and utilize the micronutrients obtained from diet or supplements.”

Another aspect of balanced diet is how it differs for a vegetarian and a non-vegetarian. Dr Hemalatha says, “While the definition of balanced diet remains same for both vegetarians and non-vegetarians, only the source of protein varies. The vegetarians can obtain protein from pulses, legumes regularly while non-vegetarians can exchange one portion of these with flesh foods or



## HOW TO IMPART MESSAGE OF AHAAR KRANTI?

- In the form of what's and why's of nutrition
- In the form of games
- As instructions such as 'how to'
- Content will be provided both online and offline
- Content will be in all vernacular languages besides English and Hindi to reach out to as many people as possible.

**A**ahaar Kranti will focus on training teachers, who, in turn, will pass on the message to the multitudes of students, and through them to their families and finally the society at large. Such a strategy was adopted for the eradication of Polio and it turned out to be a grand success.

of 400 gram of fruit and vegetables a day to lower the risk of serious health problems, such as heart disease, stroke and some types of cancer.

Dr Puri, gives a simple message, "Eat 5 different coloured fruits and vegetables everyday". She even discards the general belief of not eating fruits and vegetables at night. She says, "I feel fresh fruits can be taken anytime of the day but always in moderation."

Experts even explain that while consuming fruits and vegetables variety is as important as quantity. No single fruit or vegetable provides all of the nutrients you need to be healthy..

Dr Agarwal, prefers whole fruit instead of fruit juices to be given to children for complete nutrition.

Eating a healthy diet is all about feeling great, having more energy, improving your health, and boosting your mood. India has the unique advantage of having the knowledge of Ayurveda that has a special place for diet in health. It is time to also apply this rich knowledge of nutrition to practice. Aahaar Kranti mission focuses on this. In the end, remember-Nutrition is subjective while Balanced diet is objective. Choose your food wisely and enjoy great health.

The author is a science journalist, writer and filmmaker.

Email: [neha\\_tripathi@icloud.com](mailto:neha_tripathi@icloud.com)



eggs or fishes. Fish can be consumed 2-3 times in a week. Apart from these food groups, milk and milk products are rich sources of protein for both vegetarians and non vegetarians.

The UN General Assembly has designated 2021 the International Year of Fruits and Vegetables (IYFV). Aahaar Kranti initiative will renew the focus on nutritionally balanced diets-*Uttam evam santulit aahaar* replete in locally sourced fruits and vegetables. Fresh fruits and vegetables provide nutrients for energy and health maintenance, and to combat disease. Describing the role of fruits and vegetables in our diet, Dr Hemalatha explains that "Fruits and vegetables are essential sources of micronutrients such as Vitamins and Minerals and fibre while being low in calories. Vegetables

have complex carbohydrates that make them low in Glycemic Index, which prevents spike in blood glucose level. The high fibre content improves the gut microflora and aids immune function. Fruits and vegetables are also rich in phytochemicals that have antioxidant functions and protect our body from degenerative diseases."

Fruits and vegetables constitute one of the three food groups in the balanced diet. These are the protective food group, i.e., these foods are rich in micronutrients and help in building immunity, maintain eyes, skin, lips, etc. and protect from infections, e.g. They have vitamin A, vitamin D etc. The more colour more beneficial they are. WHO has run a campaign, The 5 A Day, which recommends eating a minimum

## Understanding the Environmental and Economic Implications of Plastic Usage

The use of plastic has considerably increased in the last few decades in all walks of life though there has been considerable discussion on banning single-use plastics in day-to-day lives. Mobile phones, laptops, electric switches, cars, clothes, shoes, toys, utensils, bottles, syringes, etc., are things that we use in our everyday life. Although they don't seem to be much like each other and perform completely different functions, all of these do have something in common. Each of these items is made from a significant quantity of different types of plastics. Plastics are a family of compounds that can be synthetic or semi-synthetic. They are polymers and can be moulded into different shapes and sizes to fit our needs. There are broadly two different kinds of plastics, namely thermoplastics and thermosets. Thermoplastics such as polyethylene, polypropylene, and polyvinyl chloride can be heated and moulded into different shapes repeatedly, while thermosets such as polyurethane, silicone, and epoxy resins cannot be moulded into different shapes through heating and cooling once it has been set.

Plastics were discovered in the early twentieth century and over the years their applications have grown manifolds due to their numerous advantages; as a result, the production of plastics rose with a steep curve globally. As with different periods in the history of mankind that are defined after the most-used material that revolutionized human lives, the current time has often been regarded by scientists as the 'plastic age'.

Along with the production and large-

scale use of plastics came the issue of plastic pollution. Discarded plastics in a variety of shapes and sizes from different sources mix with the environment as waste and often lead to serious complications.

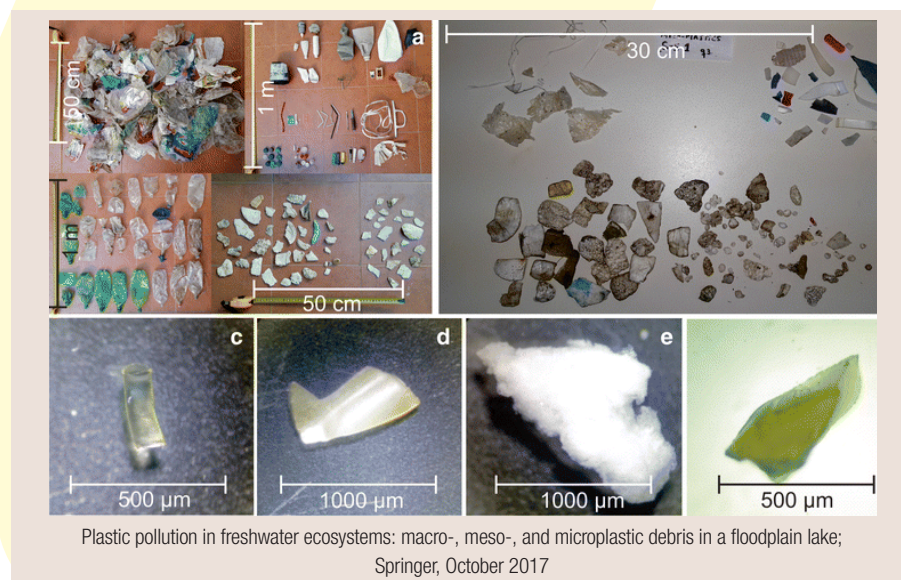
### The Genesis

Production of plastics in huge quantities started only after World War II and the production rate gained momentum in the 1950s when the plastics industry produced about 5 million tons of plastic. Soon, years passed by and the industry grew humongous. In 2018, the industry produced about 359 million tons of plastic across the globe and the quantity is growing even bigger today.

The production of plastics started with partially synthetic compounds in the early twentieth century and the first synthetic plastic discovery was that

of "Parkesine", made from cellulose treated with nitric acid and a solvent. Fully synthetic plastics appeared only in 1907 with the invention of "Bakelite", a revolutionary substance that changed our lives. Bakelite is a polymer made using phenol and formaldehyde and owing to its low electrical conductivity it was first used in electrical instruments and the industry. Years passed by and Bakelite became that wonder compound that could be used everywhere - in doorknobs, electrical and home appliances, and even in different cookware for making insulating handles. This compound, with its properties of high heat-resistance, relatively high inertness, and low electrical conductivity became one of the most sought-after compounds in our daily lives.

As further breakthroughs in science brought into light more of such synthetic polymers, we started to build our repertoire of plastics with the belief that these compounds would help us build a sustainable future as they lead us to replace non-sustainable and rare resources for their production. Most popular members of the family of plastics include polyethylene, polyvinyl chloride, polystyrene, polypropylene, polyurethane, silicone, etc. Plastics showed great promise—they made products lighter in weight and hence, fuel-efficient vehicles came up. Plastics also made the goods cheap and mostly



non-reactive to other chemicals. These advantages of using plastic goods raised demands to a whopping 359 million tonnes of plastics worldwide in 2018, with 51% of it being produced in Asia - making it the world's largest producer of plastics. Nearly 30% of the world's plastic was manufactured in China, 4% in Japan, and 17% in the rest of Asia.

### The Economics

The low cost of plastic substitutes is often an important reason for their introduction in different fields of application. It did bring down the cost of production because of the ready availability of raw materials, the cost of transport of products made from plastics due to their lightweight character, and also the overall costs incurred because of the greater longevity of plastic products. However, our greatest gap in making plastics even more economical lies in the fact that we are still mostly based on the linear economy. This means we procure raw material, create the plastic product, use it, and then discard it. This is based on the "single-use" agenda for plastics that we have created over the years. What could essentially save our costs even more, and to a significant level, would be to take those used plastic products and reuse, recycle, and upcycle them. Through reuse and recycling, we use the same plastic product either for the same or different purposes, respectively, and through the means of upcycling, we can decompose and degrade these plastics to create eco-friendly bioplastics and further degrade them to release the carbon back to earth. This would ensure a step towards sustainability in using plastics and through this model of use, we can introduce a circular economy in the world of plastics that would drastically bring down the costs even more.

### The Environmental Concerns

One of the greatest innovations in the past century has been the discovery and use of plastics. Their versatility and a bag-full of advantages including low cost have helped us easily overlook the downside and possible implications that would impair the environment and



Image Courtesy: National Ocean Service, NOAA

the ecosystem years later. Today, the ever-growing pollution caused by plastic waste is a global threat. It is estimated that all the plastics ever made have not still been decomposed and degraded completely, owing to the extremely lengthy degradation process. With only a minor fraction of plastics being recycled, supporting our "use-and-throw" attitude with plastic products calls for our immediate attention in solving the problem of plastic pollution of the environment.

The gargantuan amounts of plastic pollutants across the oceans, land, and air can be easily studied only after categorization. Based on the size, plastic pollutants are often classified into 3-4 different categories: macroplastics (>20mm in diameter), mesoplastics (5-20 mm in diameter), microplastics (<5 mm), and nano plastics (<1000 nm in diameter). Back in the 1970s, microplastics were reported in oceans, albeit based on the size of the particles only as the name came much later. However, it prompted scientists for further investigation only in 2004. Pollution due to macroplastics has been recognised globally since the 1990s. It is thought that the degradation of plastics takes thousands of years and this initially occurs through the breakdown of the particles into smaller and smaller units with the terminal carbons in the chain gaining new chemical groups, thereby unleashing new properties. With time, upon mineralisation, the carbon atoms convert into carbon dioxide and inorganic compounds.

Microplastics have already made into the bodies of many organisms through ingestion in the marine, freshwater, and terrestrial ecosystems. Plastic waste in the form of nets is known to cause entanglement of marine and freshwater

organisms. New studies also suggest that humans ingest a significant amount of microplastics through food sources, although its implications are yet to be chalked out. The harm done to marine ecosystems is of high magnitude and we are losing a lot of marine biodiversity.

The recent COVID-19 Pandemic may have had good news for the overall improvement of air quality, but the use of plastics has further grown as people stopped going outdoors for shopping and e-shopping became a way of life. This resulted in further use of plastics in packaging and delivery stuff. The government had expected that curbing plastic use and banning single-use plastic along with the imposition of the penalty would help in mitigating the problems created by the plastic menace. However, the increase in usage of sanitizers, soaps, masks, face-shields, medicines, and use of hospital equipment, saline bottles, drips, syringes has further accentuated the problem.

Prof. K. VijayRaghavan, PSA to the Govt. of India, in his inaugural speech at the 80th Synergia Forum on 23 July 2020 suggested that neglecting the environment at the altar of current economically inexpensive cheap goods of high quality as plastics have done irreversible damage to land, water, and other natural resources. It is time to rethink, redesign, and put efforts into developing substitutes that offer benefits and durability like that of plastics but have a short residence time in the environment. Interdisciplinary research involving chemists, biologists, and engineers are working in various research institutes in association with industry. Hoping to have an alternative soon on the shelves is something to look forward to.

### Acknowledgment:

This article is done as a part of the Summer Internship Project under YSL Initiative, India.

---

Debraj Manna is a PhD student at the Indian Institute of Science, Bangalore and Dr Monika Koul is an Assistant Professor at Hansraj College, University of Delhi.  
Email: dbrj27@gmail.com; drmkoul@gmail.com

# NATIONAL TECHNOLOGY DAY: S&T for national benefits

Since 1999, May 11 is celebrated as National Technology Day in India to commemorate achievements of innovations and technological excellence of India. The day has a historical perspective as well. On May 11, 1998, India achieved a major technological breakthrough by successfully carrying out nuclear tests at Pokhran. Also, the first indigenous aircraft “Hansa-3” was test flown at Bengaluru on this day. India also performed successful test firing of the Trishul Missile on the same day.

The celebration of Technology Day symbolizes India’s quest for scientific inquiry, technological creativity and innovations, and the integration of these developments for socio-economic benefits.

Since the outbreak of COVID-19, the scientific community has wholeheartedly participated in developing several solutions to combat the pandemic. Academic and research institutions came forward for development of diagnostics, vaccines, software, logistics and supply chain solutions, guidelines and SOPs, etc. Dream 2047 explores some of the notable technological innovations that helped us to counter the pandemic.

## Affordable and effective face mask

ETEX, an IIT Delhi start-up for designing and developing smart textile solutions for healthcare, came up with KAWACH, an affordable and effective face mask, for protecting and safeguarding people from COVID-19. The mask is at par with N95 in terms of proper fitting and has an engineered filtration layer that could provide up to 98% filtration efficiency (3 micron size particle; ASTM F 2101).

Prof. Bipin Kumar, Textile and Fiber Engineering Dept., IIT Delhi said, “India has several massive challenges ahead—disposal of PPEs (including mask and coveralls) after one time use and ensuring the minimum use of nonwoven technology for making

PPEs. Though a nonwoven layer is must for ensuring desired filtration level but the loose fibrous structure make the product disposable after one use. Disposing of synthetic polypropylene nonwoven could have a detrimental effect on environment. Finding other textile solution that offers reusability, biodegradability, affordability and scalability for PPEs is the need of hour; this could ensure meeting both the demand and also safeguarding our environment.”

## Portable hospital infrastructure for COVID-19

The COVID-19 pandemic highlighted the need to set up systems to improve health infrastructure, particularly in rural areas. Portable hospitals for detecting, screening, identifying, isolating, and treating COVID-19 patients in local communities could soon be a solution to tackle the increasing demands for health infrastructure. Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), an autonomous institute under the DST, Govt. of India in collaboration with ‘Modulus Housing’, a start-up incubated by IIT Madras, has come up with a solution using decentralised approach to detect, manage and treat COVID-19 patients in local communities through portable microstructures.

Defence Institute of Physiology and Allied Sciences (DIPAS) developed an antibody-based detection assay for sero-surveillance in association with



SCTIMST & IIT-Madras start-up set up portable hospital infrastructure for COVID-19

Vanguard Diagnostics Pvt. Ltd., Delhi. The test is for both spike as well as nucleocapsid proteins and covers a wide range of spectrum of the disease.

## e-Classroom software DEEKSHAK

Indian Institute of Technology (IIT) Kharagpur developed e-classroom software, DEEKSHAK to address operational issues faced during online teaching. DEEKSHAK is an online synchronous e-teaching platform that primarily uses one-way communication for bandwidth efficiency. Instead of being all students participating in a class as in a meeting software, DEEKSHAK focuses on the teacher and the learning materials. Prof. Raja Datta of Electronics and Electrical Communication Department with his postgraduate students developed the software, the current version of which can be used within a campus LAN. Teachers can also record the attendance of the students on the platform. The software has been tested at IIT Kharagpur during the initial phase of social distancing with about 40 hours of classes being conducted with a total of approximately 300 students.

## Plasma sterilization and disinfection method

Centre for Sustainable Technologies at Indian Institute of Science (IISc) developed Rapid Plasma Sterilization method for Personal Protective Equipment (RaPS). The method is specifically useful for masks used by medical personnel. This device permits reuse of the masks after sterilization. It is low-cost, easy to deploy at scale, and requires only atmospheric air and electric power as input.

The Centre also developed a high throughput ozone generator, which works using cold plasma technology, for disinfection of spaces. Ozone generated from the ozonator is used for disinfection of spaces, both mobile and stationary.

## Initiatives by Department of Biotechnology on COVID-19 vaccination

The availability of a safe and efficacious vaccine for COVID-19 is crucial in effective control of the pandemic. Nationally, several Indian industry and academia groups are involved in development of COVID-19 vaccine candidates. About 6 vaccine candidates are in clinical stage of development and about 3 vaccine candidates are in advanced pre-clinical stage of development. Additionally, more than 10 vaccine candidates are in early stages of development. Among these two vaccines, the Covishield manufactured by Serum Institute of India and Covaxin developed by Bharat Biotech have already been approved for

use and by April 2021 more than 100 million Indian's had received at least one dose of either of the vaccines.

### Rapid diagnostic kit for COVID-19 screening

DST funded FastSense Diagnostics, a start-up, to develop a rapid diagnostic kit for the screening of COVID-19. The company plans to roll out a modified Polymerase chain reaction (PCR)-based detection kit for confirmatory analysis in lesser time compared to existing detection methods. It could test (approximately 50 samples in an hour.

The portable chip-based module based on the on-chip sensing technology provides on-the-spot results in less than

15 minutes and is useful for screening large populations.

### Ventilator 'SwasthVayu' for COVID-19 patients

The National Aerospace Laboratories (NAL), Bengaluru-an institution under the Council of Scientific and Industrial Research (CSIR)-developed a non-invasive bi-level positive airway pressure (BiPAP) ventilator to treat COVID-19 patients. NAL has named it 'SwasthVayu'.



NAL develops Ventilator SwasthVayu 1

BiPAP Ventilator is an electronic breathing device used in the treatment of sleep apnea, lung disease, and to treat respiratory weakness. Non-invasive ventilation is the delivery of oxygen via a face mask and, therefore, it eliminates the need of an endotracheal airway. CSIR-NAL has enabled a spin-off technology based on its expertise in the aerospace design domain.

Ventilator-SwasthVayu is a micro-controller-based precise closed-loop adaptive control system with a built-in bio-compatible "3D printed manifold and coupler" with Highly Efficient Particulate Air (HEPA) filter. These unique features help to alleviate the fear of the spread of the virus. SwasthVayu has features like spontaneous, continuous positive airway pressure (CPAP), timed, auto BiPAP modes with provision to connect oxygen concentrator or enrichment unit externally.

NAL has also designed a protective suit that has boosted indigenous production of the PPEs.

No.	COVID-19 Vaccine Developer/Manufacturer	Vaccine Platform	Stage of Development
1.	Serum Institute with Oxford University Astra Zeneca (ICMR)	Non-replicating Viral Vector (ChAdOx1-S)	Phase III / Emergency Use Authorization provided in January 2021
2.	Bharat Biotech-ICMR	Inactivated whole virion candidate vaccine (BBV152)	Phase III / Emergency Use Authorization provided in January 2021
3.	Dr. Reddy's Laboratories	Non-replicating viral vector (Sputnik V)	Clinical Trial (Phase III)
4.	Cadila Healthcare (Zydus Cadila)	DNA Vaccine (ZyCoV-D)	Clinical (Phase III)
5.	Biological E / Collaboration	Subunit (RBD219-N1-C1)	Clinical (Phase I / II)
6.	Gennova and HDT Biotech Corporation	mRNA (HGC019)	Clinical (Phase I / II)
7.	Serum Institute-Novavax	Protein Subunit Nanoparticle based (NVX-CoV2373)	Clinical Trial under consideration
8.	Bharat Biotech & Thomas Jefferson University, USA	Rabies vaccine platform (RABV-COV19-S1, CORORAB)	Advanced Pre-clinical
9.	Bharat Biotech and FluGen Inc & University of Wisconsin	Subunit Coroflu, an intranasal vaccine based on influenza platform (BBV150)	Advanced Pre-clinical
10.	Aurobindo Pharma Limited with Auro Vaccines	Attenuated rVSV-vectored Vaccine	Advanced Pre-clinical

Acknowledgement: COVID-19 Newsletter Team of VP



## Dr Harsh Vardhan announces launch of 'Aahaar Kranti'

On April 13 Union Minister for Science and Technology, Earth Sciences and Health and Family Welfare, Dr Harsh Vardhan launched "Aahaar Kranti", a mission dedicated to spreading awareness about nutrition and to understand the importance of economically accessible local fruits and vegetables in India.

Vijnana Bharati (Vibha), Global Indian Scientists' and Technocrats' Forum (GIST), Vigyan Prasara, and Pravasi Bharatiya Academic and Scientific Sampark (PRABHASS) have come together to launch the Mission, which has a motto, 'Uttam Aahaar-Uttam Vichar' or 'Good Diet-Good Cognition'.

Aahaar Kranti is aimed to address the problem faced by India and the world -hunger and diseases in abundance. Studies estimate that India produces twice the amount of calories it consumes. However, many in the country are still malnourished. The root cause of this strange phenomenon is lack of nutritional awareness.

The Movement proposes to address the problem by working to rouse the people to the values and richness of India's traditional diet, to the healing powers of local fruits and vegetables, and to the miracles of a balanced diet. It will renew the focus on nutritionally balanced diets replete in locally sourced fruits and vegetables.

While Vijnana Bharati (Vibha)

and Global Indian Scientists' and Technocrats' Forum initiated the programme, several other agencies joined hands and agreed to pool in their expertise and resources. Besides various central and state government ministries and agencies, Vigyan Prasara and Pravasi Bharatiya Academic and Scientific Sampark (PRABHASS) are a part of this collaborative effort. More organisations would join the Mission as it proceeds.

Launching the initiative in virtual mode, the Union Minister said that it was apt that a social welfare programme like Aahaar Kranti is being launched as a public movement on the first day of Ma Annapurna's Chaitra Navaratri.

"Today when the country is reeling under the onslaught of a pandemic like COVID-19, a balanced diet serves as a special tool to reduce the impact of the pandemic. At such a time, the need to create awareness about the importance of a balanced diet has become more vital than ever before", he said.

He appreciated that overseas Indian scientists are in the forefront of the campaign. "It is a noble effort to take the message of balanced diet to every Indian. The Logo you have created for the programme is commendable and a slogan like Good Diet-Good Thought brings all the countrymen together", said Dr Harsh Vardhan.

Underscoring that only healthy individuals can lead to a prosperous

society, he noted that Indian Ayurveda has been a guide to the entire world. It is time that we used the knowledge to meet the various health and social challenges of today.

Director, Vigyan Prasara, Dr Nakul Parashar, said "The mission will work on multiple dimensions simultaneously. In terms of objectives, it will seek to promote better awareness, better nutrition and better agriculture; the messages will be imparted through the curriculum in the form of 'whats' and 'whys' of nutrition, or through the forms of games or as instructions such as 'how to'; and the content will be provided both online and offline, in all vernacular languages besides English and Hindi. The programme will focus on training teachers, who, in turn, will pass on the message to the multitudes of students, and through them to their families and finally the society at large".

On this occasion, a monthly (English and Hindi) newsletter was also launched, which is being published by Vigyan Prasara.

Dr Vijay Bhatkar, President, Vijnana Bharati; Mr Dnyaneshwar of PRABHASS, Shri Sudhir ji Bhadoria, Secretary General, Vijnana Bharati; Jayant Sahasrabudde, National Organizing Secretary, Vijnana Bharati; and Dr Yelloji Rao Mirajkar, Dr Srinivasa Rao and Shri Praful Krishna of GIST expressed hope that the new initiative will be a model for the entire world to follow.

India Science Wire Team